Surgical site infection and role of intraoperative wound irrigation with antibiotics.

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Abstract : Background: Patients undergoing midline laparotomies with contaminated and dirty surgical incision wounds were studied to determine the effectiveness of antibiotic wound irrigation in preventing surgical site infection (SSI).
Methods: This pilot study included all patients who underwent abdominal surgery with class-IV dirty and class III (contaminated) surgical incisions, as defined by the CDC (Center for Disease Control and Prevention). Patients for the study were split into an irrigation group given antibiotics and a control group. After the rectus sheath was closed in the control group, the wound was irrigated with 100 mL of normal saline prior to skin closure. Following rectus sheath closure, the wound in the antibiotic irrigation group was irrigated with Ceftriaxone (10 mL) and Metronidazole (100 mL).The frequency, severity, and duration of hospital stay of SSI were evaluated for the two groups.
Results: The study involved 20 patients in all, 10 in each group. In terms of age, gender, comorbidities, and grade of surgical wound, both groups were comparable. When compared to the control group, the incidence of SSI was lower in the antibiotic irrigation group (10% versus 30%; p=0.06). However, there was no statistically significant change. The hospital stays in the two groups were about the same length (12.5 vs. 14.5 days; p=0.74). Additionally, there was no discernible difference in the two group's pain scores.
Conclusions: When compared to saline irrigation, antibiotic irrigation reduces the risk of surgical site infection (SSI) while maintaining a similar hospital stay and postoperative discomfort in patients with contaminated and dirty surgical wounds. Nonetheless, there was no statistically substantial change.

Keywords Surgical site infection. Abdominal surgery . Wound irrigation . Antiseptic solutions . Topical antibiotics

Introduction:
The management of class III-contaminated and class IV-dirty surgical wounds raises serious concerns about surgical site infection (SSI), which increases postoperative morbidity, lengthens the average duration of hospitalisation, dramatically raises the cost of health care, and lowers quality of life.[1] SSI can occur at various rates depending on the type and location of surgery. Many participants are susceptible to developing long-term problems like incisional hernia, wound gapping, and hypertrophic scars as a result of the infections, obvious tissue loss and delayed wound healing. [2] Therefore, it is critical to take action to prevent SSI.
The research has accounted for a variety of techniques to reduce surgical site infection rates in contaminated and dirty abdominal wounds, including preoperative antiseptic skin preparation, preoperative hair removal at the required site, local intra-operative wound irrigation (IOWI), and use of topical antibiotics/antiseptics.[3] But according to several studies, the reported risk of wound infection in Class III and Class IV surgical wounds still escalates by up to 40%.[1]
Due to the obvious increased frequency of wound infection in surgical incision wounds caused by larger intraluminal bacterial amounts, it makes sense to use antibiotic irrigation to lessen bacterial wound contamination and remove blood clots and necrotic tissue from the wound. Additionally, wound irrigation helps the healing process move forward.
Even though it has been suggested that washing with antibiotic solutions is beneficial in the prevention of infection, no concrete evidence-based suggestions can be made until more information from superior clinical trials is made available. [4] In fact, consistent use of IOWI in conjunction with topical antibiotics or antiseptics may have negative consequences, cause tissue toxicity from the antiseptics, and build bacterial resistance.
The majority of research investigations, along with a few well designed trials, had been done on open appendectomies and midline laparotomies.
It's crucial to pick the right antibiotic while irrigating a wound. Enterobacteriaceae and Bacteroides are the most often isolated microorganisms from SSI of polluted and filthy wounds. [5-6] Third-generation Cephalosporin antibiotics like Cefixime and metronidazole are recommended as part of the patient's recommended antibiotic prophylaxis in these cases.[7-9]
Therefore, the purpose of this study is to determine how well intraoperative antibiotic wound irrigation (IOWI) works to stop the spread of wound infection in class III and class IV surgical wounds with midline incisions.

Methods:
This pilot study is conducted in a tertiary care facility in Maharashtra over the course of six months.
Inclusion criteria
Patients who had undergone exploratory laparotomies for abdominal pathology and who, according to the classification system used by the Centers for Disease Control and Prevention, fell into the categories of class III contaminated wounds and class IV dirty abdominal wounds are included in this study.
Exclusion criteria
Patients not included in the study include:

1. Those individuals who fall under the pediatric age category (ie patients under the age of 12 years)

2. Individuals who are geriatric patients (ie patients above the age of 70 years)
3. Diabetics with uncontrolled blood sugar level.
4. Prior to receiving patients to our tertiary care, those who were primarily treated with antibiotics.
5. Patients for whom primary incision closure is not feasible
6. Patients who required re-exploration owing to underlying pathology or who passed away from the illness during the same hospital stay were also excluded from consideration.

