RESEARCH ARTICLE

Role of Normal Saline Wound Wash and Subcutaneous Drain in Reducing Laparotomy Wound Infection: A Single-Center Study

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ABSTRACT

Background: Surgical site infections following laparotomy procedures present a major clinical challenge, particularly in developing countries where resources are limited. These infections lead to prolonged hospital stays, increased treatment costs, and significant patient morbidity. Effective yet economical prevention strategies are urgently needed in such healthcare settings. **Objective:** This study aimed to assess the effectiveness of normal saline wound wash and subcutaneous drain placement in reducing laparotomy wound infections. **Methods:** We conducted a prospective cross-sectional study on 423 laparotomy patients at Ibn Sina Medical College Hospital, Dhaka, Bangladesh, selected through purposive sampling. The duration of the study was from January 2016 to July 2019. All enrolled patients received standardized normal saline wound irrigation and subcutaneous drain placement per operatively. Surgical site infections were diagnosed using CDC criteria, and data analysis was performed using SPSS version 23.0 with appropriate statistical tests. **Results:** The study found a 14.2% SSI rate (60/423 cases), with extended subcutaneous drainage (>48 hours) showing significantly lower infections (8.9% vs 19.3%, p=0.002). Diabetes (OR=2.31, p=0.011) and emergency surgery (OR=1.87, p=0.024) were key risk factors. The intervention group had 52% lower SSI risk and shorter hospitalization (5.8 vs 7.3 days, p<0.001) versus controls. **Conclusion:** Combined normal saline irrigation and subcutaneous drainage effectively reduces laparotomy wound infections in resource-limited settings. This low-cost protocol should be integrated into routine surgical practice, particularly where advanced wound wash is unavailable, to improve outcomes and reduce healthcare burdens.

Keywords: Infection, laparotomy, Subcutaneous drain, Surgical site infection, Wound.

INTRODUCTION

Surgical site infections (SSIs) represent a major complication following abdominal surgeries, accounting for approximately 20% of all healthcare-associated infections in developing countries [1]. Following laparotomy procedures, reported SSI rates vary from 8% to 30% across different healthcare settings, with particularly high rates observed in low-resource environments [2,3]. Laparotomy wound infections pose a major challenge in Bangladesh due to high rates of surgical site infections, limited infection control practices, and emerging antibiotic resistance, particularly in

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low-resource healthcare settings. [4]. The microbiology of SSIs typically involves contamination with hospital-acquired pathogens, with Staphylococcus aureus, Escherichia coli, and Klebsiella species being most frequently cultured from infected laparotomy wounds [5]. Multiple risk factors contribute to SSI development, including patient characteristics (diabetes mellitus, obesity, malnutrition), surgical factors (operation duration, emergency procedures), and postoperative care practices [6,7]. While antibiotic prophylaxis has become standard practice, its effectiveness is increasingly compromised by antimicrobial resistance patterns and inconsistent adherence to guidelines [8]. Wound management techniques play a crucial role in SSI prevention. Normal saline (0.9% sodium chloride) remains the most commonly used irrigation solution due to its physiological compatibility, low cost, and widespread availability [9]. Comparative studies have demonstrated that saline irrigation is equally effective as antiseptic solutions for wound cleansing, while less damaging to healing tissues [10]. Combining thorough irrigation with subcutaneous drainage has shown particular promise, as drains help eliminate dead space and prevent fluid accumulation that could promote bacterial growth [11,12]. Despite existing evidence, optimal wound wash strategies for laparotomy patients in resource-constrained settings remain inadequately studied. Most research in developing countries has focused on antibiotic protocols rather than comprehensive wound management approaches [13,14] In a study where preliminary data show SSI rates following laparotomy exceeding 20%, there was a pressing need for evidence-based, cost-effective interventions [15]. This study evaluates the effectiveness of a combined approach using normal saline wound wash and subcutaneous drainage in reducing SSI rates following laparotomy procedures. We hypothesize that this simple, inexpensive intervention will significantly decrease postoperative infection rates compared to conventional practices. The findings aim to provide practical guidance for surgical teams working in similar resource-limited environments.

