Audit of Physicians' Adherence to the Antibiotic Policy Guidelines in Kuwait

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Key Words

Antibiotic policy guidelines, adherence • Rational prescribing • Kuwait

Abstract

Objective: To audit physicians' adherence to the local antibiotic policy guidelines in government hospitals in Kuwait.

Materials and Methods: The study was a retrospective review of patient records in nine hospitals between July 1 and December 31, 2008. Clinical notes and medication charts of the latest hospital admissions were checked for antibiotic prescribing. On the audit form, aspects of the prescribed antibiotic were benchmarked to the hospital antibiotic policy guidelines to evaluate adherence. **Results:** Of 2,232 reviewed records, 1,112 (49.8%) patients had 1,528 antibiotic prescriptions. Patients who received antibiotics were significantly younger than those who did not (median age: 26.3 vs. 29.8 years, $p < 0.001$) and their hospital stay was significantly longer (median: 4 vs. 2 days, $p < 0.001$). The choice of an antibiotic was appropriate and matched the policy in 806 (52.7%) prescriptions. Of such appropriate antibiotics, adherence to route of administration was observed in 768/806 (95.3%), to dose in 758 (94%), to frequency in 746 (92.6%) and to duration in 608 (75.4%). Full adherence to all aspects of antibiotic

choice, dose, route, frequency and duration was achieved in 464 (30.4%) prescriptions. In 382 (25%), the antibiotics administered were not indicated. **Conclusion:** There was low adherence to the local antibiotic policy guidelines. Physicians' antibiotic prescribing practices should be optimized. Adherence to, and update of, the policy is recommended.

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Introduction

The role of antibiotic policies is to guide physicians to prescribe all-appropriate antibiotics, avoid unjustified prescription, reduce the emergence of antibiotic-resistant bacteria, support high-quality clinical practice and minimize unnecessary expenses [1–3]. The implementation of evidence-based guidelines for use of antimicrobials had been shown to improve the overall patient outcome. Studies [4, 5] have established the efficacy of surgical antibiotic prophylaxis for reducing the risk of postoperative wound infection. Others have consistently shown an association between timely start of antibiotics for patients with serious infections and a favorable clinical outcome [6–8].

Successful implementation of an antibiotic policy is as important as development of the policy itself. However, previous studies have shown that adherence to policy recommendations has been suboptimal averaging 40% [9–11]. In this perspective, three main types of interventions are known to improve antibiotic prescribing in hospitals: (a) persuasive interventions, which focus on the educational standpoints; these include educational materials, meetings or outreach visits, local consensus processes, local opinion leaders, verbal, written or computer-based reminders as well as audits and feedback; (b) restrictive interventions which include selective reporting of laboratory susceptibilities, formulary restriction, requiring prior authorization of prescriptions by infectious disease physicians, microbiologists, pharmacists etc., therapeutic substitutions, automatic stop orders and antibiotic policy change strategies; (c) structural interventions which shift antibiotic prescribing from paper to computerized records and introduce quality monitoring mechanisms [12].

In Kuwait, a panel of multidisciplinary expert staff had drafted antibiotic policies in government hospitals almost since 1985 and were subject to regular update. However, such policies first appeared as printed pocket-size booklets in 2005 and the national antibiotic policy was printed in 2007. The national policy was distributed via the Infection Control Directorate to infection control departments in the hospitals. The infection control physicians forwarded the copies to the physicians via the heads of departments and were requested to sign a form to ensure that they received their copies. The national policy contains the broad evidence-based guidelines for prescription of antibiotics. In addition, every hospital has its own policy, which is a booklet gathering antibiotic policies from all departments based on the national policy. The hospital policy is formulated through antibiotic committee which includes representatives from the clinical departments, clinical microbiology, pharmacy and the infection control physicians as a coordinator.

Whether or not the antibiotic guidelines included in the policy are effectively applied in clinical practice has been open to question. So far, there is no available data on adherence to the local hospital antibiotic policy guidelines in Kuwait. Collection and analysis of such data are important before starting any program or campaign to promote the prudent use of antibiotics. Initially, we conducted a prestudy pilot survey on 90 records; of these 40 (44.4%) contained antibiotic prescriptions. The pilot survey aimed to examine the aptness of the designed audit

form, explore difficulties (e.g. temporary nonexistence of some patients' records during the data collection phase) and estimate the time needed for completion of the audit. Records of the pilot study were not included in the final sample. The aim of the present research was to measure physicians' adherence to the local hospital antibiotic policy guidelines in nine government hospitals.

