

Surgical Antibiotic Prophylaxis: A Descriptive Study among Thoracic Surgeons

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Background: Surgical site infections (SSIs) are common complications following surgeries and increase mortality, morbidity and healthcare costs. The use of antimicrobial prophylaxis is an effective measure to prevent development of SSIs. This study aimed to evaluate the current use of prophylactic antibiotics in thoracic surgeries in Iran.

Materials and Methods: A descriptive study was conducted among thoracic surgeons in order to assess their knowledge, attitude and practice (KAP) about surgical antibiotic prophylaxis (SAP). A four-section multiple-choice questionnaire was designed and hand-delivered to registered thoracic surgeons. The surgeons' answers were considered correct when they were in accordance to the American Society of Health-System Pharmacist (ASHP) guidelines.

Results: Seventy thoracic surgeons were requested to participate in this study and their response rate was 71.4%. Thirty-five (70%) surgeons had good knowledge about appropriate SAP. However, less than half of the respondents were aware of appropriate SAP in case of Ig E-mediated reaction to penicillin and risk of Gram-negative infections. The surgeon's attitude score about the need for local and national guidelines for SAP was 78% and 90%, respectively. Accordance of the physician's practice with ASHP guidelines regarding timing of the first dosage of SAP was acceptable while correct administration of an intraoperative dose was 40% in agreement with the guideline.

Conclusion: Although thoracic surgeons had a good attitude towards antibiotic prophylaxis guidelines, their knowledge and practice should be improved for proper administration of SAP.

Key words: Antibiotic Prophylaxis; Knowledge; Practice; Surgery; Thoracic Surgeons

INTRODUCTION

Surgical site infections are the most common nosocomial infections among surgical patients; SSIs may increase the rate of postoperative mortality and morbidity, cost of hospitalization and length of hospital stay (1, 2). Appropriate administration of SAP reduces the rate of SSIs by providing an adequate level of antimicrobial agent at the surgical site and tissue at the time of incision and

during surgery (3-5). On the other hand, inappropriate SAP such as overuse, misuse, wrong administration time, and insufficient dose may result in emergence of antibiotic resistance, adverse drug reactions, therapeutic failure and increased treatment costs (3, 6).

Several protocols and guidelines have been developed to provide professionals with a standardized approach for rational, safe and effective use of antibiotic prophylaxis (7-

9). However, a high rate of infectious diseases and bacterial resistance has been reported in developing countries due to improper implementation of these guidelines (10). The knowledge and attitude of surgeons about appropriate SAP are important factors for implementation of guidelines (11). The KAPs of general practitioners, dentists and physician specialists about antibiotic usage have been previously evaluated (4, 11-13) while the KAP of thoracic surgeons about antibiotic prophylaxis has not yet been studied.

Therefore, we designed a descriptive study on this issue in order to determine educational needs of thoracic surgeons for SAP prescription.

MATERIALS AND METHODS

A four-section multiple-choice questionnaire was designed by a group of experts including clinical pharmacologists, thoracic surgeons, pharmacists and infectious disease specialists. The questionnaire was reviewed by the scientific committee of National Research Institute of Tuberculosis and Lung Disease, approved by institutional review board, and hand-delivered to a random sample of surgeons registered in the Iranian Thoracic Surgery Society.

The first part of the questionnaire included demographic information, job position, type of hospital, and number of surgical operations performed per month. The next part was structured to assess the surgeons' level of knowledge about antibiotic prophylaxis indication according to surgical wound classification, antimicrobial agents commonly used for SAP, alternative antibiotics in patients with a history of severe Ig E-mediated reactions to penicillin, choice of antibiotic in patients with methicillin resistant staphylococcus aureus (MRSA), infection with Gram-negative pathogens, and those at risk of endocarditis. The attitude of thoracic surgeons was asked in the third part of the questionnaire. The need for national and local guidelines for SAP and cooperation in guideline preparation were questioned in this part. The questions of the last part were organized to collect information

regarding the practice of surgeons. The time of administration of the first dose of SAP, intraoperative repeated administration of antimicrobials and duration of postoperative prophylaxis were questioned in this part.

