

## Surgical Site Infections in Relation to the Timing of Shaving among the Gastrointestinal Emergency Patients through the Midline Incisions

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This randomized controlled clinical trial (RCT) was conducted among the indoor patients of general surgery wards in a tertiary level hospital in Bangladesh to assess the possible link between the surgical site infections among the gastrointestinal emergency patients of surgery through midline incisions and timing of preoperative shaving. Follow up of at least 30 days period after surgery was done in each patient and has been found that 31.7% patients in control group and 27.5% patients in experimental group has developed surgical site infections (SSIs) and the overall infection rate was found to be 29.6%. SSIs were found to be only 1.2 fold higher in case of the patients who received razor shaving at least 24 hour prior to surgery in contrast to the patients received razor shaving at OT table, but here in this RCT, the P value was found to be high and therefore said to be not significant. Grade IIIc (18.4% and 27.3% respectively) and grade IVb (21.1% and 21.2% respectively) were found to be the most common types of surgical site infections among the gastrointestinal emergency post-surgical patients.

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**Key words:** Surgical, infection, shaving

### Introduction

“Surgical sites infections” is a very important chapter in our day to day common surgical practice. The “Guideline for Prevention of Surgical Site Infection, 1999” presents the Centers for Disease Control and Prevention (CDC)’s recommendations for the prevention of surgical site infections (SSIs), formerly called surgical wound infections.<sup>1,2,3</sup> Surgical site infection (SSI) may be defined as the infection of the wound characterized by the invasion of organism through tissues following a breakdown of local and systemic host defenses.<sup>4</sup> Or, SSI is infection at the site of surgical procedure within 30 days of operation but may be within one year if

prosthetic or implant surgery is performed.<sup>1</sup> Sources of infection may be Primary: acquired from a community or endogenous source (such as that following a perforated peptic ulcer) or secondary or exogenous (Health care associated infection): acquired from the operating theatre (such as inadequate air filtration) or the ward (e.g. poor hand-washing compliance) or from contamination at or after surgery (such as an anastomotic leak). Secondary or Health care associated infections include Respiratory infection (ventilator associated pneumonia), urinary tract infections (urinary catheter associated infection), bacteraemia (associated with vascular catheter) and surgical site infections. Surgical site infections again classified into

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superficial surgical site infection (When infection involves skin and subcutaneous tissue of the incision within 30 days of operation), deep surgical site infection (infection in the deeper Musculo-fascial layers) and organ space infection (such as an abdominal abscess after an anastomotic leak).<sup>4-9</sup>

Currently, in the United States alone, an estimated 27 million surgical procedures are performed each year.<sup>10</sup> The CDC's National Nosocomial Infections Surveillance (NNIS) system, established in 1970, monitors reported trends in nosocomial infections in U.S. acute-care hospitals. Based on NNIS system reports, SSIs are the third most frequently reported nosocomial infection, accounting for 14% to 16% of all nosocomial infections among hospitalized patients.<sup>11</sup> Among surgical patients, SSIs were the most common nosocomial infection, accounting for 38% of all such infections. Of these SSIs, two thirds were confined to the incision, and one third involved organs or spaces accessed during the operation.<sup>12-14</sup> When surgical patients with nosocomial SSI died, 77% of the deaths were reported to be related to the infection, and the majority (93%) was serious infections involving organs or spaces accessed during the operation.<sup>15-16</sup> In 1980, Cruse estimated that an SSI increased a patient's hospital stay by approximately 10 days and cost an additional \$2,000.<sup>17-19</sup> A 1992 analysis showed that each SSI resulted in 7.3 additional postoperative hospital days, adding \$3,152 in extra charges.<sup>20</sup> Other studies corroborate that increased length of hospital stay and cost are associated with SSIs.<sup>21-23</sup> Deep SSIs involving organs or spaces, as compared to SSIs confined to the incision, are associated with even greater increases in hospital stays and costs.<sup>24-26</sup>

### *Preoperative Issues*

#### a. Preoperative antiseptic showering

In a study of >700 patients who received two preoperative antiseptic showers, chlorhexidine reduced bacterial colony counts nine fold (2.8% to 0.3%), while povidone-iodine or triclocarban medicated soap reduced colony counts by 1.3- and 1.9-fold, respectively.<sup>27</sup> Other studies corroborate these findings.<sup>28, 29</sup> Chlorhexidine gluconate-containing products require several applications to attain maximum antimicrobial benefit, so repeated antiseptic showers are usually indicated.<sup>30</sup> Even though preoperative showers reduce the skin's microbial colony counts, they have not definitively been shown to reduce SSI rates.<sup>31, 32</sup>

#### b. Preoperative hair removal

Preoperative shaving of the surgical site the night before an operation is associated with a significantly higher SSI risk than either the use of depilatory agents or no hair removal.<sup>16, 33-44</sup> In one study, SSI rates were 5.6% in patients who had hair removed by razor shave compared to a 0.6% rate among those who had hair removed by depilatory or who had no hair removed.<sup>45</sup>

