



LEVEL OF KNOWLEDGE TOWARD SURGICAL SITE INFECTIONS AMONG CLINICAL YEARS MEDICAL STUDENTS IN THE WESTERN REGION OF SAUDI ARABIA

Yasser Hussain Alnofaiey¹, Hulayyil Huwayda H Almuqati^{2*}, Awad Ahmed Alasmari², Mohammed Hussain W Alosaimi², Mohamed Ali M Alshehri², Abdulaziz Saud F Aljuaid², Rayan Eidhah H Alzaidi²

1. Department of Internal Medicine, College of Medicine, Taif University, Taif 21944, Saudi Arabia.
2. College of Medicine, Taif University, KSA.

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ABSTRACT

A surgical site infection is an infection that develops within 30 days following a surgery in the body where the surgical incision was performed. Aim: This study aimed to assess the knowledge of medical students about SSI in western Saudi Arabia. This study aims to assess awareness of surgical site infection among medical students in clinical years in the western region of Saudi Arabia and to show the difference in knowledge between governmental universities. We performed an observational study with a cross-sectional study design. A validated structured online questionnaire was used as a study tool. The questionnaire was distributed among the medical students through online means. Our study included 441 participants, of whom 46.7% were males. Only 7.3% of participants had a good knowledge score ($\geq 70\%$), whereas 58.5% had a poor knowledge score ($< 50\%$). There was a significant association between knowledge level with gender ($p=0.000$), university ($p=0.017$), current study year ($p=0.000$), and whether the participant had studied surgery before ($p=0.006$). Good knowledge was more evident among females (75%) than males (25%). Students of Umm Al Qura University had the highest prevalence of good knowledge (53.1%) among other groups. Similarly, senior students (78.1%), and students who had studied surgery before (100%) had better SSI knowledge. Awareness and level of knowledge regarding SSI among medical students are generally low. We recommend improving their knowledge of SSI by providing them with more courses and sessions.

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Introduction

A surgical site infection (SSI) is an infection that develops within 30 days following a surgery in the body where the surgical incision was performed. Surgical site infections can either be superficial infections that just affect the skin or deep infections which can be more severe, affecting tissues beneath the skin, organs, or implanted materials [1-3]. Those who acquire surgical site infection are up to 60% more likely to stay in the intensive care unit, five times more likely to be readmitted to the hospital, and twice as likely to die as patients who do not get SSI [4, 5].

Surgical site infections may be the most preventable healthcare-associated infection, especially when a care bundle strategy is applied because there are so many risk factors to target [6, 7]. Contaminated operations, emergency surgeries, lengthy procedures, improper sterilization, insufficient tool handling, and insufficient antiseptic surgical site preparation are examples of surgery-related issues [3, 8].

Many infection control methods, such as surgical hand preparation, increased nutritional support, pre-operative bathing, surgical site skin preparation, hair removal, mechanical bowel preparation, and the use of oral antibiotics, can help to prevent SSI. Proper hand hygiene and the use of basic precautions during invasive procedures are simple and inexpensive, but they necessitate students' education and monitoring systems. As is well known, SSI prevention is a critical component of implementing the patient safety and quality care concepts [9]. Thus, this study was conducted to assess awareness of the

surgical site infection (SSI) among medical students in clinical years in the western region of Saudi Arabia and to demonstrate the potential differences in knowledge among sociodemographic factors.

Materials and Methods

Study Design

This is an observational study with a cross-sectional sample.

Study Area and Settings

This is an observational cross-sectional study, the study was conducted in the Western region of Saudi Arabia, which is also known as the province of Mecca often referred to as Mecca, the foremost important governance is Mecca, Jeddah, and Taif.

Study Subjects

Our study population included 441 participants clinical years medical students in governmental universities which are King Abdulaziz University, Jeddah University, King Saud Bin Abdulaziz University for Health Sciences-Jeddah, Umm Al-Qura University, and Taif university either male or female in the western region of Saudi Arabia.

Inclusion Criteria

Clinical years medical students studying in governmental universities in the western region either male or female.

Exclusion Criteria

Pre-clinical years students, private school medical students, and students outside the western region.

Data Collection Methods, Instruments Used, Measurements

Study Tool

A structured online questionnaire was used as a study tool. The validated questionnaire-based survey regarding the awareness and knowledge about surgical site infection among respondent physicians and interns in King Abdulaziz university hospital. The questionnaire consists of two parts, the first talks about demographic features such as gender, age, study year, and university. The second part consists of 20 questions related to surgical site infections. The questionnaire was distributed among the medical students through online means.