METHODOLOGY

This prospective cross-sectional study was conducted at Ibn Sina Medical College Hospital, Dhaka, Bangladesh, from January 2016 to July 2019. A total of 423 patients undergoing elective and emergency laparotomy procedures were enrolled using purposive sampling. Inclusion criteria comprised patients aged ≥18 years with clean-contaminated or contaminated wounds (CDC classification), while immunocompromised patients and those with pre-existing infections were excluded.

All participants received standardized wound management:

- Intraoperative: Subcutaneous space irrigation with 500-1000 mL warmed (37°C) normal saline using pulse lavage technique
- Postoperative: Placement of closed suction subcutaneous drain (size 10-12 Fr) maintained for 48-72 hours
- Dressing protocol: On the 4th or 5th post-operative day, inspect the wound and apply a sterile dressing again.

Surgical site infections were diagnosed per CDC criteria (2016) [16] within 30 postoperative days. Data on demographics, operative details (duration, type), and infection markers (erythema, oedema, purulence, culture reports) were collected prospectively. Statistical analysis was performed using SPSS 23.0, employing chi-square tests for categorical variables and logistic regression ($p<0.05$ considered significant).

RESULT

The prospective analysis of 423 laparotomy cases revealed significant outcomes from the combined normal saline wound wash and subcutaneous drainage protocol. The cohort comprised 246 males (58.2%) and 177 females (41.8%), with a mean age of 45.3 ± 14.1 years. Comorbidities included diabetes (102 cases, 24.1%) and obesity (79 cases, 18.7%), both showing significant associations with outcomes ($p=0.028$ and $p=0.013$, respectively). Emergency procedures (264 cases, 62.4%) predominated over elective surgeries (159 cases, 37.6%, $p=0.124$). The intervention demonstrated substantial clinical impact, with an overall SSI rate of 14.2% (60 cases) - significantly lower than institutional historical data (18.7%, $p=0.001$). Stratified analysis showed superior outcomes with extended drain duration (>48 hours: 8.9% SSI vs ≤48 hours: 19.3%, $p=0.002$). Microbiological profiling of 56 culture-positive cases identified Staphylococcus aureus (18 isolates, 32.1%, $p=0.042$) as the predominant pathogen, followed by Escherichia coli (16 isolates, 28.6%, $p=0.057$). Multivariable regression confirmed diabetes (OR=2.31, 95% CI:1.42-3.76, $p=0.011$), emergency status (OR=1.87, 95% CI:1.12-3.31, $p=0.024$), and prolonged operation time (OR=2.14, 95% CI:1.29-3.41, $p=0.003$) as independent risk factors. The intervention group showed significantly shorter hospitalization (5.8±1.9 days vs 7.3±2.4 days, $p<0.001$) compared to controls.

Table 1: Demographic and Clinical Characteristics

Type	n	%	p-value
Male gender	246	58.2%	0.148
Diabetes mellitus	102	24.1%	0.028*
BMI ≥30	79	18.7%	0.013*

*Chi-square test used for categorical comparisons

Table 2: Surgical Procedure Details

Type	n	%	p-value
Emergency surgery	264	62.4%	0.124
Elective surgery	159	37.6%	0.124
GI procedures	287	67.8%	0.078

*Fisher's exact test used for comparisons

Table 3: SSI Classification

Type	n	%	p-value
Superficial SSI	38	9.0%	0.031*
Deep/organ-space	22	5.2%	0.031*

*McNemar's test for paired proportions

Table 4: Drain Duration Outcomes

Duration	SSI cases	SSI rate	p-value
≤48 hours	42	19.3%	0.002*
>48 hours	18	8.9%	0.002*

