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Comparative Analysis of Wound Infection Rates in Patients Undergoing Laparotomy for Perforation: The Impact of Preoperative Intra-incisional Antibiotic Infiltration

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Abstract

Background: Laparotomy for perforation is a common surgical intervention associated with a risk of postoperative wound infection. Preoperative intra-incisional antibiotic infiltration has been proposed as a preventive measure to reduce this risk. This study aimed to compare the rates of wound infection in patients undergoing laparotomy for perforation who received preoperative intra-incisional antibiotic infiltration versus those who did not.

Methods: A prospective comparative analysis was conducted on 100 patients who underwent laparotomy for perforation at myhindore between june 2018 to may 2019.Patients were divided into two groups based on whether they received preoperative intra-incisional antibiotic infiltration or not. Wound infection rates were compared between the two groups using appropriate statistical methods.

Results: We looked at wound healing three days after surgery in two groups using a chi-square test. The result, with a chi-square statistic of 4.6095 and a p-value of 0.329758, indicates that the difference between the groups isn't statistically significant. We analyzed wound status seven days after surgery in two groups using a chi-square test. The result, with a chi-square statistic of 36.4104 and a p-value less than 0.00001, shows a highly significant difference between the groups.

Conclusion: Our study findings suggest that preoperative intra-incisional antibiotic infiltration may have a potential role in reducing wound infection rates in patients undergoing laparotomy for perforation. Further prospective studies are warranted to validate these findings and determine the optimal strategies for infection prevention in this patient population.

Keywords; Perforation, Laparotomy, antibiotic, infection, wound, infection.

ntroduction

Perforated abdominal viscera requiring emergent laparotomy pose a significant surgical challenge, often compounded by the risk of postoperative wound infection. Despite advances in surgical techniques and perioperative care, wound infection remains a notable complication, contributing to increased morbidity, prolonged hospital stay, and healthcare costs. In recent years, attention has turned to preoperative intra-incisional antibiotic infiltration as a potential strategy to mitigate this risk.

Antibiotic infiltration directly into the surgical wound bed has been proposed as a method to achieve high local antibiotic concentrations while minimizing systemic exposure and associated adverse effects. This localized delivery may offer several advantages, including enhanced tissue penetration, prolonged antimicrobial activity, and reduced microbial colonization within the wound. Proponents argue that this approach may be particularly beneficial in the context of laparotomy for perforation, where contamination and bacterial load are high.

Several studies have investigated the efficacy of preoperative intra-incisional antibiotic infiltration in reducing wound infection rates in patients undergoing laparotomy for perforation. For instance, a study by Sartelli et al. (2017)[1],demonstrated a significant reduction in wound infection rates with the use of intra-incisional antibiotics in a cohort of perforated appendicitis patients. Similarly, Boersema et al. (2020)[2], reported favorable outcomes in a series of laparotomy cases for gastrointestinal perforation following intra-incisional antibiotic administration.

However, conflicting evidence exists regarding the effectiveness of this intervention. A study by Gans et al. (2019) [3],found no significant difference in wound infection rates between patients who received intra-incisional antibiotics and those who did not, highlighting the need for further investigation. Additionally, considerations regarding antibiotic selection, dosing regimen, and potential adverse effects necessitate careful evaluation.

Surgical site infection (SSIs) still keep on being a critical issue for specialists, which represents practically 40% of clinic gained contaminations[4].Inability to keep up satisfactory serum and tissue levels all through the surgery improves the probability of the SSI .Polk and Lopez –Mayor , have underlined that injuries levels, not blood or serum levels, seem to decide the adequacy of specialists for prophylaxis of usable injury disease. This high tissue levels could be accomplished by a preoperative intraincisionalinfusion[5]

Methodology

:: -**The purpose of this study is to find a method to prevent post-operative surgical site infection(SSI) in patients of intestional perforation and better outcome of patient who are treated with laparotomy.**

