Evaluation of antibiotic prescribing for adult inpatients at Sultan Qaboos University Hospital, Sultanate of Oman

Ghada Redha Al-Maliky,[1] Mustafa Manhal Al-Ward,[2] Aqila Taqi,[1] Abdullah Balkhair,[3] Ibrahim Al-Zakwani[1,4]

► Additional material is published online only. To view please visit the journal online (http://dx.doi.org/10.1136/ejhpharm-2016-001146)

[1]Department of Pharmacy, Sultan Qaboos University Hospital, Muscat, Al Khoudh, Oman
[2]Oman Medical College, Boushar, Muscat, Oman
[3]Department of Medicine, Sultan Qaboos University Hospital, Muscat, Al Khoud, Oman
[4]Department of Pharmacology and Clinical Pharmacy, College of Medicine and Health Sciences, Sultan Qaboos University, Muscat, Al Khoudh, Oman

Correspondence to
Ghada Redha Al-Maliky, Ghada Redha Al-Maliky, Department of Pharmacy, Sultan Qaboos University Hospital, Muscat 00968, Oman; ghada.almaliky@gmail.com

Received 25 October 2016
Revised 1 April 2017
Accepted 3 April 2017
Published Online First 9 May 2017

EAHP Statment 4: Clinical Pharmacy Services.

ABSTRACT

Objective Little is known into the prudent use of antibiotics in hospitals in Oman. This study is to evaluate antibiotic prescribing by measuring the overall compliance with the local antibiotic prescribing guidelines.

Methods An observational study involving 366 patients' admission episodes as determined by power analysis on patients (≥18 years) on oral and/or parenteral antibiotic during admission, in the period of 10 weeks (1 February–15 April, 2014). The adapted audit tool of the Barking, Havering and Redbridge University Hospitals NHS Trust was used for this study. Analyses were performed using descriptive statistics. Main outcome measures: antibiotic prescribing compliance with the local guidelines as well as the overall restricted antibiotic policy adherence at Sultan Qaboos University Hospital (SQUH).

Results The number of prescribed and audited antibiotics totalled 825, compliance with local guidelines was suboptimal at 63% (n=520), and of 211 restricted antibiotics prescribed, the overall adherence to restricted antibiotic policy was inadequate at 46% (n=98). The majority of the antibiotics prescribed were broad spectrum at 90% (n=739), mainly penicillins at 31% (n=256) and cephalosporins at 17% (n=139).

Conclusion The study has provided valuable baseline details of antibiotic prescribing patterns in SQUH. The diagnosis was documented in 89% (n=327) of the admission episodes. However, the compliance with SQUH antibiotic prescribing guidelines was suboptimal, and the overall compliance with SQUH restricted antibiotic guidelines was in 46% of the prescriptions. Further studies are required to address the reasons behind the non-compliance with local guidelines.

INTRODUCTION

The bacterial resistance is an increasingly serious threat to global public health that requires action.[1] Irrational antibiotic use is one of the contributors to bacterial resistance.[1–5] The WHO advocates that the use of antibiotics should be strictly monitored. This can be achieved through strengthening antibiotic resistance monitoring and surveillance systems and introducing evidence-based treatment guidelines.[1]

The problem of bacterial resistance has a greater impact on middle-income and low-income countries.[6] Moreover, there was a noticeable increase in the resistance in the last two decades among *Escherichia coli* and *Klebsiella* in the Gulf corporate countries (GCCs). This increase has been attributed to several factors such as 'readily available broad-spectrum antibiotics and the lack of antibiotic stewardship programmes'.[7–10] Furthermore, a recent study has argued that 'therapeutic options for common infections are limited or unavailable for those caused by resistant bacteria'. Anyone can be affected by this unfortunate fact, especially those at a higher risk of infections such as patients with cancer, immunocompromised patients, organ transplant patients, hip replacement surgery patients and other patients who have undergone major surgeries.[11]

Antibiotic prescribing guidelines are well known worldwide; they aim to improve patient clinical outcomes by reducing the adverse reactions to antibiotics and diminishing the spread and development of bacterial resistance. However, such outcomes are only apparent when antibiotic prescribing guidelines appropriately practised. Local antibiotic prescribing guidelines (Antibiotic handbook) in Sultan Qaboos University Hospital (SQUH) were first published in 1996 and last reviewed in 2006. However, despite this long history, there were no documented reports on the compliance with these guidelines.