#### c. Patient skin preparation in the operating room

#### d. Preoperative hand/forearm antisepsis

#### e. Management of infected or colonized surgical personnel

#### f. Antimicrobial prophylaxis

Preoperative preparation is another very important part of management for the patients who require surgery especially in case of emergency as well as critical. It is a vital aspect for prevention of developing postoperative complications. In case of surgically ill patients, according to the availability of time for preoperative optimization, there are five basic preoperative windows.<sup>46-49</sup>

- 1) The 4- minutes window
- 2) The 4- hours window:

Many gastrointestinal surgical emergencies are included in this category. Patients commonly are fluid and electrolyte depleted. Baseline hematological and biochemical values can be obtained, and a chest X ray and ECG performed. Preoperative resuscitation to increase the oxygen delivery to all vital tissue reduces morbidity and mortality. During the delay, however, the underlying pathology will be deteriorating and timing surgery is important. Before surgical intervention the following thing should be ensured immediately:

- a) Fluid and electrolyte replacement
- b) Correction of abnormalities of clotting
- c) Correction of endocrine abnormalities
- d) Prophylactic antibiotics coverage
- 3) The 4- days window
- 4) The 4- weeks window
- 5) The 4- months window

The ultimate aim of this RCT is to assess the possible link between SSIs and the proper timing of preoperative shaving on the basis of infection rates in both controlled and experimental groups.

### Methods

This study was a randomized controlled clinical trial from 12 May 2009 to 3 April 2011. Indoor patients of general surgery wards (Unit 1 and 2, Ward no 9+10 and 11+12), Khulna Medical College Hospital, Bangladesh were the study population. The sample size was selected by using the formula  $Z^2pq \times D$ , where,  $Z$ = given confidence level. ( $Z=1.96$  for 95% confidence level),  $p$ =Probability =20%=0.20,  $q=1.0-p=0.8$  ( $C_{1-p}$ ) Degree of error limit (the accuracy desired). Random allocation (random assignment) was the method of choice to select the sample from the hospital admitted patients during the earlier mentioned period of study. A total number of first 1200 patients (on the basis of admission serial to hospital who fulfilled the inclusion criteria) were included here initially from which 240

patients were taken as study population at an interval of 5 by using a simple random table. The patients who received razor shaving of skin at least 24 hours before the surgery were the control of this RCT which were selected on random basis. Every alternate patient, as for instance, number 1, 3, 5, ..(and so on) out of 300 (that is number 3, 13, 23, 33, 43...out of 1500) were included here as controlled group. Experimental group, the patients who received razor shaving of skin at the operation table just before operation were the experimental group of this RCT which were selected on random basis. Every alternate patient as for instance number 2, 4, 6, 8 ... (and so on) out of 300 (that is number 8, 18, 28, 38, 48... out of 1500) were included here as experimental group. Confounding variables were a) age, b) sex, c) nutritional status: BMI (body mass index), d) different types and modalities of surgery through midline incisions, e) difference in preoperative preparation and antibiotics prophylaxis regimens as well as variation in postoperative care and dressings and f) selection bias, as no blinding of the study was done.

### Inclusion criteria

- 1) Patients of gastrointestinal emergency (through 4 day preoperative window) surgery (46-49) through midline incisions were included here who received optimal preoperative prophylactic antibiotic coverage
- 2) All the patients of both control and experimental group had same type of preoperative skin preparation by povidone iodine.
- 3) Proposed patients had a skin closure by a monofilament suture material (PDS) were included as study population
- 4) Patients with an age between 20 to 50 years of both sexes were included as the study population.
- 5) Patients having a BMI (Body mass index) of 20 to 30 were included here only.

- 6) Respective patients with no congenital disability or disorder or disease were selected as population.
- 7) Only the patients found to have a surgical management based upon the basic principle of 4 days windows were included here.<sup>46-49</sup>

*Exclusion criteria*

- 1) In certain kinds of operations, patient characteristics possibly associated with an increased risk of an SSI include coincident remote site infections or colonization, diabetes, cigarette smoking, systemic steroid use, obesity, extremes of age, poor nutritional status and perioperative transfusion of certain blood products. This sort of patients were excluded from this study design

- 2) Patients receiving skin closure with a suture material other than a monofilament were not included in this randomized controlled clinical trail (RCT)
- 3) Patients with ASA 5 (American Society of Anaesthesiologists) were not included as study population.
- 4) Patients with past history of any surgery through abdominal incision or incisions were excluded from study population.

*Procedure of data analysis of interpretation*

In this clinical study, both manual and computer based statistical analysis of the data was done. Data will be analyzed manually and then rechecked with SPSS. The survey data will usually be analyzed using both analytic as well as descriptive statistic.