Data Analysis and Entry Method

Data was entered on the computer using "Microsoft office excel software". To be statistically assessed, the data was uploaded to the Statistical Package of Social Science Software (SPSS) software, version 26 (IBM SPSS Statistics for Windows, Version 26.0. Armonk, NY: IBM Corp.).

Results and Discussion

Table 1 showed the socio-demographic data of the participants. We included a total of randomly taken 441 participants who filled out our questionnaire according to the inclusion criteria. Over half of our participants (53.3%) were females and 46.7% of them were males. Of all, 70.3% were aged between 18 and 23 years, whereas 29.7% were aged 24 to 30 years. Most of our participants were students at King Abdulaziz University (37.4%), and Umm Al Qura University (37%). Over half of the participants were in the last year of their program (54.9%), and have studied the surgery module already (86.8%).

Table 2 showed the knowledge items among respondents and **Table 3** shows the knowledge score and knowledge score levels among respondents. Only 7.3% had good knowledge, 34.2% had fair knowledge, and 58.5% had poor knowledge. The average knowledge score among participants was 44.6 ± 15.7 .

Table 4 shows that there was a significant association between knowledge level with gender ($p=0.000$), university ($p=0.017$), current study year ($p=0.000$), and whether the participant had studied surgery before ($p=0.006$). Good knowledge was more evident among females (75%) than males (25%). Students of Umm Al Qura University had the highest prevalence of good knowledge (53.1%) among other groups. Similarly, senior students (78.1%), and students who had studied surgery before (100%) had better SSI knowledge.

Table 1. Sociodemographic characteristics of participants (n=441)

Parameter	Frequency (%)	
	18-23	24-30
Age, y	310 (70.3%)	131 (29.7%)
	Female	235 (53.3%)
Gender	Male	206 (46.7%)

University	Jeddah University	13 (2.9%)
	King Abdulaziz University	165 (37.4%)
	King Saud bin Abdulaziz University for health sciences Jeddah	44 (10%)
	Taif university	56 (12.7%)
	Umm Al Qura University	163 (37%)
Current study year	3rd year	2 (0.5%)
	4th year	67 (15.2%)
	5th year	130 (29.5%)
	6th year	242 (54.9%)
Studied surgery module before	No	58 (13.2%)
	Yes	383 (86.8%)

Table 2. Knowledge of participants of SSI (n=441)

	Knowledge item	Frequency (%)
1-The United States Centers for Disease Control and Prevention (CDC) has developed criteria that define SSI as an:	Infection related to an operative procedure that occurs at or near the surgical incision within 14 days of the procedure.	231 (52.4%)
	Infection-related to an operative procedure that occurs at or near the surgical incision within 30 days of the procedure, or within 1 year if prosthetic material is implanted.	136 (30.8%)
	Infection related to an operative procedure that occurs at or near the surgical incision within 60 days of the procedure.	49 (11.1%)
	Infection related to an operative procedure that occurs at or near the surgical incision within 90 days of the procedure.	25 (5.7%)
2-SSIs are classified into incisional SSIs, which can be superficial, deep or organ/space SSIs Superficial SSI means:	Infection involving both only the skin and subcutaneous tissue.	106 (24%)
	Infection involving fascial and muscle layers.	75 (17%)
	Infection involving internal organs manipulated during operation.	57 (12.9%)
	Infection involving the epidermis and dermis layers only.	203 (46%)
3-Which is true about SSI classification:	Deep incisional SSI is more common than superficial incisional SSI and organ/space SSI.	82 (18.6%)
	Deep organ SSI occurs within 60 days after the operation.	58 (13.2%)
	Superficial incisional SSI accounts for more than half of all SSIs.	190 (43.1%)
	Superficial incisional SSI occurs within 14 days after the operation.	111 (25.2%)
4-One of the most common isolated organisms in SSI is:	A-Staphylococcus aureus	209 (47.4%)
	All of the above	1 (0.2%)
	B-Streptococcus pyogenes	52 (11.8%)
	C- Escherichia coli	17 (3.9%)
	D- A+C	162 (36.7%)
5-The best time for administrating prophylactic antibiotics is:	Within 120 minutes prior to surgery.	92 (20.9%)
	Within 180 minutes prior to surgery.	29 (6.6%)
	Within 60 minutes prior to surgery.	217 (49.2%)
	Within 90 minutes prior to surgery.	103 (23.4%)
6-Chances of developing SSI are:	1-3%	77 (17.5%)
	10-5%	129 (29.3%)
	15-20%	67 (15.2%)
	3-5%	168 (38.1%)
7- All the following pre-operative antibiotics are commonly used except:	Cefazolin	58 (13.2%)
	Cefoxitin	76 (17.2%)
	Fidaxomicin	201 (45.6%)
	Vancomycin	106 (24%)
8-Which statement is correct about wound classification:	The appendiceal abscess is considered a contaminated wound.	137 (31.1%)
	Bowel obstruction with enterotomy and spillage of contents is considered a dirty wound.	73 (16.6%)
	Clean-contaminated wound is defined as an incision under sterile conditions; the entrance of a hollow viscus with no active infection.	168 (38.1%)
	A wound created in herniorrhaphy is considered a clean-contaminated wound.	63 (14.3%)