OBJECTIVES

The aim of this study was to evaluate antibiotics prescribing by measuring the overall compliance with the local guidelines using the antimicrobial prescribing care bundle of the UK as a compliance tool.

METHODS

Study design

This was an observational study (clinical audit).

Setting

The study was conducted at SQUH, Muscat, Sultanate of Oman. SQUH is a 500-bed tertiary teaching hospital, admitting approximately 7300 adult patients with infections in the medical and the ICU wards annually. Inclusion criteria included patients aged ≥18 years, admission to the medical wards and the intensive care unit (ICU), those admitted for at least 72 hours and were on oral and/or parenteral antibiotic during admission, in the period of 10 weeks (1 February–15 April 2014). Those on topical and/or vaginal antibiotic prescriptions were not included in the study. The duration of the data collection period (10 weeks) was calculated based on the admissions rate using statistical data of 2013.

Check for updates

To cite: Al-Maliky GR, Al-Ward MM, Taqi A, *et al*. *Eur J Hosp Pharm* 2018;**25**:195–199.

Data were extracted from the electronic hospital information system (TrakCare1995–2012 InterSystems). The data included patient demographics (age, gender and medical record number) and the length of hospital stay. The diagnoses as well as the specialty under which the patient was admitted to were also recorded. Infection disease markers using vital signs chart were also extracted including temperature, pulse rate, and blood pressure, at the time of antibiotic prescribing. Microbiology results, sensitivity results and haematology results, including complete blood count and C reactive protein, and allergy status were also recorded.

The audit tool of 'Barking, Havering and Redbridge University Hospitals NHS Trust', which was used in the Point Prevalence Study on Anti-infective Use, 2011[12] was also used in the current study to measure the compliance with the action prior to the administration of antibiotic therapy, ongoing antibiotic therapy and culture results and sensitivities. The tool was adapted to support the study requirements for the measurement of compliance with the local antibiotic prescribing guidelines as follows:

Questions 5 and 6: deleted, surgery cases were excluded. Questions 15, 16 and 17: modified and replaced by the set of action for culture results and sensitivities.

The compliance audit tool is described in the online supplementary appendix.

Sample size

Using the online sample size calculator by Raosoft (www.raosoft.com/samplesize.html), assuming a population size of 7300, a hypothesised inappropriate response rate of 50% at a confidence level of 95% and a margin of error of 5%, an estimated sample of 365 patients was needed.

Statistical analysis

Descriptive statistics were used to describe the data. For categorical variables, frequencies and percentages were reported. Continuous but non-normal distributed or discrete variables (length of hospital and number of antibiotics) were presented as median and IQR. Analyses were performed using Stata version 13.1.

RESULTS

A total of 366 patients' admission episodes during the 10 weeks of data collection period from 1 February 2014 to 15 April 2014 that fulfilled the inclusion criteria were recruited. The number of prescribed and audited antibiotics totalled 825. Table 1 summarises patients' demographics. The overall median age of the cohort was 58 (35–70) years with 56% (n=204) being male patients. The median length of hospital stay and the number of prescribed antibiotics were 4 (3–6) days and 2 (1–3) antibiotics, respectively. The antibiotics were mostly administered through the parenteral route.

Description of the diagnosis is outlined in table 2. Diagnosis was documented in 89% (n=327) of the episodes. Allergy status documentation was made in 59% (n=486) of the prescriptions. The type of allergy was seldom documented. The most prevalent infections included were those of the respiratory tract system 33% (n=121) with pneumonia cases predominant in 22% (n=82). Among the pneumonia cases, community-acquired pneumonia was the most frequent diagnosis in 18% (n=66). Viral pneumonia has been detected in 11% (n=9) of pneumonia cases; the diagnosis was confirmed by the respiratory viral screen test as influenza A RNA detected. Those patients were treated with 3% (n=26) broad-spectrum antibiotics. The second most frequent infection was sepsis in 15% (n=55) with MDR *Acinetobacter* infection constituting 4% (n=13) of the admissions. The third most frequent infections are those associated with urinary tract in 7% (n=25).

