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The World Financial Crisis and Human Health

In the last issue of this Journal, I briefly discussed the impact of one natural disaster on our health namely, "climate change." Little did I realize that in this issue, I might have to discuss the effect of another natural disaster on our health, i.e. the impact of the current world financial crisis. I refer to it as a "natural disaster" because it is a "disaster" to the health of most of the world's population and it is "natural" because it has been expected by financial experts as a natural consequence of the loose-ending policies of the major institutions in the rich nations in the West that lead the world economy and the over-inflated stock markets. Be that as it may, our concern in the medical profession should be focused on the consequences of the current downturn of the economy on our health. Some health consequences are very obvious while others are more subtle. Any individual who has a major portion of his wealth in the stock market, in effect suddenly became 20 - 25% poorer, just in the first 10 days of October 2008. This is not just limited to the investments of individuals, but also affected the major companies that employ thousand of people and the pension plans of several institutions. Many large firms in Oman have their pension funds invested in the stock markets of the world.

How does this impact our health and what is health? According to the Alma-Ata Declaration of 1978, "Health is a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity". This is according to the International Conference on Primary Health Care at Alma-Ata in present Kazakhstan (former Soviet Union) on 6th December 1978. It declared that health, as per the above definition, "is a fundamental human right and that the attainment of the highest possible level of health is the most important world-wide, social goal whose realization requires the action of many other social and economic sectors in addition to the health sectors". The current financial crisis deprives many of us of this "fundamental human right" e.g. It is not surprising that the suicide rate has significantly risen in Japan.

In Oman, perhaps, we have not been as greatly affected by this economic downturn as some other countries, but the food prices here have risen significantly lately. This will naturally impact on the health of the less fortunate in our society who may not be able to afford a square meal at the new prices. Food prices are still rising in many countries and there is a worldwide "food crisis". There are 850 million people going hungry each day despite a huge surplus of food production in some countries. Around 24,000 hungry people perish each day in an endless wait for food. Physicians can speak out on behalf of these hungry millions. We stand facing a hungry planet and the threat of "financial Armageddon".

Apart from this food crisis, we also have evidence that the financial crisis can cause an increase in cardiovascular events, including myocardial infarcts. Studies conducted at the University of Chicago have shown evidence of increased stress hormones and aggravated atherosclerotic plaques. This study also indicted that job lay-offs from the economic crisis lead to a two-fold increase in subsequent heart attacks and cerebrovascular events. A study reported from Duke University workers has also shown that ex-smokers are more likely to relapse, drinkers drink more, and people eat less heart-healthy foods during financial crises. The message is clear, "if you do not have the money to pay the bills, you are stuck." Historically, there are several other health consequences of the financial downturn such as the vaccinations decline of the late 90s, an increase in child infections and the stagflation of the 1970's that ended the economic model of Keynesianism. Now, it threatens our mental health as per the WHO's evaluation. Families in the USA now have to struggle with tough financial decisions needing a sacrifice of their health care. Rising unemployment and soaring drug and hospital costs impact the health care of Canadians also. Medical societies and associations have a moral responsibility to act collectively to reduce the adverse health effects of the economic downturn by a premeditated plan of preventative medicine and close monitoring. Governments equally have the obligation to avert the health effects of such a crisis by preventive measures and by acting to prevent more financial crises and not only provide 'bailout' solutions. Action is needed to neutralise the sting of this financial crisis, the food...
crisis, and the subsequent health crisis. The health consequences of this world financial crisis can be physical and mental, acute and chronic, immediate and remote, all of them needing our attention.

Prof. Muhammad Yunus, a Bangladeshi banker and economist, led the world in solving one financial lending dilemma and thus improved the lives of millions while writing a new chapter in the history of solutions for financial crises and human suffering. He was also awarded a 2006 Nobel Peace Prize for pioneering the use of micro-credit to benefit the poor. This should act as an inspiration for financial gurus and economic academicians in Oman to strive for a solution to this financial crisis and thus its health consequences. SQUMJ is encouraging the publication of any scientific endeavour from any of the SQU Colleges or elsewhere in search for a solution to this intertwined problem of health and financial crisis.

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Medical Practice in the Twenty-First Century - What, if anything, will doctors be doing?

Des Gorman

The ability of Governments to identify, fund and deliver desirable health services will be increasingly challenged by ageing populations, escalating costs of health-related technology and by increasing consumer expectations. Current health costs are unsustainable. The USA ‘health-spend’ is about 16% of gross domestic product (GDP); about 31% of this is consumed by bureaucracy and up to 45 million citizens have little or no access to health care.1, 2 Almost 10% of Australians are employed as health workers and health care costs about 10% of the Australian GDP.3 The latter is increasing by 0.5% per annum such that it will double in less than 20 years. The New Zealand Treasury has made a similar forecast,4 which is in line with Nobel Laureate Robert Fogel’s prediction that Western economies will spend about 20% of GDP on health by 2020.5 The context of this increase is that of relatively fewer tax payers in Australasia as the “baby-boomer generation” leaves the workforce.6, 7

The WHO estimates a global shortage of 4.3 million health workers for the decade 2006-16.8 It is noteworthy then that countries such as Australia, New Zealand and Oman, which are heavily reliant on recruiting overseas trained doctors,9 are counting on remaining attractive to international health workers at a time of severe global shortage. This reliance will be variously threatened by Indo-Asian doctors “staying at home” to attend to an increasing affluent middle class and by the related recent decision by the Indian Government to recognise foreign trained doctors,10 and by an enlarging and increasingly specialised health workforce in the USA.11, 12, 13

In this context, a cautious response is probably advisable to any recommendation to address shortfalls in the medical workforce by re-training nurses or other existing health workers given the generic nature of current and predicted shortages.6, 7 This is not to argue that health provider roles will or should not change, but rather that there is a need to encourage health work careers and to create new and satisfying roles for any consequent recruits.

Health workforce planning is both complex and difficult; probably the only truism is that any plan is inevitably wrong. The effective variables are plentiful and comprise cultural and social changes, which include the demand-side effects of ageing and the supply-side effects of feminisation and generational changes; macro-and micro-economic changes; new biomedical technologies, pharmaceutical and health-disease industry developments and marketing; changes in the balance of power between health ‘accountants,’ public health advocates and clinicians; changes in relative remuneration between and within

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the medical profession and other groups; successful trials of alternative health service models versus the power of established models and guilds; migration, recruitment and retention and international and private versus public recruitment changes; changes in medical indemnity; and, other changes in those factors that influence clinical decision making. 6, 7, 14, 15, 16, 17, 18, 19

A change in work hours for doctors illustrates the problems for planners. The effect of every doctor in New Zealand working one hour less per week is the same as 300 doctors leaving the health system completely. The inevitable conclusion is that health professionals must be able to be rapidly cross- and re-trained and re-deployed. Recognition of this intrinsic uncertainty also supports an emphasis on generalist and inter-professional training in all health disciplines and the need for new educational models.

We have previously proposed four categories of solution to shortfalls in health workforces: 20 the compression of the years of morbidity in later life; a better alignment of the elements of the medical education and health systems with each other and with patient care needs; an increase in the percentage of the community employed in health services and greater output from the current workforce; and, the identification and employment of disruptive innovations. 16

Compressing morbidity in later life will be difficult in the context of epidemics such as obesity and diabetes and will be opposed by increasing health service consumption by the affluent “well-worried-sick”. The commercial investment in this anxiety is considerable. 19, 21 In Australia and New Zealand, there will be relatively fewer workers, and individual productivity gains will be opposed by generational phenomena and the effect of feminisation, work life balances, litigation and practice safety, unionisation, indebtedness, demographic changes, profitable low utility practice, and by practitioner emigration. Indeed, it is probably wise that health planners begin with an assumption of an average 37.5 hour working week. 22

The proposals likely to be most useful are based on the elements of the education and health systems being better aligned with each other, to increase health literacy, and with patient care needs, and on the identification and employment of disruptive innovations. 16

A reasonable first step for a health planner is to debate the role that doctors should play in a health service. In the context of the increasing recognition that health costs are increasingly unsustainable, the only justification for a health service provider that takes 15 years to train to individual competency, and at a considerable cost, is the need for patient differentiation and care planning and oversight. These functions must be of high quality if a health service is to be outcome-focussed and cost-effective. If doctors in 2025 are to be employed to sclero varicose veins, then all communities will need many times more than the current number of medical graduates. 9 By contrast, if doctors are to be employed in a narrower range of predominantly cognitive roles, then the non-medical trained-for-purpose workforce will have to be extensive and adaptable.

To paraphrase Jean-Paul Sartre, you cannot choose not to choose; that is, to do nothing is to select the status quo of medical education and practice. We have argued previously that time in training is a poor facsimile of competency determination and that direct measures are needed. 23 The utility of such a time-independent approach has been demonstrated by the Faculty of Occupational Medicine of the Royal Australian College of Physicians. The acknowledged preface to such a system is agreement on the intended role of the worker group and consequent essential competencies (“attributes”).

This editorial then will present some generic doctor ‘attributes’ that are likely to be agreed upon and sufficiently robust to stand the test of time. These should be debated vigorously as they will determine learning outcomes and responsive curricula and pedagogies.

The doctor of the future should be professional. Effective medical practice is contingent upon skills in the professional domains of communication, quality and safety, teaching and learning, cultural competency, ethics, clinical decision-making, leadership and management, and health advocacy. 24, 25

The doctor of the future should be re-deployable. As cited above, given the uncertainty about what society might be like in 2025, let alone what the health needs and resources of that time might be, the only truism for planning the future health workforce is that the planners will ‘almost certainly get it wrong’. The inevitable conclusion then is that the doctor of the future must be able to be cross- and re-trained and re-deployed.

The doctor of the future should be able to recognise and employ suitable innovative disruptions, even if they result in personal role change. This is not the
usual case, nor is it the common history of innovations that disrupt established groups and technologies outside the health sector.16

One previous development that illustrates both these perspectives is the nurse practitioner. This innovative disruption was predictably opposed by doctors on the grounds that doctor roles and status were threatened. In the case of obstetric services in New Zealand, the result of the consequent turf war is an apparent increase in autonomy for pregnant New Zealand women, which may have been gained at the expense of quality of care.26 The initial enthusiasm of employers for nurse practitioners to undertake both general and limited scopes of practice has dissipated somewhat with the realisation that there are usually only marginal savings in time to train, and in cost to employ and deploy. In part, this occurred because nursing authorities chose to follow traditional and time-punitive pathways for aspirants to obtain the new ‘higher’ qualifications. An opportunity for innovation was lost.

In retrospect, it should not have been such a surprise that changing the name of a task-oriented practitioner would not significantly change the time it took or the cost of training and employing them unless the training was genuinely innovative, or unless there was a reduction in the quality or the quantity of the tasks undertaken. Although this threat to doctors may have been somewhat averted, nonsensical concepts persist, such as the use of nurses to triage undifferentiated patients for doctors, rather than the other way around.

The practice of differentiation is one of the few reasons why it is possible to argue that the medical section of the health workforce should be strongly rooted in science and so slow and expensive to train. The reaction of the doctors to the threat of being disrupted by nurse practitioners was understandable, given the way in which the disruption was often presented to them. It was also predictable on the basis of the history of the profession and the reaction of any community to such innovations.16 Finally, it was reactionary and unhelpful. A sensible engagement of nurse practitioners and doctors has been put off by the response.

The doctor of the future should be a physician-scientist. The history of medicine shows a persistently elevated status and consequent privileges for doctors.27 Comparison with other health providers suggests that the basis of that status and privilege is the scientific predication and evidence base of medical practice. Accordingly, contractions of training time and revisions of training for doctors should not be at the expense of quality of care; however, there is a reasonable argument that this should be predominantly clinically-oriented science. Within the sciences there is a need for some rationalisation. Organ anatomy is often taught in great detail, although such knowledge serves the interest of relatively few future proceduralists, in contrast to the often neglected teaching of surface anatomy, which is important to almost all doctors. Similarly, teaching should focus on pathophysiology as compared to physiology per se. Personal interests of basic scientists should not be allowed to dictate medical curricula.

The doctors of the future should be resilient and sceptical, and will need to be if they are to remain scientific. Already, the pharmaceutical industry exerts undue influence on health service expenditure and potentially distorts professional judgment.28 This is not accidental; in the USA, this industry spends about as much as the combined budgets of all the medical schools on direct doctor-propaganda.29 There are many examples of health-disease industry marketing triumphing over scientific practice; one is the use of MRI images to determine surgical interventions for back surgery at a time when the ‘normal’ findings in people who did not have back pain were unknown.

Inevitably, escalating health costs must be curtailed. Doctors with training and attributes for effective clinical decision making will be best prepared to assist with the difficult decisions regarding limiting applications of expensive health technologies. The ability to tolerate clinical uncertainty will also become increasingly important.

Resilience will have to be taught and reinforced through continuing medical education programmes. Such programmes do exist and have reasonable track records. Scepticism will also need to become a cornerstone of teaching. This will require a major change in examination techniques,22 as current recall-based assessments strongly reinforce the evolution of what are ephemeral hypotheses into “life long facts.”21, 23

The doctor of the future should have skills in and an understanding of health psychology, and of anthropology and sociology. There is widespread agreement that the future role of the doctor will be increasingly that of generalist individual health care within a population health approach;30 however, other than being taught statistical and epidemiological princi-
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ples, modern graduates are generally poorly equipped for effective preventive medicine. To do so requires education in health psychology, anthropology and sociology. Mindful of the marketing success of water bottlers, who have convinced the consumer to pay three times more for their water than for petrol, there is clearly great potential for modifying health-at-risk perceptions, beliefs and behaviours.

The doctor of the future should have a cognitive and general scope of practice. There is a strong financial and health outcome basis for arguing that doctors should, as much as possible, be employed in general scopes of practice.17, 31 We have already opined that a cognitively-oriented practice is the only one that would sustain critical public scrutiny in terms of how much and how long it takes us to educate doctors. To this must now be added a shift in emphasis from acute to chronic disease management.

The opposite is occurring. In our medical school, about 10% of graduates have a strong interest in becoming general practitioners. Unfortunately, more exposure to general practice does not translate into more inclination; the key issue is the quality and not the quantity of the exposure. Nevertheless, there is evidence that “immersion programmes” do work, and particularly in respect to graduates selecting rural medical careers.32, 31 The disinclination to general medical practice is in part maintained by the significant distortion of medical career choice and practice that we have described beforehand.21 This arises from the perverse and now 70 year old actuarial decision to fund medical units of practice rather than time expended.

The failure of “generalism” is global.11, 13 Bodenheimer reports that less than half the training positions in family medicine in North America are taken up by local graduates. In the same edition of the New England Journal of Medicine, Woo cites a decline in US medical graduates filling training positions, in the period from 1998 to 2006, of 51% in family medicine, 18% in internal medicine, 16% in obstetrics and gynaecology, 8% in paediatrics and of 4% in general surgery.13 To a large extent, these declines are explained by relative levels of remuneration. To the acceptance of medical education, designed to show-case general scopes of practice, must then be added the need for an urgent relative values study and realignment of remuneration and need. Fear of waiting-list blow-outs and other undesirable outcomes has prevented any such political bravery in the past; the current and emergent crisis in medical workforce disposition may warrant greater fortitude now.

Another consideration in the context of generalism is the feminisation of the medical workforce. In New Zealand, women now comprise over 50% of undergraduates and junior doctors, but only 31% of specialists, including GPs.34 With respect to the future roles of doctors, there are positives to this demographic change as the cognitive and flexible generalist roles, which many of us advocate, appeal more to women. There has been much made of the fact that women work around eight fewer hours per week,34 yet analysis of these New Zealand data shows this differential is not present in the early post graduate years, or past the age of 70, although there are, as yet, few practitioners in this latter age group. There is also a suggestion that women doctors may have longer working lives;35 however, if women are to lead a generalist revival, ways must be found to make working and training more flexible, especially through the years of specialty training and early specialist practice. This should be accompanied by a revaluing of the skills needed to effect quality chronic and integrated care, so crucial to the health of society and to controlling health costs.14, 36 The future, female dominated, medical profession will need sufficient status to exert the necessary influences to maintain high standards of patient care.35, 36 Along with redefining the role of a doctor, some thought must be given to addressing what will be regarded as ‘success’ in the medical profession in 2025.

CONCLUSION

The doctor of the future is already in training. The health system that they will inherit, the health problems of that day, and the technology, which will be available to them, can only be guessed at. The reality of the latter must underpin the outcomes, which are adopted for each stage of medical training, and the curricula and pedagogies that are consequently derived. The debate about these competencies and who decides them needs to begin.

REFERENCES


Obstructive Sleep Apnoea/Hypopnoea Syndrome and Hypertension

Mohammed A Al-Abri, Khamis M Al-Hashmi

The obstructive sleep apnoea/hypopnoea syndrome (OSAHS) is a common disorder, affecting around 2–4% of the middle-aged population. There is a strong association between OSAHS and hypertension, based on animal, large epidemiological and interventional studies. The epidemiological studies have shown a dose-response relationship between apnoea/hypopnoea index (AHI) and the risk of developing hypertension. Different mechanisms may have a role in the process of elevated blood pressure in OSAHS. Sympathetic activity is increased in OSAHS patients during sleep and wakefulness. This increase in sympathetic activity is probably due to activation of baroreflexes and chemoreflexes by frequent arousals and hypoxaemia as a result of apnoea or hypopnoea events. Continuous positive airway pressure (CPAP) has been shown to reduce sympathetic stimulation and blood pressure in OSAHS patients. Altered endothelial function may also have a role in the pathogenesis of hypertension in OSAHS subjects. Reduction of nitric oxide (NO) production and increase in the formation of free radicals may be responsible for the impairment of the vasodilatation of micro-vasculature in these subjects as a result of hypoxaemia. It has been shown that effective CPAP therapy has a reversible effect on endothelial dysfunction.

Keywords: Baroreflex; Blood pressure; Chemoreflexes; Endothelial function; Hypertension; OSAHS (Sleep apnoea/hypopnoea syndrome); Sympathetic activity.
OSAHS-related features include excessive daytime sleepiness, neurocognitive impairment, and increased motor vehicle accidents. It has also been associated with adverse cardiovascular consequences such as hypertension and impairment of cardiovascular variability. Treating OSAHS is very rewarding, for the benefit to the patient is enormous in improving the quality of life as well as preventing long-term sequelae.

There is strong evidence that patients with sleep apnoea might be at increased risk of cardiovascular disease. Patients with sleep apnoea are often hypertensive and up to one-third of hypertensive patients may have sleep apnoea. Several cross-sectional studies have shown that the prevalence of hypertension increases progressively with the severity of OSAHS. How hypertension is associated with OSAHS is not fully understood. However, repetitive episodes of airway occlusion during sleep, with consequent hypoxia, hypercapnia, dramatic changes in intrathoracic pressure and repeated arousals, may provoke a number of autonomic, haemodynamic, hormonal and neuroendocrine responses. This review focuses mainly on the epidemiological link between OSAHS and hypertension and the autonomic responses that might occur in OSAHS patients. Other aspects of the possible vasculopathy in OSAHS will also be briefly reviewed.

Epidemiology
OSAHS and hypertension have common risk factors, such as obesity, alcohol intake, age, gender and lack of exercise, which makes causation impossible to prove, using epidemiology alone. However, several epidemiological studies have revealed a strong association between OSAHS and hypertension.

OSAHS in the General Population
Early studies of the association between hypertension and snoring came from Norton et al. and Koskenvuo et al., who found that snoring was a risk factor for hypertension. Subsequent studies found that sleep apnoea was an independent risk factor for the development of hypertension, similar to age and obesity. A large epidemiological study showed that sleep apnoea significantly contributed to hypertension, independent of other risk factors. Each apnoeic event per hour of sleep added 1% to the risk of having hypertension. More evidence linking OSAHS with hypertension is provided by the Wisconsin Sleep Cohort study, which showed a dose-response association between OSAHS and de novo hypertension after 4 years of follow-up independent of confounding factors although the number of new hypertensive subjects was small. In the original report, patients with an apnoea-hypopnoea index (AHI) > 25 had a fivefold risk of hypertension. The increase in risk of hypertension was greater in thinner patients who had abnormal breathing. After correction for confounding factors, those with an AHI >15 had a 2.9-fold greater chance of developing hypertension in the following four years. A similar relationship between OSAHS and hypertension was found in the Sleep Heart Health Study. In this study of 6,000 middle-aged and older adults, the prevalence of hypertension (defined as a resting BP ≥ 140/90 mmHg or the use of anti-hypertensive drugs) increased progressively with the severity of OSAHS. After adjusting for the confounding factors, including obesity, the odds ratio in the group with severe OSAHS (AHI >30) was 1.37 (95% confidence interval (CI), 1.03-1.83; p = .005) compared with those with lowest AHI (< 1.5). A cross-sectional study in a normal population by Bixler et al. also indicated an association between hypertension and sleep apnoea independent of other risk factors. The association was strongest in young subjects, and decreased with age.

OSAHS in the Hypertensive Population
Epidemiological studies of hypertensive patients have also suggested an association between sleep apnoea and hypertension. Hypertensive patients had a greater prevalence of sleep apnoea than normotensive subjects. Grote et al. found that OSAHS was a risk factor for poor blood pressure control in younger hypertensive patients. A greater prevalence of obstructive sleep apnoea is found in adults with drug-resistant hypertension (BP > 140/90 who require a combination of three or more antihypertensive drugs) supporting the idea of an etiological role of OSAHS in the cause of hypertension.

Hypertension in OSAHS Subjects
Animal models
In dogs, obstructive sleep apnoea leads to the development of sustained hypertension. Obstructive sleep apnoea (OSA) was produced in four dogs using an occlusion valve attached to an endotracheal tube through which the dog could breathe. Obstruction of the airway by the valve was controlled by telemetry of elec-
trocardiogram (ECG) and electromyography (EMG) signals from the dog during a one to three month period. In the same dogs, sleep fragmentation was also induced. Arterial blood pressure was monitored for 12 hours every night. Obstructive sleep apnoea (OSA) caused a progressive increase in night-time mean arterial BP in each of the four dogs. There was no difference between the change in night-time BP caused by sleep fragmentation and that caused by OSA ($p = 0.4$). In contrast, the change in daytime BP caused by sleep fragmentation was significantly less than the change during OSA ($p = 0.001$). There were no changes in night-time or daytime heart rates during either OSA or sleep fragmentation. In another dog study of chronic OSA by Parker et al., acute airway occlusion during sleep increased left ventricular (LV) afterload and decreased fractional shortening. Chronic OSA caused a sustained decrease in LV systolic performance, caused by systemic hypertension and/or transient increases in LV afterload during episodes of airway obstruction.23

**Human studies**

A case-control study found that patients with OSAHS had higher blood pressure than matched control subjects. Diastolic blood pressure in patients with OSAHS was significantly greater than controls during the daytime, night-time, and overall. OSAHS patients also had significantly greater night-time systolic BP ($p = 0.01$), although daytime and overall systolic blood pressure did not differ from control subjects.8 Direct evidence that OSAHS causes hypertension is provided by intervention studies, in which continuous positive airway pressure (CPAP) reduced BP.24, 25 Nevertheless, in order to understand the pathophysiology of hypertension in OSAHS, the mechanism of blood pressure elevation is discussed below.

**OSAHS and Blood Pressure**

In healthy subjects, blood pressure normally decreases by 10% to 15% from its daytime value during sleep. This circadian drop in BP has been called dipping. However, some patients with OSAHS do not show nocturnal dipping of BP and are thus called non-dippers.26 This may relate to apnoeas and hypopnoeas, which cause repeated nocturnal increases in BP, which consequent- ly increase the mean sleeping BP.27 The greatest pressure peaks occur after apnoea and may be 100 mmHg above the baseline value.28, 29 These acute nocturnal changes may lead to persistent daytime hypertension as a long-term consequence29 with an increased risk of target organ damage.30 In a case-control study, sleep apnoea patients had significantly increased mean diastolic BP during both the daytime and night-time, and systolic BP was higher among OSAHS patients at night compared with controls. The nocturnal dip in BP was smaller in patients with OSAHS than in matched control subjects.8

Hypoxia may explain partly these variations in BP in sleep apnoea patients. In animals, repetitive episodic hypoxia causes diurnal elevation in BP in rats.31 Similarly rises in daytime blood pressure follow induced apnoeas in dogs and are probably related to hypoxaemia rather than arousal, because noise-induced arousal did not cause daytime hypertension in the same dogs.22 Increased sympathetic activation, perhaps induced by hypoxaemia, may be a key factor in causing long-term BP changes.32 However, other factors may be implicated in the development of hypertension in OSAHS patients, such as endothelial dysfunction, as discussed below.

**Sympathetic Activity in OSAHS Patients**

During sleep

Normal sleep is physiologically divided into rapid eye movement (REM) and non-rapid eye movements (NREM) sleep. NREM is further divided into 4 stages from Stage 1 to 4. In normal sleep, heart rate, blood pressure, and sympathetic nerve traffic usually decrease.33, 34 This reduction of sympathetic activity appears to increase progressively from Stage 1 to Stage 4 sleep.28 However, during REM sleep, sympathetic activity increases, to as much as double that of wakefulness.34 Blood pressure and heart rate during REM are variable, but average about the same as during wakefulness.28

In contrast, sympathetic activity is increased during sleep in OSAHS patients and the sympathetic and the haemodynamic state during sleep is determined primarily by the duration and severity of apnoea rather than by the sleep stage itself.39 Repetitive episodes of obstructive apnoea, hypoxia and hypercapnia probably act through chemoreceptor reflexes and other mechanisms to increase sympathetic drive.35 Furthermore, resumption of breathing results in increased venous return and increased cardiac output. This increased cardiac output is delivered into a severely constricted peripheral vasculature, with surges in BP.35
**Effects of Arousal from Sleep on BP**

Normal spontaneous arousals from sleep are associated with transient increases in blood pressure, heart rate and ventilation. These increases are caused by changes in sympathetic activity caused by the arousal. In a study in dogs, ventricular stroke volume (SV) remained constant when apnoea ended, if there was no arousal. However, with arousal from apnoeas, heart rate and cardiac output increased, although SV decreased. Arousal increased the systemic, but not the pulmonary arterial pressure, in response to obstructive apnoea. The increase in systemic blood pressure was more marked during NREM sleep than in REM sleep. In a large population-based study, sleep fragmentation index (SFI), calculated as the total number of awakenings or shifts to Stage 1 divided by the total sleep time per hour, was significantly associated with systolic, but not diastolic blood pressure, during wakefulness in individuals with AHI < 1. However, sleep fragmentation and blood pressure were not associated in those with AHI > 1 after controlling for the influence of the AHI. The authors concluded that sleep fragmentation was independently associated with a greater systolic blood pressure during wakefulness. Noda et al. found that end-apnoeic arousal and hypoxic asphyxia and the subsequent sleep fragmentation might contribute to nocturnal and diurnal elevation of BP. The rise in blood pressure with arousal might be caused by an increase in sympathetic activity. Sympathetic outflow remained elevated for a substantial period even after a hypoxic stimulus was removed; nevertheless, it is unwise to conclude that sleep arousal is the sole contributor to sustained hypertension in awake sleep apnoea patients. However, in patients with higher AHI, sleep disruption may modulate the BP along with other effects such as hypoxaemia and changes in intrathoracic pressure, which may overcome the effects of arousal.

**During Wakefulness**

Greater sympathetic activity in OSAHS patients may be present even during daytime wakefulness, when subjects are breathing normally and both arterial oxygen and carbon dioxide levels are normal. Circulating catecholamines and muscle sympathetic nerve activity were greater in patients with OSAHS compared with normal subjects, probably because of baroreflex dysfunction, chemoreflex excitation and endothelial dysfunction. Greater sympathetic drive in these patients may contribute, to a certain extent, to chronic elevation of resting BP. The mechanism underlying the sustained increase in sympathetic drive is not clear. Morgan et al. suggested that combined hypoxia and hypercapnia evoke long-lasting sympathetic activation. This may explain in part the increased daytime sympathetic drive in OSAHS patients. However, repeated BP increases, acting via the baroreceptors, may reset the baroreflex, permitting a higher level of sympathetic activity and BP even during wakefulness. To understand the role of the chemoreflexes and baroreflexes in BP control in OSAHS patients, these two aspects are explained in detail below.

**Chemoreflexes**

The chemoreflexes are important and powerful modulators of sympathetic activation. Hypoxia, which acts primarily on the peripheral chemoreceptors located in the carotid bodies, and hypercapnia, acting on the central chemoreceptors located in the brain stem, trigger reflex increases in minute ventilation as well as sympathetic activity. Patients with OSAHS have an enhanced vascular response to hypoxia. In a double-blind, randomised, controlled trial, it was found that muscle sympathetic nerve activity (MSNA) and mean arterial pressure were significantly reduced in OSAHS patients compared with control subjects during chemoreflex deactivation by 100% oxygen; however, the enhancement of peripheral chemoreflexes is selective to autonomic, haemodynamic and ventilatory responses in normotensive OSAHS. Furthermore, this enhancement of the reflex response to hypoxia is not explained by obesity, since obese subjects who are otherwise healthy with no OSAHS have chemoreflex responses similar to those seen in control subjects. Nevertheless, obese patients have a greater response to hypercapnia. Both hypoxia and hypercapnia have local vascular effects, causing vasodilation, which lowers the blood pressure initially, which in turn increases sympathetic activity and catecholamine release. During apnoea, sympathetic activity rises gradually, reaching its peak at the end of the apnoea, when oxygen desaturation and carbon dioxide retention are most marked. On release of the airway obstruction and resumption of breathing, increased cardiac output, together with the constricted peripheral vasculature, result in a marked increase in blood pressure. There is also a carry-over effect to the tonic activation of the peripheral chem-
oreceptors, even during normoxia, which may partly explain the increased sympathetic activity during the daytime (see above). However a double-blind study suggested that hyperoxia can suppress peripheral chemoreceptors in OSAHS patients, shown by a decrease in blood pressure and slowing of heart rate.

**BAROREFLEX AND HYPERTENSION**

There is evidence that the cardiac baroreflex is impaired if blood pressure is increased, in both humans and animals. Floras et al. found that the arterial baroreflex could buffer acute changes in blood pressure in subjects with WHO Stage 1 hypertension. However, this ability is weakened if the baroreflex sensitivity (BRS) is reduced. With the development of clinically evident cardiac adaptation to hypertension (WHO Stage 2), the contribution of the arterial baroreflex to the regulation of blood pressure is no longer detectable and the influence of cardiac and somatic afferents to reflex circulatory adjustment to activity may predominate.

**BAROREFLEX IN SLEEP APNOEA**

Patients with OSAHS have baroreflex dysfunction. Narkiewicz et al. used phenylephrine to activate baroreceptors and nitroprusside to deactivate them. Normotensive patients with OSAHS had an impaired response to baroreceptor deactivation, but not to baroreceptor activation. They suggested that the reduced baroreflex sympathetic modulation in patients with sleep apnoea was not accompanied by any impairment of baroreflex control of heart rate. In addition, OSAH patients have impaired baroreflex responses to a hypotensive stimulus. Using sequence method analysis, it has been noted that baroreflexes are impaired in OSAHS patients compared with healthy controls.

**EFFECT OF TREATING SLEEP APNOEA ON SYMPATHETIC ACTIVITY AND BP**

CPAP is the treatment of choice for majority of OSAHS patients. In addition to improvement of symptoms, CPAP treatment may also reduce sympathetic activity. Nasal CPAP was found to reduce catecholamines. Somers et al. found that CPAP treatment caused an acute and marked reduction in nocturnal sympathetic nerve traffic. However, CPAP does not reduce daytime blood pressure acutely, although it significantly reduces the large oscillations in blood pressure seen overnight in patients with untreated sleep apnoea. Nevertheless, a small fall in night-time systolic BP was seen in OSAH patients after 2 weeks of treatment, with some improvement in daytime mean arterial blood pressure in non-dippers after 3 weeks of CPAP treatment compared with the placebo. However, when effective CPAP treatment was given for a longer period (8 weeks) in a before-and-after non-placebo controlled design, there was a significant fall in both systolic and diastolic BP, independent of changes in body weight. Thus, long-term treatment with CPAP may be needed to attenuate sympathetic activation and consequently reduce BP. This idea is supported by the findings that CPAP treatment reduced the muscle sympathetic nerve activity (MSNA) in otherwise healthy OSAHS patients, although the reduction was evident only after one and a half years of treatment. Furthermore, in a randomized placebo-controlled crossover study, Faccenda et al. found that CPAP therapy reduced 24-hour diastolic blood pressure in comparison with the placebo, although the overall reduction was small, averaging 1.5mmHg over the 24 hours. The decrease was greater during the early morning period that is at 2:00 a.m. As predicted a priori, the decrease was greater in those with more nocturnal hypoaxemia (> 20% desaturations/hour).