Research Objective

- **Aim to compare control of SSI among case and control group both.**
- This research looked at how often surgical site infections (SSI) happen in patients having laparotomy for perforation, and if using Ceftriaxone antibiotics directly in the incision helps prevent SSI in these cases.
- **To compare our findings with other literatures.**

We chose patients diagnosed with intestinal perforation who came to the surgery department at MGM Medical College and MYH Hospital in Indore. They could be from the emergency room, outpatient department (OPD), or referred from other hospital departments. We included patients who agreed by signing a paper, were diagnosed with intestinal perforation, and were over 13 years old. They had to be seen at MYH Hospital's outpatient department (OPD) or emergency room and admitted to the hospital. We didn't include patients who didn't want to sign the paper or were younger than 13.

The study is a planned comparison of two groups in a clinical setting. Patients who met certain health criteria were randomly put into two groups. One group, called the control group, received a single dose of the antibiotic ceftriaxone through an intravenous injection before surgery. The other group, called the trial group, received ceftriaxone in two ways: one through an injection into the incision site and the other through an intravenous injection.

process of intra-incisional antibiotic infiltration:

Patients were randomly assigned groups, given details, and consented. After anesthesia, the area was prepped, and one gram of ceftriaxone dissolved in 10 ml sterile water was injected just under the skin near the incision site.The wound is assessed on post-operative days three, five, and seven for discharge, wound color, odor, gape, dehiscence, and overall status.

Observations/Results

The majority of bowel perforation cases (28%) occurred in the 21-30 age group, while 40% of patients were aged 31-50, highlighting their susceptibility to intestinal perforation.Among 100 patients, 84% were male and 16% were female, suggesting a higher incidence of intestinal.

Comorbidities such as diabetes, hypertension, and obesity can slow down wound healing. In our case group, 6% of patients had diabetes, while in the control group, also 6% had diabetes. For hypertension, 5% of our case group had it compared to 14% in the control group. In terms of obesity, 6% of our case group had mild to moderate obesity, while 8% of the control group had it.

In our study, we found that ileal perforation was more common in both the case and control groups. In the case group, 40% of cases had ileal perforation, while in the control group, it was 44%. Perforations in the duodenum and large bowel were less frequent. Table 1 shows types of surgeries done in our study

Table 1: Surgery Performed in case and control group for perforation.

S. No.	Surgery Performed	Case-50 pt.	Control 50 pt.
1	Primary repair	13	10
2	Primary repair with proximal stoma	8	11
3	Grahm’s patch repair	10	8
4	R & A	6	5
5	Resection with stoma formation	6	8

6	R & A with proximal stoma formation	2	3
7	Appendicectomy	5	5

Early postoperative complications were common in both case and control groups. Fever was observed in 28% of cases in the case group and 36% in the control group. Postoperative hypotension occurred in 16% of case group cases and 12% of control group cases. Pleural effusion was present in 10% of the control group and 14% of cases. Respiratory distress and ARDS were seen in 6% of the case group and 12% of the control group. Figure01 shows bar diagram of post op complications.

