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The Practice of Preoperative Antibiotic Prophylaxis and the Adherence to Guideline in Riyadh Hospitals

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ABSTRACT
The most common postoperative problem is surgical site infections. To reduce the occurrence of surgical wound infection suitably antimicrobials for prophylaxis should be administered. This study aims to assess adherence of practitioners in Riyadh hospitals to the American Society of Health System Pharmacists (ASHP) guidelines for using preoperative antimicrobial prophylaxis and to find reasons for non-adherence. The present study was carried out in Riyadh hospitals. A questionnaire was prepared to gather information from practitioners regarding surgical antibiotic prophylaxis (SAP). The survey elucidates that The improper timing of the administration of antimicrobials for SAP was attributed to the lack of knowledge of the guidelines (41.8%). The most common cause of improper antibiotic choice was drug unavailability (50.9%).Additional efforts are needed to be sure that the accepted practices of SAP in Riyadh hospitals are implemented.
***Key words**: ASHP guidelines, Riyadh, Antimicrobial prophylaxis, surgical site infection, Hospital.*

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INTRODUCTION

Surgical site infections (SSIs) are considered to be the most common and preventable health care – associated infections (HAI) [1], that are associated with high morbidity and mortality [2]. A relatively recent prevalence study found that SSIs accounted for (31.0%) of all HAIs among hospitalized patients in the US [3]. SSI is associated with a statistically increase in hospital and ICU readmission, long – term complications of the surgical site and even death [4].

Previous studies have identified multiple risk factors for SSIs, in various types of surgeries, these factors include non-modifiable risk factors such as the presence of diabetes, dyspnea and older age (age > 40 years) and modifiable risk factors such as surgical antibiotic prophylaxis (SAP) which is considered to be of the most important procedures that should be optimized to minimize the risk of SSI [5].

SAP is defined as the preoperative administration of a short course of antibiotics to prevent possible surgical site infections [6]. Suitably administered antimicrobials for prophylaxis decrease the occurrence of surgical wound infection. Prophylaxis are not used for contaminated or dirty surgeries [7,8], but is generally used in all clean– contaminated [7,9] and in some of the clean surgeries [7].

Unfortunately, there is considerable evidenced that antimicrobials are used exceedingly, and unsuitably in the prevention of SSIs [10].

One of the major factors that affect the efficacy of antimicrobial prophylaxis is the prophylaxis timing of the antibiotic administration. If we use antibiotic prophylaxis incorrectly, for example, if we use it in wrong timing or in the case of overconsumption [11], this has been shown to increase the occurrence of adverse drug reactions [12], treatment costs [13], super-infections, and the growth of new strains of microorganisms resist the effect of antimicrobial [12,14].

There are many factors that affect the selection of appropriate antibiotics such as the organism most commonly causing wound infection in the specific surgery [14] and also the relative costs of available agents.

The American Society of Health System Pharmacists (ASHP) guidelines [8] were developed based on the best available clinical evidence to provide physicians with a consistent approach to safe and effective use of antibiotics for the prevention of SSIs. Based on ASHP 2013, Cefazolin is the drug of choice in the majority of the surgical procedures; its recommended dose is 2 g for a patient weighing less than 120 kg. The antibiotic of choice should be administered 60 minutes before surgical incision, and a re-dosing interval of 4 hrs. Re-dosing is only required if there is excessive blood loss or if the procedure duration is more than two half-lives of the antimicrobial.

We perform this study to create baseline data on the manner of use of antimicrobials for prophylaxis prior to surgery as there is insufficient information and guidelines about SSIs and the use of prophylactic antibiotics in surgery in Saudi Arabia.

The present study aims to assess the application of surgical antibiotic prophylaxis and also to assess adherence of practitioners in 10 randomly selected hospitals in Riyadh to the American society of health system pharmacists guidelines (ASHP) for antimicrobial prophylaxis and to find reasons for non-adherence.The results of this study can shed light on both the strength, but more importantly the deficits of the current SAP practice as a result this knowledge could give researchers, health care professionals and decision makers a starting point for optimizing current practices .

MATERIALS AND METHODS

The underpinning design of the present study is cross-sectional. The study was carried out in 10 hospitals in Riyadh during a six-month period. The questionnaire has been previously used in a similar study in Jordan[15]. All patients of all ages undergoing surgery were suitable for inclusion into the research.