Materials and Methods

Design and Setting

The study was a retrospective review of medical records, which was conducted over a 6-month period (July 2008 to December 2008) in nine government hospitals; four of six general hospitals and five of nine specialized hospitals were chosen at random. The characteristics of these hospitals are shown in table 1. Records selected for review belonged to patients discharged from the hospitals in 2007. Because the medical records of 2007 were complete at the beginning of this study, the database of 2007 was used for case selection. Data as defined below were first stratified according to hospital. Then the suggested sample size ($n = 2,300$) was selected by proportional allocation randomly.

Ethical Consideration

The Standing Committee for Coordination of Health and Medical Research at the Ministry of Health, Kuwait, approved the study.

Audit Form

A precoded audit data collection form was designed to collect the data from medical records. The form was designed by four infection control physicians and was discussed with clinical microbiologists and statisticians. In each record, the most recent hospital admission was checked for antibiotic prescribing. The following data were recorded: patients' demographics, hospital name, unit specialty, date of last admission and discharge, the clinical diagnosis, availability of reasons/indications for prescribing, and the antibiotic-related information. Data for diagnosis were extracted from the clinical notes (symptoms and signs) of the physicians and nurses, laboratory and radiological investigations, microbiological culture and sensitivity reports and medication charts.

On the audit form, the reason/indication for prescribing antibiotics was checked and included: (a) definite or presumed diagnosis of a bacterial infection; the infections were grouped according to the standard method of grouping healthcare-associated infections as described by the Centres for Disease Control and Prevention [13]; (b) medical prophylaxis (e.g. infective endocarditis); (c) preoperative surgical prophylaxis; (d) irrational prescription for a noninfectious condition (e.g. uncomplicated bronchial asthma) or a nonbacterial infection (e.g. viral infection); (e) unclear, i.e. the information provided in the record was not sufficient to claim specific diagnosis.

Assessment of Adherence to the Policy

We proceeded by identifying the reason for antibiotic prescribing if any, checking indications and evaluating the appropri-

Table 1. Characteristics of the study hospitals

Hospital name	Bed capacity	Bed occupancy, %	Hospital discharges	Reviewed records (n = 2,232)	Records with antibiotic prescription (n = 1,112)	
					n	%
General (secondary care) hospital						
Farwaniya	650	64.6	28,444	593	242	40.8
Al-Sabah	449	61.4	18,972	371	250	67.4
Mubarak Al-Kabeer ^a	439	73.0	18,001	415	223	53.7
Al-Amiri	392	60.2	12,993	313	152	48.6
Specialized (tertiary care) hospital						
Maternity	375	69.9	20,233	286	140	49.0
Ibn Sina ^b	246	52.0	7,148	131	47	35.9
Al-Bahr ^c	74	31.0	2,056	44	19	43.2
Hamad Al-Eissa ^d	39	55.0	1,458	44	17	38.6
Al-Babtain ^e	68	44.0	1,370	35	22	62.9

General hospitals include the following specialties: general, vascular and urology, internal medicine, pediatrics, maternity, adult, pediatric and neonatal intensive care units, special care baby unit, coronary care unit.

^a General teaching hospital. ^b Neurosurgery and pediatric surgery. ^c Ophthalmology. ^d Renal transplantation. ^e Burn and plastic surgery.

ateness of the agent. Analysis of the prescription was based on the recommendations of the local departmental policy. When the antibiotic was prescribed according to the policy-cited choice and/or based on microbiological culture and sensitivity results, we considered it appropriate and then its dose, route of administration, frequency and duration were further evaluated. If more than one agent was prescribed for a specific condition, all aspects for each antibiotic were evaluated separately. A simplified version of the steps for reviewing the record to evaluate adherence to the hospital policy guidelines is given in figure 1.

Full adherence (compliance) was defined as prescription of a justifiably indicated antibiotic fulfilling the correct choice, dose, route, frequency and duration of therapy. Nonadherence (non-compliance) to the policy was considered when there was prescription of a nonindicated antibiotic (overprescription), divergence from the advisable antibiotic, or failure to have full concordance with other aspects of the dose, route, frequency or duration. When the diagnosis was unclear in the patient record or the condition which necessitated antibiotic use was not mentioned in the policy, evaluation for adherence could not be performed and was considered as nonassessable.

Compliance was calculated as the percentage of compliant prescriptions divided by compliant plus noncompliant plus non-assessable ones as follows: compliance = [(number of compliant prescriptions)/(number of compliant + noncompliant + non-assessable prescriptions)] × 100.

Sample Size Calculation

A sample size of 2,300 records was determined on an assumption that antibiotics are prescribed in 40% of the total number of hospital discharges based on results of the pilot survey at 5% significance level and power of 80% using Epi Info™ software.