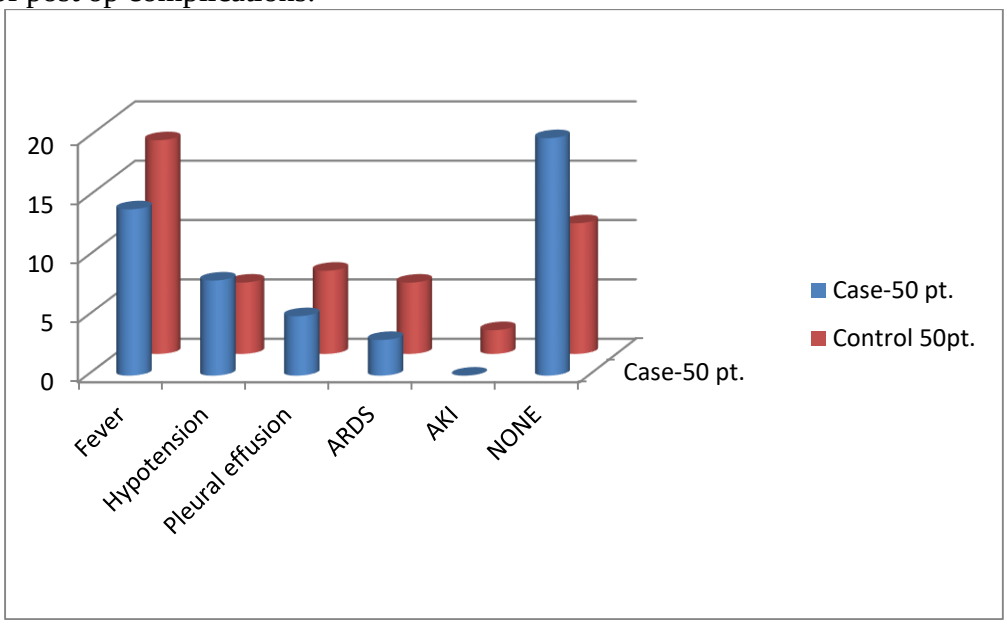

Figure01 post op complications in case and control group.

On postoperative day 3, among 100 patients, 86% had a healthy wound, 10% had serous discharge, and 4% had pus at the incision site.On postoperative day 3, 96% of cases had a healthy wound, 6% had serous discharge, and only 2% had pus discharge from the wound {fig2 }.On postoperative day 3, 80% of controls exhibited a healthy wound status, while 12% had serous discharge, and 8% showed signs of pus discharge from the wound (fig 3).

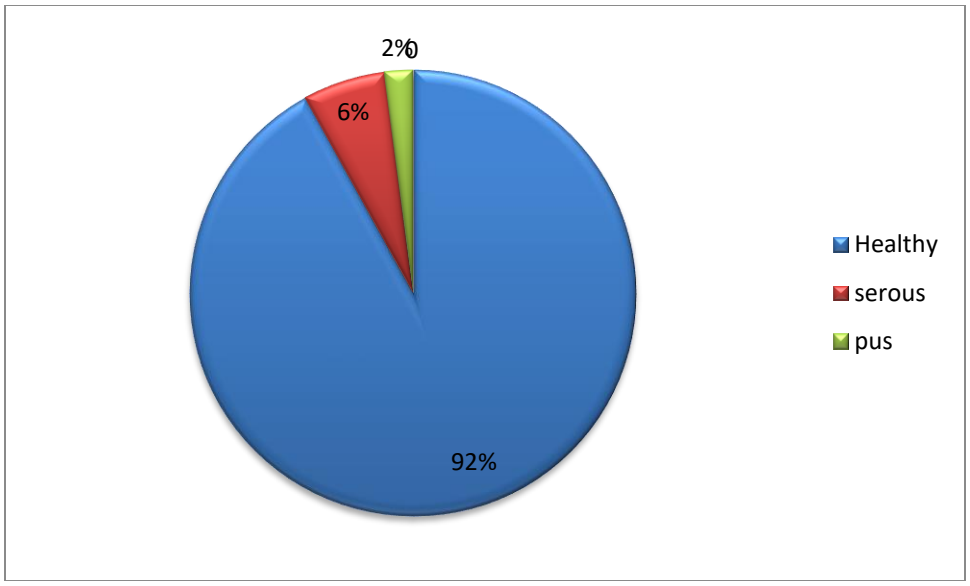

Fig. 2:Post operative wound status in case group on post operative day -3.