Table 1 Patients' characteristics and antibiotics prescribing patterns

Characteristic	Total, n=366, N=825	Male, n=204, N=447	Female, n=162, N=378
Age, median (IQR), years	58 (35–70)	58 (34–70)	58 (36–70)
LOS, median (IQR), days	4 (3–6)	4 (3–7)	4 (3–6)
Antibiotics, median (IQR), number	2 (1–3)	2 (1–3)	2 (1–3)
Route of administration, N (%)			
Parenteral	626 (76)	346 (77)	280 (74)
Oral	199 (24)	101 (23)	98 (26)
Indication, n (%)			
Medical treatment	343 (94)	186 (91)	157 (97)
Prophylaxis	17 (4.6)	12 (5.8)	5 (3.1)
No documented indication	6 (1.6)	6 (2.9)	–

LOS, length of hospital stay; n, number of patients, N, number of prescribed antibiotics.
The percentages might not add up to 100% due to rounding off.

Details of antibiotics prescribed are listed in table 3. This study demonstrates that broad-spectrum antibiotic prescriptions were predominant. The three most prescribed antibiotic types included penicillins in 31% (n=256) of prescriptions followed by cephalosporins in 17% (n=139) and macrolides in 15% (n=125).

Parenteral antibiotics switch to oral after 48 hours was only in 28% (n=376) of prescriptions. Documentation of duration: antibiotics prescribed for maximum of 7 days unless otherwise specified in medical notes was in 88% (n=722) of prescriptions. Culture and sensitivity: relevant clinical specimens for culture and sensitivity testing are obtained prior to antibiotic administration, was in 85% (n=703) of prescriptions. When culture and sensitivity results are available, antibiotics were prescribed according to positive microbiology test results, and this was only in 18% (n=147) of prescriptions.

Table 4 outlines compliance of the prescribed antibiotics with the local guidelines. Antibiotics prescribed were in compliance with the local guidelines only in 63% (n=520) of prescriptions.

Restricted antibiotics in SQUH include ciprofloxacin, imipenem, meropenem, intravenous vancomycin, teicoplanin, cefepime, tigecycline, colistin and linezolid. Prior to prescribing of infectious disease (ID) approval from physician or microbiology consultant is SQUH's policy and is mandatory. Restricted antibiotics are prescribed for 7 days, and then further approval is required. Table 5 demonstrates the ID team involvement in restricted antibiotic prescribing. Of 211 restricted antibiotics prescribed, only 46% (n=98) included the involvement of ID specialist and/or microbiologist recommendation. Meropenem was reported as the highest restricted antibiotic prescribed in 41% (n=87) of prescriptions followed by vancomycin and ciprofloxacin at 25% (n=52) and 21% (n=45), respectively.

DISCUSSION

The study demonstrated that 90% of antibiotics prescribed were broad spectrum, mainly the antipseudomonal penicillin (piperacillin in combination with beta-lactam tazobactam) 31%; followed by cephalosporins 17%, meropenem 11%, macrolides

Table 2 Detailed description of the diagnosis of the treated infections

Diagnosis, n (%)	All, N=366	Female, n=162	Male, n=204
Respiratory tract infection	121 (33)	56 (35)	65 (32)
Pneumonia	82 (22)	36 (22)	46 (23)
Viral pneumonia	9 (2)	7 (4.3)	2 (1)
HAP	7 (2)	1 (0.6)	6 (2.9)
CAP	66 (18)	28 (17)	38 (19)
URTI	8 (2)	5 (3)	3 (1)
COPD exacerbation	4 (1)	2 (1.2)	2 (1)
Cough	4 (1)	2 (1.2)	2 (1)
Bronchiectasis exacerbation	3 (1)	2 (1.2)	1 (0.5)
Cystic fibrosis exacerbation	1 (0.3)	–	1 (0.5)
LRTI	1 (0.3)	1 (0.6)	–
Unspecified/chest infection	18 (5)	8 (5)	10 (5)
Sepsis	55 (15)	25 (15)	30 (15)
MDR *Acinetobacter* infection	13 (4)	7 (4)	6 (3)
Cellulitis	24 (7)	3 (2)	21 (10)
Febrile neutropaenia	18 (5)	11 (6.8)	7 (3.4)
VOC/SCD	15 (4)	7 (4.3)	8 (3.9)
ACS/SCD	16 (4)	8 (4.9)	8 (3.9)
Fever/fever of unknown origin	15 (4)	8 (4.9)	7 (3.4)
Meningitis	5 (1)	3 (1.9)	2 (1)
UTI	25 (7)	15 (9.3)	10 (4.9)
Skin infections	6 (2)	5 (3.1)	1 (0.5)
Gastrointestinal infection	21 (6)	6 (3.7)	15 (7.4)
Gastric ulcer perforation/ bleeding	6 (2)	1 (0.6)	5 (2.5)
Diarrhoea	4 (1)	1 (0.6)	3 (1.4)
Ascites/ascetic tapping	4 (1)	2 (1.2)	2 (1)
Pancreatitis	3 (1)	–	3 (1)
Cholecystitis	2 (0.5)	1 (0.6)	1 (0.5)
Helicobacter pylori infection	1 (0.3)	–	1 (0.5)
Peritonitis	1 (0.3)	1 (0.6)	–
Others	6 (2)	1 (0.6)	5 (2.5)
Osteomyelitis	2 (0.5)	–	2 (1)
Pleural effusion/pleural aspirate	3 (0.8)	1 (0.6)	2 (1)
Fasciitis	1 (0.3)	–	1 (0.5)
No documented diagnosis	39 (11)	14 (9)	25 (12)