**OSAHS AND ENDOTHELIAL DYSFUNCTION**

The endothelium is the cell layer lining the blood vessels. It is one cell thick and senses changes in haemodynamic states. The endothelium responds to physical and chemical stimuli by synthesis or release of substances such as nitric oxide (NO), prostacyclin, endothelins, endothelial cell growth factors, inter-
leukins, adhesion molecules, and fibrinolytic factors.63 Therefore, the endothelium can greatly influence vascular tone and structure by releasing NO. Impaired endothelium dependent function and endothelium independent function in the forearm vascular bed is associated with an increased risk of acute cardiovascular events, including cardiac death.54, 65 The endothelium is a major target of oxidative stress, and this stress may play a role in the pathophysiology of vascular disease. In OSAHS, recurrent episodes of hypoxaemia followed by re-oxygenation may trigger endothelial damage, via oxidative stress, superoxide radical formation.66 The combination of superoxide radical with nitric oxide and reducing nitric oxide bioavailability in the vessel wall leads to vasoconstriction. More recent studies have shown that oxidative stress and lipid peroxidation do not appear to be the key mediator for the cardiovascular diseases in OSAHS.57, 66 This finding contradicts the results of other studies which showed that OSAHS patients have an increased status of oxidative stress such as thiobarbituric reactive substances and peroxides69 and decreased antioxidant capacity which could be reversed by CPAP treatment.70, 71 Only a few studies have shown increased expression of adhesion molecules72 and production of reactive oxygen species in leukocytes of sleep apnoea patients.73, 74 Pro-inflammatory factors such as interleukins, C-reactive protein and leukocyte adhesion molecules such as CD1575 might also contribute to the pathogenesis of developing cardiovascular diseases and merit further evaluation. In addition, prothrombotic factors75 such as fibrinogen, plasminogen activator inhibitor, and reduced fibrinolytic activity with enhanced platelet activity, may play a role in the process.76 In a randomized double-blind placebo controlled crossover trial, it was shown that OSHAS is associated with endothelial dysfunction using venous occlusion plethysmography during intra-arterial infusion of endothelium-dependent (acetylcholine and substance P) and endothelium-independent (sodium nitroprusside) vasodilator. Vasodilatation was significantly impaired in subjects with oxygen desaturations (20 dips of 4% desaturations/hr) compared to non-desaturators (p <0.05) In the same study, treatment with CPAP for 6 weeks improved forearm blood flow to all vasodilators in comparison to results after sham CPAP (p <0.05 for all vasodilators).77

CONCLUSION

Obstructive sleep apnoea/hypopnoea syndrome is a common condition and its association with hypertension is very strong. Clinically, it is essential to understand the relationship between OSAHS and hypertension for the benefit of patients in order to prevent long-term sequelae and optimise treatment. The mechanisms behind the elevation of blood pressure in OSAHS are mainly due to autonomic changes that occur as a result of recurrent arousal and hypoxia. Impairment of baroreflex and chemoreflexes may lead to sustained activation of sympathetic activities. Endothelial dysfunction may also have a role in the process of development of hypertension in sleep apnoea subjects. Effective CPAP therapy has been shown to reverse these changes and may prevent its occurrence. Further studies are required to explore the role of OSAHS in the pathogenesis of atherosclerotic changes and subsequently developing arterial stiffness. Randomised control trials are also needed to assess the effect of CPAP therapy in reversing or preventing these changes.

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Quality of Relationship with Supervisor and Work Exhaustion among Nurses

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ABSTRACT

Objectives: To study the impact of quality of relationships with supervisors, operationalised as leader-member exchange (LMX), on work exhaustion among nurses working for a hospital in Oman. Methods: Data were collected from 229 nurses using a questionnaire. Results: LMX was found to be a significant negative correlate of work exhaustion directly, as well as beyond the controlled-for correlates of gender, organisation experience, occupation experience, education level, job satisfaction, occupation satisfaction and work interfering with family. Conclusion: A perceived higher quality work relationship with one’s supervisor appears to have a significant impact on reducing perceived work exhaustion among nurses.

Keywords: Psychological phenomena and processes; Burnout, professional; Oman.

Advances in Knowledge

• Leader-member exchange (LMX) was found to impact work exhaustion after controlling for a powerful collective of control variables including: gender, organisation experience, occupation experience, education level, job satisfaction, occupation satisfaction and work interfering with family.

• Tested for the impact of LMX on work exhaustion in a non-Western sample.

Applications to Patient Care

• Work exhaustion and burnout may have negative implications for employee and patient safety in health care organisations.

• Improving the quality of work relationship between supervisors and subordinates may help to prevent health care professional burnout.

Changes at Work, Including Greater Global Competition, increased demand for services, increased use of technology, the corporate trend towards mergers, coupled with downsizing, and greater micromanagement, have collectively helped to create a more demanding work envi...
Distinguishing work versus emotional exhaustion

Two types of employee exhaustion have been examined in the burnout literature: emotional exhaustion and, more recently, work exhaustion. Emotional exhaustion is primarily due to extensive job-required interpersonal contact, while general work exhaustion has wider application to all types of jobs. Moore has defined work exhaustion as: “the depletion of emotional and mental energy needed to meet job demands”. Therefore, work exhaustion is meant to encompass emotional exhaustion. Given the wide variety of the nurses sampled in this study, it will be argued that work exhaustion was the more appropriate measure to use.

Many researchers have argued that emotional or work exhaustion is the key component to experiencing burnout, as well as the first stage of the burnout process. Moore has argued that work exhaustion should be studied as a “stand alone” outcome. Work exhaustion has been empirically linked to higher job turnover intention for information technology professionals. The meta-analysis of Lee and Ashforth showed that emotional exhaustion was significantly related to increased turnover intention.

Role of leader-member exchange in reducing work exhaustion

Leader-member exchange (LMX) theory has argued that supervisors do not use the same style in dealing with all their subordinates, but instead develop different types of relationships or exchanges, including low LMX (based strictly on formalised employment contracts and job descriptions) to high LMX (characterised by mutual trust, emotional support, respect and reciprocal influence). LMX is typically measured from the subordinate perspective; while supervisor perceived exchange (SLMX) can also be measured. Prior research has found many positive outcomes for higher LMX levels, including greater job satisfaction and commitment, stronger performance appraisal ratings, and lower stress. Work exhaustion is one kind of stress. Most empirical LMX research, including studies already cited, also focus on Westernised country samples from Europe and the United States (for a recent exception, working with a Chinese work sample, see Aryee & Chen).

Although less empirical research has directly tested the specific relationship of LMX to work exhaustion, a negative relationship would be expected. Based on the conservation of resources theory of Hobfoll, LMX would be conceptualised as a resource condition, where a resource is defined as “any object, condition, personal characteristic or energy that is valued or serves as a means of obtaining resources that are valued”. This theory suggests that work exhaustion can occur when resources, such as LMX, are lost or perceived to be inadequate. Related research has found consistent negative relationships between supervisor support and emotional exhaustion across different Westernised country samples of teachers, police officers, social workers, nurses and other health care professionals. It seems logical that higher LMX subordinates would have less work exhaustion because potential stressors such as demands and task overload are mitigated by higher levels of support from one’s supervisor. Using a large sample of Dutch university employees, Bakker, Demenrouiti and Euwena found that the quality of the relationship of the subordinate with the supervisor was negatively related to exhaustion. This suggests the first hypothesis: H1 – LMX will be negatively related to work exhaustion.

Controlling for other correlates of work exhaustion

Prior research on emotional exhaustion suggests that demographics can affect work exhaustion, including gender (females higher), and work experience (positive). Prior research has not controlled for both organisational and professional (occupational) work experience. Although they are related, employees changing organisations generally happens much more frequently than employees changing occupations. For example, Bolles has pointed out that the average USA worker under 35 years of age will go job-hunting in a different organisation every one to three years, while over
35 year olds will go look for a change of organisations every five to eight years. Bolles also points out that many individuals will change occupations at least three times before exiting the work force.

Workload has been found to be positively related to emotional exhaustion. Consistent with the idea of increased education credentials often leading to increased workload responsibilities for health care professionals, education level was also controlled for, as a proxy for workload responsibilities. Thus, gender, organisational and professional (occupational) experience, and education level were controlled for in this study.

Most prior research on burnout is cross-sectional. Therefore, job satisfaction can also be conceptualised as a negative antecedent or correlate of work exhaustion, i.e., lower job satisfaction leading to higher exhaustion. To the authors’ knowledge, prior studies have not controlled for both job satisfaction and occupational satisfaction. Academic research on occupational satisfaction and leaving one’s occupation suggests that this is typically a much more difficult type of work transition (versus leaving one’s organisation) due to the greater costs of retraining and human capital investment, disrupted work relationships, and lost time and income, typically associated with occupational change. Thus both job satisfaction and occupational satisfaction were controlled for in this study.

Role conflict is positively related to emotional exhaustion. One type of role conflict is work interfering with family, which is also a demand on the individual. Cordes and Dougherty have argued that individual and organisational demands placed on employees are the key determinants of their exhaustion. Blau and colleagues found that work interfering with family was positively related to work exhaustion for medical technologists working in the USA. Work interfering with family was therefore also controlled for. Cumulatively, this suggests the following second hypothesis: H2 – LMX will have a significant impact on explaining work exhaustion beyond the controlled for correlates of gender, organisational experience, occupational experience, education level, job satisfaction, occupational satisfaction and work interfering with family.

METHODS

The sample consisted of nurses working at Sultan Qaboos University Hospital (SQUH), a large teaching hospital in the Sultanate of Oman. Heads of various nursing departments in the hospital were asked to distribute surveys to the nurses in their departments. As a token of appreciation for completing the survey, a packet of candy was given to each department. A box was provided in the nursing superintendent’s office for submitting completed surveys. Out of 448 surveys distributed, 275 completed surveys were returned, giving a response rate of 61.38%. However, due to missing values, the final sample used for analysis consisted of 229 nurses (51.12%). We were surprised to learn during survey pre-distribution and working with hospital administration that so many of the nurses were non-Omani or expatriates. Therefore, we decided to control also for expatriate status in the measures section. Most of the expatriate nurses were from India and the Philippines, with a smaller proportion of ethnic Chinese Malaysians. Due to the international nature of the nursing and other hospital staff, English was the official language of the hospital and proficiency in English was a requirement of employment.

Work exhaustion was measured using a six-item measure based on previous research. Copyright restrictions and cost associated with the Maslach Burnout Inventory, as well as survey length constraints and the diversity of nursing grades across shifts sampled, made using this general exhaustion measure more appealing. Subsequent reliability analyses, including item-total statistics (Statistical Package for the Social Sciences, SPSS-PC, version 14), indicated that one item from the work exhaustion measure, “I am often tired or fatigued”, had a lower squared multiple correlation with the other five items, and that deleting this item would improve the alpha or internal consistency of the scale. Accordingly, this item was removed and five items were retained. Sample retained items are: “my job demands too much from me”, and “at times I feel like giving up at my job”. These retained items are more consistent with the definition of work exhaustion suggested by Moore, “the depletion of emotional and mental energy needed to meet one’s job demands”, while the deleted item focuses more on physical energy. Unless otherwise noted, all multi-item scales used a 6-point response scale, where: 1 = strongly disagree; 2 = disagree; 3 = slightly disagree; 4 = slightly agree; 5 = agree and 6 = strongly agree.

Leader-member exchange was measured using Version 6 of the LMX scale, which is a seven item measure and well accepted in the LMX literature. A sample item is: “my supervisor understands my prob-
lems and needs”.

The control variables were as follows: gender was measured by indicating 0 = male, 1 = female; organisational experience was measured by asking, “you have worked for SQUH for...” (which category): 1 = less than one year, 2 = 1-5 years, 3 = 6-10 years, 4 = 11-20 years, and 5 = more than 20 years; occupational experience was measured by asking, “you have been a nurse for...” and the above same 5 categories were used; expatriate status was measured by asking, “you are”: 0 = Omani, 1 = Expatriate; education level was measured by asking respondents to “check their level of professional qualification”, using the following choices: 1 = diploma; 2 = diploma plus post-basic specialisation certificate; 3 = bachelor’s degree, and 4 = masters’ degree. The diploma is the basic qualification for being a nurse. However, the education level attained is also affected by the expatriate status variable. For example, the qualification of Omani nurses is a diploma, awarded by the Omani Institute for Health Services, while the Indian nurses working at the hospital would have received a bachelor’s degree based on their training in India. Due to survey constraints, job satisfaction was measured using a three-item measure based on Cammann, Fichman, Jenkins & Klesh.32 A sample item is: “in general, I like my job”. Occupational satisfaction was measured by creating a parallel three-item measure, again due to survey constraints. A sample item is: “overall, I like working in the nursing profession”. Work interfering with family was measured using the four-item measure developed by Gutek and colleagues. A sample item is: “my work takes up time that I would like to spend with family/friends or just relaxing by myself”.

Beyond these formal control variables, we need to comment on shifts. Shift work research, on Westernised country samples, has generally shown that nurses on rotating shifts have higher job stress than nurses on fixed shifts.33, 34 However, in the Omani hospital studied, all nurses were on “permanent rotation”, i.e., everyone worked a few days of night shift, then a morning shift, and then an evening shift and so on. Thus, the current shift data we collected was very temporary. We did not control for shift as part of formally testing
Table 2: Hierarchical Regression for Explaining Work Exhaustion

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Note. N = 229, *p < .05; **p < .01 (two-tailed)

H2 because of additional missing data for this variable. However, to check for the potential impact of the current shift a separate series of t-tests was performed. These tests revealed that the current shift (morning versus evening versus night) did not affect work exhaustion.

RESULTS

GENERAL

Table 1 presents the means, standard deviations, scale reliabilities, and correlations for all study variables. Inspection of the scale indicates that nurses were overwhelmingly female expatriates, with high levels of job satisfaction, occupation satisfaction and leader-member exchange. This sample had prior occupational experience to that with their present employer. All multi-item scale reliabilities were over .70. Correlation results suggest that increased education level is associated with decreased job satisfaction and occupation satisfaction. Job satisfaction and occupation satisfaction, while highly related, show less than 50% overlap (r = .70), and will be retained as distinct variables. Consistent with the LMX literature, job satisfaction is positively related to LMX (r = .43). Consistent with the exhaustion literature, job satisfaction is negatively related to work exhaustion (r = -.49).

TESTS FOR HYPOTHESES

The results in Table 1 support Hypothesis 1(H1), LMX is negatively related to work exhaustion, r = -.36 (p < .01). Hierarchical regression analysis was used to test H2, and the results are shown in Table 2.

Controlled-for correlates were stepped into the regression equation as follow: Step 1 - gender, organisational experience, occupational experience, education level, and expatriate status; Step 2 - job satisfaction and occupational satisfaction; Step 3 - work interfering with family, and Step 4 - LMX. The results show that LMX results in a very modest but still significant increase. (B = -.18, change in R² = 1%, p < .05) in explaining work exhaustion, beyond these controlled-for correlates. As such these results support H2. Overall 41% (p < .01) of the variance in work exhaustion was accounted for.

DISCUSSION

Using a unique sample of nurses in Oman and a powerful collective set of control variables, this study found that leader-member exchange (LMX) had a significant impact on reducing work exhaustion. As noted earlier, research testing LMX and work exhaustion variables in non-Western samples is less prevalent. As described earlier, the expatriate nurses came from
India, the Philippines and a smaller proportion from Malaysia. To the authors’ knowledge, research has not tested for the impact of LMX on work exhaustion using a research design with as many relevant control variables. Particularly in health care settings, where burnout and work exhaustion are too often found, the importance of a perceived higher quality work relationship with one’s supervisor in reducing perceived exhaustion cannot be underestimated.

There are some limitations to this study. From a measurement perspective, the high mean levels for the job and occupation satisfaction and LMX variables, while reassuring to the participating hospital, undoubtedly contributed to lower correlational findings through restriction of range. Survey length constraints necessitated using proxy variables, such as education level for increasing task responsibilities. Future research directly testing the relationship of task responsibilities to work exhaustion and burnout is needed. Such constraints also necessitated using very short measures of job satisfaction and occupational satisfaction. Although adequate reliabilities were found for both measures, testing the robustness of findings using more common job satisfaction measures, such as the Job Diagnostic Survey is recommended.

As noted earlier, work exhaustion was only partially measured, due to cost and survey length, and broader sample applicability issues. The measure of work exhaustion used demonstrated strong internal consistency (alpha = .81) and has been previously used. Certainly testing for the impact of LMX on overall burnout and its specific components, emotional exhaustion, depersonalisation, and diminished personal accomplishment would be useful. While the Maslach Burnout Inventory or MBI is still the most common measure of overall burnout, and its components, problems have been noted with the MBI and alternative measures do exist. Studying the relationships of LMX to different types of burnout and its component measures is clearly needed in other health care organisation settings.

A limitation of the research design is the focus on one demand, work interfering with family. Given more survey space, it would have been desirable to have focused on other demands such as physical and emotional work demands. Bakker and colleagues found some support for quality of relationship with one’s supervisor significantly interacting with work demands to decrease work exhaustion, which is consistent with the Demand-Control Model of Karasek. Unfortunately, we did not find that LMX interacted with work interfering with family to affect work exhaustion. Casting a ‘broader net’ of work demand variables, to test for such interactive effects would have been useful, and is highly recommended for future research.

All data was collected at one point in time so that causal inference is limited. In addition, there is a common method variance problem since all data is self-report. Future research testing the impact of LMX on work exhaustion by assessing supervisor-perceived exchange or SMLX is also needed. In order to test for the impact of common method variance on our results, we performed the Harman one-factor test. If such a test shows that the majority of the covariance between independent and dependent variables loads on one factor, then method variance is a problem. We factor analysed all study variables and found seven factors with eigenvalues over one, including the first factor which only accounted for 28% of the cumulative covariance. Given that our ratio of number of study respondents to total number of items in the scale of 229/27 (almost 9:1) was far over the minimum recommended of 5:1 for stable factor analysis, we are confident that method variance alone is not driving our results.

Future research designs working with LMX, work exhaustion, and burnout in health care organisation settings should include other antecedent and outcome variables. For example, Lapierre, Hackett and Taggar recently found that the reverse of work interfering with family (WIF) which is measured as family interfering with work (FIW), has a negative relationship to LMX. Using a longitudinal research design and a sample of Spanish teachers, Carmona, Buunk, Peiro, Rodriguez and Bravo found that social comparison and coping style affected self-reported burnout over time. More specifically, the social comparison of downward identification, e.g., “when I see colleagues who are doing worse, I experience fear that my future will be similar”, was positively associated with burnout, while using a direct coping style, e.g., “planning ahead”, was negatively associated with burnout. In addition, the implication of work exhaustion and burnout for motivating health care professionals to change their occupations makes it important to continue to study in non-Westernised countries. Though the nurses were of different nationalities, we grouped them together as expatriates. Perhaps future studies can examine if there
are national differences in the relationship between the quality of relationship with a supervisor and work exhaustion. Future studies could also use qualitative methods to uncover the nuances of the relationship between supervisors and employees and their effects on perceived work exhaustion.

**CONCLUSION**

As already noted, from a practical implications perspective, this study shows the importance of a perceived higher quality work relationship with the supervisor in reducing perceived work exhaustion. Prior research strongly suggests that work exhaustion is the key component to experiencing burnout, as well as the first stage of the burnout process. Therefore a high quality work relationship with the supervisor may help to prevent burnout among health care professionals. We were surprised at the high ratio of expatriate to Omani nurses who participated in the study. Staffing requirements for many types of organisations, including health care, may necessitate the need to hire and retain expatriates. Given the overwhelming percentage of expatriates comprising our sample (93%) we were not able to realistically test the impact of expatriate status on work exhaustion. To the extent that burnout may be more prevalent among expatriates, due to work and non-work factors (e.g., cultural differences in work settings, less family support), this is important for future research. Finally, work exhaustion and burnout may have negative implications for employee and patient safety in health care organisations. We hope this paper stimulates follow-up research on such issues.

**REFERENCES**


ABSTRACT

Objectives: The corneal disease is a priority problem in Oman. We present patients with contact lens (CL) induced severe keratitis, admitted in the corneal unit of Al Nahdha Hospital in Oman.

Methods: The study was conducted in 2005-2006. Ophthalmologists examined the eyes using slit lamp bio-microscope. Visual acuity was noted using Snellen's distance vision chart. Specimens of corneal scraping and CLs were sent for culture and sensitivity tests. Patients with severe keratitis were admitted and treated with medicines. Corneal and visual statuses were noted at the time of discharge from hospital and after six weeks. Numbers, percentages and their 95% confidence intervals were calculated. Pre- and post-treatment vision were compared using a scattergram.

Results: The 52 eyes of 15 males and 37 female patients with corneal ulcers were examined. Thirty-two patients were between 20 to 30 years of age. Only 13 (25%) patients had visited an ophthalmologist within 24 hours of developing severe keratitis. Seventeen (33%) had central ulcers and six (11.5%) had ulcer ≥5 mm in size. *Pseudomonas* was found in 29 (55.8%) of CL and corneal material scraped from the eyes of 15 (28.8%) patients. Vision was <6/60 (legally blind) in 12 (23.1%) eyes before and in five (9.6%) eyes after treatment. Twenty-six (50%) patients were lost to follow up. Conclusion: CL related severe keratitis causes visual disabilities. Prevention and proper records are essential. Treatment improves vision and hence facilities for management should be strengthened.

Key words: Contact lens; Corneal blindness, Keratitis; Prevention of blindness; Refractive error.
Bacterial keratitis, although rare, is potentially the most devastating complication of contact lens (CL) wear. The occurrence is more common in soft lens wearers and extended wear of CLs increases the incidence 10 to 15 fold. The causes of severe keratitis could be: 1. low knowledge and skills among CL providers; 2. poor quality of the product and/or 3. misuse of lenses by the user. Whatever the cause, the sufferer is certainly the cornea and the patient. Prompt treatment is essential and, even after proper treatment, sequelae may compromise the quality of vision.

Conflicting reports suggest trends both of rising and declining incidence of CL induced keratitis. The popularity of coloured CLs has increased among younger generations in recent years. Carelessness and abuse of CL wear could result in catastrophic blindness if proper steps are not taken; hence, the American Academy of Optometry has stressed the need to impart knowledge both about the advantages of CL system and about the risks if the care of CLs is neglected.

In Oman, CL practice is the domain of private sector opticians and ophthalmologists. The National Eye Health Care Committee recently introduced a programme approach to minimise adverse events related to CL wear.

We did not find any literature on CL related complications in Middle Eastern countries. In Oman, like other Gulf countries, the climate is not conducive to sustained and healthy tear film and, at the same time, the use of the CLs is on the increase. Hence, we reviewed the cases of CL induced severe keratitis that were admitted in the cornea unit of Al Nahdha Hospital, a tertiary hospital in Oman. The profile, clinical presentation, modalities of treatment and visual status are here presented.

**METHODS**

This study was a retrospective descriptive study in which ophthalmological hospital records were reviewed. It was approved by the ethical and research committee of Al-Nahdha Hospital. In this series, we included patients that were admitted in the cornea unit of the hospital between January 2005 and December 2006. Three senior ophthalmologists of the cornea unit were our investigators.

The computerised case records of these patients were used to generate relevant information. An agreed protocol is used by ophthalmologists of the cornea unit in all cases of corneal ulcer. The history included duration of using the present CLs, initial symptoms, treatment before admission, sharing of CLs and CL hygiene practices. Eyes with acute onset of keratitis, involving the visual axis or with hypopyon, were considered to suffer from sight threatening condition and such patients were admitted into the hospital.

The visual acuity of each eye of the patient was noted using Snellen’s illiterate ‘E’ chart, held at a six metre distance from the patient. If the patient could not open the eye due to blepharospasm or photophobia, one drop of 0.4% oxybuprocaine hydrochloride (minims) was instilled. If the person could not identify the ‘E’ in the top line, the test was repeated at a three metre distance. The projection of light and perception of light rays were tested in all four quadrants for those who could not be tested for visual acuity even at 3 metre distance. The fluorescein minims were used and the corneal ulcer was observed using a slit lamp biomicroscope. The size of the ulcer was measured using a grid. The ulcer was graded as ‘less than 3 mm’, ‘3 to 5 mm’ and ‘more than 5 mm in size’. The location

- Pseudomonas organisms were mainly responsible for corneal ulcer in our patients. Corneal ulcer due to acanthomoeba was not found in our series.

**Application to Patient Care**

- Materials should be collected from corneal scraping and CLs for culture and sensitivity tests before starting antibiotic treatment.
- Until the report of culture and sensitivity is available, one should assume that keratitis is due to pseudomonas and antibiotics should be given accordingly.
- Proper records of the extent of keratitis and visual acuity are useful to evaluate the response to treatment.
of the ulcer was designated ‘central’ if it covered the pupil, ‘para-central’ if it partly covered the pupil or ‘peripheral’ if the central cornea that covers the pupil was not affected. The presence of hypopyon was grouped according to its level in the anterior chamber, the categories being: <1/3, between 1/3 and ½ and more than half of the anterior chamber.

The CLs were sent to the laboratory for culture and sensitivity tests. Minims of oxybuprocaine hydrochloride 0.4% were used to anaesthetise the cornea. The culture specimen was obtained from the edge and the bed of the ulcer. The material was inoculated on culture media (blood agar, chocolate agar, Sabraud’s agar, MacConkey agar, brain-heart- infusion broth); gram and potassium hydroxide staining was carried out and subsequently culture and sensitivity tests were performed.

The patients with severe keratitis were treated with wide spectrum antibiotics. In the presence of hypopyon, 1% atropine eye drop was instilled for cycloplegia and oral acetazolamide (250 mg four times a day) was given if the intraocular pressure was raised. The antibiotic was changed subsequently according to the culture and sensitivity report. When staining was negative and the ulcer was healed, the person was discharged. Information on the status of vision and the cornea were noted before sending patients home and during the follow up at one and six weeks. The eye examination methods were similar on admission and follow up. The patient was advised not to use CLs for the next 3 to 6 months depending upon size and severity of the ulcer. Health education was given for the care of CLs. All details were recorded in computerised case records.

A pre-tested data collection form was used to gather information from the case records. Personal logbooks of corneal specialists of the unit were also referred to. The data was then entered into a Microsoft XL spreadsheet. It was converted to the Statistical Package for Social Studies (SPSS-12) and a univariate parametric type of analysis was carried out to calculate frequencies and percentage proportions. For statistical validation, we used 95% confidence intervals (95% CI) of percentage proportions.

All patients with severe keratitis were treated free of cost. Their identities were de-linked from the results at the time of analysis. The authors presented the outcomes of this study in a national ophthalmic meeting to increase the awareness and knowledge among the CL practitioners and ophthalmologists of Oman.

**RESULTS**

Fifty-two patients had corneal ulcers in their eyes (18 in the right eye, 27 in the left eye and 7 in both eyes). The profile of the patients with keratitis is shown in Table 1. Thirteen (25%) patients had approached a cornea clinic within 24 hours and 17 (32.7%) patients had used antibiotics before visiting our institution. Twen-
ty-six (50%) patients had not used antibiotics, while in nine (17.3%) patients, this information was not available.

In our institute during the same period, 177 patients with corneal ulcers were admitted. The proportion of CL induced corneal ulcer to the total cases of corneal ulcer was 29.4%.

Daily wear is common and extended wear soft lenses and disposable CLs are extensively used in Oman compared to hard CLs which are rarely used. Therefore, we can safely assume that all the patients with keratitis in our series wear soft lenses.

The salient features of the corneal ulcers in our series are given in Table 2. One fourth of patients had peripheral ulcers. Only 35 (67.3%) patients had brought their CLs with them to be tested for bacterial growth and antibiotic sensitivity. Thirty-seven (71.2%) patients were treated with fortified gentamycin (14mg/ml) and fortified cefuroxime (50mg /ml) eye drops, while in twelve (23%) patients ofloxacin eye drops were used. Three (6%) patients were treated with ofloxacin and other fortified drugs (fortified gentamycin/fortified amikacin). Fourteen (30%) patients were admitted for three days, nineteen (36.5%) patients were admitted for one week and nine (17.3%) patients were in the hospital for two weeks. Six (11.5%) patients left hospital against medical advice before completing the treatment.

Visual acuity was tested in the eye with keratitis on admission and at the time of discharge. Twelve (23%) eyes of 52 patients with severe keratitis had visual acuity of <6/60 (legally blind) at the time of admission. In contrast, only five (9.6%) eyes of 52 patients had visual acuity of less than 6/60 following the management of severe keratitis. A percentage scattergram comparing pre- and post-treatment vision is given in Table 3. In one eye only, the vision deteriorated following treatment. After leaving the hospital, 13 (25%) of patients did not return for follow up. Only 16 (30.7%) patients had been followed up after 3 months. Twenty-eight (53.8%) patients were advised to continue ofloxacin eye drops even after leaving the hospital. Another 18 (34.6%) patients were given the gentamycin eye drops in addition to the ofloxacin eye drops. Twenty-one (40.4%) patients were also given lubricant eye drops. Topical steroids were used in treatment of only 8 (15.4%) patients. The status of the corneas following treatment is given in Table 4. Nearly half of the patients treated for severe keratitis were advised to use spectacles to correct their refractive error.

| Table 2: Characteristics of ulcers in eyes of patients with contact lens induced severe keratitis |
|---------------------------------|----------------|----------------|
| Corneal ulcer                  | Number of eyes | Percentage |
| Location                       |                |            |
| Central                        | 17            | 32.7       | 29.6 - 35.8 |
| Paracentral                    | 21            | 40.4       | 37.5 - 43.3 |
| Peripheral                     | 14            | 26.9       | 23.7 - 30.1 |
| Size                           |                |            |
| <3 mm                          | 39            | 75.0       | 73.1 - 76.9 |
| 3 to 5 mm                      | 6             | 11.5       | 8.0 - 15.0  |
| 6 mm and more                  | 6             | 11.5       | 8.0 - 15.0  |
| Hypopyon                       |                |            |
| Absent                         | 42            | 80.8       | 79.1 - 82.5 |
| 1/3 to ½ of anterior chamber   | 9             | 17.3       | 13.9 - 20.7 |
| >1/2 of anterior chamber       | 1             | 1.9        | 0.0 - 5.6   |
| Culture of corneal scraping    | Gram staining |            |
| No growth                      | 35            | 67.3       | 65.1 - 69.5 |
| Gram +ve cocci                 | 1             | 1.9        | -1.8 - 5.6  |
| Gram – ve bacilli              | 4             | 7.7        | 4.1 - 11.3  |
| Not done / Missing             | 12            | 23         | 19.7 - 26.3 |
| Culture                        |                |            |
| No growth                      | 28            | 53.8       | 51.2 - 56.4 |
| Pseudomonas                    | 15            | 28.8       | 25.6 - 32.0 |
| Missing                        | 9             | 17.3       | 13.9 - 20.7 |
| Culture of contact lens        | Pseudomonas   | 29          | 55.8       | 53.3 - 58.3 |
| Other                          | 4             | 7.7        | 4.1 - 11.3  |
| No growth                      | 2             | 3.8        | 0.1 - 7.5   |
| Not done                       | 17            | 32.7       | 29.6 - 35.8 |
Our study highlights the importance of reviewing CL induced severe keratitis. Eighty percent of our patients were less than 30 years of age. It is known that even after successful treatment of severe keratitis, corneal opacities will be unavoidable thus causing visual impairment, which could be a social and economic disaster at such a young age. Fortunately, vision improved in all except in one case in our study. Thus, prompt and standard treatment of severe keratitis is crucial to prevent visual disabilities.

*Pseudomonas* was the main organism found in CLs used in the eyes of patients with corneal ulcer in our study. Surprisingly, we did not come across keratitis due to *Acanthamoeba*, but the fact that nearly 50% of the sample were ‘without growth’ after laboratory tests in our study is worthy to note. The ulcers were mainly in the visual axis and were of < 3 mm diameter. The main characteristics of the patients in our series were: a majority of female patients; age range from 20 to 30 years; coming for treatment in the early hours of the day 24 hours after symptoms appeared.

Unfortunately, a large number of cases were lost to followup and therefore we could not compare visual recovery in nearly 48% of cases. Loss of data and patients in follow up visits are known limitations of a study based on data review. Therefore, correlation of visual impairment to the categories like causative organisms or age group could not be attempted. Further studies of a prospective nature with a larger sample are recommended.

To the best of our knowledge, this study was the first of its kind in the Gulf countries. Since complication due to CL wear is a problem of the young generation, the loss of DALYS (disability adjusted life years) will be high. In spite of treatment, it could cause unilateral blindness and/or low vision. In these circumstances, the outcomes of our study would be important not only to Oman but also to many other countries having a similar CL delivery system.

Oman has prioritised corneal diseases within its Vision 2020 initiative. Corneal complications contributed to 14% of blindness in the population aged >40 years in 2005. The majority of them were due to corneal complications of trachoma. Trachomatous trichiasis has declined in the last decade. However, the cornea is now at a higher risk due to the increased use of CLs in Oman. The scope for using CLs is large in Oman since the prevalence of myopia in 16 to 17 years old school children is as high as 12% and the compli-

### Table 3: Percentage Scatter gram: Initial and final visual acuity in eyes treated for contact lens induced severe keratitis

<table>
<thead>
<tr>
<th>Initial Visual Acuity</th>
<th>6/6 (7)</th>
<th>6/9 (0)</th>
<th>6/12 (5)</th>
<th>6/18 (3)</th>
<th>6/24 (4)</th>
<th>6/36 (3)</th>
<th>6/60 (8)</th>
<th>&lt;6/60 to 3/60 (7)</th>
<th>&lt;6/60 - PLPR+ (5)</th>
<th>Missing (10)</th>
<th>Total (52)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Follow up Visual acuity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6/6</td>
<td>1.9</td>
<td></td>
<td>3.8</td>
<td>5.8</td>
<td>3.8</td>
<td>5.8</td>
<td>11</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6/9</td>
<td></td>
<td>1.9</td>
<td>1.9</td>
<td>1.9</td>
<td>1.9</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6/12</td>
<td></td>
<td>1.9</td>
<td></td>
<td>1.9</td>
<td></td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6/18</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.9</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6/24</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3.8</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>6/36</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.9</td>
<td></td>
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<td>1</td>
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<tr>
<td>&lt;6/60 to 3/60</td>
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<td></td>
<td>1.9</td>
<td>2</td>
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<tr>
<td>&lt;3/60 to PLPR +</td>
<td>1.9</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>1.9</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not known</td>
<td>5.7</td>
<td>1.9</td>
<td>3.8</td>
<td>3.8</td>
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<td>5.8</td>
<td>5.8</td>
<td>5.8</td>
<td>5.8</td>
<td>5.8</td>
<td>24</td>
</tr>
</tbody>
</table>

PL = Perception of light; PR = Projection of light
The proportion of spectacle wear is only 70%.\textsuperscript{10, 11} In industrialized countries, it has also been noted that the proportion of severe keratitis due to CL wear has increased the total number of cases of corneal ulcer needing admission by up to 50%.\textsuperscript{12} Thus, awareness campaigns targeting these potential patients could use the information of our study to warn them of the consequences of abusing CLs.