**Results**

Table 1: age, sex and nutritional status of the study population

RCT population	Age in years		Sex		BMI	
	20-35	36-50	Male	Female	20-25	25-30
Control group	48	72	93	27	87	33
Experimental group	59	61	99	21	96	24
Total	107	133	192	48	183	57
%	44.6%	55.4%	80%	20%	76.2%	23.8%

Table II: SSI rate in relation to this RCT population

RCT population	Total	SSI	SSI rate	P
Control	120 patients	38 patients	31.7%	>0.4
Experimental	120 patients	33 patients	27.5%	
Total	240 patients	71 patients	29.6%	

According to the “Guideline for Prevention of Surgical Site Infection, 1999” and also by the definition of “The US Centers for Disease Control and Prevention” (CDC)’s, follow up of at least 30 days period after surgery was done in each patient and has been found that 31.7% (38 patients out of total 120 patients of

Table III: categorization of SSIs on the basis of Southampton wound grading system<sup>4</sup>

Grade	Control group	%	Experimental group	%
25	82 patients	68.3%	87 patients	72.5%
33 Ia	0 patients	00%	1 patients	3.0%
Ib	1 patients	2.6%	1 patients	3.0%
24 Ic	2 patients	5.3%	0 patients	00%
IIa	1 patients	2.6%	2 patients	6.1%
IIb	2 patients	5.3%	0 patients	00%
IIIa	0 patients	00%	2 patients	6.1%
IIId	2 patients	5.3%	0 patients	00%
IIIa	1 patients	2.6%	1 patients	3.0%
IIIb	4 patients	10.5%	3 patients	9.1%
IIIc	5 patients	13.2%	4 patients	12.1%
IIId	7 patients	18.4%	9 patients	27.3%
Iva	1 patients	2.6%	0 patients	00%
IVb	8 patients	21.1%	7 patients	21.2%
V	4 patients	10.5%	3 patients	9.1%

control group) patients in control group and 27.5% (33 patients out of total 120 patients of experimental group) patients in experimental group (table 2 and figure 1) has developed surgical site infections (SSIs) in different extent and the overall infection rate was found to be 29.6% in case of the total study

population (total 240 patients of gastrointestinal emergency surgical patients through midline incisions). In comparison to other studies, the overall rate of infection was found to be very high in this study (different studies suggest that in case of clean contaminated gastrointestinal surgery with open viscus and minimal spillage, SSIs rate should be less than 10% with prophylaxis and up to 30% before prophylaxis, in case of contaminated gastrointestinal surgery it should be 15-20% and up to 60% respectively).<sup>1,4</sup> Here, the p was found to be high and therefore said to be not significant.

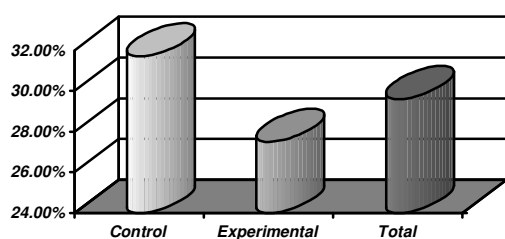


Figure 1: SSI rate in relation to this RCT population

This RCT points that SSIs were found to be only 1.2 fold higher in case of the patients who received razor shaving at least 24 hour prior to surgery in contrast to the patients received razor shaving at OT table. By using the Southampton wound grading system, in table II, the infectious site of the study population is tried to be categorized based on this study results in case of both control and experimental group.<sup>4</sup> “The ASEPSIS wound score” was not taken in consideration for interpretation of the study results.<sup>4</sup>

Table III suggests that grade IIIId (18.4% and 27.3% respectively) and grade IVb (21.1% and 21.2% respectively) were the most common types of surgical site infections

among the gastrointestinal emergency surgical patients.

### Discussion

This randomized controlled clinical trial (RCT) was aimed at to assess the possible link between the surgical site infections among the gastrointestinal emergency patients of surgery through midline incisions and timing of preoperative shaving. After the follow up for at least 30 days period following surgery it was found that 31.7% patients in control group and 27.5% patients in experimental group (table 2 and figure 1) has the postoperative complication of surgical site infections (SSIs) in different extent and the overall infection rate was found to be 29.6%. SSIs were found to be only 1.2 fold higher in case of the patients with razor shaving at least 24 hour prior to surgery in contrast to the patients received razor shaving at OT table. The P value was found to be high and therefore said to be not significant. Grade IIIId (18.4% and 27.3% respectively) and grade IVb (21.1% and 21.2% respectively) were found to be the most common types of surgical site infections among the gastrointestinal emergency post-surgical patients.

In different studies it has been suggested that clean contaminated gastrointestinal surgery with open viscus and minimal spillage, SSIs rate should be less than 10% with prophylaxis and up to 30% before prophylaxis, in case of contaminated gastrointestinal surgery it should be 15-20% and up to 60% respectively).<sup>1,4</sup> Here, in this RCT, the overall infection rate was found to be significantly higher and the p was high and therefore said to be non significant. Though this RCT was aimed to be conducted with a good number of ill subjects, but still due to some investigatory lacking, it was not free from limitations. More research studies in a very large scale in this concern are still required to depict the original scenario and to reach to an effective conclusion.

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