Statistical Analysis

Data were checked for completeness, accuracy and normality, then analyzed using the SPSS version 17 for Windows (SPSS Inc., Chicago, Ill., USA) by one of the authors (A.S.). Qualitative variables were expressed as numbers and percentages while quantitative variables were expressed as median and interquartile range. Mann-Whitney test was used to compare the median age and hospital stay. A p value <0.05 was considered as statistically significant.

Results

Of 2,300 records, 2,232 were reviewed and 68 (3%) were missing. Of the 2,232 records, 1,112 (49.8%) had 1,528 antibiotic prescriptions. Patients who received antibiotics were significantly younger than those who did not (median age: 26.3 vs. 29.8 years, $p < 0.001$) and their hospital stay was significantly longer (median: 4 vs. 2 days, $p < 0.001$). Age, gender and median hospital stay of patients are presented in table 2.

Regarding antibiotic indications, antibiotics were 'indicated' in 1,099 (71.9%) of which 936 were evaluated and 163 despite being indicated were not evaluated due to conditions not mentioned in the policy; 'not indicated' in 382 (25%) and 'not evaluated' in 47 (3.1%) due to unclear diagnosis.

With respect to adherence to local policies, antibiotic prescriptions were evaluated as follows: fully adherent

Fig. 1. Steps for reviewing the records to assess adherence to antibiotic policy guidelines.

Table 2. Age, gender and hospital stay of study patients

Patient characteristics		Review of records for antibiotic prescription			
		with antibiotics (n = 1,112)	no antibiotics (n = 1,120)	total (n = 2,232)	p value
Age, years	median (IQR)	26.3 (34.6)	29.8 (35.1)	27.9 (34.9)	<0.001
Hospital stay, days	median (IQR)	4.0 (4.0)	2.0 (3.0)	3.0 (3.0)	<0.001
Gender	male, n (%)	561 (50.5)	527 (47.0)	1,088 (48.7)	0.109
	female, n (%)	551 (49.5)	593 (53.0)	1,144 (51.3)	

IQR = Interquartile range.

Fig. 2. Situational analysis of antibiotic prescriptions.

(compliant) in 464 (30.4%), nonadherent (noncompliant) in 854 (55.9%) and nonassessable in 210 (13.7%). The situational analysis of all antibiotic prescriptions is illustrated in figure 2. The choice of the antibiotic was appropriate in 806 (52.7%). Adherence to the route of administration was achieved in 768/806 (95.3%), dose in 758 (94%), frequency in 746 (92.6%) and to duration in 608 (75.4%).

Surgical prophylaxis was the leading indication for antibiotic prescribing (735 prescriptions) distributed as follows: 'indicated': 545; 'not indicated': 190, as shown in table 3. Of the 'indicated' surgical prophylaxis, the correct choice of agent was achieved in 486 (89.2%) while full adherence to prophylaxis guidelines was achieved in 272 (49.9%), which equals 37% of all surgical prophylaxis.

Percentage of appropriateness of the agent varied from one indication category to another: bloodstream infection: 22/24 (91.7%); lower respiratory tract infection: 86/94 (91.5%); urinary tract infection: 79/90 (87.8%); and skin and soft tissue infection: 29/39 (74.4%). Nevertheless, full adherence to policy guidelines was 66.7% in bloodstream infection, 48.9% in lower respiratory tract infection, 47.8% in urinary tract infection and 56.4% in skin and soft tissue infection. Distribution of antibiotic prescriptions by indication and level of adherence to the policy are presented in table 3.

Discussion

There is a mounting universal public health concern related to higher rates of bacterial antimicrobial resistance. The misuse of antibiotics contributes to this dilemma [14]. In our study, the 25% nonindicated antibiotic prescriptions was within the range of 15.5–72% reported in other studies [15–18]. The unwarranted prescription of antibiotics among physicians could be due to inaccurate diagnosis, imprecise recognition of conditions that can be treated with antibiotics, and concerns of a poor clinical outcome when antibiotics are not given [19]. Fear of legal action by patients might have led to the tendency of self-protection [9].

The proper antibiotic choice of 52.7% of all prescriptions in this study was lower (67%) than that reported by Mol et al. [20]. Equally important, a previous study in neonatal units of four hospitals in Kuwait had shown inappropriate choice of empirical antibiotics in 76% of cases as evidenced by the antibiotic susceptibility of the reported organisms [21].