ACS, acute chest syndrome; CAP, community-acquired pneumonia; COPD, chronic obstructive pulmonary disease; HAP, hospital-acquired pneumonia; LRTI, lower respiratory tract infection; MDR, multidrug resistant; n, number of patients; SCD, sickle cell disease; URTI, upper respiratory tract infection; UTI, urinary tract infection; VOC, vaso-occlusive crisis.
Percentage might not add up to 100% due to rounding off.

Table 3 Detailed characteristics of antibiotics prescribed

Antibiotic class	All, N=825, n (%)	Antibiotic name	n (%)
Penicillins	256 (31)		
		Antipseudomonal, Tazocin (piperecillin/tazobactam)	180 (22)
		Co-amoxiclav	62 (7.5)
		Ampicillin	8 (1)
		Cloxacillin	5 (0.6)
		Amoxicillin	1 (0.1)
Beta-lactams	87 (11)		
		Meropenem	87 (11)
Cephalosporins	139 (17)		
		Ceftriaxone	91 (11)
		Cefuroxime	35 (4)
		Cefazolin	6 (1)
		Cefotaxime	5 (0.6)
		Ceftazidime	1 (0.12)
		Cefepime	1 (0.12)
Macrolides	125 (15)		
		Azithromycin	123 (15)
		Clarithromycin	2 (0.2)
Quinolones	84 (10)		
		Moxifloxacin	39 (5)
		Ciprofloxacin	45 (5)
Glycopeptide	56 (7)		
		Vancomycin	52 (6.3)
		Teicoplanin	4 (0.5)
Aminoglycosides	34 (4)		
		Gentamicin	25 (3)
		Amikacin	9 (1)
Polymyxins	16 (2)		
		Colistin	16 (2)
Lincosemide	12 (1)		
		Clindamycin	12 (1)
Sulfonamides	8 (1)		
		Co-trimoxazole	8 (1)
Tetracyclines	6 (1)		
		Tigecycline	4 (0.5)
		Doxycycline	2 (0.2)
Oxazolidinone	2 (0.2)		
		Linezolid	2 (0.2)

Percentages are column percentages.

15% and quinolones 10% and 26 broad-spectrum antibiotics were used to treat viral pneumonia where antibiotics are unlikely to provide benefits. Due to the lack of similar studies in the GCC region and since the audit tool used in the current study is of the UK, the results of this study are compared with a similar study conducted in the UK in 2011,[13] which showed that carbapenems and quinolones prescribing was much lower at 3% and 2%, respectively, and was much higher for penicillin (penicillin in combination with a beta-lactamase inhibitor) at 43%. The only explanation for the higher prescribing of broad-spectrum antibiotics at SQUH was that the prescribers were over cautious about their patients, as most of the patients were critically ill or at high risk of infections (patients with immunocompromised oncology and sickle cell haematology).