	Hairy skin	197 (44.7%)
9-Which one of these risk factors is LEAST associated with SSI:	Poor postoperative glycemic control	72 (16.3%)
	Prolonged pre-operative stay	108 (24.5%)
	Type of wound	64 (14.5%)
	All of the above	318 (72.1%)
10-Complications of SSI include which of the following:	Death	23 (5.2%)
	Fistula formation	51 (11.6%)
	The increased cost of care	49 (11.1%)
11-The CDC recommendations for the prevention of SSI include the following:	Advise patients to shower at least 1 day prior to surgery.	43 (9.8%)
	Blood glucose target level of less than 250mg/dl.	184 (41.7%)
	Maintaining mild hypothermia.	50 (11.3%)
	Pre-operative showering with antimicrobial soaps.	164 (37.2%)
12-Infected wounds can exhibit one of these presentations:	Normothermia	30 (6.8%)
	Painlessness	21 (4.8%)
	Purulent pus	345 (78.2%)
13-Prophylactic antibiotics are discontinued after surgery within:	Sweet smell	45 (10.2%)
	12 to 18 hours	103 (23.4%)
	24 to 48 hours	185 (42%)
	4 to 8 hours	78 (17.7%)
14-Regarding hair removal for surgical patients, when is the best time:	72 to 96 hours	75 (17%)
	2 hours prior to surgery.	88 (20%)
	30 minutes prior to surgery	1 (0.2%)
	30 minutes prior to surgery.	62 (14.1%)
15-Regarding hair removal for surgical patients, it's best done by:	Just prior to surgical incision.	152 (34.5%)
	The night prior to surgery.	138 (31.3%)
	Clipping	86 (19.5%)
	Electrolysis	27 (6.1%)
16-Which one of these factors impairs wound healing:	Shaving	295 (66.9%)
	Waxing	33 (7.5%)
	Exposure to water	57 (12.9%)
	Hyperthermia	66 (15%)
17-In assessing the nutritional status of a surgical patient, which statement is correct:	Protein-rich food	21 (4.8%)
	Steroid use	297 (67.3%)
	Assessing the patient through inspection and further examination should be enough.	103 (23.4%)
	Poor nutritional status is not considered a risk factor for SSI.	26 (5.9%)
18-Based on World Health Organization, the fourth step in hand hygiene technique is :	Serum albumin level is the most commonly used marker to assess nutritional status.	239 (54.2%)
	Serum magnesium is a preferred marker over serum albumin.	73 (16.6%)
	Backs of fingers to opposing palms with fingers interlocked.	87 (19.7%)
19-The first step in surgical scrubbing is:	Palm to palm with fingers interlaced.	84 (19%)
	Rotational rubbing, backward and forwards with clasped fingers of the right hand in the left palm and vice versa.	205 (46.5%)
	Rub hands palm to palm.	65 (14.7%)
20-The purpose of pre-operative skin Cleaning is:	Adjust water flow and temperature.	37 (8.4%)
	Ensure that your sleeves are at least two to three inches above your elbows.	83 (18.8%)
	Open out your gown pack onto a clean table, only grabbing the outermost edges to maximize the sterile field.	87 (19.7%)
	Remove any watches and rings from your hands.	234 (53.1%)
20-The purpose of pre-operative skin Cleaning is:	To achieve a faster operation.	26 (5.9%)
	To achieve good-looking skin.	57 (12.9%)
	To reduce the risk of skin cancer.	45 (10.2%)
	To reduce the burden of skin flora, thus reducing the risk of SSI.	313 (71%)

Table 3. SSI Knowledge levels among respondents (n=441)

Parameter	Frequency (%) / Mean ± SD
Knowledge of SSI	Good knowledge 32 (7.3%)
	Fair knowledge 151 (34.2%)
	Poor knowledge 258 (58.5%)
Knowledge score (%)	Mean ± SD 44.6 ± 15.7

