



Effectiveness of sterile glove and instrument change at the time of abdominal wound closure to prevent surgical site infection

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Abstract

SSI is the most common postoperative complication in the world across all income and developing settings, accounting for 2-11% of all surgical interventions. It increases the healthcare burden on families. Modern surgical practice aims to reduce the incidence of surgical site infection. Very few interventions are known to be effective in preventing SSI with a weak evidence base for interventions in clinical guidelines for best practice. The present study is aimed at determining the efficacy of changing gloves and instruments at the time of abdominal closure in preventing surgical site infection.

Keywords: Surgical site infection, Glove change, Wound closure

Introduction

Surgical site infection (SSI) can be defined as infections of soft tissue, organs, or spaces exposed by surgeons while performing an invasive procedure [1]. SSI is the most common postoperative complication in the world across all income and developing settings, accounting for 2-11% of all surgical interventions and up to 20% in patients undergoing emergency intraabdominal procedures [2, 3]. SSI is quite unpleasant and disproportionately affects low and middle-income countries [4]. It increases the care burden on families while also costing high due to the need for prolonged hospitalization, additional tests, therapeutic agents, and sometimes additional surgery [4, 5]. The causes for SSI are multifactorial hence there is no one-stop solution to prevent it. While patient-related risk factors are many, the surgical risk factors include prolonged procedures and inadequacy in either surgical scrub or the antiseptic preparation of the skin, as the major endogenous source of organisms for the infection is the patient's skin. The exogenous microorganisms are vectored by airborne particles, the staff (hands, other areas of the skin, and mucous membranes), or inanimate objects (instruments, material, furnishing, or irrigation solutions) [6, 7]. SSIs are classified into superficial, deep, and organ/body cavity infections depending on the depth of infection and duration after surgery. The surgical wounds are also categorized into Class I (Clean wound), Class II (Clean Contaminated wound), Class III (Contaminated wound), and Class IV (Dirty or infected wound) with infection risk being least in Class I and highest in Class IV wounds. Modern surgical practice aims to reduce the incidence of surgical site infection. However, very few interventions are effective when tested robustly. Also, the evidence base is weak to moderate for interventions included in clinical guidelines for best practice [8]. The effectiveness of preventive measures is influenced by the quality of the patient's immune defences and the type of surgical procedure. SSIs remain to be a serious postoperative complication with a significant impact on mortality and morbidity. The present study aimed to determine the efficacy of changing gloves and instruments

at the time of abdominal closure in preventing surgical site infection.

Methodology

A study was conducted at a tertiary care hospital in patients who underwent abdominal surgeries under the general surgery department.

Study design Retrospective and prospective observational study.

A retrospective review of records between Jan 2022 and June 2022 was conducted for patients admitted and meeting the selection criteria. These patients were considered as the control group.

The prospective study was conducted in patients undergoing abdominal surgeries and meeting the inclusion and exclusion criteria between the months of July 2022 to December 2022

Inclusion criteria

Patients (adults and children) who underwent emergency or elective abdominal surgery for any indication (including trauma), with an intra-operative finding of clean-contaminated, contaminated, or dirty operation with at least one abdominal incision of five cm or greater were included in the study.

Exclusion criteria

Patients undergoing clean operation (like Hernia surgeries) were excluded from the study.

Sampling and sample size

A total enumerative sampling technique was followed for both retrospective and prospective study.

A total of 195 patients in the retrospective group (control) and 171 patients in the prospective group (cases) were eligible for inclusion in the study.

Tools used for data collection

Background information and other required information of the controls were collected from the records of the patients

available in the Medical Record Department of the hospital. From the cases, we collected the data from patients through interviews and observation of the surgical site post-operatively and during follow-up visits.

We used semi-structured proforma to collect demographic characteristics and surgery-related data of the patients and the Southampton wound scoring system to assess surgical site infection. These tools were pretested on five samples to check the clarity of the items.

Data collection procedure

Administrative permission was obtained from the administrative authorities, and ethical clearance was obtained from the institutional ethics committee.

For the control group, records of all the patients who underwent abdominal surgery between January and June 2022 were reviewed and required data was collected.

For Cases, data was collected as and when the surgeries took place and during the follow-up period. As per the selection criteria, patients were recruited and hospital protocol for preoperative preparation and care, and postoperative care were followed. All the patients who underwent surgery were prepared with a thorough bath with an antiseptic detergent solution on the day of surgery. They also received a prophylactic dose of intravenous antibiotics 30 minutes before starting surgery; parts were prepared before shifting the patient to the operation theatre by shaving their hair using a razor after administration of the antibiotic. All staff involved in conducting surgery, including scrub nurses, were instructed to change their gloves before starting abdomen closure. A new set of

instruments were used for the closure of surgical wounds. Suture material and suturing methods were maintained constant in all surgeries. Wounds were observed regularly during admission and during follow-up visits for 30 days postoperatively and noted for signs of SSI using the Southampton wound scoring system.