*Logistic regression adjusted for comorbidities

Table 5: Microbiological Isolates

Organism	n	%	p-value
S. aureus	18	32.1%	0.042*
E. coli	16	28.6%	0.057
MDR organisms	13	23.8%	0.013*

*Chi-square test for pathogen distribution

Table 6: Risk Factor Analysis

Factor	Adjusted OR	95% CI	p-value
Diabetes	2.31	1.42-3.76	0.011*
Emergency surgery	1.87	1.12-3.31	0.024*
Op time >2 hours	2.14	1.29-3.41	0.003*

*Multivariable logistic regression

Table 7: Comparative Outcomes

Group	SSI rate	p-value	Hospital stays (days)	p-value
Intervention	9.5%	0.001*	5.8 ± 1.9	<0.001*
Historical control	18.7%	0.001*	7.3 ± 2.4	<0.001*

DISCUSSION

The findings of this study demonstrate that a combined approach of normal saline wound irrigation and subcutaneous drainage effectively reduces surgical site infection rates following laparotomy procedures. Our observed SSI rate of 14.2% compares favorably with rates of 18-26% reported in similar resource-limited settings during this period [1,17]. The significant reduction in infection risk (52% lower than controls) achieved through this simple, low-cost intervention is particularly relevant for surgical practice in developing nations where advanced wound wash technologies are often unavailable. The benefits of extended subcutaneous drainage duration (>48 hours) seen in our study (8.9% vs 19.3% SSI rate, p=0.002) align with previous research demonstrating that prolonged drainage reduces fluid accumulation and subsequent infection risk [18]. A multicenter study from Southeast Asia similarly found that maintaining drains for at least 48 hours decreased SSI rates by approximately 40% [19]. The microbial patterns we observed, with Staphylococcus aureus (32.1%) and Escherichia coli (28.6%) predominating, reflect well-documented surgical infection profiles in tropical environments during this decade [5]. Several key findings merit emphasis. First, the strong association between diabetes and SSI risk (OR=2.31, p=0.011) supports earlier research highlighting the importance of glycemic control in surgical

populations [6]. Second, the elevated SSI risk in emergency procedures (OR=1.87, p=0.024) confirms previous reports about the challenges of contaminated cases in abdominal surgery [7]. Third, the significant reduction in hospital length of stay (5.8 vs 7.3 days, p<0.001) reinforces the health system benefits of SSI prevention that were increasingly recognized during this period [20]. Our results compare favorably with contemporaneous studies evaluating more expensive interventions. The 9.5% SSI rate achieved through basic measures approaches the 7-10% rates reported for some advanced wound therapies in high-income settings [21], suggesting that proper implementation of fundamental techniques can yield substantial benefits. The finding that operative duration >2 hours independently predicted SSI (OR=2.14, p=0.003) aligns with surgical quality metrics being developed during this timeframe [2]. These findings have important implications for surgical practice in resource-limited settings. The protocol's simplicity - requiring only saline solution and basic drains - makes it particularly suitable for widespread adoption in district hospitals [22]. Training programs developed during this period demonstrated that proper irrigation technique and drain management could be effectively taught to surgical teams at all levels [23].

LIMITATIONS

This single-center study used historical controls rather than concurrent randomization. Microbiological sampling was incomplete, potentially underestimating pathogen diversity. The findings may not generalize to all surgical settings. The limitations suggest caution in interpreting the results.

CONCLUSION

The combined use of normal saline wound irrigation and subcutaneous drainage significantly reduced laparotomy SSI rates compared to standard care in this resource-limited setting. This simple, cost-effective protocol demonstrates that basic surgical interventions can substantially improve outcomes when properly implemented. The approach warrants consideration for broader adoption in similar environments where advanced wound wash technologies are unavailable.

RECOMMENDATION

Implement standardized wound irrigation and drainage protocols in resource-limited surgical settings. Train surgical teams in proper technique. Conduct multicenter trials to validate findings. Prioritize this low-cost intervention in national surgical safety programs. Monitor long-term outcomes following implementation.

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