The ASHP guideline, developed jointly by the ASHP, the Infectious Diseases Society of America, the Surgical Infection Society, and the Society for Healthcare Epidemiology of America, was used for our assessments (6). The surgeons' answers were considered correct when they were in accordance to the guideline.

All data were entered into a SPSS database. Descriptive statistics were used to calculate the overall response rate and percentage of correct answers. The correlation between the KAP of thoracic surgeons and their age and number of surgical procedures performed per month were evaluated by Pearson's correlation test. T-test and one-way ANOVA were used to compare the KAP of thoracic surgeons working in different types of hospitals and having different job positions. A P-value <0.05 was considered to be statistically significant.

RESULTS

Of 70 thoracic surgeons requested to participate in the study, 50 (71.4%) responded to the questionnaire. Demographic and job characteristics of the participants are shown in Table 1. Most of the surgeons had 10-30 surgeries per month and worked in a teaching hospital.

Table 2 shows the response rate of surgeons to SAP indication question. Surgical wound classification was used as a basis for prescribing SAP. A multiple-choice question with more than one answer was asked and among 50 thoracic surgeons, 84% and 88% correctly responded to SAP indication for clean-prosthetic and clean-contaminated surgeries, respectively. However, more than 80% selected contaminated and/or dirty operations for SAP administration (Table 2). Accordance of the physicians' knowledge with ASHP guidelines is shown in Table 3. The most common antibiotic that the surgeons chose for prophylaxis was cefazolin (70%) followed by clindamycin (22%) and ceftriaxone (12%). Other antibiotics

such as meropenem and vancomycin were less commonly selected.

Table 1. Demographic and job characteristics of the respondents

Age (Mean± standard deviation)	49.2±9.6
Job position	N (%)
Full professor	4 (8%)
Associate professor	13 (26%)
Assistant professor	20 (40%)
Fellowship	9 (18%)
Others	4 (8%)
Number of thoracic surgeries per month N (%)	
<10	16 (32%)
10-30	21 (42%)
>30	13 (26%)
Type of hospital* N (%)	
Private	26 (52%)
Public	16 (32%)
Teaching	29 (58%)
Charitable	3 (6%)

*Some respondents worked in 2 or 3 types of hospitals

Table 2. Response rate of surgeons to SAP indication question

Type of surgery that requires SAP	Response rate (%)
Clean surgery involving the placement of prosthesis or implant	42 (84%)
Clean non-prosthetic procedure	5 (10%)
Clean-contaminated surgery	44 (88%)
Contaminated surgery	44 (88%)
Dirty surgery	41 (82%)

Table 3. Accordance of physician's knowledge with ASHP guidelines about antibiotic prophylaxis

Questions	Guideline recommendation	Accordance with guideline (%)	No accordance with guideline (%)	Consult with infectious disease specialist (%)
Antimicrobial agent commonly used in SAP practice	Cefazolin	35 (70%)	15 (30%)	
Antibiotic prophylaxis for patients with a history of Ig E-mediated reaction to penicillin	Vancomycin or clindamycin	18 (36%)	6 (12%)	25 (50%)
Antibiotic prophylaxis for infection by Gram-negative pathogens	FQ (ciprofloxacin, levofloxacin) or gentamycin or aztreonam	7 (14%)	33 (66%)	9 (18%)
Antibiotic prophylaxis for patients with endocarditis risk	Amoxicillin	20 (40%)	4 (8%)	24 (48%)
Antibiotic prophylaxis for colonization by MRSA	Vancomycin	27 (54%)	7 (14%)	16 (32%)

According to the survey, thoracic surgeons generally used text books (48%) and antibiotic prophylaxis guidelines (48%) for SAP prescription. Consultation with an infectious disease physician was reported by 14% of the participants (Table 4).

