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Preoperative strategies to achieve zero rate of surgical site infection in patients undergoing elective surgical procedures: A prospective Observational study

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Abstract

Background: A surgical site infection (SSI) is an infection that developed after surgical procedures in the area of the human body where the procedure operated. infections occur in approximately 0.5% to 3% of patients undergoing surgery. Therefore, this study aimed to prevent the SSI rate by achieving a zero rate for patients undergoing elective surgical procedures.

Patients and methods: Prospective data collected, observational study design, the data were collected for the cases preoperative, intraoperative, and postoperatively. The incidence of SSI was assessed after 7,14, and 30 days of follow-up.

Results: The mean age was 38.4±21.6 years. 58.8% of cases were male, and 41.2% were female, 44.9% underwent surgeries under general anesthesia, 36.5% underwent surgeries under local anesthesia, 15.9% under spinal anesthesia, and 1.5% under topical anesthesia. Regarding surgical site marking sheet, 33.8% did not mark their surgical site, 14.6% of cases underwent right eye surgery site marking, 12.7% underwent left eye surgery site marking, 6.3% underwent left knee surgery site marking. Regarding the preoperative preparation, 18.2% of cases were administered prophylaxis, 50.6% of cases underwent preoperative clipping, all cases underwent preoperative bathing and using new instrument for closure. There was no incidence of SSI in any cases during follow up in 7, 14, and 30 days.

Conclusion: Prophylaxis administration, preoperative clipping, bathing, and using a New Instrument for closure were all associated with zero incidence of SSI among cases undergoing elective surgeries.

Keywords: Surgical site infection, preoperative, zero rate, prevention

Introduction

A surgical site infection (SSI) is an infection that develops after surgical procedures in the area of the human body where the procedure operated [1]. SSI is one of the preventable postoperative morbidities that is classified into 3 levels: superficial SSI, deep SSI, and organ space SSI. The wound disruption could lead to deep SSI [2].

According to data published in JAMA by Seidelman JL et al in early of 2023, up to 3 patients may suffer from surgical site infection worldwide, which leads to long lengths of stay [3]. The hospital has developed and utilized many strategies to prevent SSI; the well-systematic structured bundle for preventing SSI [2].

Avoiding the use of razors, preventing hypothermia, utilizing chlorhexidine gluconate plus alcohol–based skin preparation agents, decolonization with intranasal antistaphylococcal agents and antistaphylococcal skin antiseptics for high-risk procedures, preventing for perioperative hyperglycemia, and using negative pressure wound therapy can effectively reduce the rate of SSI [3].

Although practices related to skin cleaning vary according to different sergeries, clipping with electric clippers should be performed close to the time of surgery according to the Guidelines for Perioperative Care in Cardiac Surgery (2019) [4].

There have been studies providing different suggestions about pre-operative showering. It is recommended in the literature that patients should shower with chlorhexidine at night and in the morning before surgery [5]. Although NICE (2008, 2020) recommends that patients should shower or have a bath with soap the day before or on the day of surgery, also it was suggested that having a bath with chlorhexidine and nasal mupirocin could be useful to eliminate the risk of surgical site infections due to S. aureus despite lack of sufficient evidence [6].

It is stated in the literature that skin preparation agents such as chlorhexidine and povidone-iodine should be utilized for prevention of external surgical site infections originating from the patient's skin in the intraoperative period [7].

NICE (2020) suggests that as an alternative to chlorhexidine, alcohol-based solution of 10% povidone-iodine (Betadine Alcoholic solution) could be used for intraoperative skin antisepsis in major and minor surgical procedures [6]. The guide also reveals that 10% povidone-iodine solution (Standardized Betadine antiseptic solution) can be employed as a skin antiseptic in major and minor surgical procedures during pre-operative and post-operative periods if alcohol-based solution and chlorhexidine are not appropriate [5].