CL induced keratitis was 30% of total admissions in our institute. This rate was close to the 33% reported by Keay et al.\textsuperscript{13} \textit{Pseudomonas} was the main organism responsible for severe keratitis. Many other researchers have also noted these organisms as the main culprit of keratitis.\textsuperscript{14, 15} We found bacteria both in the sample collected from the corneal ulcer and from the CL. Mela et al., in their study, demonstrated the importance of sending both the material from corneal scraping and from the CLs for culture.\textsuperscript{16} Hence, it is important to inform the family physician or optician referring the case to ensure that the patient is sent with the CLs when the case is referred for admission and care. We found four cases with gram negative bacilli and one case of gram positive cocci. But, we could not carry out culture and sensitivity tests for them as we could not culture them on artificial media and test for sensitivity. Inoue et al. noted gram positive and gram negative bacteria and fungi and acanthamoeba in their specimen.\textsuperscript{17} A study in Belgium, reported \textit{pseudomonas} as the main culprit of CL induced severe keratitis.\textsuperscript{18}

Only 25% of our patients had consulted an ophthalmologist within 24 hours of development of symptoms showing that further strengthening of the reference system is therefore urgently needed. Opticians and family physicians should be educated about the problems related to CL use and need for prompt treatment by experts to avoid sight-threatening complications. Under the guidance of cornea specialists, a standard management protocol should be prepared to be followed by all ophthalmologists and CL practitioners. A large number of samples with ‘no growth’ after laboratory tests could be due to the use of antibiotics before the collection of the sample. The referring practitioners should be aware of the need to collect the sample both from the cornea and the lenses before commencing antibiotic treatment. Central corneal ulcers and peripheral ulcers can be due to different causes and organisms.\textsuperscript{19} In our study also, we noted that central ulcers of more than 5 mm in size were due to \textit{pseudomonas} organisms. However, gram negative organisms were noted in samples from both paracentral and peripheral keratitis. Twenty eight (53.8%) of laboratory tests reported ‘no growth’, hence associating the site of ulcer to the type of organisms should be done with caution in our study.

We could avoid perforation and its sequelae by good treatment; however, the vision remained < 6/60 due to corneal opacities in five (19%) patients. Visual acuity following successful treatment of CL induced corneal ulcer in another study was < 20/200 in two out of nine cases in a group of myopic persons using soft CLs.\textsuperscript{20} Adam et al. studied complications in persons using cosmetic CLs and found that one out of six eyes were blind after treatment.\textsuperscript{21} A study with a larger sample is recommended to confirm these observations.

A limitation of our study is that patients presenting with mild corneal ulcers that were treated in clinics and not admitted into hospital were not included in

### Table 4: Corneal status and suggested correction following treatment of contact lens induced severe keratitis.

<table>
<thead>
<tr>
<th>Location of opacity</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central</td>
<td>11</td>
<td>21.2</td>
</tr>
<tr>
<td>Paracentral</td>
<td>11</td>
<td>21.2</td>
</tr>
<tr>
<td>Peripheral</td>
<td>8</td>
<td>15.4</td>
</tr>
<tr>
<td>No opacity</td>
<td>7</td>
<td>13.5</td>
</tr>
<tr>
<td>Missing</td>
<td>15</td>
<td>28.8</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Treatment of sequel</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Keratoplasty</td>
<td>4</td>
<td>7.8</td>
</tr>
<tr>
<td>No keratoplasty</td>
<td>24</td>
<td>46.1</td>
</tr>
<tr>
<td>Missing information</td>
<td>24</td>
<td>46.1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Advice for correcting refractive error</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>To continue contact lens</td>
<td>4</td>
<td>7.7</td>
</tr>
<tr>
<td>Use of spectacles</td>
<td>12</td>
<td>25</td>
</tr>
<tr>
<td>Undergone refractive surgery</td>
<td>1</td>
<td>1.9</td>
</tr>
<tr>
<td>Missing</td>
<td>1</td>
<td>1.9</td>
</tr>
</tbody>
</table>

**Table 4:** Corneal status and suggested correction following treatment of contact lens induced severe keratitis.
our study. Although computerised case records were useful, a switch from manual to computer records coincided with our study period. This could have affected our study as the learning curve of the ophthalmologists in using the computerised system may have resulted in incomplete data. Our study was retrospective in nature; hence, the attrition of cases following discharge and loss of data were inherent limitations. Thus, the results of our study are limited to CL induced severe keratitis that needed treatment under supervision. Therefore, any attempt to extrapolate the result of our study should be undertaken with due caution.

CONCLUSION

Our study suggests that vision improves following prompt and standard treatment of CL induced severe keratitis. Prompt referral, standard management, regular follow up and proper case records are essential. In view of the high rate of corneal ulcers in CL wearers, CL dispensing practice in Oman should be monitored. Ophthalmologists, CL providers and CL users should work jointly to solve this issue.

ACKNOWLEDGMENTS

We thank the staff of the Ophthalmology Department at Al Nahdha Hospital for all their assistance and care of the patients. We also thank the staff of the health record section there. The hospital administrators gave their permission for this study and we appreciate their cooperation. We thank the patients and their relatives who in spite of their suffering gave their consent to use the information for improving eye care. We are grateful for their cooperation and support.

The authors did not have any conflicts of interest (financial or other) in conducting this study.

The subject was presented in International Ophthalmology Conference in February 2007 in Muscat, Oman.

REFERENCES


Serum Copper, Zinc and Copper/Zinc Ratio and their Relationship to Age and Growth Status in Yemeni Adolescent Girls

*Raba’a M Jumaan

ABSTRACT

Objectives: As no previous study has evaluated copper and zinc status in adolescent Yemeni girls, the purpose of this study was to measure their serum levels of zinc and copper and to examine the relationship between the serum levels of these two trace minerals with age, and anthropometric parameters. Methods: The study was conducted in April 2007 in Alwehda district in the municipality of Sana’a, Yemen. One hundred and fourteen adolescent girls were selected using systematic stratified sampling from a representative school which was randomly selected. Anthropometric indices were measured and blood samples were collected for biochemical analysis. Results: The mean ± SD for copper, zinc, and copper/zinc ratio for the entire cohort were 17.47 ± 3.31 µmol/L, 12.24 ± 1.04 µmol/L, and 1.44 ± 0.31, respectively. The prevalence of hypocuprema was 4.4% and hypercuprema was 2.6%. The levels of zinc were marginal in 96.5% of the girls and the prevalence of hypozincemia was 3.5%. The levels of copper were significantly higher (p = 0.007) and the levels of zinc were significantly lower (p = 0.003) in the 10-12 yrs girls than in other age groups. Height showed significant negative correlation with the levels of copper (p = 0.01) and significant positive correlation with the levels of zinc (p = 0.008). Conclusion: The results revealed that the Yemeni girls had marginal serum zinc levels, and 10-12 yrs girls had significantly lower zinc levels than other age groups. This provides a warning of consequent negative health effects since the physiological requirements for zinc are high in adolescence.

Key words: Copper; Zinc; Copper/zinc ratio; Growth; Adolescent girls; Yemen.
Dolescence is a period of intense physical growth and evidence from supplementation trials suggests that marginal zinc status may be common in adolescents and limit skeletal growth. Zinc and copper are essential trace elements involved in adolescent growth and development. Both copper and zinc have diverse physiological roles and the interaction between them was considered to be mutually antagonistic.

Zinc is required for the optimum function of as many as 300 enzymes. These metalloenzymes are involved in the metabolism of proteins, nucleic acids carbohydrates and lipids. They also influence gene transcription. Therefore, zinc is vital for growth and development, sexual maturation and reproduction, dark vision adaptation, olfactory and gustatory activity, insulin storage and release, and for a variety of host immune defense, among other things. Zinc deficiency can result in growth retardation, immune dysfunction, increased incidence of infections, hypogonadism, oligospermia, anorexia, diarrhoea, weight loss, delayed wound healing, fetal neural tube defects, increased risk of abortion, alopecia, decreased ethanol clearance, mental lethargy and skin changes.

Copper is necessary for growth development and maintenance of bone, connective tissue, the brain, the heart, and many other body organs. It is involved in the formation of red blood cells, the absorption and utilisation of iron, and the synthesis and release of life-sustaining protein and enzymes. Copper stimulates the immune system to fight infections, repairs tissues and promotes healing. Copper also helps to neutralize ‘free-radicals’ which can cause severe damage to cells. Deficiency in humans is rare, but it does occur under certain circumstances such as high intake of zinc or iron, increased requirement induced by rapid growth, and increased copper losses or decreased copper intake. In recent years, nutritionists have been more concerned about copper toxicity than copper deficiency. Some experts believe that elevated copper levels, especially when zinc levels are also low, may be a contributing factor in many medical conditions including schizophrenia, hypertension, stuttering, autism, fatigue, muscle and joint pain, headaches, childhood hyperactivity, depression, insomnia, senility, and premenstrual syndrome.

Studies have shown that zinc-induced alteration in other essential metals, especially copper, is responsible for the production of biological effects. A decreased plasma zinc level and increased plasma copper level have been reported in pregnancy, acute infections, malignancy, cardiovascular disease, renal disease, schizophrenia, and certain endocrine diseases such as acromegaly and Addison's disease. Therefore, the copper/zinc ratio is clinically more important than the concentration of each metal separately.

As shown above, it is important to assess the serum levels of copper and zinc, particularly in adolescents. The enhanced growth during adolescence makes the
Table 1: Descriptive data of the general characteristics of the Yemeni adolescent girls in the Alwehda district sample

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Number of girls (n)</th>
<th>Percent (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10-12</td>
<td>34</td>
<td>30.4</td>
</tr>
<tr>
<td>13-15</td>
<td>38</td>
<td>33.9</td>
</tr>
<tr>
<td>16-19</td>
<td>40</td>
<td>35.7</td>
</tr>
<tr>
<td>Total</td>
<td>112^a</td>
<td>100.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Stature-for-age percentile</th>
<th>Number of girls (n)</th>
<th>Percent (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 3rd</td>
<td>21</td>
<td>19.3</td>
</tr>
<tr>
<td>3rd</td>
<td>10</td>
<td>9.1</td>
</tr>
<tr>
<td>5th-10th</td>
<td>44</td>
<td>40.4</td>
</tr>
<tr>
<td>25th-75th</td>
<td>33</td>
<td>30.3</td>
</tr>
<tr>
<td>&gt;75th</td>
<td>1</td>
<td>0.9</td>
</tr>
<tr>
<td>Total</td>
<td>110^b</td>
<td>100.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>BMI-for-age percentile</th>
<th>Number of girls (n)</th>
<th>Percent (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;5th</td>
<td>16</td>
<td>14.8</td>
</tr>
<tr>
<td>5th-&lt;85th</td>
<td>85</td>
<td>78.8</td>
</tr>
<tr>
<td>85th-&lt;95th</td>
<td>4</td>
<td>3.7</td>
</tr>
<tr>
<td>&gt;=95th</td>
<td>3</td>
<td>2.8</td>
</tr>
<tr>
<td>Total</td>
<td>109^c</td>
<td>100.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Copper (µmol/L)</th>
<th>Number of girls (n)</th>
<th>Percent (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entire cohort &lt;12.56</td>
<td>5</td>
<td>4.4</td>
</tr>
<tr>
<td>12.56-29.83**</td>
<td>106</td>
<td>93.0</td>
</tr>
<tr>
<td>&gt;24.34</td>
<td>3</td>
<td>2.6</td>
</tr>
<tr>
<td>Total</td>
<td>114</td>
<td>100.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>10-12yrs</th>
<th>Number of girls (n)</th>
<th>Percent (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;12.56</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>12.56-29.83</td>
<td>34</td>
<td>100.0</td>
</tr>
<tr>
<td>&gt;29.83</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>34</td>
<td>100.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>13-19yrs</th>
<th>Number of girls (n)</th>
<th>Percent (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;12.56</td>
<td>5</td>
<td>6.4</td>
</tr>
<tr>
<td>12.56-24.34</td>
<td>72</td>
<td>92.3</td>
</tr>
<tr>
<td>&gt;24.34</td>
<td>1</td>
<td>1.3</td>
</tr>
<tr>
<td>Total</td>
<td>78^d</td>
<td>100.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Zinc (µmol/L)</th>
<th>Number of girls (n)</th>
<th>Percent (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;10.7</td>
<td>4</td>
<td>3.5</td>
</tr>
<tr>
<td>10.7-22.9*</td>
<td>110</td>
<td>96.5</td>
</tr>
<tr>
<td>&gt;22.9</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>114</td>
<td>100.0</td>
</tr>
</tbody>
</table>

^International reference range
**Extended normal reference range to include pre-adolescence reference range
^Two girls did not know their exact date of birth
^Four girls did not respond when they were called for weight measurement.
^Five girls were absent during height measurement.
requirement of these minerals of paramount importance. The present study was designed to determine the serum levels of copper and zinc in a randomly selected sample of Yemeni adolescent girls and to study associations between these minerals and some anthropometric indices.

**METHODS**

The study area was the Alwehda district, one of ten districts that exist in the capital city of the Republic of Yemen, Sana’a. The study subjects consisted of 114 apparently healthy girls aged 10-19 years. They were students in grades 4th-12th in a representative public school, randomly selected from a total of 5 public schools for girls that exist in that area. Twenty girls were chosen from each class using the school records by systematic sampling technique. From the 180 students selected, girls who were not in the age range of 10-19 years old were excluded. Girls with normal blood chemistry and haematology were included. Girls using vitamins and minerals supplements and girls suffering from chronic diseases were excluded. The purpose of the study was explained to the school administration and the parents of the students, and girls who did not obtain parental written consent were also excluded. Finally, 114 apparently healthy adolescent school girls were enrolled in this study. The study was approved by the Research and Ethics Committee at the Sana’a University and the ethical clearance was obtained before the study was started.

A face to face interview was conducted to record information regarding age, class level, health problems, any supplements or medications used, and menarcheal status. Anthropometric measurements were taken in school. The students were asked to remove heavy clothing and shoes. Weight was taking in kilograms using and electronic scale and height was measured using a stadiometer. Height and weight measurements were compared to the international reference values of the National Center for Health Statistics/Center for Disease Control and prevention (NCHS/CDC). Body mass index (BMI) was calculated by dividing the weight (kg) by square of height (m²). Under weight was defined as the CDC BMI-for-age percentile <5. Overweight was defined as BMI-for-age percentile ≥95 and those which fell between 85th and <95th percentiles were considered to be at risk of overweight. Stunting was defined as the CDC stature-for-age <3rd percentile, short stature <5th percentile, and long stature >75th percentile.

In April 2007, the girls were taken to Althawra General Hospital by bus in the early morning in groups of 15-30 girls each day for 5 days. Fasting blood samples (approx. 5ml) were collected in the morning between 9 and 11am at the laboratory department. Blood samples were drawn by venipuncture into vacutainer tubes and the samples were immediately centrifuged, after clotting, in patches of five clotted blood samples. The serum obtained was kept in freeze at -20 C until it was analysed 4 months later for serum copper and zinc. The metals zinc and copper were analysed by the direct colorimetric method using kits from Quimica Clinica Aplicada S.A. and analysed by the Hitachi 912 analyser. The colour reagent for copper was 3,5-DiBr-PAESA stain in acid solution. Copper is released from the ceruloplasmin protein and reduced; the cuprous ion forms a coloured complex with the stain and is measured photometrically at 582nm. The zinc ions of the sample produce a red coloured complex with 2-(5-Brom-2-pridylazo)-5-[-N-propyle-N-(3-sulfopropyl) amino]-phenol in alkaline solution, and the colour intensity was measured at 560nm. The normal reference values for the instruments for women were 80-155 µg/dl for copper and 68-115 µg/dl for zinc. The values obtained in µg/dl were converted to the international unit (µmol/L) using conversion factors (x 0.157 and x 0.153 for copper and zinc respectively).

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copper (µmol/L)</td>
<td>17.47</td>
<td>3.31</td>
<td>9.02</td>
<td>29.96</td>
</tr>
<tr>
<td>Zinc (µmol/L)</td>
<td>12.24</td>
<td>1.04</td>
<td>10.26</td>
<td>16.44</td>
</tr>
<tr>
<td>Copper/zinc</td>
<td>1.44</td>
<td>0.31</td>
<td>0.65</td>
<td>2.67</td>
</tr>
<tr>
<td>Zinc/copper</td>
<td>0.73</td>
<td>0.15</td>
<td>0.37</td>
<td>1.53</td>
</tr>
</tbody>
</table>

Table 2: The mean values and ranges of copper, zinc, and copper/zinc and zinc/copper ratios for the entire cohort (n = 114) of Yemeni adolescent girls in Alwehda district
Data were analysed using the Statistical Package for the Social Science (SPSS), Version 15. A Kolmogorov-Smirnov test for normality was performed and the means and standard deviations and prevalence were obtained by descriptive statistics. Data were analysed using the one way analysis of variance (ANOVA) followed by Tukey’s test to assess differences of continuous variable between two or more groups.

Pearson’s r coefficient was used to assess the correlation between two continuous variables. Statistical significance was assigned for p values less than 0.05.

RESULTS

The study subjects consist of 114 apparently healthy Yemeni adolescent girls. The mean age was 14.42yrs ± 2.71 and ranged from 10-19 years. The general characteristics of the girls according to age, anthropometric measurements, copper, and zinc concentrations are presented in Table 1.

Table 1 shows the percentage of girls with abnormal characteristics as compared to the international reference values. The results revealed that 96.5% of the girls had marginal serum levels of zinc and 68.8% of the girls were below the normal stature-for-age percentiles, of which 19.3% were stunted. Because the copper international normal reference range for pre-adolescent girls aged 10-12yrs was different from that for the older adolescent girls, separate descriptive data for copper were added in Table 1, and the normal reference value for the entire cohort was extended to cover both ranges. The mean levels and the ranges for copper, zinc, copper/zinc ratio, and zinc/copper ratio for the girls residing in Alwehda district are shown in Table 2.

For the entire cohort, the mean value for serum copper was normal (17.47 ± 3.31 µmol/L; 111.32µg/dL), and the mean value for serum zinc was at the lower edge of the normal value (12.24 ± 1.04µmol/L; 80.01 µg/dL), while the mean value for serum copper/zinc ratio was 1.44 ± 0.31 ranging from 0.65 to 2.67.

Table 3: The copper, zinc and cu/zn ratio of the Yemeni adolescent girls in Alwehda district according to the age category

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>Minimum</th>
<th>Maximum</th>
<th>p-value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copper (µmol/L)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10-12</td>
<td>34</td>
<td>18.66</td>
<td>3.51</td>
<td>14.16</td>
<td>29.96</td>
<td>0.002</td>
</tr>
<tr>
<td>13-15</td>
<td>38</td>
<td>17.65</td>
<td>3.30</td>
<td>9.02</td>
<td>26.48</td>
<td></td>
</tr>
<tr>
<td>16-19</td>
<td>40</td>
<td>16.34</td>
<td>2.87</td>
<td>11.71</td>
<td>23.83</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>112</td>
<td>17.49</td>
<td>3.33</td>
<td>9.02</td>
<td>29.96</td>
<td></td>
</tr>
<tr>
<td>Zinc (µmol/L)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10-12</td>
<td>34</td>
<td>11.80</td>
<td>0.78</td>
<td>10.26</td>
<td>13.85</td>
<td>0.094</td>
</tr>
<tr>
<td>13-15</td>
<td>38</td>
<td>12.61</td>
<td>1.19</td>
<td>11.06</td>
<td>16.44</td>
<td></td>
</tr>
<tr>
<td>16-19</td>
<td>40</td>
<td>12.25</td>
<td>0.96</td>
<td>10.54</td>
<td>15.07</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>112</td>
<td>12.24</td>
<td>1.05</td>
<td>10.26</td>
<td>16.44</td>
<td></td>
</tr>
<tr>
<td>Copper/zinc Ratio</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10-12</td>
<td>34</td>
<td>1.59</td>
<td>0.34</td>
<td>1.10</td>
<td>2.67</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>13-15</td>
<td>38</td>
<td>1.41</td>
<td>0.29</td>
<td>0.65</td>
<td>2.22</td>
<td></td>
</tr>
<tr>
<td>16-19</td>
<td>40</td>
<td>1.34</td>
<td>0.24</td>
<td>0.97</td>
<td>1.81</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>112</td>
<td>1.44</td>
<td>0.30</td>
<td>0.65</td>
<td>2.67</td>
<td></td>
</tr>
<tr>
<td>Zinc/copper Ratio</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10-12</td>
<td>34</td>
<td>0.65</td>
<td>.12</td>
<td>.37</td>
<td>.91</td>
<td>0.001</td>
</tr>
<tr>
<td>13-15</td>
<td>38</td>
<td>0.74</td>
<td>.17</td>
<td>.45</td>
<td>1.53</td>
<td></td>
</tr>
<tr>
<td>16-19</td>
<td>40</td>
<td>0.77</td>
<td>.13</td>
<td>.55</td>
<td>1.04</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>112</td>
<td>0.72</td>
<td>.15</td>
<td>.37</td>
<td>1.53</td>
<td></td>
</tr>
</tbody>
</table>

*aBased on Pearson’s correlation analysis test
bTwo girls were not included because they did not know their exact date of birth
When the girls were divided into three age categories, there was a statistically significant negative correlation between the age and the levels of copper ($r = -0.284$, $p = 0.002$), and the levels of copper tended to decrease with increasing age. Further analysis showed that copper levels were significantly lower in the 16-19 year old girls than the 10-12 year olds ($p = 0.007$) and there were no significant differences in the levels of copper between the 13-15 year olds as compared to the 10-12 year olds ($p = 0.383$) and the 16-19 year olds ($p = 0.179$).

Bivariate correlation analysis showed no significant correlation between the levels of zinc and the age of the girls ($r = 0.159$, $p = 0.094$). Further investigations with one-way analysis of variance (ANOVA) revealed statistically significant differences in the levels of zinc between the 10-12 year old girls and the 13-15 year olds (0.003), but no significant differences were found among the other age groups.

Analysis with one-way ANOVA also indicated statistically significant differences in the levels of copper/zinc between 10-12 year olds and the 13-15 year old girl ($p = 0.024$) and between the 10-12 year olds and the 16-19 year old girls (0.001). Copper/zinc ratios tended to decrease with increasing age. The mean values for copper, zinc, copper/zinc, and zinc/copper ratio according to the age category are shown in Table 3.

**Copper, Zinc, and Copper/Zinc Levels in Association with Anthropometric Variables**

A statistically significant negative correlation was found between the levels of copper and the height of the girls ($r = -0.245$, $p = 0.010$), and there was a statistically significant positive correlation between the serum levels of zinc and the height of the girls ($r = 0.250$, $p = 0.008$). No significant correlation was found between the levels of zinc or copper and the other anthropometric variables [Table 4].

Despite the findings that copper and zinc levels did not correlate significantly with stature-for-age percentiles, the results revealed a decreasing trend in the levels of copper and an increasing trend in the levels of zinc with increasing stature-for-age percentiles [Table 5]. Short girls had the lowest levels of zinc and the highest levels of copper compared to normal and tall girls.

### Table 4: Correlation (Pearson’s r) between copper, zinc, cu/zn and anthropometric indices in the Yemeni adolescent girls.

<table>
<thead>
<tr>
<th>Anthropometric indices</th>
<th>Copper</th>
<th>Zinc</th>
<th>Copper/zinc Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>r</td>
<td>p-value</td>
<td>r</td>
</tr>
<tr>
<td>Height</td>
<td>-0.245(*)</td>
<td>0.010</td>
<td>0.250(**)</td>
</tr>
<tr>
<td>Weight</td>
<td>-0.072</td>
<td>NS</td>
<td>0.167</td>
</tr>
<tr>
<td>BMI-for-age percentile</td>
<td>0.001</td>
<td>NS</td>
<td>0.093</td>
</tr>
<tr>
<td>Stature-for-age percentile</td>
<td>-0.032</td>
<td>NS</td>
<td>0.030</td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.01 level (2-tailed).
**Correlation is significant at the 0.05 level (2-tailed).

### Table 5: Mean values for serum copper, zinc and copper/zinc ratio of the Yemeni adolescent girls in Alwehda district according to stature-for-age category

<table>
<thead>
<tr>
<th>Stature-for-age percentile category</th>
<th>Copper (µmol/L)</th>
<th>Zinc (µmol/L)</th>
<th>Copper/zinc Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;25th (Short)</td>
<td>17.61</td>
<td>12.22</td>
<td>1.45</td>
</tr>
<tr>
<td>25th-75th (Normal)</td>
<td>17.47</td>
<td>12.26</td>
<td>1.43</td>
</tr>
<tr>
<td>&gt;75th (Tall)</td>
<td>16.33</td>
<td>12.53</td>
<td>1.30</td>
</tr>
<tr>
<td>Total</td>
<td>17.56</td>
<td>12.24</td>
<td>1.44</td>
</tr>
</tbody>
</table>
Furthermore, girls who were above the normal BMI-for-age percentile reference range had higher serum levels of both copper and zinc compared to girls who were below the normal reference range [Table 6], although, this trend was not statistically significant.

COPPER ZINC INTERACTION
There was a negative association between the levels of the copper and zinc; however, this was not statistically significant ($r = -0.018$, $p = 0.849$).

DISCUSSION
Copper and zinc are essential trace elements involved in adolescent growth and development. They have diverse physiological roles and both are particularly related to linear physical growth. Nevertheless, copper and zinc status have not been assessed in Yemeni adolescents. The first purpose of this study was to measure the levels of zinc and copper in the serum of randomly selected Yemeni adolescent girls, and the second purpose was to study the association between the levels of copper and zinc in relation to age and anthropometric indices.

The results revealed that Yemeni adolescent girls had normal serum levels of copper (17.48µmol/L; 111.32µg/dL), but marginal serum levels of zinc (12.24µmol/L; 80.01µg/dL), as compared to the international reference ranges. Comparisons with other populations showed that the obtained mean values for copper and zinc were lower than those reported for the Kuwaiti population (24.9µmol/L; 158.6µg/dl, and 15.5µmol/L; 101.31µg/dl for copper and zinc respectively) and were close to those reported for the Greek population (18.13µmol/L, 115.46 µg/dl; and 11.79µmol/L, 77.11 µg/dl for copper and zinc respectively).

The results also revealed that 96.5% of the girls had marginal serum levels of zinc, which is critical at this stage of life, when the requirements for zinc are high to meet the demands for increased physical growth. These results demanded nutritional assessments because common causes of low zinc levels are usually nutritional due to inadequate dietary zinc intakes or a diet high in fibre and phytate which reduces zinc absorption.

A high percentage (68.8%) of the girls was found to be below the normal stature-for-age percentile of which approximately 20% were stunted. These findings call for studying the effect of low serum zinc levels on some anthropometric indices, since zinc was particularly related to physical growth impairment. When relationships between the levels of zinc and the height and stature-for-age percentiles were investigated, this study revealed a statistically significant effect of zinc on the height of the girls. In fact, girls who were short had the lowest zinc levels and the highest copper levels and the levels of zinc were increasing with increased stature-for-age percentiles. However, this trend was not significant probably because the study sample size was not large enough to show any existing significance.

The relationship between the levels of copper and zinc and the age of the girls was also investigated and results showed a statistically significant correlation between them. The levels of zinc were significantly lower and the levels of copper were significantly higher in girls aged 10-12 years than the other age categories. This might cause some concerns since the adolescent growth spurt begins in girls at age 10 or 11 and reaches its peak at age 12. This intensive growth period (between 10-12 years) is characterised by a dramatic increase in height and an immense demand for zinc.

### Table 6: Mean values for serum copper, zinc and copper/zinc ratio of the Yemeni adolescent girls in Alwehda district according to BMI-for-age category

<table>
<thead>
<tr>
<th>BM-for-age percentile category</th>
<th>Mean Copper (µmol/L)</th>
<th>Mean Zinc (µmol/L)</th>
<th>Copper/zinc Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;5th (underweight)</td>
<td>17.92</td>
<td>12.27</td>
<td>1.47</td>
</tr>
<tr>
<td>5th-&lt;85th (normal)</td>
<td>17.39</td>
<td>12.22</td>
<td>1.43</td>
</tr>
<tr>
<td>85th-&lt;95th (at risk of overweight)</td>
<td>18.62</td>
<td>12.38</td>
<td>1.51</td>
</tr>
<tr>
<td>&gt;=95th (overweight)</td>
<td>18.50</td>
<td>12.39</td>
<td>1.48</td>
</tr>
<tr>
<td>Total</td>
<td>17.55</td>
<td>12.24</td>
<td>1.44</td>
</tr>
</tbody>
</table>
which can exhaust body zinc. The low zinc levels can substantially delay sexual maturation and growth and, therefore, more care should be given to the Yemeni girls in this age group.

The mean value for the copper/zinc ratio was 1.44, ranging from 0.65 to 2.67 and the results revealed that copper/zinc ratio tended to be significantly higher in girls at the pre-menarcheal age (10-12 years), than in the older post-menarcheal girls (13-19 years). These findings were in accordance with what was previously reported. The mean age for the first onset of menstruation in the studied girls was found to be 13 years, and puberty could affect the Cu/Zn imbalance. Copper levels are sensitive to estrogen levels which increase during puberty while zinc is depleted by the rapid cell divisions during growth at puberty.

**CONCLUSION**

A high percentage of marginal zinc levels is considered alarming in adolescence age, especially for girls aged 10-12 years, a period where the growth spurt demands high levels of zinc. There are some concerns, at the present time, about the consequences of marginal zinc status on the health and the linear physical growth of the studied girls. In the near future, there should be some concerns about the health of these girls as pregnant women and the health of their offspring since, traditionally, a high percentage of girls get married after they finish high school, if not before.

**ACKNOWLEDGMENTS**

The author is particularly grateful for the financial support provided by the national trade company NATCO to conduct this study. The author also expresses sincere thanks to the general director of the Al-Thawra General Hospital, members of the laboratory department for their technical assistance, the principal of the Alqods Public School, and all the students who participated in this study.

**REFERENCES**


Quantitative and Qualitative Corneal Endothelial Morphology of Omani Patients with Pseudoexfoliation Syndrome

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ABSTRACT Objective: Pseudoexfoliation (PXE) syndrome is one of the leading causes of secondary open angle glaucoma and blindness. This study explored whether in PXE eyes, preoperative changes in corneal endothelial cell morphology might be a risk factor for postoperative corneal decompensation. Methods: One hundred twenty six eyes of 69 preoperative cataract patients (43 males, 26 females) were enrolled in this cross-sectional study from the Ophthalmology Department at Sultan Qaboos University Hospital between 2003-2005. All patients were subjected to confocal biomicroscopy. Results: The mean age of patients with PXE eyes was 63.2 years. One hundred and eight (85.7%) eyes with PXE had endothelial cell counts within the normal range (1650-3500/mm²). The qualitative morphology of the endothelium of PXE corneas was highly abnormal in term of polymegathism and pleomorphism. Twelve eyes had endothelial cell counts higher than normal for that age group. Only 6 eyes had endothelial cell counts lower than normal. The mean value for the pleomorphism was found to be significantly lower than normal and for polymegathism significantly more than normal. The relationship between pleomorphism and polymegathism was stronger for males than for females and stronger for patients under 60 years than patients over 60 years. The same relationship between pleomorphism and polymegathism showed a stronger relationship for the glaucoma group as compared to the non-glaucoma group. Conclusion: This study revealed that corneal decompensation in PXE eyes can occur in presence of abnormalities in polymegathism and pleomorphism, even when the endothelial cell counts may be normal.