Table 4. SSI Knowledge in association with sociodemographic characters

Parameter	Good knowledge	Fair knowledge	Poor knowledge	P-value
Age, y	18-23 20 (62.5%)	102 (67.5%)	188 (72.9%)	0.318
	24-30 12 (37.5%)	49 (32.5%)	70 (27.1%)	
Gender	Female 24 (75%)	102 (67.5%)	109 (42.2%)	0.000
	Male 8 (25%)	49 (32.5%)	149 (57.8%)	
University	Jeddah University 0 (0%)	5 (3.3%)	8 (3.1%)	0.017
	King Abdulaziz University 12 (37.5%)	64 (42.4%)	89 (34.5%)	
	King Saud bin Abdulaziz University for health sciences Jeddah 3 (9.4%)	20 (13.2%)	21 (8.1%)	
	Taif university 0 (0%)	23 (15.2%)	33 (12.8%)	
	Umm All Qura University 17 (53.1%)	39 (25.8%)	107 (41.5%)	
Current study year	3rd year 0 (0%)	0 (0%)	2 (0.8%)	0.000
	4th year 4 (12.5%)	18 (11.9%)	45 (17.4%)	
	5th year 3 (9.4%)	32 (21.2%)	95 (36.8%)	
	6th year 25 (78.1%)	101 (66.9%)	116 (45%)	
Studied surgery module before	No 0 (0%)	14 (9.3%)	44 (17.1%)	0.006
	Yes 32 (100%)	137 (90.7%)	214 (82.9%)	

Bacterial infection and the ever-growing bacterial resistance have imposed intense hazard to human fitness. And bacterial infection ought to substantially menace the wound healing system [10]. In this study, we included 441 medical students from five different universities in the West of Saudi Arabia to assess their knowledge of SSI.

Among all participants, 52.4% of participants were aware of the CDC definition of SSI. In contrast to a study by Labeau *et al.*, (2010) [11], which found that only 7% of nurses knew the correct classification of SSI [12], 46% of medical students in our study knew that the superficial SSI refers to an infection of the epidermis and dermis, and 43.1 percent knew that the superficial SSI accounts for more than half of all SSIs.

The most prevalent organisms causing SSI were recognized by 36.7 percent of the participants (*S aureus* and *E. coli*). Nearly half of those surveyed (49.2%) were aware of the ideal time to provide prophylactic antibiotics, which is one hour before surgery. In studies conducted in Saudi Arabia and Nigeria, higher percentages (78.2 percent and 57.58 percent, respectively) were reported [9, 11].

Only 17.5 percent were aware of the SSI incidence rate, which ranged from 1% to 3%. Fidaxomicin was identified by 45.6 percent of survey participants as an antibiotic that was not typically indicated for SSI. Furthermore, 38.1 percent of medical students were aware that a clean-contaminated wound was described as an incision made under sterile conditions with a hollow viscus incision and no active infection. Less than half of the students (44.7%) were aware that hairy skin was less likely to be related to SSI.

As reported in the study of Albishi *et al.*, the CDC defines SSI as a proliferation of the pathogenic microbes that can be superficial (colonization of an incisional site inside the skin or subcutaneous fat), deep (colonization in the musculofascial layers), or in an organ or cavity [9]. According to [13], the majority of respondents named the hospital as the primary source of nosocomial illness. They also agreed that all students and patients, regardless of their diagnosis, should be considered potentially infectious and should know how to avoid and control hospital-acquired diseases.

According to our findings, gender ($P=0.000$), university ($P=0.017$), current study year ($p=0.000$), and if the subject had studied surgery before ($p=0.006$) all demonstrated a significant relationship with knowledge level. Females (75%) had a higher level of knowledge than males (25%). Among the other groups, Umm Al Qura University students had the highest proportion of good knowledge (53.1%). Senior students (78.1%) and students who had previously studied surgery (100%) also demonstrated greater SSI knowledge.

Conclusion

Awareness and level of knowledge regarding SSI among medical students are generally low. We recommend improving their knowledge of SSI by providing them with more courses and sessions and providing training programs for the future doctors which can improve the knowledge and awareness of SSI which in turn would decrease the length of hospital stay, economic costs, morbidity, and mortality rate because of SSI.

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Conflict of interest: None

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Ethics statement: The permission was taken through the questionnaire and confidently was insured by not asking for names or any source of identification. The data was secured by not asking for names or any source of identification and data was secured in an online survey and then transformed into a secured Excel file.

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