The diagnosis is the key element in the choice of antibiotic(s), although appropriate diagnosis documentation was available in 89% of the cases with 62 broad-spectrum antibiotics used for the treatment without a clear documented indication. In comparison, the point prevalence study in the UK in 2011[12] showed that the documentation of the indication was much lower, at 7% on drug chart and 60% in medical notes. A previous study the UK in 2008[14] demonstrated a close relationship between excessive use of broad-spectrum antibiotics and the spread of MDR micro-organisms. This finding may explain the high rate of sepsis cases at SQUH ICU; 24% of sepsis cases were due to MDR-*Acinetobacter* infection.

The compliance with the three sets of action of the UK care bundle was sub-optimal. Parenteral antibiotic switch to oral was in 28% of prescriptions, with no sensible clinical justification that prevents antibiotic downgrading or switch to oral. Furthermore, antibiotic prescribed according to sensitivity

Table 4 Compliance with local guidelines

Care element guideline	(I) Actions prior to the administration of antibiotic therapy, documentation of clinical indication and agent selection (%)	(II) Actions for ongoing antibiotic care, duration review (%)	(III) Culture results and sensitivities (%)	Total achieved (%)
Pneumonia	78	77	54	70
Sepsis	74	64	66	68
Cellulitis	62	65	42	56
Febrile neutropaenia	66	58	47	57
VOC/SCD	67	5	41	54
ACS/ SCD	84	63	35	61
RTI	75	74	47	65
Meningitis	96	74	74	81
UTI	64	60	49	58
Total achieved	74	65	51	63

ACS, acute chest syndrome; SCD, sickle cell disease; RTI, respiratory tract infection; UTI, urinary tract infection,VOC, vaso-occlusive crisis.

results was only in 18% of prescriptions. In comparison, a study conducted in Qatar in 2005[15] showed that the sensitivity pattern resulted in a change in empirical antibiotic therapy in 52% of a microbiologically proven infection. Additionally, the documentation of allergy in the current study was reported in 59% of prescriptions. In comparison with the point prevalence study[12] which showed that the allergy documentation was higher at 99.5%, the documentation of diagnosis and duration was lower at 60% and 14%, respectively.

The overall compliance with local antibiotic prescribing guidelines was in 63% of prescriptions. In comparison, the compliance with hospital antibiotic policy at Antrim Area Hospital in Northern Ireland was higher at 70%.[13] Additionally, the study showed inadequate adherence with local SQUH restricted antibiotics policy, at 46%. In comparison, the point prevalence study in the UK[12] showed a higher rate of adherence to restricted antibiotics policy, at 66.1%. Nevertheless, in the current study the infectious disease specialist consultation was sought prior to prescribing colistin in 87% of the prescriptions, and 100% for tigecycline, cefepime and linezolid. Therefore, these results indicate that the restricted antibiotics policy was partially effective.

This study demonstrated that the compliance to local guidelines was inadequate. This non-compliance could have been attributed to several factors such as the high turnover of doctors and the lack of appropriate training programmes for newly employed prescribers can also contribute to the problem of non-compliance as well as the poor knowledge of the existence of local guidelines. Moreover, prescribers are subjected to pressure from patients and their relatives, especially those with life-threatening diseases. In addition, health professionals fear treatment failures, which may lead to lower confidence by patients, as well as affecting the reputation of the institute. Also, it's not known whether marketing has influenced prescriber's choice of antibiotic or not. The aforementioned factors can contribute to the problem of antibiotics over prescribing and low adherence to the local guidelines. Furthermore, few of the guidelines were updated and implemented in the quality manual at the local intranet and it was not known whether the prescribers were aware of the availability of these guidelines or not.

This study was not without limitations. Since it took place at one tertiary hospital in Oman, its results may not be generalisable to the population at large. However, this study has provided valuable baseline details of antibiotic prescribing patterns at SQUH. Antibiotic handbook (local antibiotic prescribing guidelines) at SQUH was first published in 1996; despite that, this study is the first of its kind in Oman that evaluated antibiotic prescribing practice for adult inpatients at SQUH. It measured the overall compliance with the local antibiotic prescribing guidelines and gives a full description of antibiotic prescribing pattern.

CONCLUSIONS

In conclusion most of the prescribed antibiotics were broad spectrum, mainly penicillins, cephalosporins, carbapenems and quinolones. The diagnosis documentation was appropriate in most of the cases in 89% of the prescriptions. However, the compliance with SQUH antibiotic prescribing guidelines was inadequate at 63%, and the overall adherence with SQUH restricted antibiotic guideline was in 46% of the prescriptions. Further studies are needed to address the reasons behind non-adherence to local guidelines.

