ROLE OF PER-OPERATIVE WOUND IRRIGATION IN PROPHYLAXIS OF SURGICAL SITE INFECTION IN CLEAN CONTAMINATED WOUNDS

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ABSTRACT

Objective: To compare per-operative normal saline wound irrigation prior to closure with conventional simple wound closure without irrigation in terms of development of surgical site infection (SSI) in clean contaminated wounds.

Study Design: Randomized controlled trial.

Place and Duration of Study: Department of Surgery, Combined Military Hospital Dera Nawab Sahib, from Nov 2014 to Nov 2016.

Material and Methods: Group A and group B had 355 patients each. Group A was subjected to per-operative surgical wound irrigation with 300 ml of normal saline prior to skin closure while group B was subjected to conventional simple closure of surgical wound without any kind of wound irrigation. Development of postoperative SSI was checked till 30th post-operative day (POD). A *p*-value ≤0.05 was considered statistically significant.

Results: Postoperative SSI was comparatively less in group A (4.5%) as compared to group B (10.2%) which was statistically significant (*p* 0.004).

Conclusion: Per-operative surgical wound irrigation was found superior to conventional simple wound closure in terms of development of SSI in clean contaminated cases.

Keywords: Clean contaminated wounds, Per-operative wound irrigation, Surgical Site Infection, Wound Infection.

INTRODUCTION

Closure of abdominal wound is an important step of all abdominal surgeries. Wound closure is associated with well known and frequent complications of wound infection, wound dehiscence, burst abdomen, suture sinus formation, chronic wound pain and incisional hernias. Among all complications, surgical site infections (SSIs) are the most common and result in significant delay in wound healing, impair cosmetic outcome and increase healthcare costs[1]. SSIs are the third most common hospital-acquired infections and account for 14% to 16% of all such infections[2,3]. Surgeons throughout the world strive to adopt measures that can reduce the rates of SSIs. Adoption of prophylactic measures to avoid SSIs, significantly alters surgical outcome as these infections are associated not only with short term complications like fascial dehiscence and sepsis but also are independent risk factors for development of incisional hernias in the long term[4]. Well recognized and frequently adopted prophylactic measures include use of prophylactic antibiotics, sterile surgical techniques, minimizing spillage of gut contents, use of monofilamentous sutures, antibiotic coated suture materials and irrigation of wounds prior to closure with topical antibiotics or normal saline[1,5]. Rate of development of SSIs is dependent mainly on type of abdominal wound. Local studies report infection rate of 4.88% in clean cases, 8.39% in clean contaminated and up to 20.45% in contaminated/dirty wounds[6]. Moreover, length of surgical wound is

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inversely proportional to rate of development of SSIs and early detection of these infections can improve outcomes[7,8].

Intra-operative surgical site irrigation (lavage) is common practice in surgical procedures in general, with all disciplines advocating some form of irrigation before incision closure. This practice, however, has neither been standardized nor is there compelling evidence that it effectively reduces the risk of SSIs[5]. With this study we intended to compare intra operative saline irrigation of wound prior to closure with conventional wound closure without irrigation in terms of development of SSIs, thus finding out the preferable method which results in lesser incidence of SSIs in patients undergoing closure of abdominal wounds.

MATERIAL AND METHODS

This randomized controlled trial was carried out in the inpatient's surgical department of Combined Military Hospital Dera Nawab Sahib from 12 November 2014 to 12 November 2016. Sample size was calculated using WHO sample size calculator. Clearance from institutional ethical committee was obtained and informed written consent was taken from every individual. A total of 710 patients undergoing abdominal surgeries with clean contaminated wounds as per Center for disease control and prevention USA criteria (An operative wound in which the respiratory, alimentary, genital, or urinary tracts are entered under controlled conditions and without unusual contamination including appendicectomy, cholecystectomy, cesarean sections, pyelolithotomy, ureterolithotomy and vesicolithotomy) were selected for the trials. Patients with diabetes mellitus, abdominal malignancy and patients using steroids were excluded. All patients received a dose of prophylactic antibiotic before induction, Intravenous antibiotics upto 24 hrs post operatively and 3 days course of oral antibiotics. Dressing protocol and techniques for all patients remained same (Mepore dressing opened 72 hrs post-operatively and onwards changed 24 hourly). Sampling was non-probability consecutive sampling. Patients were divided into two equal groups of 355 each by lottery method. In group A, abdominal wound was irrigated with 300 ml of normal saline before closure of subcutaneous fat and skin. In group B, wound was not irrigated with normal saline before closure. In both groups subcutaneous fat was approximated with interrupted vicryl 2/0 sutures and skin was closed with interrupted prolene 3/0 sutures. All the surgeries were performed by same surgical team and patients were followed up till 30 days post-operatively to look for development of SSI. Wounds were graded as per Southampton wound grading system (Annex) and wounds fulfilling criteria of Class II and above were considered positive for SSIs. Contact numbers of patients were taken and all data was entered in the data collection performa. All collected data was analysed using statistical package for social sciences (SPSS) version 14. Mean and standard deviation was calculated for