After carefully outlining the risks, advantages, goal, and research methods to the patient, their informed consent was acquired. All patient treatment data was gathered and kept private, from the time of admission to release. In this study, the Declaration of Helsinki was observed. The sample size was chosen to be 10 in each group after taking into account all factors, including the time period and the area around the tertiary care center. Two groups of study participants were created: the control group received antibiotic solution or povidone-iodine during surgery, and the control group which did not receive intraoperative povidone-iodine and antibiotic wash.

According to the inclusion and exclusion criteria, all patients who underwent exploratory laparotomy and were included in the study were categorized into contaminated (Class III) or dirty wounds (Class IV).

One hour before surgery, patients received prophylactic doses of antibiotics (3rd generation cephalosporin and/or metronidazole).

Basic procedures like preoperative skin painting with povidone iodine-prep and spirit were carried out in both groups (cases and controls). A preliminary laparotomy was conducted along with the necessary conventional surgical procedure. If necessary, abdominal drains were kept. Peritoneum was sutured as usual. Layers of the anterior abdominal wall were sutured together, and the rectus sheath was continuously closed with ethilon/nylon 0. Vicryl 2-0 subcutaneous sutures were used (round body).

In the saline irrigation group (IOWI), the incision was washed in roughly 100 mL of normal saline before the skin was sutured together. After the rectus sheath was closed, the wound in the antibiotic irrigation group was bathed in a solution of Ceftriaxone (1gm/10mL) and Metronidazole (100 mL), as well as a local application of povidone iodine solution was done.

After irrigating the wound, skin closure was carried out using the interrupted-vertical mattress technique with 2-0 ethilon/nylon (45 mm reverse cutting needle). After the skin was closed, a povidone-iodine solution was used to clean the suture line. Over the suture line, sterile gauze dressing was applied. On the first or second postoperative day, the dressing covering the suture line was taken off to check for any immediate suture site issues.

After 48 hours, the incisions in both groups were evaluated. Infected wounds were immediately opened and usually packed. Wounds that seemed to be infected were closely monitored, and if purulent drainage, escalating erythema, induration, or warmth appeared, they were opened. Both groups underwent daily dressing changes and wound inspections. According to CDC guidelines, SSI was defined in both groups.

The SSI incidence and SSI severity (superficial incisional/deep incisional) in each group were the primary objectives. Two groups' hospital stays were compared in terms of length.

Statistical analysis

Using the chi-square test, a number of covariates, including the laparotomy wound class (Class III, Class IV), gender, comorbidities (excluding diabetes mellitus), immunosuppression, hypertension, and pulmonary tuberculosis, were evaluated for any associations with wound infection.

A p value of<0.05 was considered statistically significant for all statistical analyses.

Results: Twenty patients in all took part in the study, with 10 in the control group receiving normal saline irrigation on the wound and 10 in the antibiotic with povidone-iodine group receiving irrigation with third generation cephalosporin and metronidazole on the wound. Patients in the control group ranged in age from 18 to 60, with a mean age of 45. The patients in the antibiotic group ranged in age from 18 to 70, with a median age of 49. The majority (50%) of the study participants had perforated peptic ulcers. Ileal perforation affected 1 patient. Small bowel obstruction affected 2 patients. Sigmoid volvulus affected 1 patient. One patient developed mesenteric ischemia-related gangrenous bowel.

In the control group, 2 patients (20%) and 8 patients (80%) had class III wounds and class IV wounds, respectively.

One patient (10%) and nine (90% of the patients in the antibiotic group) had class III wounds and Class IV wounds, respectively. Seven of the patients in the control group (70%) had no comorbidities, two (10%) had hypertension, and one (10%) had tuberculosis. Eight patients in the antibiotic group had no comorbidities, one had hypertension (10%), and two had received chemotherapy (20%).(Table1).

Table 1: Variables in research population in the given demographic area.

