The Pattern and Impact of Infectious Diseases Consultation on Antimicrobial Prescription

Jaffar A Al-Tawfiq

Medical Department, Specialty Internal Medicine Unit, Dhahran Health Center, Saudi Aramco Medical Services Organization, Saudi Aramco, Dhahran, Saudi Arabia

ABSTRACT

Objectives: Inclusion of infectious disease (ID) physicians in the care of patients with possible infection can favorably affect antibiotic usage. The aim of this study was to evaluate the role of the ID consultations in reducing inappropriate antibiotic usage. **Materials and Methods:** This is a prospective study evaluating all adult ID consultations from January 2006 to December 2009. A total of 1444 consultation requests were recorded during the 4-year period. **Results:** The most frequent consultations were from cardiology (23.1%), orthopedics (8.2%), general medicine (7.8%), hematology-oncology (7.8%), gastroenterology (7.3%), and pulmonary/critical care (7.1%). The main reason for consultation was for the choice of antibiotics (75%). The commonest diagnoses prior to consultation were fever (14.7%), bacteremia (9.1%), and urinary tract infection (8.4%). Bacteremia was documented in 21.4% of cases and 12.9% were found to have no identifiable focus of infection. Antimicrobial therapy was changed in 58.7% and antimicrobials were discontinued in 14.7% of cases. The number of antimicrobial therapy was one (49.7% and 49.9%) and two (24% and 17.6%, $P = 0.0001$) before and after the consultation, respectively. In addition, 17.3% and 26.9% ($P = 0.0001$) received no antimicrobial agents before and after ID consultation. **Conclusion:** ID consultation is important to reduce inappropriate antimicrobial therapy and to limit the number of dual therapy.

Key words: Antibiotic use, Antimicrobial stewardship, Consultation, Infectious disease

INTRODUCTION

The role of infectious disease (ID) consultation is important in reducing antimicrobial use. The role was further integrated in some institutes by the development of antimicrobial improvement programs. However, some authors suggested that specialists contribute excessively to the overall cost of care and do not provide sufficient quality.[1] In an attempt to evaluate the role of ID consultation, Classen *et al*.[1] showed that ID consultation was associated with longer lengths of hospital stay, longer intensive care unit stays, and higher antibiotic costs. The significance of ID specialists in the care of specific IDs and their value to patients and hospitals was studied previously and was summarized by Petrak *et al*.[2] Other investigators described the role of ID specialists in non-patient care activities.[3] There are limited studies on the significance of ID specialists in Saudi Arabia. Thus, this study was carried out to evaluate the impact of ID specialists on antimicrobial prescribing habits.

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MATERIALS AND METHODS

Our institution provides medical care for employees and their dependants and approximately 370,000 individuals are eligible for medical care. The main hospital, which is a 380-bed referral, has five intensive care units (cardiac, medical, surgical, pediatric, and neonatal). Admissions to the hospital cover a whole range of patients and include general admissions, intensive care, and patients receiving chemotherapy for hematological and solid organ malignancy. However, there are no solid organ or bone marrow transplant services. On average, there are 36,426 admissions annually with an average length of stay of 5.3 days.

All adult ID consults were performed by a single ID physician during the study period. This is a retrospective study designed to investigate the features of ID consultations

Address for correspondence:
Dr. Jaffar A Al-Tawfiq, E-mail: jaltawfi@yahoo.com

in Dhahran Health Center, Dhahran, Saudi Arabia. The study was conducted from January 2006 to December 2009. Each consult was recorded on a predetermined form in an excel sheet. The form included the age, sex, hospital ward, antibiotic use, purpose of consultation, and diagnosis of the patient. Antimicrobial therapy before and after consultations was compared. The results of clinical cultures were also recorded. Appropriate antimicrobial therapy was based on the use of an agent with proven *in vitro* sensitivity based on culture results and the agent should have been given by an appropriate route and at adequate doses. In addition, the agent being used should have taken into account the efficacy proved by high-quality clinical trials or clinical guidelines.