Key Words: Pseudoexfoliation; Pleomorphism; Polymegathism; Confoscan.
SINCE 1917 WHEN THE FINNISH opthalmologist Lindberg first described the pseudoexfoliation (PEX) syndrome, the main intraocular production sites of PEX material have been identified as the epithelial cells of the lens capsule, the iris, the non-pigmented ciliary epithelium, and the trabecular meshwork, as well as the corneal endothelial cells. Since PEX is also associated with hypoxia of the anterior segment, it seems pertinent to acquire more knowledge of the in vivo morphology of corneal endothelial cells in addition to the existing histopathological features in order to predict problems for intraocular surgery in these eyes. The PEX syndrome is a systemic disease with mainly ocular manifestations. Its most common systemic manifestations include ischaemia, infarctions and strokes involving the myocardium, bowels and intracranial structures. Epidemiologically, PEX has a wide geographical distribution with the highest incidence in countries prone to ultra-violet light, in northern latitudes and at high altitudes,2,3

The prevalence of PEX is variable: USA (1.6%), Germany (4.0%), England (4.7%), France (5.5%), Norway (6.3%), Saudi Arabia (13%), Finland (20%), and Iceland (25% - in more than 60 years of age). The risk of developing glaucoma in PEX is 20-77%. Aasved found a nine fold increase in prevalence of PEX in first degree relatives over age of 40 years compared to the general population, suggesting an autosomal dominant inheritance.5

This study was commenced with the aim of highlighting the importance and need for preoperative evaluation of corneal endothelial cells in PEX eyes in the Omani population undergoing cataract, or other intraocular anterior segment surgery.

METHODS

A total of 69 adult patients (43 males and 26 females) and 126 eyes (78 male eyes and 48 female eyes), who met the inclusion and exclusion criteria, were enrolled in this study. The inclusion criterium was patients aged 40 years and above. Eyes with any other corneal pathology or prior surgery that would prevent reliable confocal microscopy were excluded.

All patients were subjected to refraction, applanation tonometry, slit-lamp biomicroscopy, gonioscopy and fundus examination. Eyes confirmed to have PEX on the anterior lens capsule, iris and/or endothelium before or during mydriasis were subjected to a confocal microscopic examination (Confoscan 2, Nidek Japan). Patients diagnosed with glaucoma were examined by frequency-doubled perimetry (Matrix®, Zeiss-Humphrey), Humphrey automated perimetry and OCT 2 papillometry (OCT 2 Nidek).

Confocal biomicroscopy was done under topical anesthesia (benoxinate 0.4%) using sterile transparent gel as a coupling medium. The confocal microscopy outcome of corneal endothelium was assessed in terms of endothelial cell count, polymegathism and pleomorphism. The endothelial cell count was calculated on the basis of a sample size which was different for different eyes and compared with age-matched mean values for other studies in the normal population.

The pleomorphism and polymegathism values were defined against normal values of >59.0 for pleomorphism and <30.0% for polymegathism, which means that a normal healthy cornea should have at

Advances in Knowledge
• Ocular Pseudoxfoliation syndrome induces structural changes in the morphology of the cornea that directly reflects the high risk of postoperative corneal decompensation.
• Confocal scans can help the surgeon predict this possibility and so properly counsel the patient prior to the surgery.
• This can make postoperative management more specific and result oriented.

Application to Patient Care
• The study shows the importance of confocal biomicroscopy in ocular pseudoexfoliation syndrome.
• Patient care can be more predictive and specific if the corneal status is known preoperatively.
• This can make postoperative management more specific and result oriented.
least 60% endothelial cells with regular shape or hexagonality and should not have abnormal endothelial cell sizes or areas (normal 312-320 micron square) in more than 30% of cells.

The Statistical Package for the Social Sciences (SPSS software, Version 10) was used for the analysis of the data and to make the figures. The Student’s t-test was applied to test the significance difference between the means of the groups for the variables under study and the chi-square test was used to compare the categorical variables. A \( p \)-value of .05 or less was taken as significant. Selection of the type of regression curve is based on the \( R^2 \)-values for different types of regression [Table 4]. A higher degree curve was preferred only when the difference in \( R^2 \)-values was significant.

**RESULTS**

Sixty nine patients (43 males, 26 females), with 126 eyes diagnosed to exhibit ocular PEX on slit-lamp biomicroscopy, were selected for morphometric analysis of corneal endothelium by Confoscan 2 (Nidek). All the patients were of Omani origin.

The patient characteristics were as follows, [Table 1]: The mean age of the patients was 63.45 ± 7.40 years for males and 62.77 ± 7.85 years for females. Of 126 PEX eyes the majority of patients (42.9%) belonged to age group 61-70 years, followed by 38.1% in 51-60 years age group, 15.9% in >70 years age group and 3.2% aged <50 years. The mean age for patients with PEX glaucoma was 60.81 years as compared to 64.65 years in patients with PEX without glaucoma, suggesting a younger age group for PEX glaucoma.

The endothelial cell count [Tables 1 & 2] was as follows: Seventy eight male PEX corneas had a mean endothelial cell counts of 2463.18 ± 485.28 cells/mm² compared to 2470.21 ± 544.93 cells/mm² for 48 female PEX corneas; this difference was not found to be statistically significant \( (p = 0.942) \). The overall mean endothelial cell count for all 69 patients with 126 PEX eyes was 2465.86 ± 506.68 cells/mm². The endothelial cell count of PEX eyes in this study was found to be within the normal range in 86.5%. Only 3.2% of PEX eyes had endothelial cell counts less than age-matched normal eyes. A total of 10.3% PEX eyes had endothelial cell counts that ranged even higher than that of age-matched control eyes. Most frequently (62 PEX eyes) the endothelial cell counts ranged between 2000-2500 cells/mm², and six eyes even had endothelial cell counts of more than 3500 cells/mm². The mean endothelial cell count for the PEX eyes with glaucoma (48) was 2438 ± 503.4 (1579-3974) compared to 2483 ± 511.2 (1595-4239) in PEX eyes without glaucoma (78); this difference was also not found to be statistically significant \( (p = 0.629) \).

As far as pleomorphism and polymegathism [Table 1 & 2] were concerned the following results were found. The pleomorphism (loss of hexagonality) data were abnormal in 122 PEX eyes (96.8%). Only four PEX eyes had pleomorphism of 60 and above (normal > 59.0%). Similar changes in cell density and hexagonality have been reported by Hatorri.6 Forty three PEX eyes had pleomorphism values in the range of 20-30. The mean pleomorphism (loss of hexagonality) data were abnormal in 122 PEX eyes (96.8%). Only four PEX eyes had pleomorphism of 60 and above (normal > 59.0%). Similar changes in cell density and hexagonality have been reported by Hatorri.6

Forty three PEX eyes had pleomorphism values in the range of 20-30. The mean pleomorphism for 126 eyes was 34.63 ± 11.92 (normal >59.0%). In spite of having slightly and statistically non-significant lower endothelial cell counts compared to females, the males showed better, though statistically non-significant, pleomorphism values (34.70% ± 11.90) compared to females (34.52% ± 12.12).

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**Table 1: Characteristics of 126 PEX eyes**

<table>
<thead>
<tr>
<th></th>
<th>Males (78)</th>
<th>Females (48)</th>
<th>Total (126)</th>
<th>PEX with Glaucoma (48)</th>
<th>PEX with no Glaucoma (78)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>63.45 ± 7.40 (49 - 84)</td>
<td>62.77 ± 7.85 (41 - 76)</td>
<td>63.19 ± 7.55 (41 - 84)</td>
<td>60.81 ± 8.33 (41 - 84)</td>
<td>64.65 ± 6.67 (49 - 76)</td>
</tr>
<tr>
<td>Endothelium</td>
<td>2463.18 ± 485.28 (1579 - 3974)</td>
<td>2470.21 ± 544.93 (1595 - 4239)</td>
<td>2465.9 ± 506.7 (1579 - 3974)</td>
<td>2438.0 ± 503.4 (1579 - 3974)</td>
<td>2483.0 ± 511.2 (1595 - 4239)</td>
</tr>
<tr>
<td>Pleomorphism</td>
<td>34.70 ± 11.90 (7.70 - 69.80)</td>
<td>34.52 ± 12.12 (16.2 - 59.8)</td>
<td>34.63 ± 11.92 (16.2 - 65.4)</td>
<td>37.09 ± 12.43 (16.2 - 65.4)</td>
<td>33.12 ± 11.44 (7.7 - 69.8)</td>
</tr>
<tr>
<td>Polymegathism</td>
<td>57.89 ± 15.66 (28.3 - 103.5)</td>
<td>60.10 ± 18.14 (30.7 - 105.1)</td>
<td>58.73 ± 16.61 (30.0 - 105.1)</td>
<td>59.69 ± 16.79 (30.0 - 105.1)</td>
<td>58.14 ± 16.58 (28.3 - 105.1)</td>
</tr>
</tbody>
</table>

Each cell display; Mean ± SD and (Minimum value, Maximum)
The eyes with PEX glaucoma had more pleomorphism (37.09 ± 12.43) than eyes with PEX without glaucoma (33.12 ± 11.44) [Table 1].

Pleomorphism was very frequent in 124 PEX eyes (98.4%) exhibiting abnormal size and area of endothelial cells (average area of a normal endothelial cell is 312-320µ²). The normal value for polymegathism is <30.0%. In this study, only two eyes had normal cell size/area, or had polymegathism <30.0%. The mean value for polymegathism in 126 eyes was 58.73% ± 16.61 (normal <30.0%). Females showed more abnormal values for polymegathism (60.10% ± 18.14) than males 57.89 ± 15.66), although it was not a statistically significant result.

Eyes with PEX glaucoma had more polymegathism (59.69 ± 16.79) than PEX eyes without glaucoma (58.14 ± 16.58) [Table 1]; however, this difference was not significant.

The quadratic relationship of pleomorphism on polymegathism displayed a strong inverse relationship. Classifying this relationship into different categories, it was observed that this relationship is stronger for males (R² = 0.638) than females (R² = 0.602).

The same association was found stronger in the under 60 years old age group (R² = 0.727) as compared to above 60 years old age group (R² = 0.581). Classifying the same relationship according to glaucoma versus non-glaucoma groups, it was observed that eyes with PEX glaucoma exhibit a stronger relationship (R² = 0.766) than PEX eyes without glaucoma (R² = 0.604), [Table 4].

However, the relationship between endothelium and polymegathism was not as strong as the relationship between pleomorphism and polymegathism. Even the cubic regression of endothelium on polymegathism did not exhibit a strong relationship for the same categories: gender groups: males (R²=0.121) versus females (R² = 0.167); age groups: <60 years (R² = 0.129) versus > 60 years (R² = 0.129), and glaucomas: (R² = 0.142) versus non-glaucomas (R² = 0.121) [Table 4].

PEX-glaucoma eyes were then compared with non-glaucomatous eyes. The mean age of PEX patients with glaucoma (60.81 years ± 8.33) was found to be significantly lower than the mean age of the PEX patients without glaucoma (64.65 years ± 6.67, p = 0.005); also, among the ≤60 years old age group (52 eyes), 55.8% were glaucoma cases, compared to only 25.7% glaucoma cases among > 60 year old age group (74 eyes). This difference was also found to be statistically significant (p = .001), evidencing a trend for the predominance of PEX glaucoma in the younger age group, maybe due to earlier and better means of diagnosis. PEX glaucoma seems more common among males (41%) than in females (33.3%), however, this difference was not found to be statistically significant. The mean endothelial cell count for PEX glaucoma eyes (2438.0 ± 503.43 cells/mm²) was less than for non-glaucomatous PEX eyes (2483 ± 511.46 cells/mm²). Higher values for pleomorphism were found in eyes with PEX glaucoma (37.09 ± 12.43) compared to PEX eyes without glaucoma (33.12 ± 11.44). Polymegathism was slightly more prevalent (59.69 ± 16.79) in PEX

<table>
<thead>
<tr>
<th>Factors/variables</th>
<th>Pearson correlation</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Endothelium versus Pleomorphism</td>
<td>-0.246</td>
<td>p = .005</td>
</tr>
<tr>
<td>Endothelium versus Polymegathism</td>
<td>0.072</td>
<td>Not significant</td>
</tr>
<tr>
<td>Pleomorphism versus Polymegathism</td>
<td>-0.683</td>
<td>p &lt; .000001</td>
</tr>
</tbody>
</table>
glaucoma compared to PEX eyes without glaucoma (58.14 ± 16.58); the above mentioned differences were not found to be statistically significant [Table 1].

The statistical evaluation is shown in Table 2. According to Pearson's 2-tailed correlation significance, the following parameters revealed statistically significant values ($p = .005$ or $p < .005$):

1. Pleomorphism and polymegathism for age groups <60 years versus >60 years in PEX eyes
2. Pleomorphism and polymegathism for male and female PEX eyes versus non-PEX eyes.
3. Pleomorphism and polymegathism for glaucomatous versus non-glaucomatous PEX eyes.

A significant inverse relationship was found between endothelium and pleomorphism ($p = .005$) and a very strong inverse relationship was observed between endothelium and polymegathism ($p < .00001$) [Table 3].

**DISCUSSION**

This study has shown in vivo that the corneal endothelium is significantly affected quantitatively and qualitatively by cells producing pseudoexfoliation material. Similar changes have been reported by Miyake et al.\(^7\) PEX eyes with glaucoma have more polymegathism than PEX eyes without glaucoma. The qualitative changes of the corneal endothelium by PEX, in the form of degenerating, irregular, loosely adherent cells have also been reported by Schlotzer et al.\(^8\) Seitz and Naumann have reported 85% polymegathism in PEX endothelial cells compared to 98.4% in our study.\(^9\) In another series, the same authors have reported 77% pleomorphism compared to our data of 96.8%. The difference could be due to more severe PEX in our patients. This study, however, revealed more pleomorphic values for PEX eyes with glaucoma than PEX eyes without glaucoma.

In contrast to their data, this study shows normal age-matched cell counts in most of the PEX eyes. Most of the recent series from different countries show a female preponderance of PEX; however, reports from Ethiopia,\(^10\) Greece\(^11\) and Oman\(^4\) show that males are affected more than females. Notwithstanding, these data may be biased since the diagnoses have mainly been done on clinical grounds. Our study has revealed PEX glaucoma in a younger age group which means that these patients should be followed up early in life.

The present study shows less endothelial cell counts in the PEX eyes with glaucoma as compared to PEX eyes without glaucoma. The difference, however, is not significant. This observation is supported by Knorr et al.\(^12\) Thus, even though endothelial cell counts may be normal in age-matched PEX eyes, the latter may exhibit significant morphological changes with respect to their size/area (polymegathism) and shape/hexagonality (pleomorphism). This could be the reason for PEX keratopathy with subsequent early and rapid corneal decompensation.\(^13\) Since cataract is the most common anterior segment intraocular surgery performed world wide, the implications of PEX on corneal endothelial cells are quite demanding.\(^14,15\)

The overall incidence of intra-operative complications in PEX eyes has been reported to be 4-7% depending on the preexisting pathology. The general clinical opinion is that in PEX eyes a prolonged corneal recovery after intraocular surgery is frequent. This study has shown that corneal endothelial cell anomalies may provide a morphological basis for this event. The data clearly emphasises the importance of preoperative confocal analysis of PEX corneas.

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**Table 4: R\textsuperscript{2} values for different type of regression curves**

<table>
<thead>
<tr>
<th>Regression curve of:</th>
<th>Linear</th>
<th>Quadratic</th>
<th>Cubic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pleomorphism on Polymegathism</td>
<td>0.467</td>
<td>0.619</td>
<td>0.625</td>
</tr>
<tr>
<td>Males and Females</td>
<td>0.461 &amp; 0.484</td>
<td>0.638 &amp; 0.604</td>
<td>0.648 &amp; 0.603</td>
</tr>
<tr>
<td>Age ≤ 60 yrs. and Age &gt; 60 yrs.</td>
<td>0.586 &amp; 0.406</td>
<td>0.725 &amp; 0.573</td>
<td>0.727 &amp; 0.581</td>
</tr>
<tr>
<td>Glaucoma and No glaucoma</td>
<td>0.643 &amp; 0.402</td>
<td>0.765 &amp; 0.604</td>
<td>0.765 &amp; 0.623</td>
</tr>
<tr>
<td>Endothelium on Polymegathism</td>
<td>0.017</td>
<td>0.060</td>
<td>0.124</td>
</tr>
<tr>
<td>Males and Females</td>
<td>0.070 &amp; 0.001</td>
<td>0.077 &amp; 0.099</td>
<td>0.121 &amp; 0.167</td>
</tr>
<tr>
<td>Age ≤ 60 yrs. and Age &gt; 60 yrs.</td>
<td>0.010 &amp; 0.038</td>
<td>0.039 &amp; 0.075</td>
<td>0.129 &amp; 0.129</td>
</tr>
<tr>
<td>Glaucoma and No glaucoma</td>
<td>0.002 &amp; 0.036</td>
<td>0.068 &amp; 0.065</td>
<td>0.142 &amp; 0.121</td>
</tr>
</tbody>
</table>
CONCLUSION

Pseudoexfoliation in Omani population is associated with increased corneal endothelial pleomorphism and polymegathism predisposing to early corneal decompensation after intraocular, mainly cataract, surgeries, even when the endothelial cell counts may be within normal limits.

ACKNOWLEDGMENTS

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REFERENCES


Use of Intravenous Sulprostone for the Termination of Pregnancy with Fetal Death in Second and Early Third Trimester of Pregnancy

*Anita K Mohan, Mariam Mathew, Syed G Rizvi

ABSTRACT

Objective: To study the efficacy of intravenous sulprostone (Nalador) for the termination of pregnancy with fetal death in second and early third trimester of pregnancy.

Methods: This is a retrospective collection and analysis of data from a cohort of 97 women with fetal death between 12-30 weeks gestation treated with intravenous infusion of a prostaglandin analogue, sulprostone, to achieve expulsion of the products of conception. It was conducted in the Department of Obstetrics and Gynaecology, Sultan Qaboos University Hospital, Oman. The data collected was from January 2000 to December 2005. Sulprostone was started as an intravenous infusion of 15µgm/hr and titrated to a maximum of 240µgm/hr to a total dose of 500µgm/day, as per the departmental protocol. The patients’ demographic data, gestational age, induction-expulsion interval, the need for evacuation, side effects and complications were studied. Results: Out of the 97 women who received sulprostone, 90 aborted within 24 hours. The average induction-expulsion interval was 11.9 ± 8.0 hours. Sulprostone use was associated with few side effects and was well tolerated by patients. Although most of the patients required evacuation and curettage, the blood loss was minimal. Only six out of 97 women required blood transfusions and two patients needed hysterotomy. Conclusion: We found sulprostone an efficient drug for termination of pregnancy with fetal death in second and early third trimester of pregnancy.

Keywords: Sulprostone; Prostaglandin; Intrauterine fetal death.

Advances in Knowledge

• This is the first study from Oman that analyses use and effect of sulprostone for the termination of pregnancy with fetal death in second and early third trimester of pregnancy.

• The findings of this study confirm the safety of sulprostone for the above mentioned indication.
Use of Intravenous Sulprostone for the Termination of Pregnancy with Fetal Death in Second and Early Third Trimester of Pregnancy

**Application to Patient care**

- This data can be compared with other prostaglandins in recent use, like misoprostol.
- Sulprostone can be safely used for termination of pregnancy in patients with a previous caesarean section.

**Termination of pregnancy with intrauterine fetal death in the second and third trimester has always posed a challenge to the obstetrician. Various surgical and medical methods have been used for this purpose. Sulprostone (PGE2 analogue) and misoprostol (PGE1 analogue) are the most widely used prostaglandins for termination of pregnancy. Sulprostone has been the only drug used for termination of pregnancy in our institute since the year 1995.**

Most studies used intramuscular sulprostone with or without intravenous sulprostone. A review of the literature shows only a few studies using intravenous sulprostone alone. We undertook this study to find out the safety and efficacy of intravenous sulprostone in cases of termination of pregnancies with second and early third trimester fetal deaths

**METHODS**

This was an observational cohort study with retrospective data collection and analysis conducted in the Department of Obstetrics and Gynaecology, Sultan Qaboos University Hospital, Muscat, Oman. The data collected was between January 2000 and December 2005. All ninety seven (97) women with a gestational age ranging from 12 to 30 weeks and fetal death, confirmed by ultrasound, were included in this study. Six women with medical complications like hypertension, cardiovascular disease and bronchial asthma were excluded. All 97 women who received sulprostone were included in the analysis. These patients were admitted to the Gynaecology Ward and intravenous sulprostone was started as per the departmental protocol, after confirming normal full blood count and serum electrolytes. Written consent was obtained from all women. None of the patients received cervical priming prior to sulprostone infusion.

Sulprostone is a 16-phenoxy derivative of methylsulphonylamid prostaglandin E2. One ampoule contains 500µgm of active sulprostone in 7.45 mg dried form. The known side effects are nausea, vomiting and diarrhoea. The departmental protocol for use of sulprostone was as follows: the infusion is prepared by adding 500µgm sulprostone to 50 ml of normal saline and the infusion is started via a syringe pump at 1.5 ml/hr (15µgm/hr). The rate is doubled every hour to a maximum of 240µgm/hr and a total dose of 1500 µgm over 24 hours. Medical records were reviewed regarding each patient’s age, parity, any previous cesarean section, gestational age, induction-expulsion interval, blood loss, need for analgesia, evacuation, side effects and complications. The induction-expulsion time interval was taken as the primary end point and the others as secondary end points.

Statistical analysis was performed using SPSS (Statistical Package for the Social Sciences), Version 10 computer software. A p value <0.05 was considered to be statistically significant. The chi square test was used to test the association of categorised variables; the t-test and ANOVA (Analysis of variance between groups) test were used to test the significance of the difference in induction abortion interval between different groups.

**RESULTS**

During the six-year period from January 2000 to December 2005, 97 women had induction with sulprostone for fetal death in the second and early third trimester of pregnancy. Figure 1 shows the age distribution of the study group. The age ranged from 18 to 42 years with a mean of 28.6 ± 6.0 years.

Eighty-five women were between 12 to 22 weeks of gestation and 12 were at more than 22 weeks. Most of our patients were Omani nationals (86.7%) and the rest were from various other countries.

The primary end point induction-expulsion time interval, was calculated from the start of the sulprostone until the expulsion of the fetus. The average time required for patients of less than 22 weeks gestation was 10.9 ± 8.6 hours and those at more than 22 weeks was 12.0 ± 8.0 hours. This difference was also not found to be statistically significant (p = 0.649). A total of 90 patients expelled the fetus within 24 hours. The longest time taken was 62 hours 25 minutes and the shortest was 1 hour 25 minutes with a mean of 11.9 ± 8.0 hours. Two (2.1%) patients needed repeat doses...
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after the initial dose of 1500 µgm.

Twenty-seven women (27.8 %) were nulliparous and five (5.2%) were of parity 8 or more. The highest parity in this study group was 12. Figure 2 shows the relationship between parity and the time taken for expulsion. Although nullipara showed the shortest induction-expulsion time and para 8 and above showed the maximum time, this difference was not found to be significant ($p = 0.821$).

The rate of complete expulsion, defined as the simultaneous passage of the fetus and placenta was 22.7%. Seventy-three women (75.3%) needed evacuation. No relationship was found between complete expulsion rate and age ($p = 0.372$) or parity ($p = 0.643$) of the women.

There were 11 (11.3%) patients with previous caesarean sections, including two patients with two previous and one with three previous caesareans. Sixty-seven percent of patients with previous caesarean sections needed evacuation whereas 78% of the group without a previous caesarean needed evacuation; this difference was not found to be statistically significant ($p = 0.447$). None of the patients with a previous caesarean section had a scar rupture or blood transfusion, whereas five patients without a previous caesarean required a blood transfusion.

The requirement of analgesia in the study group was as follows: 47% of patients required analgesia with pethidine, 42% received no analgesia and the others received diclofenac or midazolam.

The incidence of gastrointestinal side effects was limited and clinically acceptable. Systemic side effects requiring discontinuation of therapy with sulprostone were not observed in this study. Only 3 patients (3.06%) had itching and redness at the intravenous cannula site.

Two women in this group had a hysterotomy. The first patient was a Gravida 2 Para 1 with a previous caesarean section at 14 + weeks gestation and confirmed fetal death. She had a large cervical fibroid (10 cm diameter). She received 2 courses of sulprostone without any response hence a hysterotomy was done.

The second patient was a Gravida 4 Para 2 at 16 weeks gestation, confirmed fetal death, with two previous caesarean sections. After 8 hours of sulprostone infusion the patient complained of severe abdominal pain. A laparotomy and hysterotomy was done. The previous scar was found to be intact.

**DISCUSSION**

Various medical methods have been described for the expulsion of the fetus in pregnancies with intrauterine fetal deaths: prostaglandin (PG) analogues (mifepristone, gemeprost or sulprostone) with or without antiprogesterone priming (mifepristone). In our institution the PGE2 analogue, sulprostone, is used as a continuous infusion for management of second and early third trimester fetal deaths.

Intravenous, intramuscular and extra amniotic use of sulprostone has been described in the literature. Intramuscular sulprostone has been effectively used for preoperative cervical dilatation in the first trimester with minor side effects, mainly abdominal pain. Antiprogestin mifepristone given orally prior to intramuscular sulprostone facilitates termination of second trimester pregnancies by sulprostone alone without added side effects. Our study did not use mifepristone. Intramuscular sulprostone is no longer recommended for medical abortion due to its association with myocardial infarction.

Kunz et al. in his study of 160 women on second trimester pregnancy termination with intravenous (IV) sulprostone found a mean induction-expulsion interval of 16h 56min. Our primary end point, i.e. induction-expulsion time interval, was 11.9 ± 8.0 hours. Haemorrhage occurred in 6% of our patients compared to 7.5% in Kunz's study.

Jain and Mishell defined 'complete expulsion' as expulsion of both the fetus and the placenta without operative assistance. The rate of complete expulsion in our study was 22.7 % compared to 32% in Jain and Mishell's study. The risk of haemorrhage is 4 in 1,000 at more than 20 weeks. We had five patients who required blood transfusion as a result of excessive bleed-
Use of Intravenous Sulprostone for the Termination of Pregnancy with Fetal Death in Second and Early Third Trimester of Pregnancy

Caring for pregnancy with a previous uterine scar is always a challenge. No matter what method is used for termination, there is a greater risk of uterine rupture in these patients than in those women without a scar. Prostaglandins are still a reasonably safe and predictable method of termination of pregnancy even in cases of previous caesarean section. Women should be appropriately counselled about the risks and consequences and supervised closely in labour.\(^6\) Shapira et al., in their study of second trimester abortion by extra-amniotic prostaglandin infusion in 282 women including 35 cases with previous caesarean section, did not observe any case of uterine rupture.\(^7\) There are few case reports of uterine rupture after use of sulprostone with fetal deaths in second and third trimester in a scarred uterus.\(^6\) Out of the 12 women with previous caesarean sections in our study, there was no case of uterine rupture.

Side effects including nausea, vomiting and diarrhoea are characteristics of prostaglandin administration and are due to prostaglandin’s stimulatory effect on the gastrointestinal tract. Gastrointestinal side effects were minimal in our study. Only 3% patients had itching and redness at the cannula site, which, however, did not warrant a discontinuation of the therapy.

Cardiovascular disease, liver/kidney disease and bronchial asthma are contraindications for the use of sulprostone as suggested by the manufacturer. Cardiac arrests have been reported with bolus dose of IV sulprostone of 30µgm.\(^9\)

Gemund et al. have reported the use of continuous low-dose sulprostone intravenous for pregnancy termination in 30 women with severe preeclampsia and eclampsia.\(^10\) This study, including two patients with a severe deterioration of pulmonary function and one maternal death after induction, does not permit definitive conclusions regarding safety in such patients. Patients with hypertension, heart disease and bronchial asthma were not included in our study.

**CONCLUSION**

Our study showed that intravenous use of sulprostone was both safe and effective in the termination of pregnancy with fetal death in second and early third trimester of pregnancy; however it requires continuous intravenous access and close monitoring of maternal vital signs.

**REFERENCES**


**Figure 2: Induction-abortion/delivery interval in different parity group**

![Figure 2: Induction-abortion/delivery interval in different parity group](image-url)
Impact of Geographical Proximity on Health Care Seeking Behaviour in Northern Oman

Ahmed Al-Mandhari, Samir Al-Adawi, Ibrahim Al-Zakwani, Mohammed Al-Shafaee, Liyam Eloul

ABSTRACT Objectives: Despite its impact on health policy, the relationship between geographical proximity and health care seeking has received scant attention in the medical literature. This paper aims to evaluate the relationship between geographic proximity and health care usage behaviour among patients seeking medical consultation in the northern region of Oman. Methods: During 2006-2007, data was collected via face-to-face interviews among 428 randomized patients seeking medical consultation in various primary health care centres in the northern region of Oman. The association between geographical proximity as a reason for seeking health care and other predictors was also analysed using multivariable logistic regression. Results: The data suggest that preference for geographical proximity as a reason for seeking health care is strongly associated with marital status, previous exposure to traditional medicine and health education, as well as history of immunisation. Conclusion: This finding supports the view from elsewhere that geographical proximity remains a strong catalyst for care seeking in Oman. The psychosocial factors affecting care seeking are discussed. Keywords: Geographic proximity; Health care utilization; Arab/Islamic; Clinical-based study; Oman.

Advances in Knowledge
• The study shows that geographical proximity remains a strong catalyst for health care seeking in Oman.
• Socio-cultural teaching appears to play a major part in what may appear to be a paradoxical and idiosyncratic relationship between geographical proximity and health care seeking behaviour.
• The study stimulates the need to conduct further studies that look more closely at the issues of health care seeking behaviour, particularly in remote areas and with regard to the use of traditional medicine centres.
SINCE THE WORLD HEALTH ORGANIZATION launched ‘Health for All by Year 2000’, many health planners in developing countries have expanded and diversified health care services in order to achieve viable health equity. However, one source of attrition around this endeavour is the lack of understanding surrounding care seeking behaviour among health care consumers. An understanding of care seeking behaviour can act as a basis on which to lay the groundwork for developing strategies to improve awareness and to identify barriers to timely interventions and treatments. Attention to care seeking behaviour would likely impact health care utilisation and, albeit indirectly, reduce the high maternal and infant mortality rates, as well as heightening the health indicators of a country.

Various studies have converged on the view that the use of health care services is related to factors such as service accessibility and quality of service, beliefs underpinning avoidance of distress and individual differences. Although most of these studies have been derived from a variety of populations, to our knowledge, few studies examine the factors leading to health care seeking behaviour in Arab populations and their generalisation is often limited to specific clinical populations.

This paper attempts to examine the factors associated with the utilisation of health care among general health care consumers in Oman, an Arab/Islamic country situated in the south-eastern corner of the Arabian Peninsula. Once observers labelled Oman the “Tibet of Arabia” or characterized it as a “beleaguered hermit kingdom” due to its isolation and mediaeval-like society; however, Oman has experienced rapid modernisation in the past few decades. The British Medical Journal has stated that, “Money from oil has brought Omancis progress through development in less than 20 years, development that took a thousand years in Europe”. With the improvements in health care, the country has experienced a significant decline in maternal and child mortality.

Studies from other countries around the world are beginning to show that the use of health care services is related to geographical proximity to health care centres. Emerging views suggest that many clinical conditions and their outcomes often depend, among other things, on the geographical proximity of care facilities. For example, in some emerging economies in many parts of the world, health care accessibility is limited to urban areas and therefore health inequity has been heightened due to an asymmetry in the availability of health care services reflecting an urban-rural disparity. In some studies, it has been reported that morbidity and mortality in a clinical population are invariably related to the geographical proximity of the health care centres. Although the ability to access health care is influenced by myriad factors, the relationship between care seeking and distance travelled has not been widely reported in developing countries. This is problematic when one bears in mind that in many developing countries there exists a drastic disparity in the availability of health care services between different geographical regions of the country. With the spread of universal free health care in Oman, the question remains: ‘How does geographic proximity contribute to care seeking and, by implication, health equity in the country?’

The recent rise in affluence in Oman has blurred the once-clear gap between rural and urban environments, as social services and infrastructure developments have spread equally to all regions of the country. The United Nations Children’s Fund has estimated that for the past several years 96 percent of the population of Oman has had access to health care services. The population density of Oman has been estimated at 8.3/km². The bulk of the population is located in the towns and villages adjacent to the capital, Muscat, and towns along the northern Batinah coast. The rest of the population is distributed throughout the southern and interior regions of the country. In a recent health...
system ranking, the WHO ranked Oman as the most "efficient" health care system in the world in terms of outcome. Therefore, given the quality of the health care services, and the geographical characteristics of the country, Oman, is an interesting ground to explore the influence of geographical proximity to health care centres on health care seeking behaviour. It is hypothesised that health care seeking behaviour is invariably
influenced by the geographical proximity of care centres to target populations.

**METHODS**

**STUDY AREA AND POPULATION**

According to the World Bank, Oman is categorised as an upper-middle-income economy.\(^2^8\) The majority of Oman’s population is located either in the north or in the far south of the Sultanate; these two regions are separated by a stretch of desert known as the Empty Quarter. For logistical reasons, the present study was limited to the northern regions of Oman, which include a number of larger coastal towns, including the capital, Muscat, as well as a number of towns in the more mountainous interior. This population segment was found to reflect the ethno-cultural variety present in Omani society.\(^2^9\)

**DATA COLLECTION**

Oman offers universal free health care to its approximately 2.5 million citizens. The present study was conducted in 2006-2007 in a number of public hospitals located in the region of interest. Data was collected using face-to-face interviews. For consistency, and to accommodate illiterate patients, questionnaires were read out loud to the subjects rather than being self-administered. The interviews were conducted by trained researchers, predominantly second and third year medical students from the College of Medicine and Health Sciences, Sultan Qaboos University. During our preparation for this study, the interviewers were trained to read out the items of the questionnaire and to code the responses with precision and reliability; we observed substantial inter-coding agreement for the scale items \((r = 0.86, p < 0.001)\).