Data analysis

SPSS version 16 was used for the analysis of the data. Frequency, percentage, and chi-square tests were performed.

Result

This study included a total of 366 patients, of which 171 cases were studied prospectively from July 2022 to December 2022, and 195 patient records from Jan 2022 to June 2022 were retrospectively reviewed. The demographic data (table 1) in both groups were similar, with 13% of cases and 12.3% of controls being < 18 years of age.

A good gender balance is noted, with 52.1% vs 52.8% of males and 47.9% vs 47.2% of female participants among cases and controls. Amongst the cases, the most common surgeries performed were appendectomy followed by hepatobiliary with 36.8% and 28.1% with small bowel being the least (7.6%). A similar trend was noted in the control group with 33.3% appendectomy followed by 28.2% hepatobiliary and 8.2% small bowel surgeries. While only 33.3% of cases were diabetics, 42.5% of controls were diabetic. Similarly, the number of smokers was slightly higher amongst controls as compared to cases with 32.8% and 21.7% respectively.

Table 1: Demographic characteristics of study sample in cases and controls.

Variables	Cases (n=171)		Controls (n=195)		P value
	Frequency	Percentage (%)	Frequency	Percentage (%)	
Age groups					
<18 years	23	13.0	24	12.3	0.926
>18 years	148	87.0	171	87.7	
Gender					
Male	89	52.1	103	52.8	0.487
Female	82	47.9	92	47.2	
Type of Surgery					
Appendectomy	63	36.8	65	33.3	<0.01
Colon & Rectum	16	9.4	22	11.3	
Hepatobiliary	48	28.1	55	28.2	
Laparotomy	31	18.1	37	18.9	
Small bowel	13	7.6	16	8.2	
Co-morbidities					
Diabetes					
Yes	57	33.3	83	42.5	0.99
No	114	66.7	112	57.4	
Smoking					
Yes	37	21.7	64	32.8	0.24
No	134	78.3	131	67.2	

Table 2: Distribution of sample in cases and controls based on information related to surgery.

Variables	Cases (n=171)		Controls (n=195)		P value
	Frequency	Percentage (%)	Frequency	Percentage (%)	
Type of surgical wound					
Clean contaminated	123	71.9	140	71.8	0.982
Contaminated	31	18.1	34	17.4	
Dirty	17	9.9	21	10.7	
Timing of surgery					
Emergency	103	60.2	116	59.5	0.851
Elective	68	39.7	79	40.5	

Operative approach					
Midline	86	50.3	107	54.8	0.507
Non midline	85	49.7	90	45.1	
Length of incision					
>5cm	116	67.8	138	70.8	0.770
<5cm	55	32.2	57	29.2	

Both groups, i.e. cases, and controls were homogenous in terms of the type of surgical wound with 71.9%, 18.1%, and 9.9% of clean-contaminated, contaminated, and dirty wounds respectively amongst cases and 71.8%, 17.4% and 10.7% amongst control group. Most of the cases were emergencies with 60.2% and only 39.7% were elective whereas amongst controls, 59.5% were emergencies and 40.5% were elective. All surgeries were performed through an open approach with well-balanced numbers amongst cases and control with 50.3% and 54.8% midline incisions respectively. 67.8% of cases and 70.8 % of controls had incisions more than 5cm.

Table 3: Comparison of incidence of SSI in cases and controls

Presence of SSI	Cases (n =171)		Controls (n= 195)		P value
	F	%	F	%	
Yes	19	11.1	42	21.5	0.007
No	152	88.9	153	78.4	

A new set of gloves and instruments were used by all staff involved in conducting surgery including scrub nurses before starting abdomen closure. The rate of SSI was 19 (11.1%) amongst cases as compared to 42 (21.5%) in the control group. This strongly indicates that routine change of gloves and instruments before starting abdominal closure reduces the risk of SSI (Table 3)