RESULTS

A total of 1444 consultation requests were recorded during the 4-year period. The number of consultations per year was 385 (26.6%) in 2006, 372 (25.7%) in 2007, 370 (25.6%) in 2008, and 317 (21.9%) in 2009. However, the annual ID consultation rate was 1.7 per 100 discharges. This included 680 (47.1%) females and 764 (52.9%) males. The mean age ± SD was 56.3 ± 20.3 years. The recommendations of the ID physician were followed in all patients as defined by adherence to the recommendations related to therapy or diagnostic tests.

The most frequent consultations were from cardiology (23.1%), orthopedics (8.2%), general medicine (7.8%), hematology-oncology (7.8%), gastroenterology (7.3%), and pulmonary/critical care (7.1%). The remaining consultations were distributed among the other specialties. The main reason for consultation was for the choice of antibiotics (75%). The most common diagnoses prior to consultation [Table 1] were fever (14.7%), bacteremia (9.1%), and urinary tract infection (8.4%). Positive blood culture was documented in 21.4% of cases and 12.9% were found to have no identifiable focus of infection. The most common isolates of blood cultures were coagulase negative staphylococcus (67; 21.7%), methicillin susceptible *Staphylococcus aureus* (47; 15.2%), *Escherichia coli* (18; 5.8%), and Extended Spectrum Beta-lactamase (ESBL)-producing *E. coli* (13; 4.2%). A positive urine culture was obtained in 204 (14.2%) of cases. *E. coli* constituted 54% of all urinary isolates.

Antimicrobial therapy was started in 1183 (82%) patients prior to the initiation of ID consult. The most common antimicrobial use is shown in Table 2. The most common antimicrobial agents were cephalosporin (31%), carbapenems (28.1%), and fluoroquinolones (22.5%). It was interesting to note that antimicrobial therapy was changed in 58.7% and antimicrobials were discontinued in 14.7% of cases after ID consultation. In addition, the number of antimicrobial therapy was significantly more before than after ID consultation. The number of antimicrobial therapy was zero (17.3% and 26.9%, $P = 0.0001$), one (49.7% and 49.9%), and two (24% and 17.6%, $P = 0.0001$) before and after consultation, respectively. The use of combination therapy was deemed necessary when the clinical situation of the patient (e.g., *Pseudomonas aeruginosa* infection, polymicrobial infections, or for patients at risk of multidrug-resistant organisms) justified its use.

Of particular interest is the change in antimicrobial therapy in patients with bacteremia. Among patients with methicillin-susceptible *S. aureus*, antibiotic was changed to nafcillin in 80% (38 of 47) patients. A total of 67 patients had coagulase-negative *Staphylococus* in blood culture and antimicrobial therapy was discontinued in 65% of those patients as there was no evidence of infection. Antimicrobial change based on culture and clinical diagnosis was most

Table 1: The most frequent diagnosis before ID consultations

	Number	%
Fever	214	14.8
Urinary tract infection	139	9.6
Bacteremia	137	9.5
Others	123	8.5
Skin and soft tissue infection	111	7.7
Pneumonia	100	6.9
Sepsis	72	5.0
Surgical site infection	72	5.0
Diabetic foot ulcer	69	4.8
Intrabdominal	53	3.7
Osteomyelitis	46	3.2
Endocarditis	44	3.0
Tuberculosis	41	2.8
Leukocytosis	34	2.4
Central nervous system infection	29	2.0

Table 2: The most common antimicrobial use prior to the initiation of ID consult

	Number	%
Cephalosporin	367	31.0
Carbapenem	333	28.1
Fluoroquinolones	266	22.5
Vancomycin	230	19.4
PCN	170	14.4
Metronidazole	64	5.4
Aminoglycoside	53	4.5
Antifungal	45	3.8
Clindamycin	42	3.6
Anti-TB	25	2.1
Macrolide	8	0.7

PCN: Penicillin; TB: Tuberculosis

commonly performed in patients with *Clostridium difficile* infection, empyema, febrile neutropenia, candidemia, septic arthritis, osteomyeilitis, and endocarditis [Table 3].