The questionnaire was composed of twenty questions. These questions resolved around three main aspects. The first aspect was designed to collect basic information related to the hospital and its surgical teams, such as the type of the hospital, number of beds, number of surgeons in the team, most common surgical procedures in each department in the hospital and the number of surgical procedures performed by the surgeons. The second aspect of the questionnaire provided important information relating to SSI and the practice of SAP in Riyadh as reported by the practitioners recruited in the present study. The following information was collected regarding this aspect: infection rate, most common pathogen causing SSI, the responsible person for SAP, the main and alternative antibiotic regimens prescribed for SAP including the timing of the first dose, the frequency, duration of therapy, the use of SAP in different types of surgical wounds and antimicrobial dosing in surgical procedures lasting more than 4 hours. The last aspect of the questionnaire focused on sources of hospital SAP practice and reasons for improper timing for antibiotic administration or even improper choice of antibiotic. Depending on the purpose of the questions they were either multiple choice questions or open ended essay questions.

The questionnaire was hand-delivered to about 100 practitioners in a closed envelope. In addition to the questionnaire, the envelope contained an invitation letter to study accompanied by a brief description of the study and its aims and objectives. After a period of 2 weeks the reminders were collected from the hospitals included. Completion of the questionnaire was voluntary and confidential.

The suitability of preoperative antimicrobial prophylaxis was assessed as per guidelines of ASHP because it provides the practitioners with evidence based recommendations for rational use of antimicrobials as preoperative prophylaxis.

After we collected the data from the practitioner's surveys we started analyzing the data using Statistical package for Social Sciences (SPSS) version 20 software. When the frequency of non-mutually exclusive components is presented their summed frequency may be more than 100% due to more than one answer being selected per question.

RESULTS AND DISCUSSION

A survey was carried out in 10 hospitals in Riyadh city, the largest city of Saudi Arabia, during a 6-months period. One hundred surgeons were invited to participate, but only 55 surgeons (55.0%) completed the questionnaire. Types of the surveyed hospitals are shown in Table 1. As noted from the table a large proportion of the included Practitioners were affiliated with military and public hospitals, while only (3.6%) of the included practitioners were affiliated with university hospitals. The included hospitals varied in capacity and classified as (less than 200 beds, 200-500 and more than 500 beds). According to hospital capacity, The capacity of (2.4%) of the included hospitals less than 200 beds, (61.9%) of the included hospitals 200-500 beds and (35.7%) more than 500 beds. On average the total number of surgical procedures performed by the recruited surgeons was (20.0). The most common procedure was

(Gastrointestinal procedures) followed by (ENT) and (Orthopedic and Obstetric - gynecologic), while (Cardiothoracic surgeries) was the least commonly performed procedure.

Table 1. Types of the surveyed hospitals

Type of hospital	Frequency of included physicians	Percent of included Physicians
Military	19	34.5
University hospital	2	3.6
Public	19	34.5
Private	15	27.3
Total	55	100.0

Many of the participants (47.3%) stated that surgical site infection rates were (1.0-5.0%), while (43.6%) reported that surgical site infection rates were less than (1.0%). According to the most common pathogens causing surgical site infections *Staphylococcus aurous* (*S. aureus*) was the causing pathogen for infections in (66.0%) of the cases, *Escherichia coli* in (24.0%) of the cases and *Klebsiella pneumonia* in (6.0 %) of the cases (Figure 1).

Medical personnel responsible for prescribing the antibiotics were the practitioners in (52.7%) of the cases, shared responsibility in (29.1%) and nurse responsibility in (16.4%). About (76.1%) of the practitioners stated that they will give a second dose of antibiotic if the procedure lasted for more than 4 hours. Approximately (38.2%) of surgeons utilized more than two doses of SAP, (27.3%) utilized two doses, and (34.5%) utilized one dose only.

In most of case Cefuroxime was used for surgical prophylaxis (50.9%), followed by Ceftriaxone (used in 20.0%), followed by Augmentin® (used in 12.7% of cases) and Cefazolin (used in 3.6%). The most common cause of improper antibiotic choice was drug unavailability (50.9%) followed by institution policy (36.4%). The first dose of the first choice antibiotic regimen administered less than 1 hour before surgery in (40.0%) of cases, at the time of anesthesia induction in (32.7%) and 1-2 h before surgery in (16.4%) of cases. The antibiotic course is given over up to 1 day in (58.2%) of cases and over up to 3 days in (18.2%) of cases. The improper timing of the administration of antimicrobials for SAP was attributed to the lack of knowledge of the guidelines (41.8%), followed by workflow (32.7%) and then by lack of organizational communication (25.4%).

In the present study, (60.8%) of recruiting surgeons reported that the hospital has a clinical pathway or a clinical guideline of antimicrobial prophylaxis for surgery. The survey elucidates that surgeons depend fundamentally on guidelines (40.0%), department protocol (30.9%) and textbooks (27.3%). The Descriptive analysis of surgical antibiotic prophylaxis practice is shown in Table 2.

