



A Point Prevalence Survey of Antimicrobial Usage for Surgical Site Infections- A Pilot Perspective from Holy Makkah, Saudi Arabia

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Authors' contributions

This work was carried out in collaboration among all authors. Authors AH, HSF, MAG, SA and AMB designed the study. Authors AAA, HSH and HSB performed the statistical analysis. Authors RTM, RMA and SSE wrote the protocol. Authors AH, HSF, MAG, SA, AMB and MSI wrote the first draft of the manuscript. Authors AAA, HSH, HSB and MSI managed the analyses of the study. Authors AH, RTM, RMA, SSE and MSI revised the manuscript. All authors read and approved the final manuscript.

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ABSTRACT

Introduction: This study aimed to assess the incidence, microbiological features and management of surgical site infections (SSIs).

Methodology: All patients in the surgical ward were followed from admissions until discharge during the study period. Only hospitalized patients with certain SSIs within 30 days of surgeries were included in the study.

Results: A total of 457 patients were followed during the study period. Interestingly, only 9 (1.9 %) of the patients developed SSIs. Most of the patients were males 6 (66.7%) and Saudi nationals 7 (77.8 %). The most common surgical procedures were laparoscopic and orthopedic surgeries with a similar rate of 3 (3.3 %).

Conclusion: This study revealed that the incidence of SSIs was quite lower at the hospital where the study was conducted and different types of antibiotics were used and recommended for prophylaxis.

Keywords: Surgical site infections; surgery; SSIs; antibiotics; Saudi Arabia.

1. INTRODUCTION

Surgery is the treatment of injuries, deformities, and ailments by manual or instrumental means. Surgery has been divided into different departments according to their anatomical differences [1,2]. For instance, general surgery mainly focuses on abdominal organs (stomach, esophagus, colon, liver, pancreas, bile duct, gallbladder, small bowel, often thyroid gland, breast surgery, and hernias) and orthopedics deal with bone and connective tissue surgeries. Each type of surgery has variable chances to develop an infection at the site of surgery after completion [1-3].

Surgical site infections (SSIs) are the complications of surgeries that arise most often because of the presence of an intrinsic or extrinsic pathogen to the site of incision, and it is one of the leading causes of illness to a surgical patient. A large proportion of post-operative SSIs is caused by antimicrobial-resistant pathogens e.g. MRSA (methicillin-resistant *Staphylococcus aureus*) or *Candida albicans*. SSIs typically occur after surgery within thirty days of surgery. The infections that occur at the skin site where incisions are made are called superficial incisional SSIs. The second type of SSIs is the deep incisional SSIs that occur underneath the incision area in tissues and muscles or their surroundings whereas the third common SSIs are the organ/space SSIs that can occur after the

surgery in those areas which were not involved in the surgery i.e. any area other than skin, muscles, and surrounding tissues that were actually involved in the surgery. This includes a body organ or a space between organs [4,5].

In Saudi Arabia, the incidence of nosocomial infections, by a study carried out during 2014 was 2.2 % in orthopedic surgery [6-8]. To the best of our knowledge, there is no study conducted in Makkah region hospitals before to report the incidence of SSIs. This study aimed to assess the incidence of SSIs in surgical wards, their management, microbiological features, and economic measures.

2. MATERIALS AND METHODS

A point prevalence approach was adopted to record antibiotic usage in the surgical ward of a single hospital in Makkah, Saudi Arabia. Data collected from patients' files during hospitalization anonymously. All the data received from this study were analyzed using SPSS version 22. Appropriate descriptive and inferential statistics were applied for data analysis. The study was started after the approval of the concerned authorities.

2.1 Inclusion Criteria

- All surgical male and female patients under general surgery, urology, and

cardiothoracic departments at the time of the study.

- All adult patients between ages 18 and 75 years.
- Patients who were diagnosed and confirmed to acquire SSIs or those who fulfill CDC criteria for SSIs.
- Male and female patients developing SSIs within 30 days after Surgery.

2.2 Exclusion Criteria

- Male and female patients with surgical implants and trauma patients.
- Patients with infections that developed after 30 days of surgery.
- Patients with other infections not SSIs e.g. hospital-acquired pneumonia etc.
- Patients with incomplete files or missing data.

3. RESULTS

Table 1 indicates the demographic characteristics of 9 patients who developed SSIs out of a total of 457 studied patients. A total of 6 patients (66.7%) were from the male surgical ward and 3 patients (33.3%) were from the female surgical ward. The mean age of the participants was 20.156±2.132 and 77.8% were Saudi nationals and 22.2% were non-Saudis.

Table 2 shows the different types of surgeries reported. 55.6% were electives while 44.4% were done in an emergency. Various categories were observed under different types of surgeries, like laparoscopic, breast, vascular, gastric and orthopedic.

Table 3 depicts the details of medications used for post-surgical treatments. These were of different groups, i.e. cephalosporins, penicillins, macrolides, carbapenems, quinolones, aminoglycosides, metronidazole, etc.

4. DISCUSSION

A wide variety of micro-organisms- gram-positive cocci and bacilli, gram-negative cocci and bacilli, non-spore forming and spore-forming bacteria, aerobes, and anaerobes- are responsible for SSI's but *staphylococcus aureus*, *Enterococcus* species, *Escherichia coli*, and coagulase-negative staphylococci are most commonly isolated pathogens [9,10] and according to

various studies, a large proportion of post-operative SSIs are caused by antimicrobial-resistant pathogens e.g. MRSA (methicillin-resistant *Staphylococcus aureus*) [11-13].