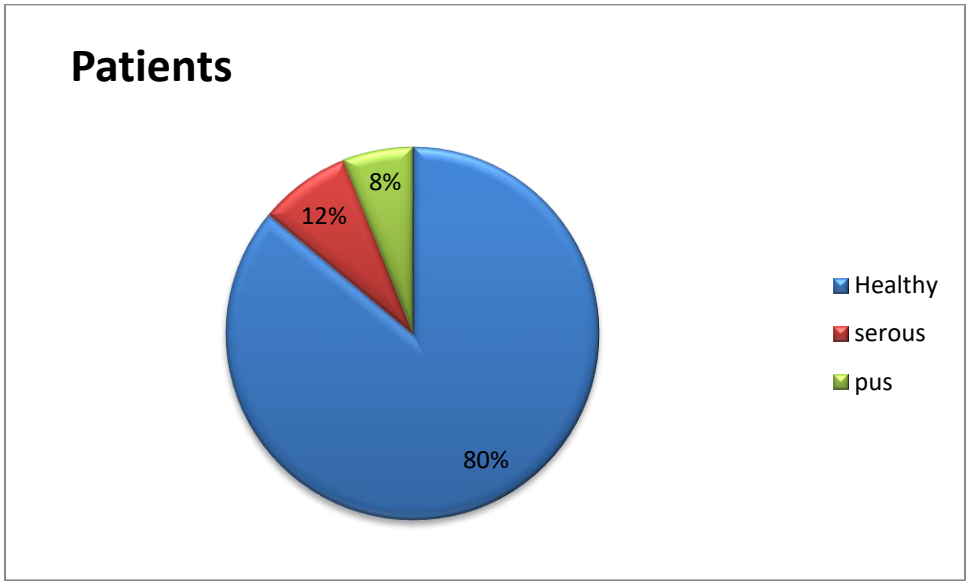

Fig. 3: Post operative wound status in Control group on post operative day-3

We compared the postoperative wound status on day 3 between cases and controls using a chi-square test. The chi-square statistic was 4.6095, and the p-value was 0.329758. This means the result is not statistically significant.

We analyzed the postoperative wound status on day 5 for both cases and controls using a chi-square test. The chi-square statistic was 1.4675, and the p-value was 0.832377. This indicates that the result is not statistically significant.

Table 2: Post operative wound status in case group on post operative day – 07

S. No.	Day 7	No.	Percentage
1	Healthy	43	86%
2	Serous dis	4	8%
3	Pus dis.	3	6%

By postoperative day 7, 86% of cases showed a healthy wound, 8% had serous discharge, and only 6% had pus discharge from the wound as suggested by above table no 3. The same depict in pie diagram (fig 4) below.