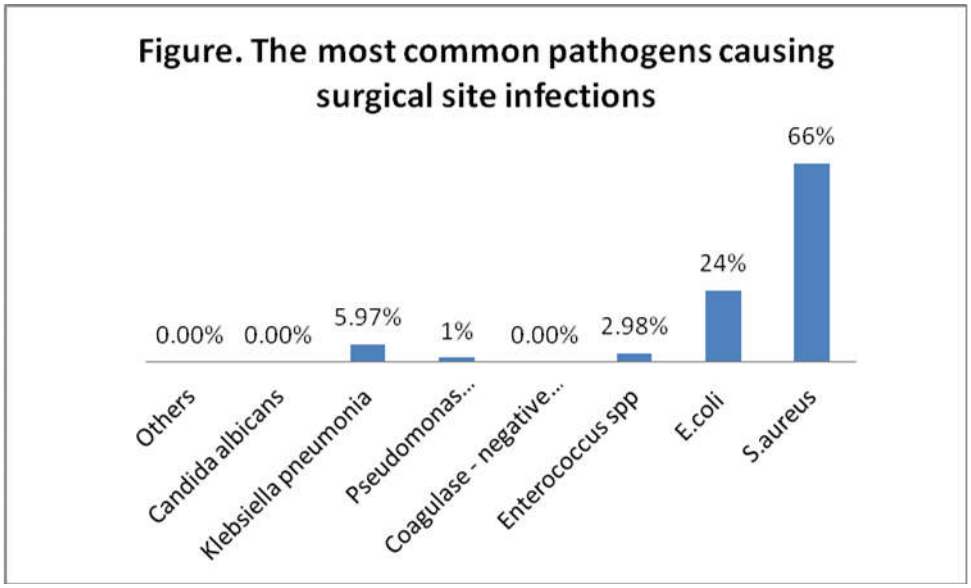

Figure 1: The most common pathogens causing surgical site infections

Table 2. Descriptive analysis of surgical antibiotic prophylaxis (SAP) practice

	N* (%)
Based on sources used by practitioners to extract practice guidelines	
Guidelines	22 (40.0%)
Textbook	15 (27.3%)
Knowledge from initial training	10 (18.2%)
Consultation	1 (1.8%)
Use of any antibiotic available	3 (5.5%)
Departmental protocol	17 (30.9%)
Others	2 (3.64%)
Based on timing of first SAP dosage	
>2 h before operation	3 (5.5%)
1–2 h before operation	9 (16.4%)
Less than 1 h before operation	22 (40.0%)
At the time of induction of anesthesia	18 (32.7%)
After operation	3 (5.5%)
Based on number of SAP doses per surgical procedure	
1 dose	19 (34.5%)
2 doses	15 (27.3%)
>2 doses	21 (38.2%)
Based on the responsibility for prescribing the antibiotics	
Physician	29 (52.7%)
Pharmacist	1 (1.8%)
Anesthesia administrator	0 (0.0%)
Nurse	9 (16.4%)
Shared responsibility	16 (29.1%)
Based on antimicrobial agents commonly used in SAP practice	
Cefazolin	2 (3.6%)
Cefuroxime	28 (50.9%)
Ceftriaxone	11 (20.0%)
Augmentin	7 (12.7%)
Other antimicrobials	7 (12.7%)
Based on the causes of improper timing of SAP	
Work flow	18 (32.7%)
Lack of organizational communication	14 (25.5%)
Lack of knowledge of guidelines	23 (41.8%)
Others	0 (0.0%)
Based on causes of improper antibiotic choice	
Drug unavailable	28 (50.9%)
Drug cost	3 (5.5%)
Institution policy	20 (36.4%)
Patient not insured	0 (0.0%)
Others	4 (7.3%)

* Multiple Answers Allowed

Most of surgeons used SAP incorrectly. About (1.5%) of the surgeons employed SAP for clean and (36.0%) for clean-contaminated surgeries. However, (31.6%) used SAP for contaminated surgeries, and (30.9%) for dirty operations.

This study offers unique insights on SSI frequency and common practices related to the SAP in Riyadh. Furthermore, the present study provided valuable information regarding adherence to the American

Society of Health-System Pharmacists (ASHP) guidelines for antimicrobial prophylaxis prior to surgery and explored the causes of non-adherence.

Results of the present study showed that practitioners depend in selecting an antimicrobial agent(s) for prophylaxis on information taken primarily from either guidelines or from textbooks, which have been embraced in practice by the hospitals. Nevertheless, the results of the survey show inconsistencies between ASHP guidelines and what is actually practiced in terms of choice of the appropriate antibiotics and time of administration.