Table 1. Demographic characteristics of the patients

Demographic characteristics	n (%)
SSIs rate	
Male surgical ward	6 (66.7)
Female surgical ward	3(33.3)
Gender	
Male	6 (66.7)
Female	3 (33.3)
Age (mean, SD)	20.156±2.132
Nationality	
Saudi	7(77.8)
Non-Saudis (Residents)	2 (22.2)
BMI	
Normal	1 (11.1)
Overweight	2 (22.2)
Obese Class 1	1 (11.1)
Obese Class 2	3 (33.4)
Obese Class 2	2 (22.2)
Comorbidities	
DM	3 (33.3)
HTN	3 (33.3)
CKD	0
IHD	1 (11.2)
Others	2 (22.2)
Marital status	
Married	3 (33.3)
Unmarried	6 (66.7)

Table 2. Different types of surgeries and wound class

Variables	N (%)
Surgery information	
Elective	5 (55.6)
Emergency	4(44.4)
General surgery categories	
Laparoscopic	3 (33.4)
Breast	1(11.1)
Vascular	1(11.1)
Gastric	1(11.1)
Orthopedic	3(33.3)
Wound class	
Clean – contaminated	3(33.4)
Contaminated	2(22.2)
Dirty	2(22.2)
Unknown	2(22.2)

The risk of SSI is increased by numerous factors that increase the endogenous contamination or

increase the risk of exogenous contamination or diminish the efficacy of the general immune response or local immune response [14]. Factors such as age, obesity, comorbidity, increased ASA score, surgical wound class, duration of surgery, etc. all add significant risk to the development of SSIs. Moreover, risk factors of SSI development in hospitalized patients can be divided into preoperative, intra-operative and post-operative factors, prevention of all and care of which is essential to decrease the incidence of SSIs.

Table 3. Post-surgical antimicrobials/antibiotics used

Drugs	N(%)
Cefepime	9(100%)
Amikacin	1(11.1%)
Imipenem	1(11.1%)
Tazocin	1(11.1%)
Levofloxacin	1(11.1%)
Metronidazole	9(100%)
Meropenem	9(100%)
Ampicillin	3(33.3%)
Ciprofloxacin	9(100%)
Vancomycin	2(22.2%)
Erythromycin	1(11.1%)
Ceftriaxone	2(22.2%)
Cefazolin	1(11.1%)

To assess the overall significance and prevalence of SSIs around the globe, a systematic review of the literature was carried out on numerous online databases such as PubMed, Science Direct, EBSCO host and Google Scholar published during 2000-2017. The keywords used for the search were (SSIs prevalence Gulf Region, SSIs prevalence South Asia, SSIs prevalence Europe, SSIs prevalence in the United States and Canada and SSIs prevalence in Saudi Arabia. The median incidence of SSIs in Asia was to be 13.5 %, Europe 10.8%, USA 7.6, Africa 15.8 and Gulf 2.33). Risk factors constantly recognized associated with SSIs included increased age, comorbidities, elevated American Society of Anesthesiologists (ASA) score of patients, their frailty, surgery type and length of hospital stay.

The prevalence of SSIs varies globally, higher in developing countries as compared to a developed one. In the United States of America (USA) alone, the SSIs number is approximately 500,000 amongst an estimated 27 million surgical procedures which make up 18.5% [15].

Based on the reports of the National Nosocomial Infections Surveillance System (NNIS), the third most frequently reported nosocomial infection (NIs) is SSIs, accounting for 14-16% of all NI in hospitalized patients [16]. A prevalence survey was undertaken in 2006 in the United Kingdom (UK) suggested that approximately 8% of the patients in the hospital have healthcare-associated infections (HCAIs) and SSIs accounted for fourteen percent of such infections and nearly five percent of among those who have a surgical procedure [17]. In the UK, SSIs alone account for 77% of deaths of surgical patients [18]. According to Mayon-White et al. the prevalence of NIs in the UK in 1998 was 21% with surgical wounds accounting for 5-34% of the total and this value decreased to ten percent in 2001 [18,19]. The reported rates of NI in Tunisia. [20] Algeria [21] and Gabon [22] were 9.4%, 16.2%, and 11%, respectively. The reported rate of nosocomial infections in surgical and rehabilitation services of Gabriel Toure Hospital, General Surgery department of Gabriel Toure Hospital and Centre Hospitalier Universitaire du Point G were 10.2% [23], 9.6% [24] and 13.8% [25], respectively. The prevalence of SSIs in Vietnam was 10.9% and SSI rates in abdominal, obstetric-gynecological, urological, orthopedic, ENT (otolaryngology), general, neurosurgical and cardiothoracic surgeries were 14.9%, 2.4%, 6.9%, 11.9%, 16.7%, 25%, 20% and 33.3% respectively [26-28].

On the other hand, in developing countries, the rate of SSIs is considerably high as compared to first world countries. According to the World Health Organization (WHO), 2011, SSIs are the most frequent HCAIs hospital-wide in low and middle-income countries with a pooled incidence of 11.8 per 100 patients undergoing surgical procedures [29,30].

5. CONCLUSION

This study revealed that the incidence of SSIs was quite lower at the hospital where the study was conducted.

6. STUDY LIMITATIONS

This study determined the incidence of SSIs only in one hospital in one city. These findings cannot be generalized to the entire country hospitals as each hospital has its infection control policies and procedures. Therefore, there should be further studies done involving patients from multiple settings.

CONSENT

Written consent was obtained from the study participants.

ETHICAL APPROVAL

This study was initially approved by the ethical review board of the college of pharmacy, Umm Al Qura University, Makkah with approval number UQU-COP-EA-143903 followed by ethical approval by the institutional review board of general directorate of health Makkah region, Kingdom of Saudi Arabia.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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