Table 5 ID team involvement in restricted antibiotic prescription

Antibiotic	No of times prescribed, N=211	No of times ID team consulted, n (%)
Meropenem	87	33 (38)
Vancomycin	52	32 (61)
Ciprofloxacin	45	9 (20)
Colistin	16	14 (87)
Teicoplanin	4	3 (75)
Tigecycline	4	4 (100)
Linezolid	2	2 (100)
Cefepime	1	1 (100)

ID, infectious disease.

What this paper adds

What is already known on this subject

- ► Antibiotics have been used irrationally in the western world.
- ► This has led to bacterial resistance with global public health consequences.
- ► Little is known about the prudent use of antibiotics in Oman.

What this study adds

- ► Antibiotic compliance with the local guidelines in Sultan Qaboos University Hospital is suboptimal.
- ► Restricted antibiotic compliance is even worse in Sultan Qaboos University Hospital.

Competing interests None declared.

Provenance and peer review Not commissioned; externally peer reviewed.

REFERENCES

1. WHO. Antimicrobial resistance. Available at http://www.who.int/mediacentre/factsheets/fs194/en/ (accessed 20 Apr 2014).
2. Rhomberg PR, Jones RN. Summary trends for the meropenem yearly susceptibility test information collection program: a 10-year experience in the United States (1999-2008). *Diagn Microbiol Infect Dis* 2009;65:414–26.
3. Pérez-Trallero E, Marimón JM, González A, *et al*. In vivo development of high-level fluoroquinolone resistance in Streptococcus pneumoniae in chronic obstructive pulmonary disease. *Clin Infect Dis* 2005;41:560–4.
4. Sherrard LJ, Graham KA, McGrath SJ, *et al*. Antibiotic resistance in Prevotella species isolated from patients with cystic fibrosis. *J Antimicrob Chemother* 2013;68:2369–74.
5. Ison CA, Town K, Obi C, *et al*. Decreased susceptibility to cephalosporins among gonococci: data from the Gonococcal Resistance to Antimicrobials Surveillance Programme (GRASP) in England and Wales, 2007-2011. *Lancet Infect Dis* 2013;13:762–8.
6. Zaidi AK, Huskins WC, Thaver D, *et al*. Hospital-acquired neonatal infections in developing countries. *Lancet* 2005;365:1175–88.
7. Memish ZA, Ahmed QA, Arabi YM, *et al*. Microbiology of community-acquired pneumonia in the Gulf Corporation Council states. *J Chemother* 2007;19(Suppl 1):17–23.
8. Zowawi HM, Balkhy HH, Walsh TR, *et al*. β-Lactamase production in key gram-negative pathogen isolates from the arabian Peninsula. *Clin Microbiol Rev* 2013;26:361–80.
9. Al-Tawfiq JA, Stephens G, Memish ZA. Inappropriate antimicrobial use and potential solutions: a Middle Eastern perspective. *Expert Rev Anti Infect Ther* 2010;8:765–74.
10. Al-Muharrmi Z, Rafay A, Balkhair A, *et al*. Antibiotic combination as empirical therapy for extended spectrum Beta-lactamase. *Oman Med J* 2008;23:78–81.
11. Paphitou NI. Antimicrobial resistance: action to combat the rising microbial challenges. *Int J Antimicrob Agents* 2013;42:S25–28.
12. Barking, havering and Redbridge hospitals NHS trust. Trust Board papers 7th September 2011. Available at https://www.hsj.co.uk/Journals/2011/11/03/d/b/r/BHR.pdf (accessed 28 Jan 2017).
13. Aldeyab MA, Kearney MP, McElnay JC, *et al*. A point prevalence survey of antibiotic prescriptions: benchmarking and patterns of use. *Br J Clin Pharmacol* 2011;71:293–6.
14. Aldeyab MA, Monnet DL, López-Lozano JM, *et al*. Modelling the impact of antibiotic use and infection control practices on the incidence of hospital-acquired methicillin-resistant Staphylococcus aureus: a time-series analysis. *J Antimicrob Chemother* 2008;62:593–600.
15. Hanssens Y, Ismaeil BB, Kamha AA, *et al*. Antibiotic prescribing pattern in a medical intensive care unit in Qatar. *Saudi Med J* 2005;26:1269–76.