Based on ASHP guidelines, antibiotics are not indicated for clean procedures, furthermore administrating antibiotics for dirty and contaminated surgeries is classified as a treatment and not as prophylaxis. Despite these recommendations, (31.6%) used antibiotics inappropriately for contaminated surgeries, and (30.9%) for dirty operations. Deviations from the ASHP guidelines in this aspect have been previously reported in a multicenter study conducted in Jordan [15].

Three parameters of SAP appropriateness were evaluated in the present research: the antibiotic of choice, the timing of therapy initiation and the dosage regimen (dose, frequency and duration). Most important characteristics of an appropriate antibiotic for surgical SAP include: reasonable safety, proven efficacy, spectrum of activity against organisms frequently encountered in surgery, desirable duration of action and low price. Based on ASHP Cefazolin is the drug of choice for SAP in most procedures as it meets the above mentioned criteria [16,17] .Surprisingly, only (3.6%) of the surveyed physicians reported using Cefazolin for SAP in Riyadh hospitals, the second - generation Cephalosporin (Cefuroxime) was most commonly used in the surveyed departments, followed by the third generation (Ceftriaxone). This is opposite to what was reported in recent studies in Qatar and even Saudi Arabia. For instance the most commonly used antibiotic in Hammad Hospital in Qatar[16] and Aseer area [17] in Saudi Arabia was Cefazolin. Although there are methodological differences between these studies (retrospective analysis of patient records) and the current study (cross – sectional survey of physicians), those differences pinpoint important inter and intra-regional differences in antibiotics prescribing for surgical prophylaxis.

The administration of antimicrobial in the correct time is considered an important factor for effective prophylaxis. Inappropriate timing may lead to low plasma concentration of the antimicrobial agent at the time of incision and throughout the surgery, causing higher infection rates. Based on the ASHP guidelines published in 1999 the optimal time for administering the pre-operative antibiotic dose is at induction of anesthesia, a recommendation that was followed by (32.73%) of surveyed physicians. Updated ASHP guidelines, published in 2013 altered the previous recommendation to 60 minutes before surgical incision (exceptions are fluoroquinolones and vancomycin), this is a more specific time frame than the previously recommended time. In that context, the majority of surgeons reported administrating the first antibiotic dose earlier than this time limit, i.e. less than 1 hour before surgery in (40.0%) of cases, or late than this time limit i.e. 1-2 hour before surgery in (16.4%) of cases.

The SAP should provide antimicrobial coverage from the time of incision until the time of incision closure which for most procedures requires only one dose. Unfortunately, as much as (64.8%) reported using more than 1 dose and although (58.2%) of physicians discontinued prophylactic antibiotics within 24 hours, (18.2%) of physicians reported using extended SAP for 3 days. Overuse and inappropriate use of antibiotics leads to the development of resistant strains, slows recovery, increases the duration of hospital stay, in addition to increasing the overall costs on the health care system [18].

There is no doubt that different guidelines regarding SAP have been developed and their efficacy in clinical trials have been proven. The Pathman model descries four key aspects required for knowledge translation: awareness, agreement, adoption and adherence [19]. The physicians must be aware of the guideline, they must agree with it, they must decide to adopt in their practice, and adhere to the recommendations and apply them in appropriate cases. The results of the current study unveiled an important hindrance to the application of the guideline which is lack of awareness and knowledge. For instance, the most common reason for the improper timing of the antimicrobial prophylaxis administration was lack of knowledge about the guidelines (41.8% of the cases) [20] .

The response rate in the present study was relatively low [21] as only (55.0%) of the invited physicians participated in the study, a finding that is not surprising, as low response rate by physicians is a well documented phenomenon and many attempts have been made to solve this problem. Although there are many causes for unresponsiveness such as lack of time, lack of interest in the study or even some concerns relating to confidentiality issues, there is a possibility that there are differences in the knowledge and practices of responders as opposed to non-responders. If this is the case, then there is a chance of overestimating positive results. Another possible cause for over-estimating positive results is the nature of the study, which depends on self reporting [22]. A technique that is associated with overestimation of adherence to guidelines.

Therefore, to overcome problems related to lack of knowledge with updated guidelines programs of continuous education might be helpful. Such programs should emphasize on active learning activities such as educational outreach visits as traditional passive education methods are not likely to change physician's behaviors [20]. However, measuring learning outcomes of these educational programs should not solely depend on self reporting questionnaires, as although they are valuable, other methods could be used in addition to them such as frequent hospital audits on practices.

CONCLUSION

In conclusion, practitioners in Riyadh hospitals are aware of the importance of antimicrobial prophylaxis before surgeries. However, additional efforts are needed to be sure that the accepted practices of SAP in Riyadh hospitals are implemented. This might be achieved by the establishment of continuous medical education programs for practitioners and other health care professionals, and by frequent assessment of compliance with evidence-based SAP guidelines.

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