It is possible to prevent complications due to surgical site infections in the post-operative period with scientific knowledge-based high-quality nursing care. Therefore, nurses play a crucial role in prevention of wound infections [6].

Nurses are primarily responsible for wound care and wound dressing to minimize the risk of post-operative infections. They perform the wound assessment in terms of haemorrhage, exudate, inflammation, and paleness every day. They keep the wound closed until the next day in the absence of the abovementioned signs. They also provide guidance for other professionals in the surgical team when necessary [5].

Different views about wound care, renewal of wound dressing, and leaving the wound open still exist. It is stated in a review that wound dressing can be removed 24–72 h after cardiac surgery in accordance with asepsis principles [6]. Guidelines for Perioperative Care in Cardiac Surgery (2019) recommend that sterile wound dressing should be removed in post-operative 48 h and that the wound should be left open [4].

Different views about cleaning surgical wounds are stated in the literature. NICE guidelines (2008) require that surgical wounds should be cleaned with sterile saline solution up to 48 h after surgery5 and that 10% povidone-iodine solution (standardized Betadine antiseptic solution) could be used as an alternative skin antiseptic after major and minor surgical procedures.6 Guidelines (2019) for Perioperative Care in Cardiac Surgery propose that washing the incision site with chlorhexidine every day could be useful [4].

Showering is an important hygiene practice. Time of showering after surgery varies with the type of surgery and status of the surgical wound. Wound healing should be taken into consideration while deciding the time of showering. When patients shower after surgery is usually determined by health professionals. Since personal hygiene is a critical aspect of the healing process and plays an important role in prevention of infections, it should not be disregarded .

Hence, this work was conducted to prevent the SSI rate by achieving zero rate for patients undergoing elective surgical procedures.

Patients and Methods

This work was a prospective data collected, observational study design, the data were collected from the cases preoperative, intraoperative and postoperatively included 672 cases admitted to Qasim University Medical City for elective surgical procedures. The study was started from June 2022 to June 2023 after approval by Qasim University Medical City. The patient's informed written consent was acquired.

All cases were subjected to history taking (age, sex, preoperative diagnosis, type of surgery), preoperative approxaches (prophylactic antibiotics, Preoperative Clipping, and bathing, Using New instrument set for wound closure), and postoperative care (follow up for 7,14 and 30 days)

Preoperative bathing

The patients showered with tap water without rubbing the wounds within 48–72 h after surgery.

Firstly, a safe showering environment was created. To prevent hypothermia, the room temperature was kept at 20–23°C.27 For patient safety, an anti-slip mat was placed on the bathroom floor. In addition, a shower chair was provided, so the patients could sit while showering. To avoid the risk of infection, the bathroom was cleaned and disinfected prior to use. A different anti-slip mat and chair cover were used for each patient.

Secondly, patients' vital signs were monitored. The patients were allowed to stand up out of their beds and were closely monitored to prevent falling in case of orthostatic hypotension.

Then the patients were taken to the bathroom. They were seated on the shower chair. The temperature of the shower water was maintained within the range specified in the literature (37.7–46.0°C).

Patient preferences about the water temperature were also taken into account. Their hair was washed with tap water and shampoo with non-antibacterial/antiseptic features. After that, they were allowed to stand up. All body parts, including the sternotomy site and the site from which the graft was obtained for bypass, were allowed to come in

contact with water without direct application, soaking, or rubbing. Showering was completed in about 10 min. Immediately after the shower, the incision site and the entire body were dried with a clean, soft towel made of cotton. Then the sternotomy incision site was cleaned with povidone-iodine and left to dry naturally. Finally, the patients dressed in clean clothes. During all these stages, the researcher received help from a relative of the patient and took care to protect the privacy of the patients.

Preoperative clipping

Clipping consists of cutting the hair, usually with electric clippers, to leave w1 mm of hair.