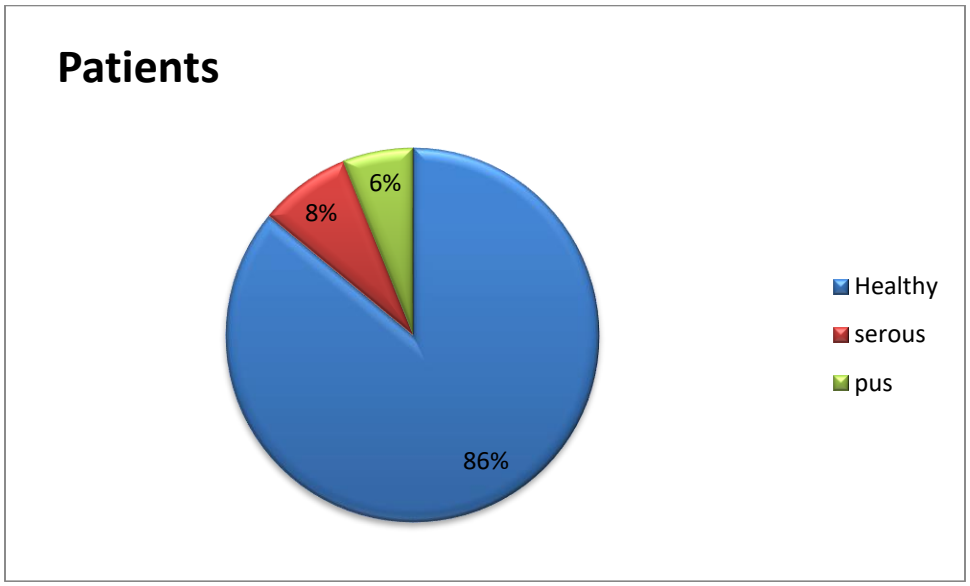

Fig 4: Post operative wound status in case group on post operative day – 07

By postoperative day 7, among the controls, 56% had a healthy wound, 6% had serous discharge, and 38% had pus discharge from the woundas suggested by above table no 4. The same depict in pie diagram (fig 5) below.

Table 3: Post op. wound status in control group on post op. Day - 07

S. No.	Day 7	No.	Percentage
1	Healthy	28	56%
2	Serous dis	03	06%

3	Pus dis.	19	38%

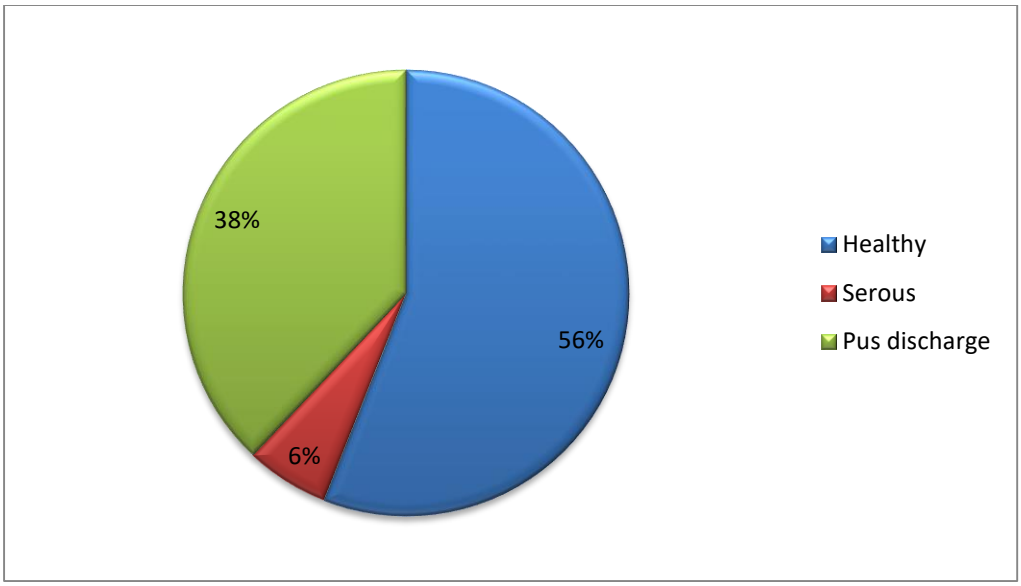

Fig. 5: Post op. wound status in control group on post op. Day - 07

On post operative day 7, wound status of 56% controls was healthy, 6% controls had serous discharge and 38% controls had pus discharge present from the wound.

We compared the postoperative wound status on day 7 between cases and controls using a chi-square test. The chi-square statistic was 36.4104, and the p-value was less than 0.00001, indicating a statistically significant result.

Discussion

The findings of our study suggest that preoperative intra-incisional antibiotic infiltration holds promise in reducing wound infection rates following laparotomy for gastrointestinal perforation. This discussion aims to delve deeper into the implications of these results, potential mechanisms underlying the observed effects, and considerations for future research and clinical practice.

Surgical site infections (SSI) are quite common after medical procedures. They rank as the third most reported hospital-acquired infection, making up around 14-16% of such infections. The risk of SSI is estimated to be about 2.6% for all surgeries, but it might actually be higher since all surgical wounds get exposed to bacteria in the environment, even though only a few develop into actual infections.