DISCUSSION

ID service plays an important role in improving antimicrobial use by providing expert advice on the appropriate use of antimicrobial agents, education of prescribers, and developing and implementing evidence-based guidelines. The current study deals with reducing the use and thus the costs of antimicrobial agents in an acute care setting. It was suggested that consultation with an ID specialist is one of the six clinical strategies to reduce inadequate antimicrobial treatment in the hospital setting.[4] Many studies demonstrated improved patient outcomes when ID physicians were involved in the care of patients with bacteremia, with the advantage of reducing morbidity, mortality, and cost of care.[2] However, limited data is available on the established acceptable numbers of consultations per 100 admissions. Some studies quoted a range as high as 4.1-6/100 admissions.[5-8] Thus, the rate of ID con sultation in our hospital seems to be lesser than the range of figures reported previously. There is good evidence that ID consultations improve antimicrobial use and clinical outcomes and lower the costs of antimicrobial therapy.[2,9,10]

Our data demonstrate important results. First, antimicrobial therapy was changed in 58.7% and antimicrobials were discontinued completely in 14.7% of cases. Second, the number of antimicrobials use was lower after the consultation than before consultation. It was estimated that antimicrobial agents are used inappropriately approximately half the time in hospital practice.[11] In a study from Italy, ID consultation led to reduced costs because of the use of less-expensive antibiotics and the reduction of third- and fourth-generation cephalosporins, piperacillin/tazobactam, teicoplanin, and parenteral quinolones.[12]

Table 3: Most common diagnoses associated with antibiotic change

	Antibiotic changed	Total	%
Clostridium difficile infection	18	19	94.7
Empyema	9	10	90.0
Eebrile neutropenia	13	15	86.7
Candidemia	10	12	83.3
Septic arthritis	7	9	77.8
Osteomyeilitis	32	44	72.7
Endocarditis	30	42	71.4
SSI	45	66	68.2
Bacteremia	105	155	67.7
Prosthetic joint infection	16	24	66.7
TB	27	43	62.8
CNS infection	18	29	62.1
SSTI	56	95	58.9
DFU	40	68	58.8
Discitis	15	27	55.6
Epididymoorchitis	7	13	53.8

SSI: Surgical site infection; TB: Tuberculosis; CNS: Central nervous system; SSTI: Skin and soft tissue infection; DFU: Diabetic foot ulcer

In our study, antimicrobials were changed in 58.7% and were discontinued in 14.7% of cases. Similarly, in a Turkish hospital, the therapy was changed in 57.4% of patients and antibiotics were not necessary for 9.8%.[13] This finding is consistent with previous studies where the use of antimicrobial therapy was judged to be inappropriate or required change. In a study by Yinnon,[8] there was a change of therapy or discontinuation of antibiotics in 46%. Other studies found that 41-66% of antimicrobial therapy was changed after ID consultation.[5,6] It is also believed ID consultations influence patient care by recommendations regarding antimicrobial change or discontinuation.[8] Thus, 70.4% of the ID consultation in the current study would be considered to have clinical benefit and impact.

It is interesting to note that the majority of changes in antimicrobial therapy were in patients with *C. difficile* infection, empyema, febrile neutropenia, candidemia, septic arthritis/osteomyeilitis, and endocarditis. In addition, appropriate antimicrobial therapy was instituted in 80% of patients with *S. aureus* bacteremia. Although we did not specifically consider the mortality rate in those patients, it is reported that ID consultation is associated with a 56% reduction in 28-day mortality.[14] In addition, appropriate antibiotic therapy for *S. aureus* bacteremia is associated with lower relapse rates and mortality.[15]