Surgical Antimicrobial Prophylaxis Use Evaluation Protocol

The compliance of SAP practice guideline recommendations was evaluated by comparing the following parameters against ASHP recommendations: indication, choice of antimicrobial agent, dose, route of administration, time of administration of the first preoperative dose, and duration of postoperative prophylaxis [8].

Statistical analysis

All Data were entered and analyzed using SPSS V28 (IBM Corp.). Categorical data were expressed as frequencies and percentages, while continues variables were presented as mean ± standard deviation (SDs).The Chi-square was used to evaluate demographics, A P-value of less than 0.05 was considered to be statistically significant.

Results

Table (1): Patient characteristics for the studied cases

		All N=672
Age(years) (Mean ± SD)		38.4±21.6
Sex n(%)	**Male**	395(58.8%)
	Female	227(41.2%)
Allergy n(%)	**NKDA**	600(89.3%)
	Dust	14(2.1%)
	Nuts	3(0.4%)
	Other	55(8.2%)
Specialty n(%)	**OPHTHALMOLOGY**	203(30.2%)
	ENT	173(25.7%)
	GENERAL	82(12.2%)
	ORTHOPAEDIC	76(11.3%)
	Urology	50(7.4%)
	OB-GYNE	11(1.6%)
	Dental	8(1.2%)
	Surgery	7(1%)
	Other	62(9.2%)

Data are presented as mean±SD or frequency (percentage). ENT: Otorhinolaryngology, NKDA: No known drug allergy.

Regarding the demographic data, the mean age was 38.4±21.6 years. 58.8% of cases were male, and 41.2% were female. 89.3% of cases showed NKDA, and 2.1% showed an allergy to dust. **Table 1**

Table (2): Surgical data for the studied cases

		All N=672
Anesthesia Type	**GA**	302(44.9%)
	Local	245(36.5%)
	Spinal	107(15.9%)
	Topical	10(1.5%)
	Conscious sedation	7(1%)
	Regional	1(0.1%)
Surgical Site Marking Sheet	**No**	227(33.8%)
	Right eye	98(14.6%)
	Left eye	86(12.7%)

	Left knee	43(6.3%)
	Right knee	38(5.8%)
	Both eye	11(1.6%)
	Left ear	10(1.4%)
	Nose	4(.6%)
	Both ears	4(.6%)
	BACK	2(.3%)
	ANAL	2(.3%)
	Other	147(21.8%)

Data are presented as frequency (percentage). GA: General anesthesia.

Our results showed that 44.9% of cases underwent their surgeries under general anesthesia, 36.5% underwent their surgeries under local anesthesia, 15.9% under spinal anesthesia, and 1.5% under topical anesthesia. Regarding surgical site marking sheet, 33.8% did not mark their surgical site, 14.6% of cases underwent right eye surgery site marking, 12.7% underwent left eye surgery site marking, 6.3% underwent left knee surgery site marking. **Table 2**

Table (3) Preoperative precautions and follow up for the studied cases.

		All N=672
Prophylaxis (if any)	**No**	550(81.8%)
	Yes	122(18.2%)
Preoperative Clipping	**No**	332(49.4%)
	Yes	340(50.6%)
Preoperative Bathing	**No**	0(0%)
	Yes	672(100%)
Using New Instrument for closure	**No**	0(0%)
	Yes	672(100%)
Incidence of SSI	**Postoperative follow-up 7 days**	0%
	Postoperative follow-up 14 days	0%
	Postoperative follow-up 30 days	0%

Data are presented as frequency (percentage). SSI: surgical site of infection

Regarding the preoperative preparation, 18.2% of cases subjected to prophylaxis, 50.6% of cases underwent preoperative clipping, all cases underwent preoperative bathing and using new instrument for closure. There was no incidence of SSI in any cases during follow up in 7, 14, and 30 days. **Table 3**

Discussion

The major finding in our study demonstrated that regarding the preoperative preparation, 18.2% of cases subjected to prophylaxis, 50.6% of cases underwent preoperative clipping, all cases underwent preoperative bathing and using new instrument for closure. There was no incidence of SSI in any cases during follow up in 7, 14, and 30 days.