Surgical prophylaxis was the commonest indication for antibiotic prescribing in our study, comparable to that of Tourmousoglou et al. [22]. Figures of full adherence to surgical prophylaxis guidelines varied in the literature

Table 3. Distribution of antibiotic prescriptions by indication and level of adherence to the policy

Antibiotic prescription	All anti-biotics	Proper choice	Proper choice within all indicated antibiotics, %	Proper choice within each indication category, %	Full policy-adherent prescription	Full adherence within all indicated antibiotics, %	Full adherence within each indication category, %
<i>Adherence assessed</i>							
<i>Antibiotics indicated</i>							
Indicated surgical prophylaxis	545	486	60.3	89.2	272	58.6	49.9
Lower respiratory tract infection	94	86	10.7	91.5	46	9.9	48.9
Urinary tract infection	90	79	9.8	87.8	43	9.3	47.8
Skin and soft tissue infection	39	29	3.6	74.4	22	4.7	56.4
Gastrointestinal infection	35	27	3.3	77.1	18	3.9	51.4
Upper respiratory tract infection	32	23	2.9	71.9	10	2.2	31.3
Other infections ^a	27	19	2.4	70.4	19	4.1	70.4
Bloodstream infection	24	22	2.7	91.7	16	3.5	66.7
Medical prophylaxis	22	15	1.9	68.2	6	1.3	27.3
Eye infection	18	12	1.5	66.7	9	1.9	50.0
Ear, nose and throat infection	10	8	1.0	80.0	3	0.6	30.0
Subtotal	936	806	100		464	100	
<i>Antibiotics not indicated</i>							
Nonindicated surgical prophylaxis	190	–	–	–	–	–	–
Nonindicated medical condition ^b	192	–	–	–	–	–	–
<i>Adherence not assessed</i>							
Antibiotics indicated for conditions not covered in policy	163	–	–	–	–	–	–
Antibiotics for unclear diagnosis/condition	47	–	–	–	–	–	–
Total	1,528	–	–	–	–	–	–
^a Infection of bone, surgical site and central nervous, reproductive and cardiovascular systems.							
^b Uncomplicated bronchial asthma, viral illnesses, and others.							

[22–24]. Lower percentages were reported in other studies [18, 25]. The difference in these findings could be due to differences in the method in each study.

The rationale for prescribing a nonindicated surgical prophylaxis in our study might be the fear of complications, sense of more self-assurance of the surgeons when the patient receives antibiotic, or nonacquaintance with the policy recommendations. Therefore, it is crucial for surgeons to understand the true role of prophylaxis, and the drawbacks when used inappropriately. They should be aware of the optimal prophylactic antibiotic, when and for how long it should be given. The key obstacles to local policy adherence need to be explored.

In general, organizational obstacles such as delay in performing or lack of a system to review the required investigations, inconsistent antibiotic availability, and work intensity in the presence of other issues like weak triage system possibly play a role [26]. Likewise, lack of senior support for junior staff or no audit of the prescribed an-

tibiotic regimen and failure to change a familiar ward-popular antibiotic or combination of antibiotics have been shown to influence the empirical and other policy-related guidelines [27, 28].

The appropriate use of antimicrobials is an essential part of patient safety and deserves careful oversight and guidance. Given the association between antimicrobial use and the selection of resistant pathogens, the frequency of inappropriate antimicrobial use is often used as a surrogate marker for the avoidable impact on antimicrobial resistance. The combination of effective antimicrobial stewardship with a comprehensive infection control program has been shown to limit the emergence and transmission of antimicrobial-resistant bacteria [25]. The primary goal of antimicrobial stewardship is to optimize clinical outcomes while minimizing unintended consequences of antimicrobial use that include toxicity, the selection of pathogenic organisms (such as *Clostridium difficile*), and the emergence of resistance. The secondary

goal is to reduce health care costs without adversely impacting quality of care [25].

New antibiotic stewardship tools, such as the use of a blood biomarker-derived treatment algorithm, have been shown to reduce antibiotic consumption. The biomarker, procalcitonin, that is released rapidly into the bloodstream in the presence of an infection, has demonstrated utility in guiding decisions regarding antimicrobial therapy [29]. Introduction of such biomarkers in treatment guidelines in Kuwait could minimize indiscriminate use of antibiotics.

To improve adherence to antibiotic policy, we recommend that more efficient control measures should be developed and implemented which include availability of the guidelines on the hospital information system, monitoring antibiotic misuse through repetitive audits and continuous education of the physicians to raise their awareness of proper prescription. Policies should be revised and periodically updated to cover all conditions treatable with antibiotics.

The study has some limitations. It was a descriptive study for levels of adherence to hospitals' antibiotic policies but did not explore different factors influencing adherence rates. Differences in the content of antibiotic policies between the hospitals included were not studied and data on microbiology analysis were not presented.

Conclusions

The developed antibiotic policies have not been adequately implemented. This suboptimal adherence to antibiotic policies may have had an impact on antibiotic-resistant rates and healthcare-associated infection incidence rates. Although there was good adherence to the proper antibiotic choice, failure to comply with appropriate dosing, route, frequency and duration of treatment as well as overprescribing were the reasons for poor adherence to the policy as a whole.

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