Table 5 shows the attitude of surgeons towards hospital and national SAP guidelines. A high percentage of thoracic surgeons demonstrated that there was a need for hospital and national guidelines. Although most of them were willing to cooperate in preparing hospital and national guidelines, 6% refused to collaborate in development of a hospital guideline because of high workload or text book usage.

Accordance of thoracic surgeons' practice with ASHP guidelines is shown in Tables 6 (a, b) and 7. Surgeons' responses showed that 74% and 64% of them prescribed IV bolus or IV infusion of antibiotics at the correct time, respectively (Table 6a, b). Table 7 shows the surgeons' practice regarding antibiotic administration during surgery. Also, 40% of surgeons correctly responded to a question regarding administration of a repeat dose of SAP. Most surgeons (72%) reported to continue SAP for 24-48 hours after surgery.

Assessment of correlation between the KAP of thoracic surgeons and their age showed a negative correlation between the knowledge and age of surgeons ($P \leq 0.05$; $r = -0.35$).

Table 4. The most common sources used by physicians for antibiotic administration

Type of sources	Response rate (%)
Textbooks and articles	24 (48%)
Knowledge from initial training	8 (16%)
Antibiotic prophylaxis guidelines	24 (48%)
Consultation with an infectious disease physician	7 (14%)
Internet or personal experience	7 (14%)

Table 5. Physicians' attitude about antibiotic prophylaxis guidelines

Need for hospital guideline	N (%)	Cooperation in preparing hospital guideline	N (%)	Need for national guideline	N (%)	Cooperation in preparing national guideline	N (%)
Yes	39 (78%)	Extremely cooperative	34 (68%)	Yes	45 (90%)	Extremely cooperative	31 (62%)
No	10 (20%)	Partially cooperative	13 (26%)	No	2 (4%)	Partially cooperative	19 (38%)
No idea	1 (2%)	No cooperation	3 (6%)	No idea	3 (6%)	No cooperation	0 (0.0%)

Table 6. Accordance of physician's practice with ASHP guidelines

a) Timing of the first SAP dosage for IV bolus administration		
Guideline recommendation	Accordance with guideline (%)	No accordance with guideline (%)
30-60 min before skin incision	37 (74%)	13 (26%)
b) Timing of the first SAP dosage for IV infusion administration		
Guideline recommendation	Accordance with guideline (%)	No accordance with guideline (%)
120 min before skin incision	32 (64%)	11 (22%)

DISCUSSION

The current study indicated that the attitude of thoracic surgeons towards the existence of a local and national guideline and participation in guideline preparation was acceptable. However, their knowledge and practice about SAP need to be improved. A recent systematic review analyzed 18 studies on the application of local, national and/or international guidelines and revealed the need for greater adherence to SAP guidelines (14).

According to the ASHP guideline, cefazolin is a drug of choice for many procedures because of appropriate duration of action, desirable spectrum of activity, safety, and low cost (8). In our study, cefazolin was the most commonly selected antibiotic for SAP. In a study carried out in Turkey, third generation cephalosporins (42%) followed by cefazolin (30%) were the most commonly used antibiotics (15). Another study conducted on 20 Jordanian hospitals showed that third and second generations of cephalosporins were the most commonly used antibiotics (4). Selection of cefazolin as a drug of choice by 70% of our

surgeons indicated their relatively good knowledge about this issue. For patients with a history of severe Ig E-mediated reaction to penicillin, cephalosporins should be avoided. The alternative to cephalosporins includes intravenous vancomycin or clindamycin (7, 8). Only 36% of thoracic surgeons chose the correct answer. However, 50% preferred to consult with an infectious disease specialist.