The study population consisted of Omani patients visiting the sampled health centres. Inclusion criteria required participants to be at least 18 years old and cognitively intact. The participant sample was randomised in the following way: one out of every five patients entering the reception area of each health centre for a routine outpatient visit was invited to volunteer for an interview. The participants were explicitly informed that any information they provided in the course of the interview would remain completely anonymous and that their participation would not in any way affect their treatment. No invited patient declined to be interviewed.

The interview process was carried out in the health centres over a two week period. At each health centre a minimum of 50 patients per research assistant were interviewed during the span of this study. Data from the Ministry of Health have shown that, on average, the present targeted health care centres cater to the needs of approximately 90% of the population of this particular region of Oman.\(^3^0\) In total, 428 subjects participated in this study.

**ASSESSMENT MEASURES**

The questionnaire was developed to fit the situation on the ground, using a number of items that have been used in previous studies, modified for the present context.\(^3^1, 3^2\) As detailed in Table 1, the information elicited from the participants included demographic data such as age, sex, marital status, and level of education. In addition, other information germane to the framework of care seeking, such as history of chronic illnesses, usual source of health care, frequency of health care facility usage, and attendance at health education sessions was also sought. The concept of geographical proximity, although variously defined elsewhere, in the present context is defined as a measure of nearness to the health care setting. This item was elicited by asking the participants whether they perceived the nearest health centre as close to them or as far away. The answers were quantified in terms of (1) ‘yes’ or (0) ‘no.’ The final questionnaire was pre-tested and piloted on convenience samples among students and staff at the College of Medicine and Health Sciences.

**STATISTICAL ANALYSIS**

Descriptive statistics were used to illustrate the data. For categorical variables, frequencies and percentages were reported. Differences between groups were analysed using Pearson’s \(\chi^2\) tests or Fisher’s Exact tests (for cells of less than 5). For continuous variables, means and standard deviations (±SD) or medians and absolute ranges were presented as appropriate. Mean differences between groups were analysed using the Student’s t-test and the Wilcoxon Mann-Whitney test whenever appropriate.

The association between participants’ geographical proximity to a health centre as a reason to seek health care and various other predictors were analysed using multivariable logistic regression. The predictors in the model included age, gender, marital status, literacy, history of chronic illness, use of regular chronic medications, type of health care resource facility attended,
the study enrolled a total of 428 participants. The demographic, clinical and health care resource characteristics of the cohort are shown in Table 1. The overall mean age of the cohort was 33 ± 12 years with an age range from 18 to 74 years. Sixty two percent (n = 264) of the participants were females. The majority of the participants were married (n = 281, 66%), literate (n = 352, 82%), did not have a history of chronic illness (n = 289, 68%) and were not taking regular medications (n = 352, 82%), did not have a history of chronic illness (n = 289, 68%) and were not taking regular medications (n = 289, 68%). Most of them listed the government as their main source of health care (n = 306, 72%). How-

The multivariate logistic model was extensively examined by evaluating the model's assumptions and overall model fit. The overall model fit was assessed using the Hosmer & Lemeshow goodness-of-fit statistic.33 This approach analyses the actual responses versus the predicted responses; theoretically, the observed and expected counts should be close or equal. Based on the χ² distribution, a Hosmer & Lemeshow statistic with a p-value greater than 0.05 is considered a good fit. Another measure of good fit is the area under the Receiver Operating Curve (ROC). 34 The ROC is a graph of sensitivity versus one minus specificity, as the threshold cut-off is varied, and also calculates the area under the curve. Sensitivity is the fraction of true positives, while specificity is the fraction of the true negatives. The ROC provides a measure of the model's discriminatory power. A model with perfect prediction has an ROC of 1.0, while an area of 0.5 provides no better discrimination than chance. An a priori two-tailed level of significance was set at the 0.05 level. Statistical analyses were performed using STATA (Data analysis and statistical software) Version 9.2.

RESULTS

The study enrolled a total of 428 participants. The demographic, clinical and health care resource characteristics of the cohort are shown in Table 1. The overall mean age of the cohort was 33 ± 12 years with an age range from 18 to 74 years. Sixty two percent (n = 264) of the participants were females. The majority of the participants were married (n = 281, 66%), literate (n = 352, 82%), did not have a history of chronic illness (n = 289, 68%) and were not taking regular medications (n = 352, 82%). Most of them listed the government as their main source of health care (n = 306, 72%). However, 20% (n = 86) of the participants listed their main source of health care delivery as being from a traditional system. The reasons to seek health care included visits for treatment of acute ailments (n = 167, 39%), follow-up visits (n = 130, 30%), and visits for vaccination (n = 131, 31%). Only just over a third of the participants had attended health education programmes (n = 143, 33%).

The final model was significant [Wald χ² (12) = 32.21; log likelihood = -129.9298; p = 0.001] and all the variables accounted for 11 percent of the variance in the model (Pseudo R² = 0.11). Furthermore, the goodness-of-fit statistics indicated an overall good model fit (Hosmer & Lemeshow χ² (8) = 13.78, p = 0.087; area under the ROC curve = 0.75). Married participants were 2.56 times more likely to endorse close proximity to a health care centre as a reason to seek health care than the unmarried participants (95% CI 1.24 to 5.29, p = 0.011). The participants using traditional health care compared with those using government health care sources were 2.95 times more likely to use close proximity to a health care centre as a reason to seek health care (95% CI 1.03 to 8.44, p = 0.043). Furthermore, those attending the health care centre for vaccination compared to those attending the centre for the treatment of acute conditions were 3.53 times more likely to use close proximity to a health care centre as a reason to seek health care (95% CI 1.47 to 8.48, p < 0.001). Additionally, the participants that had attended health education programs were 2.28 times more likely to endorse close proximity to a health care centre as a reason to seek health care resources than those who had not attended health education programs (95% CI 1.03 to 5.04, p = 0.042).

DISCUSSION

Some interesting findings have emerged from the present data. First of all, close inspection of the descriptive analysis suggests that geographical proximity was preferred among Omanis of a slightly greater age (33±12 versus 29±12, years), who were married, or who had sought health education. Furthermore, geographical proximity was perceived to play a significant role among Omanis who had sought health care for medically acute complications, those attending follow-up visits or those who were seeking vaccination.

In logistic regression, four factors appeared to have the greatest impact on the trajectory between geographical proximity and care seeking. First of all, being married was a significant predictor for endorsing geographical proximity as essential for health care seeking. A possible explanation for this is that being married would entail parenthood and, for most people in Oman, embracing a more connected lifestyle within the extended family. In traditional Omani society, individuals who have reached puberty are expected to marry, at least in rural communities. Newly married couple often reside in the paternal family's residence, which requires them to fulfil the typical role of a mem-
ber of the extended family. Marriage itself is considered a sacred and unbreachable institution that entails procreation. Current population patterns in Oman fit with a second phase ‘demographic transition’ which entails a declining death rate complemented by a high birth rate, with the bulk of the population falling in the infant to adolescent age group. While infant mortality was 242 per 1,000 live births in 1970, it has since fallen to 13 per 1,000 live births in 2004. The fertility rate, which indexes the average number of children per couple, was 7.2 in the 1970’s, to 6.6 in 1990s and more recently has become 3.4. Having a greater number of children in the household is likely to increase the frequency with which an individual would need to attend a health care centre, thus making it vital to have health care at one’s reach. It is likely that being married will correlate highly with parenthood, and that child care is one cause for an individual to prefer geographical proximity to health care centres.

Health education is the second variable that played a major role in determining preference for close proximity to health care services. The data suggest that subjects who have attended health education programs were more likely to suggest close proximity to a health care centre as a reason to seek health care resources than those who did not attend health education programmes. There are two potential explanations for this finding. One is the possibility that those who seek health education are the type of people who are generally overly concerned about their health. The literature abounds with reports describing how some individuals insist that they are ‘diseased’ despite repeated assurance to the contrary. Such patients tend to seek care in primary as well as tertiary medical settings, and account for a large number of consultations, ‘doctor shopping’, unnecessary tests, multiple surgeries, and a variety of other procedures which result in what is known in some hospitals as the ‘fat file syndrome’. It is possible that those who are overly concerned about their health have a tendency to attend health education courses, and therefore are more likely also to prefer geographical proximity to health care. Individuals with such a disposition would therefore prefer a short distance to their health care centre because it represents quick accessibility to health care and, subjectively, provides reassurance in the event of ill health. Another possibility is that those who have attended health education courses may have been exposed to one’s propensity for disease and ill-health. Awareness about potential risk factors for illness may instil a preference for geographical proximity to health care centres.

While immunisation campaigns have been met with some resistance in certain parts of the world, with universal free health care Oman has succeeded spectacularly in overcoming rampant infectious diseases. Disease eradication and immunisation programs are quickly reaching all corners of the country. Therefore, it was not seemingly surprising that vaccination plays an important role in care seeking in the present data. It can be speculated that the improvement in quality of life in Oman, among other things, assisted by a universal immunisation programme, has heightened Omanis’ faith in modern health care to the extent that proximity to a health care centre is considered an essential pathway for disease eradication and prevention.

The final variable that made a significant contribution to the significance of geographical proximity was the tendency to seek traditional medicine. It has been reported that the traditional health care system meets 60-80 percent of health care needs in many parts of the world. Traditional medicine, sometime referred to as ethno-medicine, is a vague term used loosely to distinguish ancient culture-bound health care practices that existed before the application of modern scientific medicine. Despite the poor efficacy of ethno-medicine from a scientific perspective, there is evidence that its popularity knows no bounds in many parts of the world. The reason for such an esteemed status involves the fact that its explanatory models are deeply grounded in the local folklore concepts of health and illness. Contrary to modern health care, traditional medicine does not relegate human beings to mechanistic organisms. There is also the suggestion that some of the healing rituals common in traditional medicine may serve as psychotherapeutic support. Within this relevant discourse, reports have emerged to suggest that there are a substantial number of health care seekers who transverse both traditional and modern health care systems, often in tandem. Given this complex situation, it is not therefore surprising that those subjects who have utilised traditional medicine may also prefer to have close proximity to modern health care centres. It would be theoretically interesting in the future to index psychosocial correlates of care seeking behaviour among those people who have a tendency to seek help from both traditional and modern health care systems.
care settings.

There are issues that warrant caution in interpreting the results of this study. First of all, the generalisation of this study may be limited by the fact that the data was collected only in one specific region of Oman, and was restricted to those seeking health care services. There is evidence to suggest that people in a clinical setting tend to respond differently to questioning than those approached in a community setting. Notwithstanding this view, the study focused on factors affecting health care seeking behaviour and therefore it was practical to explore a clinical population. An important omission in the present study is that the actual distance between the patient’s domicile and the health care centre was not examined. Previous studies have suggested an inverse relationship between travel distance and health care utilisation, and the fact that sampling was conducted in health care centres may have skewed our results. Secondly, data was collected using an interview method rather than a self-administered format. This may have confounded patient responses because of lack of anonymity. Since the literacy rate in Oman is 74.4 percent, it was decided to read the items to all subjects, rather than allowing them to self-administer the survey. It is possible that this approach may have resulted in a reluctance to reveal sensitive information. There is an indication that the lay public in Oman regard their doctor with high esteem, and as someone one could confide in. However, there is no indication that the items on the questionnaire were overly sensitive. Thirdly, the items on the questionnaire had not been subjected to protracted validation methods, and therefore the efficacy of the questions may be uncertain, both psychometrically and conceptually. This is especially the case given that this study was conducted in a cultural setting where research is not usual, and among patients who are not often studied. Further research of a similar nature but with more rigorous methodology is therefore recommended.

CONCLUSION

With the much-heralded ‘Health for All by Year 2000’, a genuine effort to heighten health care delivery that transcends geographic location has been attempted in many parts of the world. Because some populations are sparsely distributed, health planners have been obliged to build health care services that can be accessed by all. However, that is a dearth of studies that have examined the relationship between the geographical proximity of health care centres to the target population and health care utilisation. From the present study conducted in Oman, the data suggest that there are four factors that play a part in the relationship between geographical proximity and health care seeking: demographic variables such as marital status, history of health education and vaccination, as well as previous exposure to traditional medicine. Socio-cultural teaching appears to play a major part in what may appear to be a paradoxical and idiosyncratic relationship between geographical proximity and health care seeking. The study stimulates the need to conduct further studies that look more closely at the issues of health care seeking behaviour, particularly in remote areas and with regard to the use of traditional medicine centres.

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Objective: Identification of relevant allergens that are prevalent in each environment which may have diagnostic and therapeutic implications in allergic diseases. This study aimed to identify the pattern of sensitisation to inhalant allergens in Omani patients with asthma, allergic rhinitis and rhinoconjunctivitis.

Methods: The study was carried out during three consecutive years (2004-2006) at the allergy skin test laboratory of Sultan Qaboos University Hospital, Oman. Records of patients who had undergone an allergy skin prick test with a referring diagnosis of asthma, allergic rhinitis or rhinoconjunctivitis were reviewed. Two panels were used during the 3 years period. The frequencies of positive skin tests were analysed.

Results: 689 patients were tested, 384 for the first panel and 305 for the second panel. In the first panel, the commonest positive allergens were: house dust mites (37.8%), hay dust (35.4%), feathers (33.3%), sheep wool (26.6%), mixed threshing dust (25.8%), cat fur (24.2%), cockroach (22.7%), straw dust (22.7%), grass (16.1%), penicillium (19.7%), Alternaria alternata (14.1%) and Aspergillus Niger (13.8%). In the second panel, the commonest positive allergens were also house dust mites: Dermatophagoides pteronyssinus (30.8%), Dermatophagoides farinae (47.9%); Mesquite (Prosopis glandulosa) (35.7%), Russian thistle (Salsola kali) (34.4%), Alternaria alternata (34.4%), and Aspergillus Niger (34.4%).

Conclusion: The pattern of sensitisation to environmental allergens in Omani patients seems to be similar to other reports from the Arabian Peninsula. Methods to identify and characterise environment specific allergens are needed.
Environmental allergens are important immunopathogens that contribute to the pathophysiology of allergic diseases represented mainly by bronchial asthma, allergic rhinitis and rhinoconjunctivitis. It is very important to identify the most relevant allergens in each environment as they differ from one to another. This has diagnostic and therapeutic implications. These patients may benefit from environmental allergen control measures and, where medical therapy is not sufficient to control their symptoms, immunotherapy might be beneficial; hence, the identification of allergens is vital.

Atopy is the tendency of an individual to develop specific IgE against common allergens in the environment. IgE mediates the early phase response of an allergic reaction by involving mast cells as an effector cell that release chemical mediators which are responsible for the clinical features of an allergic reaction. Asthma is a worldwide problem that affects around 10-15% of all populations. In Omani children, as assessed by ISAAC study, the prevalence rates of reported diagnoses of asthma and allergic rhinitis were higher in older children, 20.7% and 10.5%, compared with 10.5% and 7.4% respectively, in younger children. Asthma is a chronic inflammatory airway disease characterised by the presence of inflammatory cells and cytokines in the airway mucosa that lead to inflammation responsible for the symptoms of asthma. The etiology of asthma is multifactorial, the role of allergy in asthma is well established; for example, there is a strong link between house dust mites (HDM) sensitisation and the development of asthma. Allergic rhinitis is a common medical condition characterised by nasal, throat, and ocular itching; rhinorrhea; sneezing; nasal congestion and, less frequently, coughing. Patients could be sensitised to perennial or seasonal allergens that are present in the environment. Patients with allergic rhinitis may benefit from specific immunotherapy in case medical treatment is insufficient to control their symptoms. There is now evidence supporting a link between asthma and allergic rhinitis which may have therapeutic implications. Most of the experience of environmental allergies comes from the Western hemisphere. There are several studies conducted in neighbouring countries which have shown a different pattern of allergies from the West. Little is known about the pattern of environmental allergies in Oman. The aim of this study was to identify the pat-
tern of sensitisation to inhalant allergens in Omani patients with asthma, allergic rhinitis and rhinoconjunctivitis.

**METH ODS**

Medical records of allergy skin tests of patients with a referring diagnosis of asthma, or allergic rhinitis or rhinoconjunctivitis for three consecutive years 2004-2006 were reviewed. The patients had been referred to the allergy skin test laboratory from the pulmonary, ENT, child health, and other clinics at Sultan Qaboos University Hospital (SQUH) and Ministry of Health hospitals in Oman. SQUH is the referral centre for allergy skin testing for the whole country. The allergy laboratory is supervised by pulmonologists and recently by an allergist. Patients consents verbally for the skin prick tests.

There were two panels of extracts used during the three year period, bought from two different companies, and represented by two different graphs in the results. The panel of allergens used consisted of common inhalant allergens believed to be of significance. In the first period, the extracts used were bought from Benocard Company. In the second period, the extracts used were bought from Allergy Laboratories, Inc., USA. Skin prick tests were performed by qualified technicians according to standard method. Disposable Greenlan needles, lancet 23G, were used to prick the skin. Histamine positive control and diluent negative control were used. A skin test was considered positive when a wheal was 3 mm greater than the negative control. Eight patients (7 from the first period and 1 from

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</tr>
<tr>
<td>Non-Omani</td>
</tr>
<tr>
<td><strong>Referring Clinic</strong></td>
</tr>
<tr>
<td>Chest</td>
</tr>
<tr>
<td>ENT</td>
</tr>
<tr>
<td>Child Health</td>
</tr>
<tr>
<td>Ophthalmology</td>
</tr>
<tr>
<td>Other</td>
</tr>
<tr>
<td><strong>Diagnosis</strong></td>
</tr>
<tr>
<td>Asthma</td>
</tr>
<tr>
<td>Allergic rhinitis</td>
</tr>
<tr>
<td>Rhinoconjunctivitis</td>
</tr>
</tbody>
</table>
the second period) were not included in the analysis as they had negative histamine control; none tested positive for negative control.

Using the Statistical Package for the Social Sciences (SPSS), data were entered into two different sheets. For the analysis of baseline characteristics, the data were combined and frequencies were calculated. The two panels of allergens were analysed separately, as they are different and the frequencies were calculated.

**RESULTS**

There were a total of 689 patients with asthma, allergic rhinitis and rhinoconjunctivitis tested during the study period. A total of 384 were tested for the first panel and 305 for the second panel. The youngest patient was 5 years old and the oldest 81 years old; the median age was 30 years. The majority of patients were referred from the chest and ENT clinics. Of the patients tested, 39.2% had a diagnosis of asthma, 61.3% allergic rhinitis and 1.9% rhinoconjunctivitis. Baseline data are summarised in Table 1.

During the first period [Figure 1], the commonest positive allergens were house dust mites with 37.8% of patients being sensitised, hay dust (35.4%), straw dust (22.7%), mixed threshing dust (25.8%), grasses (11.5%) (in 11 cases the extract was not available), trees (10.4%), maize (16.1%), cotton flock (10.7%), animal allergens, sheep wool (26.6%), horse hair (17.4%), cat fur (24.2%), cow hair (7.8%), feathers (33.3%), cockroaches (22.7%) (in 19 cases the extract was not available); mould allergens: *Alternaria alternata* (3.6%), *Aspergillus Niger* (3.4%), and *Aspergillus fumigatus* (1.3%).

During the second period [Figure 2], the commonest positive allergens were also house dust mites: *Dermatophagoides pteronyssinus* (50.8%), *Dermatophagoides farinae* (47.9%); pollen allergens: mesquite (*Prosopis glandulosa*) (35.7%), Russian thistle (*Sal-sola kali*) (34.4%), Bermuda grass (*Cynodon dactylon*) (19.7%), grass mix-five standard (18.0%) and wheat cultivate (14.1%) [in 2 cases the extracts were not available]; animal allergens: cat (13.8%), dog (2.6%), horse hair and dander (2.6%), feather mix 3.0%; moulds: *Aspergillus Niger* (3.3%), *Aspergillus fumigatus* (1.6%), *Penicillium notatum* (4.3%) [in 11 cases the extract was not available] and *Alternaria tenius* (3.9%) and cockroach (32.1%).
DISCUSSION

In this study, we are able to demonstrate that house dust mites are the commonest sensitisation in Omani patients; half of all patients were sensitised to them which is in agreement with other studies conducted on asthmatic patients elsewhere. About one third of patients were sensitised to mesquite tree and Russian thistle, both common plants in Oman. Grasses contributed to 10% of cases. However, there are other plants in Oman that are potentially allergenic like date palm (Phoenix dactylifera), a widely planted tree in Oman, for which it may be necessary to test. The families of Chenopodiaceous and Compositae plants both exist in Oman and may contribute to sensitising agents. Hay dust, straw dust and mixed threshing contributed to about one third in the first period, but these were not individual allergens. One third of patients were sensitised to cockroaches implicating a significant contribution.

In Oman, animals are not often allowed into houses, but sometimes there are domestic cats and dogs that stay around houses and people might get exposed to their allergens. Horses are mainly raised in stables and exposure might be limited to people that work with them. The difference in rate of sensitisation between the two panels could be because of lack of standardised allergens made by different manufacturers. Some people raise cattle, goat and sheep in small farms attached to the backyard of their houses. Pigeons are found in Oman; it is not a common practice to keep them inside houses, however exposure to their feathers is still possible as they nest on buildings. There were more patients sensitised to animals and birds in the first period than in the second period. This might be due to variation in allergen extracts because of lack of standardised allergens made by different manufacturers. Goats are raised in Omani farms and sometimes close to houses therefore it might be an important allergen that should be tested in conjunction with sheep. In general, not all patients necessarily need to be tested unless there is a history of exposure or ownership of a certain animal or bird.

Oman is a warm country with a dry weather, except in the coastal area where it may be humid in the summer. Houses are usually exposed to sun all year around and well ventilated, and usually there are no basements. Moulds grow in humid places and are well known to cause allergies; their environmental control might be more amenable than other allergens and immunotherapy is readily available, hence all patients should be tested. In both study periods, they did not contribute significantly in patients tested; however, it might be useful to use mixtures of moulds rather than individual ones to minimise skin pricks and, if immunotherapy is contemplated, individual moulds could then be tested.

CONCLUSION

The pattern of sensitisation to environmental allergens in Oman seems to be more or less similar to other reports published from Arabian Peninsula. Methods to identify and characterise unique allergens through a pollen survey may still be necessary. This will help in the management of patients with asthma and rhinoconjunctivitis who are sensitised to environmental allergens and may benefit from environmental control measures and immunotherapy.

ACKNOWLEDGMENTS

This study was approved by the Institutional Review Board (Scientific & Ethics Committee) of College of Medicine at Sultan Qaboos University

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and safety of specific immunotherapy with SQ allergen extract in treatment-resistant seasonal allergic rhinoconjunctivitis. Allergy Clinic Immunol, 2006; 117:319-325.


17. Skin tests used in type I allergy testing position paper. EAACI. Sub-committee on skin tests of the European Academy of Allergology and Clinical Immunology. Allergy 1989; 44:1–59.

Satisfaction among Expectant Mothers with Antenatal Care Services in the Musandam Region of Oman

Mohammed Ghobashi, Rajiv Khandekar

ABSTRACT

Objectives: As client feedback is useful to improve health service delivery, assessments should be undertaken periodically. This study aimed to determine the level of satisfaction among expectant mothers visiting health institutions for antenatal care services in the Musandam region of Oman in 2005.

Methods: This was a cross sectional survey in a hospital setup. Women registered in the antenatal clinics of different health institutions of Musandam region were interviewed. Arabic speaking investigators in six health institutions of Musandum region collected personal profiles, details of different antenatal services offered and responses regarding the satisfaction with these services. The number and percentage of responses were calculated to grade the level of satisfaction.

Results: Eighty-three registered women who visited antenatal clinics in six health institutions were interviewed. The overall satisfaction for antenatal care was of excellent grade in 49 (59% - 95% confidence interval 48.5 - 69.6) participants. Sixty-seven (81%) women were happy with services at antenatal clinics mainly because of the attitude of the doctors and nursing staff. The leading causes of dissatisfaction were the laboratory services and overcrowding during morning hours.

Conclusion: The women attending antenatal care services in Musandam were highly satisfied with the services offered; however, there was scope for further improvement. The Ministry of Health in consultation with the caregivers should focus on improving antenatal services.

Key words: Antenatal care; Patient satisfaction; Oman

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Advances in Knowledge

• Reviewing the client’s perspective should be an integral part of health programme management.
• Client satisfaction related to antenatal care services in the Musandam region of Oman was very good.
• Feedback of clients should be complemented by direct observations of process and resource evaluation.

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CLIENT SATISFACTION IS THE LITMUS TEST that enables health programmes to assess the impact of their services; hence, it is an integral part of the ‘quality assurance process’ of health delivery.1 The satisfaction of female clients of antenatal care services has been studied in the past in other countries.2-5 Dowswell et al.6 performed a meta-analysis in 2001 to review the work of different researchers on this subject and suggested that more information is still needed. Apart from a thesis of a PhD student,7 no such feedback has been obtained in the past in Oman. Our study focuses on a remote area of Oman, which has a predominantly Muslim health clientele. Analysing satisfaction levels with the free services offered in a remote region of a Middle Eastern country is a useful way to improve the services and can provide a model for others to follow. Musandam is the northern most region of Oman. As this region is surrounded by part of the United Arab Emirates, access to the rest of the regions of Oman is difficult. The Oman Ministry of Health (MoH) provides health services to the 28,378 residents of the region. There are three hospitals and three primary health centres.7 Qualified medical doctors and nursing staff provide antenatal care services to expectant mothers in these institutions. Staff members were trained in different countries like India, Egypt, Pakistan and Iraq and many of them do not speak Arabic. Obstetricians provide high quality antenatal, natal and postnatal care at the regional hospital and one local hospital. The 6,136 women aged 15 to 49 years of age in Musandam could use these services. The health services charge US $ 2.5 as a case fee. The terrain is so difficult and diverse that the services are offered either by boats or helicopter in some areas of the region. Complicated cases are transported to the tertiary care unit situated nearly 500 kilometres away in Muscat. Ambulances for such critical cases have to travel over mountainous roads, thus imposing unavoidable but definite risks on the patients.

The national coverage of antenatal services in Oman is more than 99%. Around 97.5% of the expectant mothers give birth in the institutions while the rest deliver at homes under the supervision of a trained nurse.8, 9

In 2005, the staff of the MoH Maternal and Child Health Care Program evaluated the satisfaction of expectant mothers who visited the health institutes of Musandam region. The authors here present the outcome of this study and propose ways to improve the services. Following this study, the Mother and Child Health Program of Oman was encouraged to undertake similar surveys in other regions.

METHODS
This was a cross-sectional study approved by the ethical committee of the MoH of the Musandam region. As no biological product was taken solely for the purpose of research and the study was conducted within the health institutions as part of operational research to improve health care systems, we obtained verbal instead of written consent from the participants. The expectant mothers visiting health institutions of the region between 3 and 9 January 2005 were enrolled in the study. To represent nearly 423 annual deliveries taking place in the region, we selected a sample for our study. We assumed that an excellent grade of satisfaction for the antenatal care services would be 80% of clients. To achieve 90% power and 95% confidence in-

• Communicating with clients in their native language could be the key to satisfying their antenatal service needs.
• Presence of community support group members or Arabic speaking health staff improves cooperation of participants in a study.

Applications to Patient Care
• Health staff should communicate effectively with expectant mothers during their antenatal visits, as this is key to improving their satisfaction.
• If possible, waiting time for laboratory tests results should be reduced and clients informed about the normal procedure and time needed for such tests.
• The process of health education for expectant mothers in Musandam should be reviewed and made more client-friendly.
### Table 1: Characteristics of the study population, Musandam region, Oman

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
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<td><strong>Age group</strong></td>
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<td></td>
</tr>
<tr>
<td>&lt;20</td>
<td>4</td>
<td>4.8</td>
</tr>
<tr>
<td>20 to 24</td>
<td>28</td>
<td>33.7</td>
</tr>
<tr>
<td>25 to 29</td>
<td>26</td>
<td>31.3</td>
</tr>
<tr>
<td>30 to 34</td>
<td>17</td>
<td>20.5</td>
</tr>
<tr>
<td>35 and more</td>
<td>8</td>
<td>9.6</td>
</tr>
<tr>
<td><strong>Wilayat</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Khasab</td>
<td>50</td>
<td>60.2</td>
</tr>
<tr>
<td>Deba</td>
<td>23</td>
<td>27.7</td>
</tr>
<tr>
<td>Bukha</td>
<td>8</td>
<td>9.6</td>
</tr>
<tr>
<td>Madaha</td>
<td>2</td>
<td>2.4</td>
</tr>
<tr>
<td><strong>Nationality</strong></td>
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<td></td>
</tr>
<tr>
<td>Omani</td>
<td>66</td>
<td>79.5</td>
</tr>
<tr>
<td>Non-Omani</td>
<td>17</td>
<td>20.5</td>
</tr>
<tr>
<td><strong>Literacy level</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Illiterate</td>
<td>13</td>
<td>15.7</td>
</tr>
<tr>
<td>Can read &amp; write</td>
<td>4</td>
<td>4.8</td>
</tr>
<tr>
<td>School education</td>
<td>51</td>
<td>61.4</td>
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<tr>
<td>Higher education</td>
<td>15</td>
<td>18.1</td>
</tr>
<tr>
<td><strong>Babies in past</strong></td>
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<td></td>
</tr>
<tr>
<td>Aborted</td>
<td>25</td>
<td>30.1</td>
</tr>
<tr>
<td>No babies</td>
<td>18</td>
<td>21.7</td>
</tr>
<tr>
<td>1 to 3 babies</td>
<td>47</td>
<td>56.6</td>
</tr>
<tr>
<td>4 or more babies</td>
<td>18</td>
<td>21.7</td>
</tr>
<tr>
<td><strong>Married life (n = 76)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;1 year</td>
<td>10</td>
<td>12.0</td>
</tr>
<tr>
<td>1 to 4.9 years</td>
<td>19</td>
<td>22.9</td>
</tr>
<tr>
<td>5 to 9.9 years</td>
<td>15</td>
<td>18.1</td>
</tr>
<tr>
<td>10 and more years</td>
<td>33</td>
<td>39.8</td>
</tr>
<tr>
<td><strong>Occupation</strong></td>
<td></td>
<td></td>
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<tr>
<td>Home maker</td>
<td>68</td>
<td>81.9</td>
</tr>
<tr>
<td>Teacher</td>
<td>7</td>
<td>8.4</td>
</tr>
<tr>
<td>Staff nurse</td>
<td>1</td>
<td>1.2</td>
</tr>
<tr>
<td>X-ray technician</td>
<td>1</td>
<td>1.2</td>
</tr>
<tr>
<td>In Air force</td>
<td>1</td>
<td>1.2</td>
</tr>
<tr>
<td>Head teacher</td>
<td>1</td>
<td>1.2</td>
</tr>
<tr>
<td>S. Nutrition</td>
<td>1</td>
<td>1.2</td>
</tr>
<tr>
<td>Missing</td>
<td>3</td>
<td>3.6</td>
</tr>
<tr>
<td><strong>Pregnancy stage</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1st trimester</td>
<td>12</td>
<td>14.5</td>
</tr>
<tr>
<td>2nd trimester</td>
<td>21</td>
<td>25.3</td>
</tr>
<tr>
<td>3rd trimester</td>
<td>50</td>
<td>60.2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>83</td>
<td></td>
</tr>
</tbody>
</table>
interval of the study with a 10% acceptable error of margin, we needed to interview 78 clients. To compensate for possible refusals, we included five more women. In fact, in the field part of our study, all enrolled agreed to participate thus the final sample was 83 women.

The participants were selected in series in a health institution on a randomly selected day and were those coming for an antenatal visit. First, we randomly selected the health institution. Then we selected one day from five working days of the week to visit each institution. On that day, we enrolled the women in sequence (meaning pregnant women visiting the clinic one after another as they presented on the day that was randomly fixed for conducting the study in that institution.), as per the number required for that health institution. The numbers interviewed per health institution were based on the proportion of females in the 20 to 40 years age group in that catchment area.

Arabic speaking Omani nursing staff and medical orderlies were our study staff. The Community Support Group (CSG) members who were Omani nationals were also involved as they were known to most of the participants and hence we could reduce the risk of the impact of involving health staff in the study. These CSG members assured the participants that negative responses would not affect the service being offered to them. They were trained in the study methodology. A pilot study to test the methods and the questionnaire was carried out in Khasab hospital, Musandam, prior to the field work. This helped us in fine-tuning the questions to suit local Arabic words as well as standardising the method of conducting the interview.

During the study period, the staff visited the female waiting area of the antenatal clinics. They explained the purpose of the study to waiting expectant mothers and obtained their verbal consent to participate. Their replies were noted. The response of the person accompanying the patient was not noted, but also considered as additional feedback for administrators. The interview was conducted in a separate room. The available resources, personal care given by the attending staff and the time spent at six places namely reception, the nursing station, doctor’s consultation room, laboratory, counselling and pharmacy were covered in the interview. A close-ended questionnaire was prepared to collect responses. Each question had five grades of response. We calculated cumulative points by summing up the responses addressing the same group of questions. To minimize the social desirability bias, we explained the purpose of the survey, involved the CSG members in the Arabic translation, explained the questions and options for responses, especially if the health staff was non-Arabic speaking, and strictly followed the cultural and social norms.