	Antibiotic group (n=10)	Saline irrigation group (n=10)	p-value
Age of patient	49	45	0.52
Gender male (N%)	7 (70%)	6 (60%)	0.51
Comorbidities (N%)	2 (20%)	3 (30%)	0.89
Class of wound - dirty contaminated wound (N%)	9 (90%)	8 (80%)	0.34

The frequency of surgical site infection (%) between groups [30% versus 10%: p=0.06] by chi square test was not found to be statistically significant.

Table no. 2 Comparison of wound infection within the groups

Surgical site infection	Antibiotic irrigation group (N=10)	Saline group (N=10)	p-value
Yes (N%)	1 (10)	3 (30)	0.06
No (N%)	9 (90)	7 (70)	0.06

The average stay in hospital of patients within both groups was [12.5 days +/- 7 days v/s 14.5 days +/- 8 days: p value=0.7] which was not significant statistically.

Discussion:

A frequent yet serious side effect of surgical intervention is surgical site infection. Post-op infection frequently necessitates a second operation and a lengthier hospital stay, and it may result in less than ideal surgical results. [7] Prior to skin closure, prophylactic IOWI has been recommended to reduce wound contamination and the risk of surgical site infection.

However, there are no specific recommendations backed by data that can be used. [8] Additionally, the methods for irrigation with antibiotic solution concentration, application volume, and application time are not standardized. It would have been suggested by now to standardize the use of antibiotics in surgical site irrigation and to use them frequently prior to skin closure had it shown that irrigating the surgical site with antibiotics reduced the incidence of SSI.

This research was thus carried forward to discover the role of IOWI with antibiotics and povidone iodine solution in decreasing surgical site infection in Class III and Class IV wounds.

In the current research it was found that the surgical site infection was less in the antibiotic irrigated group compared to the control group, yet, the difference between the two groups was not statistically significant.

IOWI with antibiotics and povidone iodine presents to be a logical measure to decrease bacterial contamination in surgical site and clean the wound from blood clots and necrotic tissue. Parcells et al compared the surgical site irrigation with saline, povidone-iodine solution and antibiotic (Imipenem) and found significant lesser wound infection in antibiotic group.[9]

There have been concerns raised about avoiding infection and epidemiology control studies; they indicated that the current evidence is sufficient to rule out irrigation of the surgical site due to variations in antibiotic, amount, irrigation time, and frequency. [10]

When IOWI with antibiotics and povidone is advised to focus on specific infections to anticipate the financial benefit, the contemporary meta-analysis by Muller et al. showed a significant decrease in the frequency of wound infection. [11] The number of patients included in the study was smaller than expected since a larger number of patients could make up for the tiny change in the rate of surgical site infection caused by the time duration cloud.

One of the key variables that influences the entire cost of healthcare, loss of manpower, patient satisfaction, and overall quality of life is the length of the hospital stay. The primary pathology for which the patient underwent surgical intervention, general nutrition and condition of the patient, presence or absence of septic foci, requirement for ventilator support, and presence and grade of surgical site infection are just a few of the factors that influence how long a patient stays in the hospital.

Numerous studies have shown that having a surgical site infection significantly lengthens the time spent in the hospital.

According to Alphonso et al research, patients with wound infections were staying in the hospital longer and consuming more hospital resources as a result. [12] Participants in this study who had wound infections spent more time in the hospital overall. However, there was no significant difference in the length of hospitalization between the IOWI with povidone iodine and the antibiotics group as compared to the control group. The slight decline might potentially be the result of both groups having fewer surgical site infections than that needed for statistical significance.

Both groups experienced similar post-operative pain at the incision site.

Post Op pain is influenced by a number of factors, including the type of incision, class of wound, depth of dissection, presence of infection at the surgical site, patient nutrition and build, immune response, and pain threshold.

In this study, the control group, which received no antibiotics or povidone iodine irrigation, did not have significantly higher rates of wound infection severity, surgical site infection severity, or length of hospital stay. The similarity in visual analogue scores between the two groups must be the result of minute variations in the factors that almost certainly influence postoperative pain.To examine the shift in the amount of pain reduction in the control group (antibiotic irrigation), a larger sample size may be more informative.

Conclusion:

Increasing the sample size In patients with Class III and Class IV surgical incision wounds, comparing the two groups (i.e., saline irrigation and antibiotic irrigation) may result in a lesser surgical site infection with equal hospitalization and postoperative pain. However, no evidence that was statistically strong enough to support a substantial difference between the two groups was found.

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