However, Gok et al [5] reported that the ISS incidence among cases who underwent bathing preoperatively was higher higher than expected in the published literature [9]. According to the Centers for Disease Control and Prevention (CDC) criteria, the presence of at least one of the signs and symptoms of infection in the sternal incision site was considered as a sternal infection in this study [10]. This might have raised our overall incidence of infection.

Unlike evidence from the literature, the rate of sternal wound infections was significantly higher in the non-shower group in the current study although they had a short duration of surgery.

Regarding previous study on the rate of sternal wound infections, Gok et al [5] showed that developing 1 month after surgery was lower than that on Day 14 after surgery in the non-shower group. This decrease can be attributed to having a shower after removal of the sutures on the drainage site. Besides, intragroup comparisons of sternal wound infections showed that the patients in the shower group with a longer duration of pre-operative hospital stay had a significantly higher rate of sternal wound infections. More importantly, early post-operative showering considerably decreased the risk of sternal wound infections and even proved protective against sternal wound infections independently of other factors.

Therefore, it can be suggested that sternal wound infections in the shower group were not due to early post-operative showering but instead resulted from their descriptive characteristics and surgery-related variables, especially long hospital stay before surgery.

In a systematic review, it was stated that meeting daily hygiene needs is part of the surgical wound healing process and that early bathing or showering does not create a risk for wound infections, but instead reduces the risk of infections due to hygiene-related factors [11].

Carlson also found that showering 12–48 h after surgery does not increase the risk of surgical site infections [12]. Hsieh et al.[13] also reported that showering with tap water 48 h after thyroidectomy, pulmonary tumour resection, and excision of an inguinal hernia or skin tumours was safe and did not create a risk of surgical site infection.

In a study by Neues and Haas, [14] none of the patients who showered with water and soap 48 h after varicose veins surgery developed infections. Heal et al. [15] reported that there was not a significant difference between the patients with minor surgery who showered in the post-surgical 12 h and those who showered 48 h after surgery. Likewise, in three different studies, there was no significant difference between the patients who took a shower and those who did not. They even showed that keeping surgical wounds dry for a long time had no benefits.

Contrasted to our results, Moges et al. [16] reported that of the patients for whom prophylaxis was indicated and administered, 6 (4%) received antimicrobial agents which are not adequate to cover the bacteria most likely to be encountered at the specific surgical site, and hence none of the select antibiotics were appropriate for the surgical procedures. Cefazolin, which is the first choice of antimicrobial agent for surgical prophylaxis according to both the ASHP and local treatment guidelines, was administered to none of the patients in the present study. Similar finding was documented by Halawi et al [17].

Contrasted to our results, Moges et al. [16] reported that patients who received postoperative prophylaxis for greater than 24 h after surgery had 3.5 times higher risk of developing SSI than those whose postoperative prophylaxis discontinued within 24 h after surgery . This can be attributed to the fact that prolonged use of prophylactic antimicrobials is associated with the emergence of resistant bacterial strains and the excess use of antimicrobials can contribute to secondary infections, such as those caused by Clostridium difficile [18].

Those patients who had clean-contaminated wounds were 4.5 times more likely to develop SSI than those who had contaminated wounds. Similar finding was documented in a study conducted in a tertiary care teaching hospital in Addis Ababa, Ethiopia.[19] The low incidence of SSIs in contaminated wounds than clean-contaminated wounds in the present study might be due to close attention taken to contaminated wounds at the time of the procedure since surgeons knew that there is high degree of bacterial contamination in this wound class.

Conclusion

Prophylaxis administration, preoperative clipping, bathing, and using a New Instrument for closure were all associated with zero incidence of SSI among cases undergoing elective surgeries.

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Figure 1: Ultrasound Guided ESPB Technique