Table 4: Factors influencing SSI

Factors	Cases (n =171)		Controls (n= 195)		P value
	SSI positive F (%)	SSI Negative F (%)	SSI positive F (%)	SSI negative F (%)	
Type of Surgery					
Appendicectomy	03 (15.8)	60 (39.5)	04 (9.5)	61 (39.9)	<0.001
Colon & Rectum	01 (5.3)	15 (9.9)	09 (21.4)	13 (8.5)	
Hepatobiliary	06 (31.6)	42 (27.6)	08 (19.0)	47 (30.7)	
Laparotomy	05 (26.3)	26 (17.1)	15 (35.7)	22 (14.4)	
Small bowel	04 (21.1)	09 (5.9)	06 (14.3)	10 (6.5)	
Co-morbidities					
Diabetes					
Yes	08 (42.1)	49 (32.2)	15 (35.7)	68 (44.4)	0.168
No	11 (57.9)	103 (67.8)	27 (64.3)	85 (55.6)	
Smoking					
Yes	06 (31.6)	31 (20.4)	15 (35.7)	49 (32.0)	0.072
No	13 (68.4)	121 (79.6)	27 (64.3)	104 (68.0)	
Type of surgical wound					
Clean contaminated	08 (42.1)	115 (75.7)	33 (78.6)	107 (69.9)	0.069
Contaminated	07 (36.8)	24 (15.8)	07 (16.7)	27 (17.6)	
Dirty	04 (21.1)	13 (8.6)	02 (4.8)	19 (12.4)	
Timing of surgery					
Emergency	11 (57.9)	92 (60.5)	23 (54.8)	93 (60.8)	0.094
Elective	8 (42.1)	60 (39.5)	19 (45.2)	60 (39.2)	
Operative approach					
Midline	14 (73.7)	72 (47.4)	34 (81.0)	73 (47.7)	<0.001
Non-midline	05 (26.3)	80 (52.6)	07 (16.7)	80 (52.3)	
Length of incision					
>5cm	17 (85.9)	99 (65.1)	39 (92.9)	99 (64.7)	<0.001
< 5cm	02 (10.5)	53 (34.9)	03 (7.1)	54 (35.3)	

In both groups higher incidence of SSI was noted among those who had undergone hepatobiliary and laparotomy surgery, used a midline approach for surgery, and 5cm incision which is statistically significant (table 4). Also, noted that dirty and contaminated wounds had a higher chance of SSI than clean contaminated wounds.

Discussion

Our study found that routine change of gloves and instruments before starting abdominal wound closure reduced the rate of surgical site infection by 10.4% at 30 days post-surgery as compared to the control group. WHO surgical safety checklist was maintained and followed for all patients as per hospital protocol. Prophylactic intravenous

antibiotic was administered to all the patients and parts were prepared by shaving hair using a razor after administration of antibiotics as per hospital protocol to all patients. A new set of gloves and instruments were used by all staff involved in conducting surgery including scrub nurses before starting abdomen closure. A reduction in SSI persisted across most variables. This suggests that introducing a simple change in routine practice shall benefit patients undergoing abdominal surgeries by reducing the risk of surgical site infection as it increases morbidity and mortality while also causing strain on patients’ finances and the healthcare system.^[9] This low-cost intervention is feasible in low-income setups in reducing surgical site infection. Although the risk of SSI is usually considered in the presence of large glove tears or

gross contamination and less obvious when the instruments and gloves are grossly clean and neat, widespread knowledge of pathogens and the occurrence of micro-perforations in surgical gloves theoretically supports this intervention ^[10]. A meta-analysis of studies investigating such care bundles even suggested wound closure protocols, including glove and instrument change, are the most important components of these bundles ^[11]. Yet, recent WHO guidelines on SSI prevention have withheld this practice due to a lack of definite evidence while highlighting the need for well-designed RCTs for the same ^[12]. In our study, we have observed a significant reduction in surgical site infection with no significant interaction or effect between the variables and the result. The CHEETAh trial, an international, cluster-randomized, multicentric trial showed a statistically significant primary outcome of reduced SSI within 30 days postoperative period in the intervention group as compared to the control group ^[13]. Other risk factors responsible for post-operative SSI include patient-related factors like diabetes mellitus, smoking, obesity, immunosuppression, preoperative hair removal technique, preoperative antibiotic prophylaxis, skin disinfection, surgical field asepsis, hand disinfection, instrument sterilization, surgical site drainage and level of wound contamination ^[14]. Preoperative hair removal can be done in multiple ways, the conventional method being the usage of razor blades, and newer methods include the usage of clippers and depilatory creams. SSI is found to be lower with the latter methods than the former as it predisposes to microtrauma ^[15]. Timing of hair removal also has had its fair share of discussion with a slight reduction in SSI noted when hair is removed on the day of surgery as compared to the day before or in the operation theatre ^[16]. In our study, antibiotic prophylaxis was given 30 minutes before shifting the patient to operation theatre and parts were prepared by shaving with a razor blade. These were uniformly followed in all patients as part of hospital protocol for surgical patients.

It is very important to ensure minimal risk of developing SSI as it can be a major healthcare and economic burden to the patient and the countries, more so in the low- and middle-income countries. Hence ensuring preoperative homeostasis of the patient alongwith following the necessary preoperative methods is crucial in preventing SSI.

Conclusion

It is essential to prevent surgical site infection to reduce post-surgery morbidity. An effective way of achieving this is by changing sterile gloves and instruments at the time of closure of abdominal wounds. This is a cost-effective method and can be easily adopted in LMICs. This technique is effective in reducing surgical site infections more so in cases of contaminated abdominal wounds.

Limitation

This study was conducted for a short period. Study can be extended for a longer duration and include more sample size.

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