The identity of the participants was de-linked from the responses. The person analysing the data was unaware of the study area and the names of the participants. The data was computed using EPI Data. The frequency and percentage proportions of the important outcomes were calculated using the Statistical Package for Social Studies (SPSS), Version 9. We used the parametric method of univariate analysis. Each strong positive response was given +2 points. A positive response was given +1 point. An equivocal response was awarded ‘0’ score. A negative answer was considered as poor and was given ‘-1’ score. Severe dissatisfaction was graded as ‘very poor’ and given a ‘-2’ score. The overall satisfaction of the expectant mother was graded into ‘Excellent’, ‘Good’, ‘Poor’ and ‘Very poor’ categories by using the 25% percentile of the sum of response for different categories of antenatal services.

### Table 2: Satisfaction with different components of antenatal care in the Musandam region of Oman

<table>
<thead>
<tr>
<th>Topic</th>
<th>Excellent</th>
<th>Good</th>
<th>Poor</th>
<th>Very Poor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinic</td>
<td>62</td>
<td>21</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Attending doctor</td>
<td>67</td>
<td>16</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Attending nurse/midwife</td>
<td>72</td>
<td>11</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Waiting time</td>
<td>11</td>
<td>62</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>Laboratory services</td>
<td>12</td>
<td>11</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Pharmacy support</td>
<td>0</td>
<td>81</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>49</td>
<td>34</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Note: The option ‘cannot say’ was not ticked by any participant for any of the questions.
RESULTS

Eighty-three participants were sequentially enrolled and interviewed in our study. Their profile suggests that they were educated and distributed in different wilayats (districts) of Musandam region [Table 1]. The distribution of 15 to 45 years old participants in relation to the population in different wilayats of Musandam region was calculated. The proportion of the target population in Khasab, Daba, Bukha, Madah wilayats was 64.6%, 18.3%, 9.4% and 7.7% respectively. The population of Madah wilayat was under-represented in our study. Of the 17 non-Omani participants, seven were Muslim while five each were of Hindu and Christian religion. All 66 Omani females were Muslims.

The levels of satisfaction for different components of the antenatal care service delivery were calculated [Table 2]. Forty-nine respondents (59%) reported an ‘Excellent’ grade of overall satisfaction. The rest of the participants reported ‘Very good’ levels of satisfaction. Waiting times during the visit and the support in the pharmacy fell short of clients’ expectations. The waiting time was counted and compared with the response of the client. The leading causes of satisfaction are given in Table 3. The positive behaviour of the health staff and the warm reception mothers received in the antenatal care unit were the most satisfying parts of the services.

Weakness in the laboratory services, long waiting periods in the clinics, especially during the morning hours, and non-availability of Arabic speaking doctors were the areas for improvement [Table 4]. We considered waiting time after the registration of a new/old case. A ‘very poor’ grade of satisfaction was considered to be a weak area of antenatal services. The dissatisfaction expressed mainly related to the process of imparting health education (commitment, availability of time and language barrier) and not to the availability of health education material.

DISCUSSION

The importance of client satisfaction and feedback has been highlighted in the literature, but scientists have used different methods of assessing patient satisfaction. Noting observations, evaluating available resources, reviewing the attendance with time and even monitoring the time spent at different places of antenatal care are different methods used. In our study, we recorded client’s perception about overall care and also different components of the antenatal care services. Each method has advantages and disadvantages. Direct observations are more specific and reliable but they do not incorporate clients’ perspectives. Feedback from clients is collected only through suggestion boxes in many institutions, but they may mainly contain complaints and rarely positive experiences. Even these complaints are written often without proper understanding of the limitations of the providers; hence, the outcomes of such studies should be linked to the review of available resources before interpreting them.

Our study showed that clients, in general, have a positive opinion of the antenatal care services offered in the Musandam region. This matched with the observations of Yan T et al. and Hildingsson et al. In the former study, the participants were pregnant women with foetal anomalies in a province of Canada, while the later study covered three European countries.

Interaction of caregivers with the clients has always been the key to high satisfaction with the service. In our study, an ‘Excellent’ grade of satisfaction for subcomponents of health staff behaviour confirms this observation. Doctors were considered ideal for imparting technical knowledge, providing emotional

<table>
<thead>
<tr>
<th>Topic</th>
<th>Number</th>
<th>%</th>
<th>95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reception by health staff is good</td>
<td>47</td>
<td>56.6</td>
<td>45.9-67.3</td>
</tr>
<tr>
<td>Clear instructions</td>
<td>7</td>
<td>8.4</td>
<td>2.4-14.4</td>
</tr>
<tr>
<td>Medical orderly available with doctor in ANC</td>
<td>5</td>
<td>6.0</td>
<td>0.9-11.1</td>
</tr>
<tr>
<td>Put number on cards</td>
<td>7</td>
<td>8.4</td>
<td>2.4-14.4</td>
</tr>
<tr>
<td>Good, clean clinic</td>
<td>8</td>
<td>9.6</td>
<td>3.3-15.9</td>
</tr>
<tr>
<td>Good clinic arrangement</td>
<td>4</td>
<td>4.8</td>
<td>0.2-9.4</td>
</tr>
<tr>
<td>Good laboratory services</td>
<td>2</td>
<td>2.4</td>
<td>0.0-5.7</td>
</tr>
<tr>
<td>Satisfied with service</td>
<td>6</td>
<td>7.2</td>
<td>1.6-12.8</td>
</tr>
<tr>
<td>Timely work</td>
<td>1</td>
<td>1.2</td>
<td>0.0-3.5</td>
</tr>
</tbody>
</table>

Table 3: Causes of satisfaction with antenatal care in the Musandam region
support and assisting in decision making, although female nurses and midwives were more acceptable as they can reassure pregnant women and alleviate their anxiety. 15

Health education and communication in the local language are stressed to improve client satisfaction. 14, 16 In our study, the presence of Arabic speaking CSG members helped us in overcoming the language barrier between service providers and clients.

The dissatisfaction with the laboratory services and facilities and the long waiting period for antenatal care, especially in the morning hours, were noted in our study. We did not note the time taken waiting for a laboratory test and the waiting time for the test results; hence we are not sure if the dissatisfaction of clients about the length of waiting time was genuine or whether it was due to improper counselling about time needed for laboratory procedures. Further studies should therefore explore this issue and propose corrective measures if required. These issues were also the reasons for low satisfaction in a study covering four countries including Saudi Arabia (a neighbouring country of the present study area). 17

Few participants in our study were practising a religion other than the Muslim one. In addition, we had not planned to study the influence of religion on the main outcomes. Hence, we could not associate the client’s religion to the level of satisfaction for antenatal care in our study. Tsianakas et al. has reported that health providers’ lack of cultural appreciation was one of the reasons for dissatisfaction among women of Islamic background in Australia. 18 Thus, if antenatal care is delivered with specific consideration to the religion commonly practiced in this area, it will be more acceptable.

Fifty participants were in their third trimester of pregnancy. In antenatal services, women visit more frequently during this period compared to the earlier trimesters. Their response could be a cumulative one of their experience of services not only for the current visit but also of the earlier visits. In such circumstances, high satisfaction is suggestive of availability of satisfactory antenatal services for at least one year in the study area. Due to the possibility of misclassification bias, we did not study differential satisfaction in relation to the trimester of pregnancy.

Sixty-six females (79.5%) had school education in our study. The literate participants are likely to be more aware of newer developments in the field of antenatal care and their expectations are also likely to be higher compared to the illiterate females. In view of the high literacy rate among the participants, the high satisfaction rate for the antenatal care services in our study is worth noting.

Waiting time has been reported to influence the satisfaction of clients. 5, 17 In our study also, this factor was linked to dissatisfaction with the services; however, it did not match with the time noted independently by field staff. Although we did not have any benchmark for the time required at different stages of the antenatal care, grievances about delays, especially in laboratory tests should be taken into consideration in the future.

Communication by providers to with the women during antenatal visits plays an important role. 12, 15 Three out of eight doctors were able to speak Arabic with patients in our study area. The clients’ stress on the need for Arabic speaking doctors and it being one

<table>
<thead>
<tr>
<th>Topic</th>
<th>Number</th>
<th>%</th>
<th>95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laboratory services</td>
<td>30</td>
<td>36.1</td>
<td>25.8 - 46.4</td>
</tr>
<tr>
<td>Crowding clinic in the morning</td>
<td>16</td>
<td>19.3</td>
<td>10.8 - 27.8</td>
</tr>
<tr>
<td>Non-availability of Arabic speaking doctor</td>
<td>12</td>
<td>14.5</td>
<td>6.9 - 22.1</td>
</tr>
<tr>
<td>Health education services not good</td>
<td>6</td>
<td>7.2</td>
<td>1.6 - 12.8</td>
</tr>
<tr>
<td>No explanation of antenatal clinic</td>
<td>6</td>
<td>7.2</td>
<td>1.6 - 12.8</td>
</tr>
<tr>
<td>Not listening to complaints of pregnant women</td>
<td>1</td>
<td>1.2</td>
<td>0.0 - 3.5</td>
</tr>
<tr>
<td>Unavailability of gynaecologist</td>
<td>5</td>
<td>6.0</td>
<td>0.9 - 11.1</td>
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<tr>
<td>Long waiting time</td>
<td>5</td>
<td>6.0</td>
<td>0.9 - 11.1</td>
</tr>
<tr>
<td>No Sonar test</td>
<td>5</td>
<td>6.0</td>
<td>0.9 - 11.1</td>
</tr>
</tbody>
</table>

Table 4: Causes of dissatisfaction among pregnant women, Musandam region
of the main reasons for dissatisfaction, suggest that language could be a possible barrier in communication between doctors and expectant mothers in our study area.

Our staff belonged to the Ministry of Health, the only health service provider in this remote region of Oman. The possibility of social desirability bias cannot be ruled out entirely in such circumstances, but the community’s willingness to voice dissatisfaction about deficiencies in governmental services is often observed in hospitals. They give written complaints to the administrators or raise the issue in the Majlis Al Shura (national parliament) through the local representatives. In such a situation, fear of compromised antenatal care is unlikely to be the cause of the high proportion of ‘Excellent’ scores in our study. A postal response approach for collecting information has less risk of social desirability bias and was used by Brown et al. However, such an approach was not feasible in our study as the terrain in the Musandam region is very difficult and the community is well accustomed to verbal surveys at their health institutions mainly for estimating the magnitude of key diseases.

As our sample was selected by sequential methods all clients that attended the antenatal services during 2005 did not have an opportunity to participate in the study. Hence the outcome of the present survey should be generalised with caution for all the expectant mothers of the region.

CONCLUSIONS

The women attending antenatal care services in Musandam were highly satisfied with the services offered, but there is scope for further improvement. The Ministry of Health in consultation with the caregivers should focus on improving antenatal services.

ACKNOWLEDGMENTS

This subject was the thesis of Dr. M Ghobashi for his Master’s degree in Hospital Administration.

We thank the health administrators of the region of Musandam and the Maternal and Child Health Care Program of Oman for its support of the study. We appreciate the contribution of community support group members and of the dedicated nursing staff of the Musandam health institutions. We thank the participating women for their overwhelming responses. Mr Saleh Al Harby assisted in data entry and statistical analysis.

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Hairy Cell Leukaemia in Oman
Four cases

*Arundathi Kurukulasuriya, Asia Al-Rashdi, Muhanna Al-Muslahi

ABSTRACT
Hairy cell leukaemia (HCL) is a rare, clonal, chronic lymphoproliferative disorder commonly seen in males in the middle years of life. Pancytopaenia with moderate to massive splenomegaly is the most common clinical presentation. Diagnosis is made on detecting the lymphocytes with abundant cytoplasm which spread into hair-like processes on peripheral blood and bone marrow smears, thus giving the name, “hairy cell leukaemia”. The bone marrow aspirate is frequently a dry tap. The trephine biopsy has the characteristic features of a honeycomb appearance and flow cytometry is typically CD103, CD25, FMC7, CD11c, gamma or kappa light chain positive with the classic B lymphocyte markers CD19, CD20, CD79a. Purine analogues followed by granulocyte-colony stimulating factor (G-CSF) to manage the febrile neutropenia is currently the treatment of choice. A 10 year disease free survival is recorded with these management strategies. Experimental use of anti CD20 and CD22 has also shown promising results in the treatment of this disease. We report four cases of HCL diagnosed in a span of two years at the Royal Hospital, Muscat, Oman.

Key words: Hairy cell leukaemia; Lymphoproliferative disorder; Case report; Oman.
white blood cells (WBC) - 0.8 x 10⁹/L, absolute neutrophil count (ANC) 0.3 x 10⁹/L, platelets - 48 x 10⁹/L. Renal and liver function tests were normal other than for a low serum albumin. The blood picture confirmed the presence of pancytopenia with no blast cells or dysplastic changes. He was resuscitated with blood transfusion and intravenous antibiotics. Nursed in isolation, the bone marrow aspirate was performed once his condition stabilised.

The bone marrow aspirate and trephine biopsy showed hairy cells. The cytochemistry was positive with tartrate resistant acid phosphatase (TRAP).

The immunohistochemistry on the trephine biopsy showed the lymphocytes were positive for CD20, CD79a and DBA 44.

Flow cytometry (FCM) on the bone marrow aspirate was positive for CD19, CD20, CD22, CD25, CD103, CD11c, FMC7 and kappa light chain and negative for CD3, CD5, CD7, CD10, CD23, CD38.

The diagnosis of hairy cell leukaemia was established, but the patient refused intravenous chemotherapy and received three mega units of interferon alpha subcutaneously thrice a week for six months. He achieved a complete haematological response and his CBC remained stable six months after cessation of therapy.

CASE 2

An Omani male, aged 62 years, was referred from another hospital for pancytopenia, diagnosed with myelodysplasia (MDS) and treated with blood transfusions, erythropoietin and granulocyte-colony stimulating factor (G-CSF) without significant response. He was admitted to the Royal Hospital with fever, malena, haematemesis and had cervical lymphadenopathy, bilateral basal crepitations with a splenomegaly of 6cm and a hepatomegaly of 4cm. His CBC revealed a severe pancytopenia with: Hb% - 3.4 g/dL, WBC – 3.1 x 10⁹/L, ANC -0.4 x 10⁹/L, platelets 5.0 x 10⁹/L. His blood picture and the bone marrow aspirate showed hairy cells positive for TRAP. The immunohistochemistry was positive on the trephine for CD20, CD79a and DBA44 confirming the diagnosis of hairy cell leukaemia. The flow cytometry (FCM) results on the bone marrow aspirate was positive for CD19, CD20, CD22, CD25, CD11c, FMC7 and kappa light chain.

He was admitted to the Intensive Care Unit with acute renal failure and septic shock and the blood culture showed a heavy growth of yeast. He succumbed to septicaemia and died a few weeks after admission despite intensive supportive care, broad spectrum antibiotics and antifungal therapy.

CASE 3

An Omani male, aged 47 years, a known diabetic on oral hypoglycaemics, was referred from a peripheral hospital for investigation of pancytopenia, hepat-
osplonemegaly and fever. He had diarrhoea positive for salmonella which was treated before he arrived at the Royal Hospital. He recounted a two month history of backache and fever. He had hepatosplenomegaly with no lymphadenopathy. A computed tomography (CT) scan showed no evidence of mediastinal lymphadenopathy. His CBC revealed an Hb% - 8.9 g/dL, WBC – 2.6 x10⁹/L, ANC 0.4x10⁹/L, platelets – 94.0 x 10⁹/L. The blood picture, bone marrow aspirate and the trephine biopsy showed hairy cells. The TRAP was unsatisfactory. The marrow aspirate was inadequate for FCM. The trephine biopsy was positive for CD79a, CD20 and DBA44.

He was treated with cladribine 0.14 mg/kg infusion over two hours for five days. He had two episodes of febrile neutropenia which were treated successfully with intravenous antibiotics. Six months later, his blood count improved to Hb 10.2 G/dL, WBC 3.1x10⁹/L, ANC 1.9 x10⁹/L and platelets – 141.0 x 10⁹/L.

C A S E 4

An Iraqi woman, aged 36 years, was referred for pancytopaenia detected on a routine CBC following a lower segment caesarian section. A CT scan showed a para-aortic lymphadenopathy in her chest and moderate hepatosplenomegaly. Her haematological parameters confirm the presence of bilineage cytopenia: Hb% -12.0 G/dL, WBC - 1.7 x10⁹/L with ANC 0.2x10⁹/L, platelets – 102.0x 10⁹/L. The bone marrow aspirate and trephine biopsy showed hairy cells. The trephine biopsy was positive for CD20, CD79a and DBA44.

The FCM on the bone marrow aspirate was positive for CD19, CD20, CD22, CD25, CD103, FMC7 and kappa light chain.

She was treated with intravenous cladribine 0.1mg/kg continuous infusion for seven days. She continues to be followed up in the region where she lives and her CBC is normal.

D I S C U S S I O N

Middle aged people are more affected by HCL, with a male-female ratio of 5:1. Three of our patients were male and one was a female. The characteristic presentation is with pancytopaenia in more than 50% of patients, moderate to massive splenomegaly in 85%, with or without hepatomegaly in 40% and bone marrow infiltration. Opportunistic infections are common. Rare presentations include vasculitis, splenic rupture, bony involvement, neuropathy, and autoimmune haemolytic anaemia. Guillain-Barré syndrome has been reported in association with HCL or following cladribine treatment.

The peripheral blood shows the lymphocytes with shaggy hair like cytoplasmic projections in 90% of patients. Although it leads to a distinct morphological diagnosis, sometimes a severe pancytopaenia, a dry bone marrow aspirate due to reticulin fibrosis could deprive us of this diagnostic information because of
the paucity of cells. Then the diagnosis is often based on the trephine biopsy which shows a patchy, diffuse infiltrate of the hairy cells, described as having a fried egg or honey comb appearance.\(^3\) This occurs because the lymphocyte nuclei are spaced far apart due to the retraction of the cytoplasmic processes. The characteristic infiltrate of the spleen is in the red pulp and this is the only small B cell non Hodgkin’s lymphoma that is diagnostic of this disease.\(^1\) Thus, morphology, cytochemistry and immunohistochemistry on the trephine biopsy, aspirate with acid phosphatase is resistant to tartrate (TRAP). This is also done as immunohistochemistry on the trephine biopsy. There are no specific chromosomal abnormalities or molecular genetic alterations that are diagnostic of this disease.\(^1\)

Infiltration of the kidneys, colon, adrenal glands, myocardium, meninges, pancreas and connective tissue have been reported.\(^3\)

Cytochemistry and immunohistochemistry play an important role in the diagnosis of HCL. Cytochemistry on the hairy lymphocytes in blood or bone marrow aspirate with acid phosphatase is resistant to tartrate (TRAP). This is also done as immunohistochemistry on the trephine biopsy. There are no specific chromosomal abnormalities or molecular genetic alterations that are diagnostic of this disease.\(^1\) Thus, morphology, cytochemistry and immunohistochemistry on the trephine biopsy/flow cytometry are useful tools in diagnosis of this uncommon lymphoma in its leukemic phase. The hairy cells strongly express CD 103, CD25, FMC7, CD11c, and the B cell markers CD20, CD 79a and monoclonal kappa or lambda light chains.\(^1\)

Supportive care with packed red cells and platelets were the mainstay of replacement therapy for the cytopenias in our patients.

The current treatment of HCL is with the purine analogues, 2 chlorodeoxyadenosine (2CdA/cladribine) and pentostatin. Treatment is indicated for patients with significant cytopenia, symptomatic splenomegaly, recurrent serious infections and constitutional symptoms. Cladribine is used as a single infusion or a course of subcutaneous injections.\(^11\) The two widely used infusion regimens are either 0.1 mg/kg continuous intravenous infusion over 24 hours for seven days or 0.14 mg /kg intravenous infusion over two hours for five days, with no statistically significant difference in the rate of response or complications between the two regimens.\(^12, 13\) A high incidence of febrile neutropenia is recorded with this treatment.\(^14-17\) G–CSF is used to overcome this side effect. It is rare that more than one course of treatment is required. In a recently published randomised study in 132 patients with untreated HCL, one group of patients were treated with the standard regimen of cladribine 0.14mg/kg daily for 5 days, while the other group was treated with a weekly dose of cladribine for six weeks. Both regimens where found to be equally effective; the weekly regimen was not, in fact, safer nor did it reduce toxicity or the risk of infections.\(^18\) Treatment is discontinued once complete remission (CR) or partial remission (PR) is achieved with normalisation of peripheral blood counts.\(^19\) Cladribine could induce a durable and long lasting remission in the majority of patients with only a single cycle of therapy and the relapsed patients could be treated successfully with a repeated cycle of cladribine.\(^20-22\) There is a good correlation between minimal residual disease as demonstrated by DBA44 immunostaining and risk of relapse.\(^22\)

Single IV pentostatin is administered intermittently for a longer treatment duration, but may result in a lower incidence of febrile neutropenia.\(^23, 24\) It is usually administered in cycles of 4 mg/m2 twice weekly, repeated every 8 weeks \(^25\) for three cycles. It was found to be highly effective in treating HCL with prolonged remission duration and without an increase in subsequent risk of malignancy.\(^25, 26\)

Most patients remain disease free for ten years following treatment with purine analogues. CR is achieved in 80- 85% of patients. No patient has been followed up long enough to assess cure.\(^27, 28\) The role of consolidation and maintenance therapy in preventing relapse or progression of the disease has not been evaluated. Interferon alfa is also used for those patients with intercurrent infections and severe cytopenias.\(^29\) CR is seen in 20-30% of patients.\(^30\) For patients with severe thrombocytopenia and massive spleens, splenectomy is considered.\(^31\) Monoclonal antibodies against CD20 (rituximab) and CD22 have now shown activity against HCL.\(^30\) These antibodies seem to achieve good responses in the group relapsing on cladribine; however, its main role maybe useful in combination with purine analogues.\(^30\)

**CONCLUSION**

HCL manifests in the middle years of life, with a male predominance, characterised by pancytopenia caused by moderate to massive splenomegaly. It is an easy diagnosis to make on the morphology of well made blood and bone marrow smears. Although there are no specific markers for HCL, cytochemistry and flow cytometry readily confirm the diagnosis. This is the first report of HCL in Oman. The diagnosis and
management was based on current guidelines. The outcome of clinical remission was achieved in 3 patients and one patient succumbed to an opportunistic infection.

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Varicella zoster infections are considered to be mild and ubiquitous infections predominantly affecting the paediatric population. However, in adults and in specific groups of patients, such as those who are immunosuppressed, varicella infections can be fulminant and life-threatening. We here present a case report of a young female patient with a normal immune system who had a fulminant varicella infection with multiorgan involvement.

Key words: Chickenpox; Herpes virus 3, human; Rhabdomyolysis; Disseminated intravascular coagulation; Pneumonia; Case report; Oman

Varicella virus infection in humans can result in two distinct clinical syndromes: chickenpox and herpes zoster. Chickenpox, which develops after initial exposure to the virus, is a common trivial illness of childhood characterised by typical exanthem and a self-limited course. However, in adults, varicella can behave differently with much more severity and involvement of different organ systems.1, 2 This is more common in immunosuppressed patients and those on chemotherapy.1 In the following case report, we present a case of fulminant varicella infection with multiorgan involvement in an immunocompetent young adult.

Our patient was a 22 year old, unmarried, female university student; a non-smoker with no history of any significant medical illness. The patient first presented to her local health centre in Ibi, Oman with a history of sudden onset of severe back ache radiating to both lower limbs. She also had had a mild fever of 2 days duration. The patient was prescribed analgesic medications and discharged home from the primary centre. She presented the next day to the local hospital in Ibi with the characteristic rash of chickenpox involving her face and trunk. She continued to be febrile during this presentation and also continued to have severe back ache. The patient had been exposed two weeks previously to chickenpox in her family. She was seen...
by the internist on call who made a clinical diagnosis of chickenpox. Routine investigations were done and showed elevated liver enzymes with a severely altered profile. Her chest radiograph was normal. The patient continued to be febrile throughout her stay in this secondary care institution. The repeat liver function tests showed a further rise and in her liver enzymes and worsening coagulation with high prothrombin time (PT) and activated partial thromboplastin time (APTT). Her fibrin degradation product (FDP) value was reported as very high at 640; however, there was no bleeding from any sites of the body. She received fresh frozen plasma (FFP) and the antibiotics and antiviral drug were continued. The patient was transferred the next day to our institution, Sultan Qaboos University Hospital, for further care. On arrival, she was febrile, drowsy and severely tachycardic and tachypnoeic with a pulse rate of 140 and respiratory rate of 30. Pulse oxymetry revealed her saturation to be 70% in room air. The polymorphic rash with vesicles and swabs was still present, but limited to the face and trunk. The chest examination revealed fine crepitations bilaterally. There were no focal neurological deficits and abdominal examination did not reveal any organomegaly. The liver span was found to be 7 cm clinically. The patient was immediately admitted to the Intensive Care Unit and was started on noninvasive ventilation. Blood investigations and an urgent chest X-ray were done revealing bilateral nonhomogenous haziness extending up to the mid zone. The liver functions revealed very high enzymes with aspartate aminotransferase in the range of 5555u/l and alanine aminotransferase 2225 u/l with normal bilirubin. The coagulation profile showed gross derangement with high PT time, APTT and thrombin time values. A complete blood count revealed severe polymorphonuclear leucocytosis with thrombocytopenia. Her blood was sent for varicella serology and polymerase chain reaction (PCR) and also for serology for other viral haemorrhagic fevers such as dengue and Crimean-Congo. The provisional working diagnosis at this stage was fulminant varicella infection with pneumonia, hepatitis and disseminated intravascular coagulation with consumptive coagulopathy along with super added sepsis. The patient was started on acyclovir at a dose of 10 mg/kg 8 hourly and the antibiotics were upgraded to meropenem and amikacin. Cryoprecipitate, FFP and platelet concentrate were administered on suggestion of the hematologist. The patient tolerated the noninvasive ventilation for the next 24 hours, but on the second day of admission she desaturated and had to be intubated and mechanically ventilated. She also started to have fresh bleeding from the Foley catheter and the nasogastric tube. This was associated with a drop in her haemoglobin. Her coagulation profile continued to be deranged in spite of repeated cryoprecipitate and FFP transfusions. Her liver functions also continued to worsen. An ultrasound of her abdomen did not reveal any evidence of obstruction to the biliary tract or reduction in liver size. Vancomycin was added to cover the possibility of staphylococcal sepsis. Her varicella serology was negative for immunoglobulins (IgG and IgM) indicating the susceptibility for infection and the Varicella zoster virus polymerase chain reaction (VZV PCR) in her blood was reported as positive indicating ongoing viremia. Other serological tests, including human immunodeficiency virus (HIV), dengue and Crimean-Congo fevers were negative. A peripheral smear examination showed evidence of disseminated intravascular coagulation (DIC) and suggested sepsis, with no underlying haematological abnormalities. On the third day of admission, the patient continued to

<table>
<thead>
<tr>
<th>Complete Blood count</th>
<th>Coagulation Profile</th>
<th>Liver Function Tests</th>
<th>Renal function tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>Haemoglobin(Hb)11.2gram</td>
<td>Prothrombin Time (PT) 18.8 seconds</td>
<td>Alanine amino transferase (ALT) 1278 U/L</td>
<td>Sodium (Na ) 132mmol/l</td>
</tr>
<tr>
<td>Neutrophil 80%</td>
<td>International Normalised Ratio (INR) 1.65</td>
<td>Aspartate aminotransferase (AST) 2550 U/L</td>
<td>Potassium (K+ ) 4.3mmol/l</td>
</tr>
<tr>
<td>Lymphocyte 16.4%</td>
<td>Activated Partial thromboplastin time (APTT) 40 seconds</td>
<td>Alkaline phosphatase (ALP) 316 U/L</td>
<td>Urea 1.92 mmol/l (5.4mg/dl)</td>
</tr>
<tr>
<td>Platelets 235 cells/mm³</td>
<td></td>
<td>Bilirubin 44.6 micromol/litre (27mg/dl)</td>
<td>Creatinine 38.89 micromol/litre (0.44mg/dl)</td>
</tr>
</tbody>
</table>
be sick and her ventilatory requirements rose significantly. A repeat chest X-ray showed extension of the haziness bilaterally, especially on the left side. An urgent pulmonology opinion was sought and the patient underwent an emergency bronchoscopy during which thick gelatin like mucous plugs were removed from both sides. The lungs cleared significantly after this procedure and the ventilatory requirements in terms of oxygen requirement and positive end-expiratory pressure (PEEP) started decreasing over the next few days. However, her coagulation continued to be abnormal for the next 3 days although the liver function tests showed a progressive decline in the enzymes, but with a rising bilirubin level. This bilirubin was predominantly unconjugated and was thought to be a result of the ongoing haemolysis. A PCR performed on a bronchoalveolar lavage specimen revealed the deoxyribonucleic acid of the Varicella zoster virus. On advice of the haematologist, the patient continued to receive packed red blood cells concentrate, platelet concentrates, FFP and cryoprecipitates based on her coagulation profile. The patient started showing signs of improvement in terms of coagulation profile by the 7th day of admission and over the next few days her FFP and cryoprecipitate requirements came down. Bleeding from the catheter and nasogastric tube stopped by the 10th day and the ventilatory parameters showed a steady improvement. The liver function test also gradually improved with normalization of her enzymes and bilirubin. She was extubated on the 14th day of admission, but had a resurgence of fever the next day and a repeat sputum culture grew Pseudomonas aeruginosa. She was continued on antibiotics and vigorous chest physiotherapy. She became afebrile two days later and was shifted to the ward on 17th day of admission. The patient continued to improve steadily and was discharged on the 21st day of admission. Her varicella serology was repeated in the second week and came out to be positive indicating an acute infection. A repeat VZR PCR was negative. The final diagnosis at discharge was severe Varicella zoster infection with varicella hepatitis, pneumonia and coagulopathy.

**DISCUSSION**

Varicella zoster is a DNA virus belonging to the family of Herpes viridae and causes the two distinct clinical syndromes of varicella chickenpox and herpes zoster. The attack rate for varicella is approximately 90% in susceptible individuals. In the majority of the cases, especially in children, varicella is a very mild infection characterised by skin lesions, low grade fever and malaise. The skin lesions include maculopapules, vesicles and swabs in various stages of development and appear on the trunk and face initially, before spreading.

### Table 2: Results of laboratory investigations on the patient

<table>
<thead>
<tr>
<th>Date</th>
<th>Day-1</th>
<th>Day-2</th>
<th>Day-3</th>
<th>Day-4</th>
<th>Day-5</th>
<th>Day-10</th>
<th>Day-12</th>
<th>Day-15</th>
<th>Day-17</th>
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<tbody>
<tr>
<td><strong>Complete Blood Count</strong></td>
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<td></td>
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<td></td>
<td></td>
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<tr>
<td>Haemoglobin</td>
<td>10.9</td>
<td>6.7</td>
<td>8.3</td>
<td>8.4</td>
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<td>10.2</td>
<td>11.2</td>
<td>9.9</td>
<td>10.7</td>
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<tr>
<td>Total Count</td>
<td>30.9</td>
<td>23.2</td>
<td>27.7</td>
<td>16.1</td>
<td>9.9</td>
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<td>12.2</td>
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<td>79.8</td>
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<tr>
<td>Lymphocyte</td>
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<td>16.8</td>
<td>8.7</td>
<td>11.3</td>
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<td>11.4</td>
<td>10.6</td>
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<tr>
<td>Platelets</td>
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<td>72</td>
<td>203</td>
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<tr>
<td><strong>Liver Function Test</strong></td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>ALT</td>
<td>2524</td>
<td>2327</td>
<td>860</td>
<td>245</td>
<td>87</td>
<td>67</td>
<td>49U/L</td>
<td>49U/L</td>
<td>49U/L</td>
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<td>AST</td>
<td>5555</td>
<td>4360</td>
<td>2958</td>
<td>540</td>
<td>89</td>
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<tr>
<td>ALP</td>
<td>357</td>
<td>416</td>
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<td>160</td>
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<td>155</td>
<td>170U/L</td>
<td>170U/L</td>
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<tr>
<td>Albumin</td>
<td>280</td>
<td>270</td>
<td>310</td>
<td>280</td>
<td>300</td>
<td>320</td>
<td>350G/l</td>
<td>350G/l</td>
<td>350G/l</td>
</tr>
<tr>
<td>Bilirubin</td>
<td>530.4</td>
<td>649</td>
<td>906.3</td>
<td>2907</td>
<td>1333</td>
<td>1060</td>
<td>974μmol/litre</td>
<td>974μmol/litre</td>
<td></td>
</tr>
<tr>
<td>Protein</td>
<td>520</td>
<td>490</td>
<td>540</td>
<td>500</td>
<td>600</td>
<td>630</td>
<td>710g/l</td>
<td>710g/l</td>
<td>710g/l</td>
</tr>
<tr>
<td><strong>Coagulation profile</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>PT</td>
<td>18.2</td>
<td>14.6</td>
<td>13</td>
<td>11</td>
<td>11.1</td>
<td>11.4</td>
<td>11 seconds</td>
<td>11 seconds</td>
<td></td>
</tr>
<tr>
<td>INR</td>
<td>1.77</td>
<td>1.42</td>
<td>1.25</td>
<td>1.05</td>
<td>1.06</td>
<td>1.09</td>
<td>1.05</td>
<td>1.05</td>
<td>1.05</td>
</tr>
<tr>
<td>APTT</td>
<td>76</td>
<td>58</td>
<td>48</td>
<td>39</td>
<td>38</td>
<td>36</td>
<td>32.7 seconds</td>
<td>32.7 seconds</td>
<td></td>
</tr>
<tr>
<td>Thrombin Time</td>
<td>54.6</td>
<td>59.4</td>
<td>34.6</td>
<td>24</td>
<td>13.8</td>
<td>13.8</td>
<td>13.9 seconds</td>
<td>13.9 seconds</td>
<td></td>
</tr>
</tbody>
</table>

ALT = alanine aminotransferase; AST = aspartate aminotransferase; ALP = alkaline phosphatase; PT = prothrombin time; INR = international normalized ratio; APTT = activated partial thromboplastin time
to other parts of the body. The patient is infectious 48 hours before the onset of the rash and throughout the vesicle development until all the vesicles are crusted. The severity of rash varies from person to person. Immunocompromised patients tend to have a more severe rash and are more prone to visceral involvement. Our patient was a 22 year old healthy female student and the reason for the fulminating nature of her varicella remains unclear. The diagnosis of varicella was confirmed serologically as well as with VZV PCR. She initially had severe back ache, which is not a characteristic presentation of varicella. The cause for this symptom could be a myeloradiculopathy which has been reported as a neurological complication of varicella infection. The rapidity of clinical deterioration and involvement of multiple organ systems of the body was the most striking feature in this patient. The patient had a clear chest X-ray initially, only developing features of pneumonia on the 4th day of admission, followed by rapid respiratory deterioration needing urgent intubation. Special emphasis has to be placed on the role of bronchoscopy in these patients, which will help in clearing the thick gelatin like mucous plugs, especially in cases of nonresolving pneumonias. The severe coagulopathy leading to disseminated intravascular coagulation needed constant support with cryoprecipitate and FFP along with platelet concentrates. The use of appropriate antibiotics to prevent bacterial infections, especially by streptococcus and staphylococcus, also helped in controlling the features of sepsis in this patient. Our case emphasizes the fact that varicella infection in immunocompetent adults can be severely complicated and potentially fatal. Various studies have shown the rate of visceral involvement in varicella infection in the immunocompromised to be around 30-50% and, in the absence of treatment, 15% of cases can be fatal. However, there are no authoritative studies to show the magnitude of visceral involvement or fatality with varicella infection in immunocompetent individuals. In a recent study conducted in Saudi Arabia, the complication rate in varicella infection was found to be 1.5% and the overall fatality rate was found to be 0.05%. Another study in Germany, done to assess the epidemiological pattern of varicella complications, revealed the majority as neurological with encephalitis leading the list. This was followed by infectious complications; in particular infection by streptococcus pyogenes was associated with a worse outcome. Other known complications of varicella include myocarditis, hepatitis, rhabdomyolysis with renal failure, acute glomerulonephritis and arthritis. The possibility of these complications and the unpredictability of the severity of varicella infection in adults indicates the need for early treatment with antivirals and immunisation in seronegative adults.