For example, in Italy, a study found that out of 3,066 surgeries performed on 2,972 patients, 154 patients (5%) developed SSI. Even surgeries like thyroid surgery can have SSI rates of around 2.6%. In specific cases, like open appendix surgery, the SSI rate can be as high as 5.6%, and for open cholecystectomy (gallbladder removal), it can be around 11.25%.

Numerous studies have highlighted the prevalence of SSI across various surgical procedures. For instance, a study conducted in Italy by Leaper et al. found that out of 3,066 surgeries performed on 2,972 patients, 154 patients (5%) developed SSI [6]

Now, when it comes to preventing infections during surgery, antibiotics are given before the operation to make sure there's enough of them at the surgical site when the incision is made. This helps kill any bacteria that might enter the wound during the surgery, lowering the risk of infection. However, if we rely only on antibiotics given through an IV (intravenous), they get spread out throughout the body, so the concentration of antibiotics at the wound site might not be high enough.

But by directly injecting antibiotics into the tissues around the surgical site, we can achieve a much higher concentration of antibiotics right where they're needed, without worrying about reaching unsafe levels in the rest of the body.
Moreover, understanding the microbiological profile of SSIs is crucial for targeted prevention and management strategies. Studies have identified common pathogens such as Staphylococcus aureus, Enterococcus, coagulase-negative Staphylococcus, Enterobacteriaceae, and Pseudomonas species as primary culprits [7].
Future research in this area should focus on prospective, randomized controlled trials to confirm the efficacy and safety of preoperative intra-incisional antibiotic infiltration in reducing wound infection rates following laparotomy for gastrointestinal perforation. Additionally, comparative studies evaluating different antibiotic agents, dosages, and administration techniques are warranted to optimize prophylactic strategies and minimize the risk of antimicrobial resistance. Furthermore, economic analyses assessing the cost-effectiveness of intra-incisional antibiotic infiltration relative to standard prophylactic measures are needed to inform clinical decision-making and healthcare resource allocation.

Conclusion

In conclusion, our study adds to the growing body of evidence regarding the potential benefits of preoperative intra-incisional antibiotic infiltration in reducing wound infection rates in patients undergoing laparotomy for perforation. Through a retrospective comparative analysis, we observed a significant reduction in wound infection rates among patients who received intra-incisional antibiotics compared to those who did not. This finding underscores the importance of considering intraoperative antibiotic strategies as part of perioperative care protocols for patients undergoing emergent laparotomy for perforation.

However, it is essential to interpret these findings within the context of the limitations of our study, including its retrospective nature and the potential for confounding variables. Further prospective studies with larger sample sizes and standardized protocols are warranted to validate our results and elucidate the optimal antibiotic regimens, dosages, and timing for intra-incisional administration.

Incorporating preoperative intra-incisional antibiotic infiltration into clinical practice may hold promise for reducing the burden of postoperative wound infections and improving surgical outcomes in this high-risk patient population. Nevertheless, multidisciplinary collaboration and ongoing research efforts are necessary to refine perioperative strategies and enhance patient care in the management of perforated abdominal viscera.

Overall, our findings underscore the importance of a comprehensive approach to infection prevention in patients undergoing laparotomy for perforation, with preoperative intra-incisional antibiotic infiltration representing a potentially valuable adjunctive measure in this regard. Further research is warranted to optimize its implementation and evaluate its long-term impact on clinical outcomes and healthcare resource utilization.

Take home message

The comparative study underscores the importance of optimizing antibiotic delivery methods for surgical prophylaxis to mitigate the risk of SSIs. While intravenous administration remains a standard practice, local infiltration emerges as a promising approach to enhance antibiotic concentrations at the surgical site and potentially improve infection prevention outcomes. However, addressing the persistent challenge of SSIs requires a multifaceted approach encompassing enhanced infection control practices, antibiotic stewardship, and tailored risk assessment strategies to achieve significant reductions in SSI rates.

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Disclosure

The authors declare no conflicts of interest

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