One limitation of the current study is the inclusion of a single hospital in the analysis and the fact that the study did not address the cost benefit analysis. However, improved use of antimicrobial agents may decrease the rates of multidrug-resistant organisms and the associated expenditure on broad spectrum drugs.[8] Although we did not specifically analyze cost factor of ID consultation, we believe that the consultation had significant impact on cost. This belief is based on the fact that antimicrobial therapy was changed in 58.7% and was discontinued in 14.7% of cases. This highlights the beneficial impact of consulting an ID specialist on reducing unnecessary or ineffective prophylactic antibiotics. In addition, appropriate antimicrobial therapy is associated with increased cure rates.[16]

REFERENCES

1. Classen DC, Burke JP, Wenzel RP. Infectious diseases consultation: Impact on outcomes for hospitalized patients and results of a preliminary study. Clin Infect Dis 1997;24:468-70.

2. Petrak RM, Sexton DJ, Butera ML, Tenenbaum MJ, MacGregor MC, Schmidt ME, *et al*. The value of an infectious diseases specialist. Clin Infect Dis 2003;36:1013-7.
3. McQuillen DP, Petrak RM, Wasserman RB, Nahass RG, Scull JA, Martinelli LP. The value of infectious diseases specialists: Non-patient care activities. Clin Infect Dis 2008;47:1051-63.
4. Kollef MH. Inadequate antimicrobial treatment: An important determinant of outcome for hospitalized patients. Clin Infect Dis 2000;31:S131-8.
5. Sexton DJ, Corey GR, Ingram CW, Morris VM, Haywood HB 3rd. Consultation in university-based and community-based infectious disease practices: A prospective study. Clin Infect Dis 1995;20:391-3.
6. Wilkins EG, Hickey MM, Khoo S, Hale AD, Umasankar S, Thomas P, *et al*. Northwick Park Infection Consultation Service. Part I. The aims and operation of the service and the general distribution of infection identified by the service between September 1987 and July 1990 [see comment]. J Infect 1991;23:47-56.
7. Sexton DJ. Rates of infectious disease consultations in hospitals of different sizes and types, 1986-1987. Rev Infect Dis 1991;13:527.
8. Yinnon AM. Whither infectious diseases consultations? Analysis of 14,005 consultations from a 5-year period. Clin Infect Dis 2001;33:1661-7.
9. Paterson DL. The role of antimicrobial management programs in optimizing antibiotic prescribing within hospitals. Clin Infect Dis 2006;42:S90-5.
10. Sunenshine RH, Liedtke LA, Jernigan DB, Strausbaugh LJ, Infectious diseases society of America emerging infections network. Role of infectious diseases consultants in management of antimicrobial use in hospitals. Clin Infect Dis 2004;38:934-8.
11. Moleski RJ, Andriole VT. Role of the infectious disease specialist in containing costs of antibiotics in the hospital. Rev Infect Dis 1986;8:488-93.
12. Della Loggia P, Gherardi V, Pellegrino F, Cocchi I, Esposito R, Kiren V. Improving the appropriateness of antibiotic prescription in hospitals: A pilot study assessing the effectiveness of an infectious diseases specialist's consultation programme. Int J Antimicrob Agents 2008;31:488-9.
13. Yapar N, Erdenizmenli M, Oğuz VA, Kuruüzüm Z, Senger SS, Cakir N, *et al*. Infectious disease consultations and antibiotic usage in a Turkish university hospital. Int J Infect Dis 2006;10:61-5.
14. Honda H, Krauss MJ, Jones JC, Olsen MA, Warren DK. The value of infectious diseases consultation in *Staphylococcus aureus* bacteremia. Am J Med 2010;123:631-7.
15. Asgeirsson H, Kristjansson M, Kristinsson KG, Gudlaugsson O. *Staphylococcus aureus* bacteraemia: Nationwide assessment of treatment adequacy and outcome. J Infect 2011;62:339-46.
16. Fishman N. Antimicrobial stewardship. Am J Med 2006;119:S53-61.

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