C O N C L U S I O N

Our case demonstrates the fact that varicella infections can be life threatening even in immunocompetent adult patients. The pattern of involvement of multiple systems is also of interest and made the management of this patient quite challenging. The importance of supportive care and significance of early bronchos-
copy for the removal of gelatinous mucous plugs in the management of varicella pneumonia needs to be stressed in addition to antiviral therapy. Our case also rightly raises the question of the importance of vaccination against varicella virus infections at least in patients with high risk of developing a severe disease.10

REFERENCES


Compound heterozygosity for Hb S and Hb S-Oman

Case report

*Suresh Venugopal, Alphonsa Shaju, Suchata Dhuri, Thuraiya Al-Harthy, Khalid B Jabal

ABSTRACT

The haematological and clinical findings of a three year old Omani girl, phenotypically compound heterozygote for Hb S and Hb S-Oman, are presented, further substantiated by family studies. The necessity of reviewing cases with sickle cell haemoglobin in Oman is stressed.

Keywords: Haemoglobin S Oman; Haemoglobin S Disease; Abnormal haemoglobin; Haemoglobinopathies; Sickle cell anaemia; Sickle cell trait; Case report; Oman.

The classical sickle cell trait has one βs mutation (β6 Glu→Val). Hb S-Oman has two mutations in cis. in the same β chain, one the classical βs mutation (β6 Glu→Val), and the second (β121 Glu→Lys), identical to that found in a variant namely Hb O Arab. Hb S-Oman increases the sickling tendencies, but the clinical symptomatology is influenced by co-existing alpha thalassaemia. No homozygous Hb S-Oman has been reported in the literature.

CASE REPORT

A three year old Omani girl from the Al-Kindi tribe from Barka, a town on the coast about 80 km northwest of Muscat, presented to the Ear, Nose and Throat department of Al-Nahdha hospital in September 2007 with complaints of recurrent sore throat, 5-6 times a year. The clinical diagnosis was recurrent acute follicular tonsillitis. The past history revealed that she was diagnosed to have sickle cell anaemia with a history of haemolytic crises and frequent admissions to a tertiary care hospital and had had a recent blood transfusion. A tonsillectomy was planned and a complete blood cell count (CBC) and sickling test were requested as preoperative investigations. The CBC showed, among other parameters: Hb - 9.34g/dl; red blood cell volume - 3.45 x 10^12/L; haematocrit - 22.4%; mean cell volume - 65fl; mean cell haemoglobin - 27.1pg;
mean cell haemoglobin concentration - 41.7g/dl and red cell distribution width - 18.9%. The sickling test was positive. From the blood film examination, the most important feature was the presence of many Napoleon hat x-shaped red blood cells and classical sickle cells [Figure 1]. The white blood cell count was 5.53 x 10^9/L (normal 6 -18) and platelet count was 552 x 10^9/L (normal 150 - 450). Given the presence of numerous Napoleon hat x-shaped red blood cells in the blood film with moderate anaemia and a positive sickling test, the presence of Hb S-Oman was suspected and the patient was referred to the genetic blood screening unit of our hospital. The results of this screening were as follows: G6PD activity was normal; the high performance liquid chromatography (HPLC) profile showed: Hb A - 49%; Hb A2 - 2.3%; Hb F - 30.8%; Hb S - 12.3% and a presumptively Hb S-Oman - 5.6% in the HbC window. The presence of Hb A was believed to be due to the recent blood transfusion. The family studies revealed the HPLC profile of the father (also from the Al-Kindi tribe) to be: Hb A - 70%; Hb A2 - 3%; Hb F - 1%; Hb S- 26% and he was diagnosed as having sickle cell trait. He was clinically asymptomatic. The HPLC profile of the mother showed: Hb A - 83%; Hb A2 - 3%; Hb F - 1%, and an abnormal component in the HbC window, very likely Hb S-Oman - 13%, so she was diagnosed to have having the Hb S-Oman trait. The two brothers of the index case had normal HPLC profiles.

**DISCUSSION**

This case report stresses the importance of examining the blood film, which revealed the presence of Napoleon hat x-shaped red blood cells [Figure 1] characteristic of red blood cells containing HbS-Oman.1,2,3

The presence, in addition, of classical sickle cells in the smear, as seen in Figure 1, prompted family studies, and confirmed the inheritance of Hb S and Hb S-Oman in this patient. Thus she was diagnosed as compound heterozygote for Hb S and Hb S-Oman.

During a follow up at Al-Nahdha Hospital, after the blood transfusion, the HPLC profile of the patient revealed the presence of Hb S-Oman at 12% and Hb S at 25% matching with the level observed in her parents for respective abnormal haemoglobins.

The first report of Hb S-Oman in the literature was by Langdown JV et al. in 1989.4 The first description of compound heterozygosity for Hb S/Hb S-Oman in a one year old female from Oman was reported in 2002.4

The pathophysiology of the sickle syndrome in this compound heterozygote patient must be the result of interaction between HbS and HbS-Oman, the sickle mutation (β6Val) favouring sickling and the O-Arab mutation (β121Lys) favouring haemolysis and changes in red blood cell shape.5 It is important to note that such patients who are compound heterozygotes for Hb S and Hb S-Oman behave clinically like sickle cell anaemia. Our case, who had frequent admissions to hospital with haemolytic crises and who received numerous blood transfusions, fully supports this fact. Our study highlights the importance of reviewing the sickle cell cases in Oman carefully, including those categorised as HbC trait or sickle cell disease (as HbS-Oman behaves as HbC on HPLC).

The mother of this patient, who is heterozygous for Hb S-Oman (13%), is clinically asymptomatic. Published reports state that the clinical manifestations in heterozygous Hb S-Oman are only observed in individuals having more than 20% of Hb S-Oman, whereas individuals with a lower percent of Hb S-Oman (14% and below), and concomitant homozygosity for single gene deletional alpha thalassaemia, are clinically asymptomatic, and have only slight to moderate red blood cell changes.3 Thus both exploration of alpha thalassaemia and family studies will be useful in predicting the clinical outcome.
CONCLUSION

A patient who has compound heterozygosity for Hb S and Hb S-Oman behaves clinically like a case of sickle cell anaemia. An awareness of existence of Hb S-Oman, an eye for Napoleon hat x-shaped cells on blood film, a review with HPLC in all cases of known sickle cell anaemias, along with family studies, is recommended to unearth cases of Hb S-Oman.

REFERENCES


Orthopaedic Manifestations of Date Thorn Injury
Case series

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ABSTRACT Date palm thorn injuries are common in Middle Eastern countries where there are many date palm plantations. Most of the injuries happen to workers in the plantation or to children. Injuries, if detected, can be treated without subsequent complications, but in children the diagnosis can very easily be missed resulting in late complications. The hand, being the most exposed part of the body, is the most affected. Embedded thorns can produce lesions mimicking those of osteomyelitis. The foot is exposed to injuries in people who walk barefoot in the plantations. The author presents five cases of date thorn injury which presented with late complications. All three patients with hand injuries had periostitis, and one of them had an intraosseous thorn producing osteomyelitis. Two patients presented with osteolytic lesions of the metatarsals with intraosseous thorn in one patient. All cases recovered completely leaving behind no sequlae of the bony infection.

Key words: Hand; Metatarsal; Bone cyst; Osteomyelitis; Periostitis; Foreign body granuloma; Case Report; Oman.

ORGANIC FOREIGN BODY GRANULOMA, including date thorn, should be considered in the differentials of a lytic lesion with or without sclerotic lesions of the bone. The foreign body reaction which results from thorn injury can mimic various bone, joint and soft tissue disorders. Date palm thorn injuries are common in the Sultanate of Oman with its extensive farming of date palms. The thorns, lying beneath the trees in places where children play, produce injuries to exposed parts, mostly in the hands, knees and foot. There are various reports of date palm thorn injuries in the literature, with eight cases of metacarpal lesions reported so far. There are reports of thorn induced osteomyelitis of the metatarsals and cuboid, from areas where people walk barefoot.

METHODS

Data regarding all patients who presented to Ibri Regional Hospital with the following ICD (International Classification of Diseases) codes were reviewed for the last 4 years:

1, 2, 3, 4, 5, 6, 7, 8, 9
There were 253 cases during this four year period with injuries related to foreign body intrusion in the body, of which 137 (54%) were related to injuries by date thorns. Eighty-two cases involved the upper extremity, mostly the hand and fingers. Fifty-five cases were in the lower extremity, mostly involving the toes and foot. Eighteen cases of foreign body granuloma involving the hand and 9 cases of granulomas of the foot were excised in the operating room. The rest of the cases were managed as outpatients. X-rays were done in all cases of granulomas to rule out skeletal lesions due to date thorns. Most of the cases also underwent an ultrasound scan to localize the foreign body.

There were two cases of skeletal lesions in the foot, one in a 12 year old boy. He presented with pain and swelling of the left foot of one year duration. His X-rays showed a lytic lesion of the shaft of the second metatarsal with cortical thickening. The swelling was non-tender and there were no signs of inflammation. The patient underwent curettage of the lesion under general anesthesia and was found during surgery to have an intraosseous thorn.

A lady presented with a swollen right foot, recur-
ring for the past two years. She did not recollect any antecedent injury. Her X-rays of the foot were doubtful of a lytic lesion of the metatarsal and hence a computed tomography (CT) scan of the foot was done. This showed an osteolytic lesion over the base of the fourth metatarsal. The lesion was curetted and the offending thorn piece was removed from the intermetatarsal space. She eventually recovered fully.

Three young people children presented with lesions in the small bones of the hands; all boys aged 6, 11 and 16 years respectively.

The boy aged 6 years was initially treated for an injury, and was immobilised in a slab for a short while. Later on, he presented with pain and swelling of the hand. Radiographs after few weeks showed periosteal reaction of the third metacarpal with a lytic lesion over the base of the metacarpal on the left side. The lesion healed after curettage of the lesion and removal of the offending thorn.

Another boy presented with a swollen right hand after an injury with date thorn. The boy recollected the injury from a date thorn in the garden a month prior to his presentation. There was periosteal reaction over the entire shaft of the fourth metacarpal. The lesion healed after removal of the offending thorn and removal of the granulation tissue. Another boy had no definite history of trauma, but presented with painful swelling over the right middle finger. There was periosteal reaction over the dorsum of the proximal phalanx of the middle finger. The lesion was successfully treated by curettage.

### Table 1: Characteristics of the date thorn injuries in the five cases

<table>
<thead>
<tr>
<th>No</th>
<th>Age in years /sex</th>
<th>Clinical details</th>
<th>Radiology</th>
<th>Lesion</th>
<th>Management</th>
<th>Histopathology</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6/M</td>
<td>Fall in garden; Pain and swelling of left hand</td>
<td>Periosteal reaction over the shaft of 4th metacarpal</td>
<td>Soft tissue swelling dorsum of right hand</td>
<td>Excision of granuloma, two date thorn pieces removed at surgery</td>
<td>Inflammatory cell reaction, with pieces of foreign bodies</td>
</tr>
<tr>
<td>2</td>
<td>11/M</td>
<td>Injury with date thorn in garden</td>
<td>Periosteal reaction over the shaft of 4th metacarpal</td>
<td>Swollen dorsum of right middle finger</td>
<td>Lesion curetted through a window, granuloma cured, thorn removed</td>
<td>Inflammatory cell reaction, with pieces of foreign bodies</td>
</tr>
<tr>
<td>3</td>
<td>16/M</td>
<td>No definite history of trauma</td>
<td>Periosteal reaction over the shaft of 2nd metatarsal, with sclerotic margins</td>
<td>Bony swelling over the dorsum of left foot, over the 2nd metatarsal</td>
<td>Thorn removed from interdigital space of 4th and 5th toes. Base of 4th metatarsal curetted</td>
<td>Fibrocollagenous and fibroadipose tissue with inflammatory granulation tissue, with pieces of thorn</td>
</tr>
<tr>
<td>4</td>
<td>12/M</td>
<td>No definite history of trauma; swelling in dorsum of left foot of 1 year duration</td>
<td>Osteolytic lesion base of 4th metatarsal. Confirmed with CT scan</td>
<td>Tender swelling dorsum over base of 4th and 5th metatarsal</td>
<td>Thorne removed from interdigital space of 4th and 5th toes. Base of 4th metatarsal curetted</td>
<td>Inflammatory cell reaction</td>
</tr>
<tr>
<td>5</td>
<td>23/F</td>
<td>Swelling in right foot of 2 years duration</td>
<td>Osteolytic lesion base of 4th metatarsal. Confirmed with CT scan</td>
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</table>
**DISCUSSION**

Date thorn is a modified leaf that ends in a spine of the palm tree, *Phoenix anarensis*, which is widely cultivated in the Middle-East countries. Penetrating injuries of the extremities by date thorn are common in Middle Eastern countries. Children are exposed to thorn injuries because of their contact with date palms in gardens or plantations. There may not be any visible signs of injury. If detected, attempts at removal may leave part of the sharp tip of the thorn inside the body. The initial symptoms are usually mild and disappear in a few days, but some patients present late with granuloma or bony pathology. A diagnosis of a date thorn foreign body is considered when there is a history of trauma and a periosteal reaction or lytic lesion is seen in the radiographs. A date thorn embedded near a bone can produce a pathological reaction resulting in periostitis or osteomyelitis. A retained thorn can present as synovitis, arthritis, rheumatism, granuloma or osteomyelitis.

Gerle named the pathology “thorn-induced pseudo-tumor of bone.” Maylahn called them thorn-induced “tumors of bone.” In most of the cases, the thorn is removed by the patients causing little morbidity. If retained in the tissue it can cause an inflammatory reaction leading to development of foreign body granulomas. A thorn stab produces an acute local inflammatory reaction in the tissues even if no part of the thorn remains in the body. Antibiotics are indicated only if the culture turns positive for a particular organism. Durr et al reported a case of intraosseous thorn in the diaphysis of the fifth metatarsal in a fifty-six year old lady. Organic plant material when present in or near a bone can produce lesions in bone that are lytic or sclerotic or a combination of both. There is usually a delay in seeking medical help or there is a delay in diagnosis with the mean time of presentation in various reports of around four months. Granuloma is due to incomplete removal of the date thorn by the patient retaining the sharp tip inside the soft tissue, of which the patient is unaware. Most of the thorn related injuries occur in the hand, it being the most exposed body part. So far only eight metacarpal lesions and three phalangeal lesions have been reported.

The thorn, once entered, produces a granuloma by foreign body reaction, resulting in periosteal reaction or osteolysis. Once inside the joint, the thorn can cause synovitis due to a chemical reaction. Most children do not identify the initial injury, making the diagnosis difficult. The periosteal reaction may mimic osteomyelitis, trauma or Ewing’s sarcoma. If the thorn remains in the subperiosteal region this can cause a subperiosteal reaction and periosteal elevation. Subsequent to this the cortical bone is devitalized resulting in a sequestrum. A periosteal reaction should also be differentiated from the periosteal reaction of stress fractures, as the lesions of thorn-induced skeletal changes are seen mostly in the paediatric age group. Because palm thorns are not radio-opaque, X-rays are negative for the foreign body until and unless bony lesions develop. Thorns can be seen in the tissues as echogenic structures surrounded by inflammatory hypoechoid tissue during an ultrasound scan. High performance ultrasonography is useful for preoperative assessment of the granuloma and for localizing the foreign body. As plain radiographs and even an ultrasound may not show the foreign body, a magnetic resonance imaging (MRI) scan may have to be done. There are reports where even an MRI has failed to show the foreign body. Date thorn granuloma is usually not suppurative, unless contaminated with organic material from the farm. Bacterial growth in date thorn injury is rare. Many organisms have been identified in the tissues, though bacterial growth is infrequently reported from date thorn lesions. Authors suggest that *Pantlea agglomerans* should be considered in aseptic arthritis of the joints after date thorn injuries. This organism is considered less aggressive and can cause protracted local inflammation.

Date thorn palm may contain some toxic substance, probably an alkaloid substance, which causes osteolytic reactions in the bone. Kelly, in 1966, was the earliest to prove that the theory, as reported by various authors, of alkaloids in the thorn was wrong as removal of the thorn cures the inflammation. The small bit of retained thorn may not contain enough alkaloids to initiate an inflammatory response. Contrary to this, in synovitis the symptoms usually persist after removal of thorn even after partial synovectomy, and total synovectomy is needed for complete resolution. The speculation of alkaloids causing the granuloma is not scientifically proven yet. No microorganisms are usually grown from the tissue, and the infection that occurs is secondary. Youssefzadeh, in 1978, reported a case of sclerotic and lytic lesions in the fifth metacarpal due to thorn-induced granuloma in an eight year old boy. The interval between the entry of foreign
Orthopaedic Manifestations of Date Thorn Injury

body and the appearance of bony changes in the radiographs, in the study by Yousefzadeh, ranged from three weeks to two years.\textsuperscript{15, 20}

Maylahn,\textsuperscript{7} as early as 1952, suggested that thorn induced granuloma should be considered in the differentials of bone neoplasms. As early as 1936, Maylahn came across a date thorn injury of the fibula resulting in a granuloma and radiological features of Ewing’s sarcoma.\textsuperscript{7}

The lesion in the fourth metacarpal of a child was diagnosed by Barry\textsuperscript{1} as due to tuberculous infection. A similar case was treated by Dhillon et al\textsuperscript{17} with antituberculous drugs until a wooden splinter was extruded. Tuberculosis was considered in the differential diagnosis by various authors.\textsuperscript{1, 3, 17, 20}

CONCLUSION

Date thorn granuloma should be kept in mind while treating extremity bone and joint infections in children in the Middle East countries. The diagnosis is easy when there is history of injury with a date thorn. The granuloma should be excised and the bone must be debrided after removal of the thorn. Appropriate antibiotics must be started after intraoperative culture. Date thorn granuloma should be suspected if there are osteolytic or sclerotic lesions in the extremities of children from areas where date palms are grown extensively.

REFERENCES


ABSTRACT  Atypical lymphocytosis due to infections is classically seen in viral and chronic bacterial infections. A four year old boy with acute streptococcal infection presented at Al-Nahdha Hospital, Muscat, Oman, with follicular tonsillitis and bilateral cervical lymphadenitis. The blood film showed 33% atypical lymphocytes. Serologically, immunoglobulin M (IgM) antibodies were positive for cytomegalovirus, herpes simplex virus, and Epstein Barr virus, but the patient responded dramatically to antibiotics.

Key words: Atypical lymphocytes; Acute streptococcal infection; Lymphnode; Case report; Oman.

An Unusual Case of Atypical Lymphocytosis

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A cute bacterial infections usually produce neutrophilic leucocytosis. Chronic bacterial and viral infections typically cause lymphocytosis. However, acute streptococcal infections can lead to atypical lymphocytosis as well as elicit false positive viral antibody results.

C A S E  R E P O R T

A 4 year old boy from Barka, Oman, came to the Ear, Nose and Throat (ENT) Department of Al-Nahdha Hospital, Muscat, Oman, on 4 November 2007 complaining of fever and difficulty in swallowing for the last 4 days. On clinical examination, both the tonsils were huge and studded with follicles. There were bilateral cervical lymphnodes, each measuring 7cm x 6cm, tender, soft and hot. The clinical diagnosis entertained was follicular tonsillitis with bilateral cervical lymphadenitis. The patient was immediately admitted to the ENT. A complete blood count (CBC) on admission showed Hb = 11.5 g/dl. The total white blood cell count (WBC) count = 7.6 x 10^9/L and the platelet count = 237x10^9/L, which was normal, but the erythrocyte sedimentation rate (ESR) was 15 mm at 1 hour, which was mildly above the normal range of 10 mm at 1 hour. A sample sent for blood culture subsequently revealed no growth. The throat culture grew normal flora, but the swab showed gram positive cocci. The CBC was repeated 3 days later on 7 November and showed Hb = 10 g/dl; total WBC count = 14.7x10^9/L and platelet count = 141x10^9/L. A differential WBC count showed 33% atypical lymphocytes. We advised that a monospot test be done and the clinicians put the patient on a course of intravenous augmentin. The same day (7 November), the monospot test results were negative. We immediately requested an Epstein Barr virus (EBV) immunoglobulin M (IgM) antibody test and a TORCH (toxoplasmosis, other agents, rubella, cytomegalovirus, herpes simplex) test. Next day, the CMV (cytomegalovirus) IgM came out positive. We requested a polymerase chain reaction (PCR) test to detect CMV DNA. On 9 November, the herpes simplex IgM test came out positive. On 10th November,
the EBV IgM antibody test also came out positive. Clinically, the patient was afebrile, the lymphnode enlargement on both the sides had vanished, and he had responded very well to antibiotics. He was discharged on the same day. The PCR test result arrived on 12 November and did not detect any CMV DNA in the plasma. But an antistreptolysin O (ASO) titre done on the sample was increased and measured 400 IU. The boy came for a follow up in December 2007. Clinically and haematologically (CBC, differential WBC count and ESR) he was absolutely normal.

**DISCUSSION**

This 4 year old boy had an acute onset of fever and dysphagia. The dysphagia was due to the severe enlargement of both the tonsils. Contributing to the above was bilateral, tender, soft and hot cervical lymph node swellings. His tonsils were studded with follicles and tender soft and hot. A diagnosis of lymphadenopathy fitted well with an acute bacterial infective pathology. Sensing the severity of the condition, the boy was admitted to the hospital. The throat swab revealed many gram positive cocci, but the throat swab culture grew normal flora and the blood culture did not reveal any growth. This could be explained by the fact that this patient was referred from Barka and was already on oral antibiotic treatment. It is well known that a prior antibiotic treatment can lead to no growth on culture.¹

The CBC repeated 2 days later on the automated haematology analyzers revealed mild anaemia, leucocytosis and mild thrombocytopenia. A blood film was prepared. The most striking feature on this film was the presence of numerous atypical lymphocytes with deep basophilic cytoplasm and large, round to oval to indented to irregular nuclei. No blasts were seen [Figure 1]. A differential count revealed 16% neutrophils, 51% lymphocytes and 33% atypical lymphocytes. A diagnosis of atypical lymphocytosis was made. Viral infections are one of the commonest causes of lymphocytosis and atypical lymphocytosis.² Such a large percentage of atypical lymphocytes made the laboratory entertain the diagnosis of viral infection.

We advised a monospot test to rule out infectious mononucleosis, but the clinicians thought and acted otherwise. They were sure that it was an acute bacterial infection and put the patient on a course of intravenous augmentin.

To our surprise, the subsequent monospot test result came out negative. We immediately requested an EBV antibody test to increase the specificity of the test and also asked for a TORCH test. Unlike the clinicians, we were pursuing the viral etiology. When CMV IgM antibody test came out positive, the laboratory entertained the diagnosis of cervical lymphadenitis due to acute CMV infection and requested a blood PCR test to detect CMV DNA.

The next day, the *herpes simplex* virus IgM antibody test came positive. We were puzzled. A day later when EBV IgM antibody also came positive for this patient, we were confused. A diagnostic dilemma set in. Was the patient suffering from cytomegalovirus infection or a *herpes simplex* virus infection or an EBV infection?

We turned our attention to the patient in the ward. We were amazed to see the patient afebrile, with tonsillar and lymphnode enlargement having disappeared, playing in the toy room and ready for discharge. After 7 days of antibiotic treatment, the sick looking boy was perfectly normal. The experience and expertise of the clinicians had won the case.

The laborious laboratory scientists looked lost. The PCR test result arrived two days after the patient’s discharge and did not reveal CMV DNA in the plasma, confirming that the patient did not have CMV infection. Did he have *herpes simplex* or EBV infection? Facilities for doing a PCR test for *herpes simplex* and EBV were not available. Fortunately, one of our scientists had done an ASO titre on this patient and it was increased and measured 400 IU. An ASO titre of >166 Todd units is seen in 80% of children with streptococcal pharyngitis.³

By now, things were getting clearer. We analysed the case comprehensively. Here was a patient who pre-

![Figure 1: Blood smear showing atypical lymphocytes](image-url)

EBV antibody test to increase the specificity of the test and also asked for a TORCH test. Unlike the clinicians, we were pursuing the viral etiology. When CMV IgM antibody test came out positive, the laboratory entertained the diagnosis of cervical lymphadenitis due to acute CMV infection and requested a blood PCR test to detect CMV DNA.

The next day, the *herpes simplex* virus IgM antibody test came positive. We were puzzled. A day later when EBV IgM antibody also came positive for this patient, we were confused. A diagnostic dilemma set in. Was the patient suffering from cytomegalovirus infection or a *herpes simplex* virus infection or an EBV infection?

We turned our attention to the patient in the ward. We were amazed to see the patient afebrile, with tonsillar and lymphnode enlargement having disappeared, playing in the toy room and ready for discharge. After 7 days of antibiotic treatment, the sick looking boy was perfectly normal. The experience and expertise of the clinicians had won the case.

The laborious laboratory scientists looked lost. The PCR test result arrived two days after the patient’s discharge and did not reveal CMV DNA in the plasma, confirming that the patient did not have CMV infection. Did he have *herpes simplex* or EBV infection? Facilities for doing a PCR test for *herpes simplex* and EBV were not available. Fortunately, one of our scientists had done an ASO titre on this patient and it was increased and measured 400 IU. An ASO titre of >166 Todd units is seen in 80% of children with streptococcal pharyngitis.³

By now, things were getting clearer. We analysed the case comprehensively. Here was a patient who pre-
sented acutely with fever, swollen, follicle studded tonsils and enlarged bilateral tender, soft and hot cervical lymphnodes. The throat swab had showed numerous gram positive cocci. The ASO titre was increased and the patient dramatically and completely responded to antibiotics. Taking into consideration, the presenting symptoms and signs, the laboratory data and clinical response, the diagnosis was crystal clear. The patient suffered from an acute streptococcal infection.

However, two features demanded explanation. One was the high percentage of atypical lymphocytes in an acute bacterial infection and the second was the CMV IgM, herpes simplex IgM and EBV IgM, all positive in a patient with acute streptococcal infection. Lymphocytosis often occurs in young children in response to infections which produce a neutrophil reaction in adults. This explains the lymphocytosis and atypical lymphocytes seen in our case with acute streptococcal infection which typically produces a neutrophilic leucocytosis in adults. However, it is worthwhile noting that according to the literature, lymphocytosis is usually rare during such acute bacterial infections except in pertussis. The rarity and paucity of literature on this subject prompted the publication of this report. It is well documented in the literature that in response to stress, lymphocytes that are characterised by nuclear and cytoplasmic distortion appear in the blood. Thus, another explanation for atypical lymphocytosis in this child could be the stress caused by dysphagia. False positive CMV IgM can be due to cross-reactions between infections caused by closely related viruses like the acute EBV infection. The CMV IgM axsym assay shows a lack of specificity in acute EBV infection hence precautions must be taken when CMV IgM results are interpreted. The above mentioned published fact, plus the absence of CMV DNA in plasma in this patient, proves that the CMV IgM result was false positive. Acute herpes simplex virus infections typically produce pharyngitis and stomatitis and very rarely lead to such huge bilateral tonsillar enlargement. Failure of a patient with suspected streptococcal throat infection to improve within 48 hours should evoke suspicion of infectious mononucleosis, but our patient responded very well to antibiotics thus ruling out a primary infection by EBV.

Thus in this patient with acute upper respiratory and lymphnode inflammation due to streptococci, well known for its immunological warfare, and taking into consideration the entire clinical, pathological and therapeutic scenario, IgM antibodies to CMV, HSV and EBV were false positive.

**CONCLUSION**

Haematologically, a large number of atypical lymphocytes can be seen in the blood film of a patient with severe, acute upper respiratory streptococcal infection. Immunologically, false positive IgM antibodies to CMV, HSV and EBV can be observed in patients with such severe acute streptococcal infections.

**REFERENCES**

Right Aortic Arch with Aberrant left Subclavian Artery

*Anupam K Kakaria, Sukhpal Sawhney, Rajeev Jain

The patient, a 53 year old man, presented at Sultan Qaboos University Hospital, Oman, with a history of abdominal pain and alternating constipation and diarrhoea. A

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Colonoscopy and a barium enema revealed a short segment of annular narrowing and a large polypoid mass in the rectodigmoid region. Subsequent histopathology identified a moderately differentiated adenocarcinoma. Computed tomography (CT) scans of the thorax and abdomen were carried out as staging procedures. The CT of thorax demonstrated a right aortic arch. The left common carotid artery, the first major artery to arise from the arch, is followed by the right common carotid, right subclavian and left subclavian arteries. The aberrant left subclavian artery takes its origin from a prominent Kommerell’s diverticulum at the distal end of aortic arch. The descending aorta continues inferiorly to the right side of the vertebral column. The findings are consistent with a right arch of aorta with aberrant left subclavian artery [Figures 1 and 2].

Approximately 0.1% of population has a right sided aortic arch, and about half of these have an aberrant left subclavian artery which may arise either directly from the aorta or from the Kommerell’s diverticulum. Although an aberrant left subclavian artery may occur in isolation, it is the commonest anomaly associated with a right aortic arch. Any symptoms, which result from an aberrant left subclavian artery, are associated with compression of the esophagus or trachea and are most likely to occur if its origin is dilated.

REFERENCES

A 42-YEAR-OLD WOMAN PRESENTED WITH abdominal pain, increasing hirsutism and clitoromegaly [Figure 1]. Her plasma testosterone levels were very high (total testosterone: 33.3 ng/mL, free testosterone: 912 pg/mL) and the canver antigen 125 (CA-125) test was 120 U/mL. The computed tomography showed a large, 12.7 x 7.2 cm, lobulated, enhancing mass with central necrosis originating from the right ovary with a moderate amount of ascites. The preoperative diagnosis was Sertoli-Leydig cell tumor. The patient had an exploratory laparotomy where a total hysterectomy, bilateral salpingooopherectomy, lymph nodes dissection and omentectomy were performed [Figure 2]. The tumour, which was removed, was confined to the right ovary and there was no evidence of adjacent structures involvement. No ascites was seen. During the surgery, the patient’s blood pressure went up to 240/140 mmHg. Postoperatively, the patient was doing well though her blood pressure was uncontrolled so was started on
Steroid Cell Tumor

Micardis® (telmisartan). Serum levels of testosterone returned to normal a few weeks after the surgery. The histopathological diagnosis was a steroid cell tumor, not otherwise specified [Figure 3].