Annex

Southampton scoring system

Grade	Appearance
0	Normal healing
I Normal healing with mild bruising or erythema:	
A	Some bruising
B	Considerable bruising
C	Mild erythema
II Erythema plus other signs of inflammation:	
A	At one point
B	Around sutures
C	Along wound
D	Around wound
III Clear or haemoserous discharge:	
A	At one point only (<2cm)
B	Along wound (>2cm)
C	Large volume
D	Prolonged (>3 days)
Major complication IV Pus:	
A	At one point only (<2cm)
B	Along wound (>2cm)
V Deep or severe wound infection with or without tissue breakdown; haematoma requiring aspiration	

The wound grading system used was simplified for the use of analysis.
By using the worst wound score recorded and information about any treatment instituted either in hospital or the community, wounds were regarded in four categories:
(A) normal healing;
(B) minor complication;
(C) wound infection-wounds graded IV or V or wounds treated with antibiotics after discharge from hospital, irrespective of the wound grading given to them by the nurse; and
(D) major haematoma-wound or scrotal haematomas requiring aspiration or evacuation.

quantitative variables like age. The categorical or qualitative variables like gender and wound infection were presented in terms of percentages and frequencies. Independent sample t-test was applied for the comparison of age between groups. Both groups were compared for wound infection (categorical value) applying Chi-Square test. A *p*-value ≤0.05 was considered statistically significant.

RESULTS

A total of 710 patients undergoing surgery falling under clean contaminated surgical wounds were recruited and were randomly divided into two equal groups of 355 each. The age distribution ranged from 15-74 years in the study. Minimum age was 15 years (n=1) and maximum age was 74 years (n=1) with mean age of 42.04 ± 13.28. Mean age in group A was 41.05 ± 13.14 while mean age in group B was 43.03 ± 13.35 (*p*-value 0.047). Out of total 710 patients, 63.8% (n=453) were males and 36.2% (n=257) were females. Gender wise distribution among the two groups is given in table-I. Among 453 males, 35 individuals developed SSIs; While among 257 females, 17 developed SSI with an insignificant *p*-value of 0.58 (table-II). SSIs were checked till 30th post op day. Group A revealed 4.5% (n=16) SSI rate as compared to group B which was 10.14% (n=36). The groups had a statistically significant difference in the frequency of SSI with a chi-square *p*-value 0.004. Comparison between frequencies is given in table-III.

Table-I: Gender distribution among groups.

Gender	Group		Total
	A	B	
Male	227 (63.9%)	226 (73.7%)	453
Female	128 (36.1%)	129 (36.3%)	257
Total	355	355	710

p-value 0.92.

Table-II: Comparison of male vs female in terms of SSI.

SSI	Gender		Total
	Male	Female	
Yes	35	17	52
No	418	240	658
Total	453	257	710

p-value 0.58.

Table-III: Comparison of saline irrigation versus conventional wound closure in terms of frequency of SSI.

Surgical Site Infection		Study Group		Total
		Group A (Saline Irrigation)	Group B (Conventional wound closure)	
Yes	N	16	36	52
	%	4.5%	10.14%	7.3%
No	N	339	319	658
	%	95.5%	89.8%	92.7%
Total	N	355	355	710
	%	100.0%	100.0%	100.0%

p-value 0.004.