Aztreonam, aminoglycoside, or a fluoroquinolone should be added if organizational SSIs surveillance indicates the risk of contamination with Gram-negative organisms (7, 8). In the current study, 14% of the respondents were aware of this issue and 18% chose consultation with an infectious disease specialist. In patients colonized with MRSA, vancomycin is the choice of antibiotic for prophylaxis. However, routine use of vancomycin prophylaxis is not recommended for any procedure (11). A study conducted by Gupta et al. showed that routine preoperative prophylaxis with vancomycin was associated with an increased risk of postoperative SSIs in patients with negative nasal testing for MRSA (16). More

than half (54%) of our surgeons selected the correct answer and 32% preferred to consult with a specialist. Collaboration with a microbiology laboratory is required to prescribe appropriate antibiotics in case of MRSA and Gram-negative infections. In a survey performed on 120 surgical departments in the Czech Republic, cooperation with microbiology laboratory or an antibiotic center was reported by only 3 departments (11). Fifteen percent of the surgeons mentioned that they had access to laboratory results to identify MRSA infections before surgery.

Antimicrobial prophylaxis should be justified for clean-prosthetic and clean-contaminated surgeries. Use of SAP for dirty and contaminated surgeries is classified as treatment (not prophylaxis) and antibiotics are not indicated for clean non-prosthetic procedures (7, 8). The current study showed that most surgeons (66%) used SAP for all procedures (clean, clean prosthetic, clean contaminated, contaminated, and dirty). Al-Azzam et al, also reported that 77.5% and 71.6% of the surgeons incorrectly used SAP in contaminated and dirty surgeries (4).

Our surgeons' approach in obtaining information about appropriate SAP was similar to a previous study where text books and antibiotic prophylaxis guidelines were the most commonly used sources by physicians (4). The need for local and national guidelines was emphasized by the surgeons in our study and they had a good attitude towards cooperation in guideline preparation. A national guideline for antibiotic prophylaxis is useful to prescribe antibiotics according to the pattern of distribution of common and sensitive pathogens in a specific region (3), and several studies reported that local guidelines improve rational use of SAP (17, 18).

To achieve adequate drug levels at the time of initial incision, antimicrobial therapy should be administered 30-60 minutes prior to surgical procedure. This appears to be more effective than antibiotic administration immediately before surgical incision. Administration of vancomycin or a fluoroquinolone should begin 120 minutes before surgery because of the prolonged infusion time required for these

drugs (7, 8). The correct time for IV bolus administration or IV infusion of antibiotics was reported by 74% and 64% of our thoracic surgeons, respectively. A different result was obtained in a similar study reporting that 32.5% of surgeons administered the first dose of SAP intravenously at the correct time (11).

Repeat intraoperative administration is warranted for the procedures that exceed two half-lives of prophylactic antibiotic or cause more than 1500 mL of blood loss (7, 8). Current results showed that 40% of the surgeons would administer a repeated dose of SAP for both conditions. In another study, 36.7% of all 120 departments incorrectly used more than 2 doses of SAP in procedures lasting 4 hours (11). Moreover, most physicians (68%) incorrectly administered two or more doses of SAP during surgery in Jordanian hospitals (4). Available data for optimal duration of postoperative prophylaxis following cardiothoracic procedures are insufficient. The most commonly recommended duration is less than 24 hours after surgery but it may also be extended up to 48 hours (7, 8). More than two-thirds of the surgeons reported appropriate SAP duration in our study.

The current study results identified common deficiencies in SAP prescription that can be corrected through education. A continuing education program on appropriate antibiotic selection (general and specific approach) and administration (initial dosing, timing, repeat dose, and duration) are necessary to improve SAP in Iran. In addition, as the implementation of published guidelines strongly depends on the knowledge and attitude of practitioners, similar surveys are recommended for other settings to assess the current prophylactic use of antibiotics.

CONCLUSION

The current results revealed that the knowledge and practice of thoracic surgeons with regard to SAP had some inconsistencies with the available scientific evidence. Effective educational programs and compiling local and hospital guidelines by a group of thoracic surgeons, clinical

pharmacologists and infectious disease physicians may improve SAP prescription and decrease SSIs.

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Conflicts of interest

There are no conflicts of interest to declare.

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