Steroid cell tumours of the ovary account for approximately 0.1% of all ovarian tumours and are subdivided into 3 subtypes: stromal leuteomas, Leydig cell tumours, and steroid cell tumours, not otherwise specified (NOS). The steroid cell tumour (NOS) is the most common of the 3 subtypes, accounting for approximately 60% of these tumors and the majority of them show virilisation.\(^1,2\) \(25-45%\) of which are clinically malignant.\(^3,4\) Estrogen secretion occurs in 6% to 23% of the tumors, which may be associated with menorrhagia, postmenopausal bleeding, or even endometrial adenocarcinoma. Cushing’s syndrome occurs in 6% to 10% of the cases. Approximately 25% of the cases of steroid cell tumours (NOS) are not associated with hormonal disturbances.\(^1\) They can occur at any age, but usually develop in adults with an average age of 43 years.\(^1\) Steroid cell tumours often present as unilateral solid tumours and occasionally as cystic tumours. Necrosis or calcification is frequently associated.\(^5\) Ovarian steroid cell tumours are characterised by cells with abundant intracellular lipids, which are similar to adrenocortical cells.\(^6\) The classical gross finding of steroid cell tumor (NOS) is a solid, well-circumscribed ovarian mass. Microscopic findings include diffusely arranged cells, although tumor cells may be present in nests, clusters, cords, or columns. The stroma is most commonly scant, but may be prominent and can occasionally be fibromatous, edematous, or myxoid. The cells are polygonal to round, with distinct cell borders and central nuclei, and they often have prominent nucleoli. The cytoplasm varies from spongy in lipid-rich cells to granular and eosinophilic in lipid-poor or lipid-free cells [Figure 3]. The mainstay of ovarian steroid cell tumor is surgery. Careful follow-up evaluation should include a measurement of sex hormone levels, particularly for those patients who demonstrated elevated levels before removal of the primary tumor.

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THE GURU OF FRENCH FEMINISM AND existentialist ethics, Simone de Beauvoir, epitomised the view that biology is not destiny. She remarked, “one is not born, but rather becomes, a woman”. Simone de Beauvoir would turn in her grave if she knew about Sarah Bekaert’s volume, *Women’s Health: A Practical Guide for Healthcare Professionals*. The very fact that it focuses on women’s health appears to challenge Simone de Beauvoir’s premises about gender and identity. Of course, the world has changed since Simone de Beauvoir’s heyday. The discussion as to whether culture or biology plays the major role in the development of womanhood has been relegated to a trivial footnote by our contemporaries. The spirit of this age, as encapsulated in the Sarah Bekaert’s volume, emphasises the fact that females are different from males. As if to vandalise Simone de Beauvoir’s legacy, the view that biology is destiny has been firmly embraced by mainstream medical culture. This has grown out of increased interest in what makes women tick in health related matters, so that tailored-made and evidence-based etiology, prevention and treatment for women can be consolidated.

This wind of change has found important allies. In the past decade, the Office on Women’s Health in the US Department of Health and Human Services has been established. Several publications have also emerged focusing on solely on women’s health. The academic approach in this endeavour includes scholarly publications such as *Health Care for Women International, Women & Aging, Women & Therapy*, to name just a few. There is also the new *Harvard Guide to Women’s Health*. Other ivy league universities have joined the bandwagon, churning out many books on similar issues, further testifying to the current relevance of this issue.

In this context, Sarah Bekaert’s volume brings fresh insight into a field that has been progressively nurtured by her experienced as a paediatric nurse with degrees in gynaecology and reproductive health and membership of the British Association for sexual health and HIV. The volume aims to familiarise the practitioner with the disorders and conditions that manifest differently or exclusively in women. Thus, if the knowledge it contains is applied properly, it may be the best way to ensure proper health care for women.

**BOOK REVIEW**

*Women’s Health*  
*A practical guide for healthcare professionals*

Author: Sarah Bekaert  
Pub. Date: October 2007  
ISBN-978 1 84619 029 2  
Orders: http://www.radcliffe-oxford.com
The volume is a practical guide addressing the unique, multidisciplinary aspects of women's health issues. The goal of the author is to offer the practitioner a quick reference guide to possible diagnosis according to symptoms, and the tests that could be performed with to reach a diagnosis. In order to provide a comprehensive guide, brief descriptions of the conditions and tests are included for the convenience of the reader.

The chapters are grouped into five sections: Symptom sorter, Conditions, Tests and procedures, Contraception and Sexually transmitted infections. The first chapter provides a comprehensive view of the possible signs and symptoms of common female health concerns. It is intended only as a guide and should not be a substitute for communication and liaison with colleagues.

The author presents and discusses almost all areas of women's health including menstrual symptoms, hormonal changes, sexual health, pelvic conditions, pregnancy and infertility, in addition to breast symptoms, urinary symptoms and weight. The chapter on tests and procedures gives an idea about those commonly used in relation to women's health. It includes the physical examination, blood tests, imaging and samples. The reader would be particularly impressed with the final two chapters which deal with contraception and sexually transmitted infections because of their significance in many women's lives. All five chapters are brief overviews of medical issues relevant to women. The selection of topics is very extensive.

Is this volume a retreat from the hard won advances of feminism? It may be so for Madame Simone de Beauvoir's 'diehards.' This book is, however, not a challenge to such classic treatises, but simply a teaching manual with high-quality graphics and photographs accompanied by a generous number of tables. It is easy to read because it maintains a simple structure. The strength of the volume is that women's health issues are simplified. The book provides basic information on conditions, tests required and links to useful related resources. Thus, it will be useful for medical students, interns and residents. Because of the simple language used it can also be used by a layperson concerned about women's health. The book would be an essential guide for all medical practitioners, but more so for female practitioners with specific interest in women's health. Its audience could even include males who are well known to dwell at the lower end of evolutionary ladder in term of their understanding of the female body and health. The take home message is that women's health should require special consideration. The book departs from the previous chauvinistic approach and teleological debate as to whether or not biology is destiny.

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In the age of emerging objectification of the male gender, perhaps heralding female hegemony but yet in patrilineal terrains, there is a consensus that masculinity may be a curse in disguise. Consider the headlines: females are outshining males in college entrance examinations and a yobbo is seen as the archetypal source of all social ills. In the medical fraternity, the trend is catching on fast. Academic publishers are churning out books on men’s health. The message is becoming clear: modern males are either an endangered species or endangering the status quo of the world. Unless rescue measures are undertaken, the consequences will be dire. Imagine the world without males? Even in matrilineal societies this idea appears to be an alarming proposition.

David Conrad and Alan White have edited Men’s Health: How to Do It. The volume is mantled with the assumption that typical macho cholos, or so called ‘Y chromosome owners’ are reluctant to seek care in medical settings. Males tend to abhor hospitals, hiding their miseries in vanity. In the final analysis, the inevitable would become inevitable. Being both reluctant to introspect and resistant to external pressure, males are in the top of the list of those who fall prey to many types of ill-health. This is testified to by the silent epidemic of male gender related diseases, disabilities and untimely deaths often occurring at tender ages.

With various authors contributing to the 16 chapters, Conrad and White have produced a ‘dirty hands manual’ offering tips on how to approach males about health and educate them to curb the negative sequelae of their masculine lifestyles. The manual is divided into three parts with ample summary boxes, vignettes and cartoon-like illustrations; reader friendly tables and figures are also available. In the spirit of simplicity, the chapters are embedded with subheadings. Some sections are narrated with questions and answers. The first part of the volume comes with a catchy title: “Men’s health – What’s it all about?” Part two of the book starts with abbreviations that have not cropped up earlier, but still within the spirit of simplicity. Some ‘hints’ and ‘warnings’ are highlighted on many pages. Fancy titles have not been spared either, including: “Erectile dysfunction and male incontinence clinics”, “Sex and relationship education in schools with boys”. These chapters are a mishmash of information with antics like ‘anti-bullying work’. The final part, far from being anti-climax, describes the history of men’s health. Some tips and personal testimonies on how to be a men’s health worker are vividly chronicled. The impression is given that Men’s Health should be supplied as a standard manual for health workers. The theme of the volume is obviously orthogonal to Arnold Schwarzenegger’s image of macho masculinity.

Like anything in life, there is the other side of the story but, for this volume, it is not hyperbole. The
writing is simple but, like Sudoku, one needs to be very attentive to grasp the flow of information. Many abbreviations crop up without explanation. Despite its practical application, the book overlooks the role of women in the lives of men. Therefore it disregards the statement that behind every strong man is a stronger woman. Another source of attrition is the explicit ‘medicalisation’ of all that it takes to be a ‘Y chromosome owner’. Medicalisation is a sociological concept that misconstrues mundane characteristics such as baldness or socially constructed misbehaviours as ‘diseases’ which should naturally call for medical attention. From this perspective, the volume fails to differentiate between social deviance, illness and endowments that are natural to man. Isn’t masculinity and all that it entails part and parcel of the Y chromosome? But why should the blueprint of masculinity be medicalised? To paraphrase Arthur Schopenhauer, isn’t struggling with difficulties as natural to a man as grubbing in the ground to a mole? Related to medicalisation, there emerges the issue of a self-fulfilling prophecy. As social psychologists would confess, if negative labels are assigned to certain traits of masculinity, even a wrong assumption about a particular event or behaviour can breed itself into a new entity that is consistent with the original faulty assumption. What is often overlooked in this context is that the behaviour of modern day ‘Y chromosome owners’ may be deeply rooted in socialisation forces. In many paternalistic societies, boys are differently socialised. In the Arab part of the world, daredevil (shuja’ā) masculine behaviour is encouraged by society. This view echoes the Roman philosopher, Marcus Cicerō’s, notion that “a man’s chief quality is courage”. In such an atmosphere, risk taking or, in its extreme form poor impulse control, is paradoxically intrinsically sanctioned. It is no wonder therefore that men, with their socially patterned risk taking propensities, are likely to succumb to drug addiction and other health risky behaviours. Therefore, unless Wordsworth’s euphemism, “the child is father of the man” is considered as a part of the equation, all the efforts to curb the dark side of masculinity would likely to end in vain or as empty rhetoric. Finally, although the volume should be applauded for its audacity in formulating the protocol for addressing male problems, scant attention is paid to methods of measuring the outcomes of such an undertaking.

Who should read this book? The authors unabashedly propose that all healthcare professionals, health managers or simply all aspirants in the emerging field of men’s health should read this volume. The strength of this book is that it is a manual filled with anecdotes, cartoons and, for brevity, at the end of each chapter references, an index and appendices are provided to consolidate the message. The manual does not pretend to be anything more than a practical approach to the development and implementation of a men’s health program for the situation in the UK. Unlike other previous approaches, the message has ecological validity in that it aims to reach the culprits on their own turf, be it in the tavern or on the football pitch.

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If you think that your dishdasha*, after tucking your khanjar** around it, is helping you hide your extended waistline, you may actually be hiding something of sinister consequence to your health. Male fatness, or android obesity, that manifests as an expanded waistline is now perceived in the medical profession as a key precursor of many intractable illnesses from diabetes to cancer, as well as a myriad of others that lead to poor quality of life, disability or simply shortened lives. Of course, this is not new; the ‘father’ of medicine, Hippocrates, long ago indicated that corpulence leads to untimely death. This view has been recently resurrected in the volume, Hazardous Waist: Tackling Male Weight Problems. When one sees the title of this book, it appears that it is one of those ‘self-help’ books with directions on how to curb one’s mass of adiposis tissue. The title appears to suggest new age themes like those of Dr. Deepak Chopra, (Indian medical doctor and popular writer on spirituality and diverse topics in mind-body medicine), but browsing through the pages, we realize that this book is no ‘psycho babble’ or esoteric book enticing people to recharge their ‘chakra.’ The volume is neither reminiscing of ‘gutbuster’ exercise or drugs that often appears as e-mail spam.

Alan White and Maggie Pettifer have edited chapters from presentations previously conducted under the auspices of the Men’s Health Forum which took place from 2004 in the UK. It synthesises the literature and all that the services of weight problems entail among the male population. The statistics are staggering and the situation is overwhelmingly bleak. Males are more gluttonous and sedentary and are unlikely to be unaware of their belly fat or simply deny its size. More dishearteningly, males are less likely to do something about it than females. Most demoralising, males with central obesity have a higher risk of succumbing to ill-effects of obesity.

Although there are many academic publications highlighting the global epidemic of obesity, this volume uniquely focuses on the male gender. The motto of the book is the formula that what works for females may not be the best solution to preventing the rising tide of hazardous waist among males. Then, you may wonder, in the age of ‘schism’ and ‘ism’, is this book just dangerously revamping and evoking ‘gender wars’ and

* Traditional Omani men’s robe
** Traditional Omani dagger
stereotypes? Is a thin veneer of health-speak actually just masking male bashing? The answer is emphatically no. The book simply raises awareness of male weight problems and it is built around the theme that the waist’s circumference in males has reached the danger zone and that this trend is taking on epidemic proportions. The first part of the volume addresses the challenges of male weight problems. Under this heading, there are six chapters synthesising the multidisciplinary and gender sensitive approach to central obesity and its impact on psychological, medical and social outcomes. The second part of the book, divided into fifteen chapters, addresses how to tackle male weight problems. It highlights the important roles of primary health care, community and an ‘obesogenic’ environment in the effort to confront the health risks posed by obesity in men.

Although eating disorders are becoming global challenges, the book derives its database from the UK and Australian populations. Both of them are a heterogeneous collection of different ethnic groups, so the book does transcend the white middle class situation. References to the World Health Organization also crop up on many occasions. Scholarly work and statistics on the prevalence of obesity in minorities and even a chapter featuring the situation among South Asian men are given audience in this volume. Despite the well established association between genetic factors and obesity, it is the socio-cultural context that is central to the predisposition, onset, course and outcome of obesity and more importantly, biopsychosocial factors that are of major importance in designing interventions and obesity management plans.

Whereas the lower classes are increasingly succumbing to obesity in Western Europe and North America, in the Arabian Gulf its first victims are urban elites who are likely to live a sedentary life with no physical activity to balance out its effects. Related to this, in many societies, is the message that obesity is bad for health would likely go unheeded. There many societies where thinness is perceived as socially undesirable whereas plumpness is regarded as a status symbol and beautiful. There is also the perception that the ‘cult of thinness’ pervading our media is deeply rooted in a western-centric perspective on body-image. Against this background, unless cultural forces are employed as catalysts for curbing obesity, health education among different ethnic groups will have a limited impact due to their different concepts of health and body image. As this volume does discuss the situation in some sub-cultural groups in the UK, its message can be applied to situations elsewhere.

Reading between the lines, however, this volume appears to be insidiously polemical, trumpeting great tribulation. The argument is that if no urgent measures are taken, obesity will be equivalent to the mediæval bubonic plague or other more recent scourges that have decimated humanity. As any fear monger or student of social stigmatisation would attest, the consequence of grandiloquent rhetoric can be the birth of negative perceptions which can in turn cause the intended message to trigger a boomerang effect. It is widely known that any social construct or culturally de-valued phenomenon that is labelled as negative is likely to go underground only to resurface later when the condition has reached a stage of irreversible deterioration. Despite this caveat, the chapters are well-written, backed up with citations and fully indexed. Although the book has as many as twenty-five authors, we do not find the common rumblings often come across in books authored by many contributors. The approach of this volume is to give balanced practical guidance to individuals, institutions and all the stake-holders, derived from empirical and evidence-based research as well as personal experience. The book is technical and yet any avid reader could grasp its content. Most of the jargon is well defined. The book draws its expertise from the myriad talents of professors of men’s health, dieticians, sociologists, psychologists and others. This is indeed a multidisciplinary endeavour. This volume should be on the reading list for all health care practitioners, nutritionists and other professionals who are advancing the cause of health education. If there is no steadfast effort to curb the obesity of their husband and boys in the household, women would also benefit from reading it to know why their husbands are likely to leave them as widows.

REVIEWER
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Riding the Diabetes Rollercoaster
A new approach for health professionals, patients and carers

Authors: Helen Cooper and Robert Geyer
ISBN: 978 1 84619 045 2
Orders: http://www.radcliffe-oxford.com

The book provides a new approach in looking at diabetes as a health problem with complex dimensions affecting patients, their families and health professionals. The authors have adopted a particular approach to diabetes, starting with a brief introduction to diabetes, outlining some of its main aspects and charting historical developments to show why it is such a perfect example of a complex system. They highlight the growing number of patient with diabetes worldwide, now reaching epidemic proportions, and the consequent social and economic impacts.

In the second chapter, they introduce the reader to the basics of complexity science. Using a historical approach, the authors chart the pathways of complexity’s emergence out of the natural sciences in the early twentieth century and its spilling over into the medical and social sciences at the end of that century. Following this historical and theoretical exposé, they apply different concepts of complexity to the management of diabetes.

Diabetics run the additional risk of developing psychological problems; indeed, the prevalence of mental health problems in people with diabetes exceeds that found in general populations. Therefore, in chapter 4, the authors approach the psychological aspects of the problem of balancing patients’ mood swings due to the anxieties caused by diabetes. They also discuss negative attitudes, coping difficulties, eating disorders, depressions, anxiety and other disorders which frequently complicate the health care of diabetics and are often missed. Poor psychological functioning causes suffering, can seriously interfere with daily diabetes self-management, and is associated with poor medical outcomes and high costs. They highlight the need to integrate personal experiences into the educational process, so acknowledging the expertise the patient develops from living with diabetes. In chapter 5, the authors discuss the complexity of the management of diabetes viewing, on the one hand, the medical expert’s emphasis on the importance of glucose control. On the other hand, they discuss the patient’s viewpoint on living with diabetes on a day-to-day basis and so acquiring valuable knowledge and experience of their condition and its management. Ultimately, they therefore become experts in living with their disease.

The authors also contrast the hierarchical with the interactive approach to the management of diabetes. The emphasis is on how to help diabetics of all ages to understand and communicate what is happening to
them. The design of interactive counselling and learning aids is also discussed; for example, three ‘Diabetes Boxes’, each one a three-dimensional hand-made cube, can be used to stimulate discussions and to help people to develop knowledge and understanding of the biological and psychological concepts relating to diabetes, and help them to understand and express their feelings about having the disease. Each box relates to a specific theme. The idea of the three-dimensional diabetes boxes is to encourage people to make their own box modelled on their own particular needs or situation.

The sixth chapter discusses diabetes as a cascade of complexity. It is presented as a gateway event for anyone developing the disease since it combines new regularities (monitoring diet, exercise, blood glucose levels, etc.) with the new, unpredictable events (integrating one’s lifestyle with new regularities, personal reactions, patient-career relationships, family responses, etc.). Once someone passes through the gateway, they can not go back. The main point of this chapter is that helping patients to make most of their walk is the truly caring approach expected from health professionals and others.

In chapter 7, there is an emphasis on the management of diabetes through complementary therapies. It covers lifestyle therapies such as medications and relaxations; Eastern therapies such as Chinese medicine and acupuncture; natural therapies such as herbalism and homeopathy; manipulative therapies such as chiropractic and osteopathy; mind therapies such as hypnotherapy and spiritual healing, and the arts such as dance, music, and art. Combining modern and complementary medicine provides the best of both approaches and would seem to be common sense.

However, the scientific barrier that lies between them is both a lack of research to prove the effectiveness of complementary therapies and the difficulty of applying the methods of conventional medical research to such treatments. Notwithstanding, relaxation therapy is presented as a widely used and scientifically proven diabetic therapy.

The final chapter of this book summarises for the reader the effectiveness of the complexity approach for dealing with diabetes: the recognition of the importance of the interwoven physical and mental aspects of diabetes. It argues that if one is going to support people with diabetes effectively the health system must pay more attention to and spend more money on mental health aspects. Similarly, complementary therapies that have been shown to have an impact on mental health must be researched to support their common use in medical practice. The complexity approach, which was outlined in this book, is a radical new approach to understanding and managing diabetes that embraces its challenges and uncertainties using the latest advances in complexity theory. From this perspective, the diabetes rollercoaster is a normal curve and is a mirror of life itself. Learning this tool may alter the approach to diabetes.

This book is a good and interesting read for anybody dealing with diabetes, including health professionals, careers, families and patients themselves.

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Re: Physicians, Climate Change & Human Health

To the Editor,

I congratulate you for having chosen a very pertinent topic for your Message from the Editor-in-Chief, in the July 2008 issue of SQUMJ.1 This is a global issue which has vast and long term effects on everyone in every region of the world. It is even more gratifying to note that you want physicians in all capacities to be aware of the issue and contribute to solutions in whatever capacity that they can.

Perhaps an equally if not more important theme and, in my opinion, the most important health matter today from the prevention point of view, is that of unhealthy lifestyles. This is again an issue of worldwide importance, but of special significance to this region and this country in particular where we are experiencing a flood of its after-effects. Vast masses of the population, especially young children and youth are being adversely affected by this scourge, due probably to wealth and easy access to every amenity of life, many of which are not being used judiciously. It is therefore of special relevance to all physicians with the need for them to be pro-active rather than reactive.

Lifestyle is important to us as individuals, families and as communities, as we all in our turn contribute to overall national health. Unfortunately, this subject has not yet been the focus of any World Health Day. Unhealthy lifestyles are perhaps equally if not much more dangerous and devastating than climate change, especially for our most vital resource, our new generation, which carries the hopes and aspirations of every country. If the effects of climate change will affect the lives of millions, unhealthy lifestyles trap billions. Every branch of medicine will face the consequences and they will pose a gradually increasing burden and challenge for them in the coming decades, with, unfortunately, with little hope of successful solutions, if present trends continue and the world clings to unhealthy lifestyles as the dearest, most cherished and attractive thing on earth.

Excuse me for my rather strongly expressed sentiments, but this is a reality and it needs expressing in clear and strong words for the world and to those who can make the most difference: parents, teachers and doctors, all of whom are presently playing a rather passive instead of a strong and proactive role.

In Oman and other Gulf states, we already have certain adverse factors, such as a high proportion of consanguinity and genetic defects which gives us little chance of escape from many health problems. We therefore have no choice but to choose, establish and propagate this golden option: a healthy lifestyle. This is a strong, cost-effective preventive strategy against the fury of many modern diseases, many of them incurable and life-long afflictions which top the global list of causes of morbidity and mortality and to which we are unfortunately and helplessly both succumbing and contributing.

This region has innumerable risks and dangers knocking at its door, waiting to enter and afflict the lives of us and our families. We can and have imported the best hospitals of the world, but this will never improve the overall general health of the nation. Hospitals are meant for the sick and those who are lucky enough to be aware of their disease and have it detected. Unawareness of health problems has unfortunately become rampant in the modern world, even though we are saturated with information and information technology. We know everything that goes on in the most distant corners of the world, but give little importance and time to what is going on within our bodies and our families.

In Oman, we have provided the very best of everything to our most loved ones, our children, right from birth, keeping them safe and on the road to health. Why do we then allow them as they grow older to take on our unhealthy lifestyle, most of it imported from the knowledgeable West, and allow them to contribute further to our already high national health risks? Why do we allow them detour off the road to health and safety? This is exactly what we are doing, of course unknowingly and maybe unintentionally. Are they immune to the health risks of adult life? Do they have to experience the same fate as we and others and run these risks till their old age and death?
Can we not change the present environment and scenario? Why cannot we as parents, teachers and doctors be
good, healthy and responsible role models so making a healthy lifestyle a social norm and a mass movement? We
certainly can do it if we control our gradually increasing desires, strengthen our will power and, most important
of all, give deep and serious thought to the future of our children, our families and our nation.

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Forthcoming Medical Conferences, Courses and Workshops

3-4 January 2009 - 1st International Otology Conference
King Faisal University College of Medicine & King Fahd Hospital of the University, Al Khobar Saudi Arabia
Email: mededucation@kfu.edu.sa

18-21 January 2009 - 6th International Scientific Conference for Medical Students in the GCC countries
Faculty of Medicine & Health Sciences, UAE University, Al Ain City. Information
Email: info.gcc6mconf@uaeu.ac.ae Web: www.gcc6mconf.uaeu.ac.ae

20-22 January 2009 - The Art of Ultrasound Scanning in Fetal Care
King Faisal Specialist Hospital and Research Centre, Riyadh, Saudi Arabia. Information
Email: web_symposia@kfshrc.edu.sa Web: www.kfshrc.edu.sa/symposia

27-29 January 2009 - Radiation Safety in Medicine
King Faisal Specialist Hospital and Research Centre, Riyadh, Saudi Arabia.
Email: web_symposia@kfshrc.edu.sa Web: www.kfshrc.edu.sa/symposia

4-5 February 2009 - Hot Topics in Pediatrics
King Faisal University College of Medicine & King Fahd Hospital of the University, Al Khobar Saudi Arabia
Email: mededucation@kfu.edu.sa

17-18 February 2009 - Pediatric Infectious Diseases Seminar
King Faisal Specialist Hospital and Research Centre, Riyadh, Saudi Arabia. Information
Email: web_symposia@kfshrc.edu.sa Web: www.kfshrc.edu.sa/symposia

17-19 March 2009 - International Workshop on Basic Ultrasound in Obstetrics & Gynecology
King Faisal University College of Medicine & King Fahd Hospital of the University, Al Khobar Saudi Arabia
Email: mededucation@kfu.edu.sa

24-25 March 2009 - Workshop on Updates in Obstetric and Regional Anesthesia
King Faisal Specialist Hospital and Research Centre, Riyadh, Saudi Arabia. Information
Email: web_symposia@kfshrc.edu.sa Web: www.kfshrc.edu.sa/symposia

31 March-2 April 2009 - 2nd Cleft Lip and Palate Workshop
King Faisal Specialist Hospital and Research Centre, Riyadh, Saudi Arabia. Information
Email: web_symposia@kfshrc.edu.sa Web: www.kfshrc.edu.sa/symposia

4-5 April 2009 - Magnitude of Vascular Access in Dialysis Patients
King Faisal Specialist Hospital and Research Centre, Riyadh, Saudi Arabia. Information
Email: web_symposia@kfshrc.edu.sa Web: www.kfshrc.edu.sa/symposia

7-9 April 2009 - International Medical Care and Diagnostic Conference and Exhibition - IMD Dubai 2009
Email: gurpreet.arneja@index.ae Web: www.imd.ae

28-29 April 2009 - Advances in Wound Care
King Faisal Specialist Hospital and Research Centre, Riyadh, Saudi Arabia
Email: web_symposia@kfshrc.edu.sa Web: www.kfshrc.edu.sa/symposia
2-6 May 2009 - Care of the Elderly
King Faisal University College of Medicine & King Fahd Hospital of the University, Al Khobar Saudi Arabia
Information - Email: meducation@kf.edu.sa

6-7 May 2009 - The Child with Neurodevelopmental Disabilities: From birth to a fruitful adulthood
King Faisal University College of Medicine & King Fahd Hospital of the University, Al Khobar Saudi Arabia
Email: meducation@kf.edu.sa

6-7 October 2009 - The Health Consequences of Global Warming
King Faisal Specialist Hospital and Research Centre, Riyadh, Saudi Arabia
Email: web_symposia@kfshrc.edu.sa Web: www.kfshrc.edu.sa/symposia

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مرض الفيروس المُثبِط الأفراد المُولِّمين المعدي الخاطئ المصيب لعدة أعضاء تقرير حالة

تقرير حالة
سوبر أحمد عبد الله باهر راجي كريشنان

تغاثر الزُرعون المزدوج للهيموغلوبين المنخلي والهيموغلوبين المنخلي العماني
تقرير حالة
سوبر فينجولوج بالفسنالدا شاجو، سوجانا نوري، ثريا الخفيلي، خالد سليم بيت جيل

مظاهر إصابات العظام بأًشواك النخيل
مجموعة حالات
اسام سويش

حالة غير اعتيادية للكَتْرَة اللَّمْفايَات يَا النَّمْثِيَة
سوبر فينجولوج جاني جورج سالمة الخفيلي

صورت شعاعية طبية مهمة
القوس الأبهري الأدنى مع شرين جَحَّ الترقوة الأيسر الزانغ
منهج كلارون، سحيلي سوامي، راجي فيجين

ورم الخلية السريروية
عمرو الغارسي، أمين الطالب

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صحة الرجال - كيف الوصول إليها؟
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الخصر الخطر: معالجة مشاكل الوزن لدى الذكور
المؤلف: آلان وانات، مجلسي بيتيفر
مراجعة: سمير العموري

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والمرضى ومن بينهم
المؤلفون: هيلين كوير وروبرت جيفر
مراجعة: علي العموري

رسالة إلى الأُخر
اشارة إلى: الأطباء. تغيرات الطقس وصحة الإنسان
مشتاق خان

إعلانات
المؤتمرات والمواعيد والدورات الطبية القادمة

دليل المؤلف
الاكتيوات

رسالة التحرير
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التحرير
الممارسة الطبية في القرن الواحد والعشرين - ماذا سيفعل الأطباء؟
بيس جورمان

مراجعة
متلازمة انقطاع النفس النومي الكامل/الجزيئي وعلاقتها بارتفاع ضغط الدم
محمد بن عبد الله المصري، خميس بن محمد الهاشمي

بحوث أساسية وسريرية

نوعية العلاقة مع المنشفة وإنهاك العمل عند المرضى
بنيكارمو مودينتسي جاكي بل، أحمد الندري

فرحة القرنية الناجحة من العدسات اللاصقة والتي تم علاجها في وحدة المستوى الثالث
للعين في عمان - دراسة وصفية
وكين شاه ياناني شاد رافي جنر، محمد عبد الطيف الرئيسي

تقييم مستويات النحاس والزنك ونسبة النحاس إلى الزنك في مصل المراهقين اليمنيين ودراسة العلاقة بين مستويات هذا الأملاح في المصل ومقايسات النمو
رابع محمد مجعان

وضع حالياً بطانة قرنية العين لدى المرضى العمانيين المصابين بتضلاع القرنية الكاذبة مع الطبيعة العين
أوستن، وليد الله جوني، نادية الخروصي، بياتريس سيدي رفيقي

استخدام حقن السيروستيرويد في إنهاء الحمل في حالة وفاة الجنين في الأثنا thuế الثاني وبداية الأثنا thuế الثالث
أيضاً كريتنا مريام ستيفن، سيدي جواهر رفيقي

تأثير العوامل من القرب الجغرافي كسبب لسلوك اللجوء للرعاية الصحية في شمال عمان
أحمد المنرجي، سمير العدوي، إبراهيم الزكاري، محمد الشافعي، ليم الول

طبيعة التحسين للمستحاثات التشوية عند العمانيين المصابين بمرض الربو وحساسية الأنف والعينين
سامي محفوض، غاياء الشديدان، راشد العبدي، علوي جولي، عمر الرواد، برازي فياري

رضي الحوامل من خدمات ما قبل الولادة في منطقة مسقط بسلطنة عمان
محمد المناشي، راحف خانديكار

تقارير حالات

أتيضاً تم التصوير التشريحي في سلطنة عمان
أربع حالات
اريكسلي كويكولاس، أنيتا الراشدي، مهنا الأصلي
تقدم مجلة جامعة السلطان قابوس للبحوث العلمية بنشر مقالات محكمة للأبحاث الأساسية والتطبيقية في مجالات العلوم الطبية. وتتولى مجلة بعثة فضائية، حيث تجمع بين تلقين أوراق علمية ذائعة بثرة في مجالات أحدث التطورات في التخدير، الصيدلية، الأبحاث، الدراسات الطبية، صحة الإسراء، وأعمال التأ(userid omitted). الأمراض، العلاج، العلاج، التدريس، التحري، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريس، التدريد الالكتروني: mjournal@squ.edu.om

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المجلة الطبية لجامعة السلطان قابوس

2008

العدد الثاني: نوفمبر

الأبراج: تغيرات النطقية وصحة الإسنان: تغيرات النطقية في الفجر الواحد والعشرين - ماذا سيفعل الأطباء؟

مشكلة احتفاظ النفس الحول الكامن/الحول، وعلاقاته بارتفاع ضغط الدم.

نوعية العلاقة مع الشريك والدكاك عند المرضى.

دراسة وصفية قوة الفرصة الناتجة عن العدالة الم범ية التي تم علاجها في مجال السنوات الثلاث للفتة في عمان.

تحليلاً وخصصية تقييم مستويات المصاحبة والردية للمرضى من الناحية الإدراكية في مجال حملات السفريات ودراسة العلاقة بين مستويات هذه الأعراض في الحال ومحاسبة التنفيذ.

أجريت في فريق السفر الدولي للمرضى للتحكم في حالة السير في الأثناء الثالث وداء الألوت الثالث.

تأثير العوامل من فحص الأعراض في كسب سلوك اللجوء إلى نزعة ودية في مجال علاج.

دراسة التحسيس للمستشفيات المشتركة عدى المريضين المصابين بمرض الربو ونسبة الألف والعينين.

قياس كفاءة جهاز ما قبل الولادة في منطقة مستشفى مملوء بسلوكية عمان.

المراجعات: انتظام المراضات الطبية في سوق عمان.

 BuzzFeed: الأعراض الشائعة في فترات النوم.

مرض القلب - احتمالية أعراض لدى_age أعراض تشير إلى حالة.

العوامل الإضافية: لسائبين أعمه (غير حالة - تغيير حالة).

العوامل الإضافية: لسائبين أعمه (غير حالة - تغيير حالة).

مطالعة إصلاح النظام بالشوكات النجم - مجموعة حالات
g

العوامل الأخرى: تغييرات طفيفة وصحة الإسنان:

النهاية الأمين مع تسيراً في الرؤية الأيسر البائغ.

الشفاء - السلوك الاجتماعي للᠦᠶᠶ

وصفة السلوك - الكف الاحترام?

الخصرURAL: يعاني مشاكلاً زمن لدى الذكور.

حملة (المشكلة السريعة) لداء السكر - طرقية ضعية للمريض في القطاع الصحي - والرضي ومن برمجيه.

أشرطة إلى أطقم : تغيرات النطقية وصحة الإسنان.