DISCUSSION

SSI after abdominal surgery is a serious complication that continues to bedevil the surgeon and threaten the patient[9]. It is one of the most frequent postoperative complications worldwide and preventive measures are still an important research topic[10]. It has significant impact on health care cost, both for the patients and hospitals. Among SSIs, superficial SSI are most often associated with environmental contamination/surface contamination by bacteria and trials revealed that once there was no contamination in the operating room, no SSI was

detected[11]. Spillage of gut contents is the other major factor influencing rate of development of SSIs and high infection rates are not uncommon, especially in visceral surgery[7,10]. Local studies carried out in Pakistan revealed the SSI rates of 4.88% for clean cases, 8.39% for clean contaminated cases and as high as up to 20.45% for contaminated and dirty cases[6]. From time to time, multiple methods have been tried for SSI prophylaxis with variable results. Recently, trials are being conducted on various prophylactic measures to avoid SSIs, most common research topics being: use of antibiotic coated sutures and intra-operative surgical wound irrigation. Meta analysis revealed a decrease in overall SSI rates with use of antibiotic coated sutures (10.4%) versus controls where antibiotic coated sutures were not used (13.0%)[12].

Intra-operative surgical site irrigation (lavage) is a common practice in surgical procedures in general, with all disciplines advocating some form of irrigation before incision closure[5]. Incision irrigation affords a three-fold benefit: First, to hydrate the bed; second, to assist in allowing better examination of the area immediately before closure; and finally, by removing superficial and deep incisional contamination and lowering the bioburden and expedite the healing process. The clinical practice of intra-operative peritoneal lavage is highly variable and is dependent solely on surgeon preference. This practice, however, has been neither standardized nor is there compelling evidence that it effectively reduces the risk of SSIs. Moreover, consensus is yet to be achieved on the type of irrigant that is most effective in irrigation to reduce SSIs. Commonly used irrigants worldwide include gentamycin, chlorhexidine and isotonic saline. A meta analysis for role of gentamycin to reduce SSI in colorectal surgery was carried out and showed a decrease in wound infection rate in Western Europe[13]. Topical antiseptics, including chlorhexidine and pyodine-iodine, can have a cytotoxic effect on keratinocytes and may actually impede wound healing and are not recommended for use anymore[14]. Normal saline is universally available and a cost effective solution (compared to topical antibiotics) when used as wound irrigant. Being isotonic with normal human tissue it is hypertonic for bacteria and hence has an excellent safety profile when compared to chlorhexidine and pyodine-iodine solution. Keeping in view these properties we studied its effect on clean contaminated surgical wounds and compared it to controls where wound irrigation was not carried out.

Trials carried out in 2000 reported a significant decrease in wound infection rate in patients subjected to wound irrigation with 300 ml of normal saline peroperatively[15]. A systematic review and meta-analysis was conducted in 2015 to compare intra operative wound irrigation to no irrigation of wound, revealing significant decrease in SSI rate among patients undergoing intra operative wound irrigation[16]. Another comprehensive meta-anlysis was carried out including 59 randomized controlled trials to see the effectiveness of wound irrigation in terms of SSI's[16-18]. However, it revealed an absolute difference of 13 fewer SSIs per 1000 people treated with irrigation compared with no irrigation; hence, there was no clear difference in risk of SSI between irrigation and no irrigation (relative risk 0.87) in these trials. When compared to our study, we found statistically significant (*p*-value 0.004) decrease in wound infection rate with use of isotonic saline as wound irrigant intra-operativley.

Our study had certain limitations. Role of normal saline as irrigation agent was compared only to controls where no irrigant was used. Further trials are needed to compare its use with other irrigants including topical antibiotics. Moreover, we only studied its role in clean contaminated cases and future trials are needed to demonstrate its role in clean as well as contaminated and dirty surgical wounds. Furthermore, role of normal saline should be analysed among patients with diabetes mellitus and other immuno compromised states where there is risk of delayed wound healing (which

were excluded in our study groups). It is necessary to perform additional larger studies for standardization of the technique of wound irrigation to reduce post-operative surgical site infections.

CONCLUSION

The study presents a tendency for lesser frequency of wound infection rates in patients treated with intra-operative isotonic saline irrigation versus conventional wound closure without irrigation. Thus intra-operative wound irrigation with normal saline is superior to conventional wound closure without irrigation in terms of development of SSIs.

CONFLICT OF INTEREST

This study has no conflict of interest to be declared by any author.

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