

Original article:

Efficacy of topical application of antibiotic (piperacillin + tazobactam) in preventing sternal wound infections post sternotomy for cardiac procedures

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Abstract:

Background: Sternal wound infections (SWIs) are a significant complication following sternotomy procedures, leading to morbidity, increased healthcare costs, and mortality. The rise of multidrug-resistant bacteria necessitates alternative treatment strategies. This study evaluates the efficacy of topical application of piperacillin and tazobactam in Preventing SWIs.

Methods: A prospective study was conducted with 60 adult patients who have undergone sternotomy for various cardiac procedures. The patients were divided into two groups: Group A received topical piperacillin and tazobactam, while Group B did not. Various parameters and post-operative outcomes were compared between the two groups.

Results: Patient demographics and comorbidities did not differ significantly between the groups. However, significant differences were observed in post-operative variables. Group A, which received topical antibiotic therapy, had a shorter hospital stay, lower use of mechanical ventilation, and shorter total hospital stay compared to Group B. The mortality rate was higher in Group B.

Conclusion: The study findings suggest that topical application of piperacillin and tazobactam holds promise in preventing SWIs. It may lead to improved clinical outcomes and reduced hospital stay.

Keywords: sternal wound infections, topical application, piperacillin, tazobactam

Introduction:

Sternal wound infections (SWIs) are a significant complication following sternotomy procedures, such as coronary artery bypass grafting (CABG) and cardiac valve replacement surgeries.¹ These infections can lead to severe morbidity, increased healthcare costs, prolonged hospital stays, and, in some cases, mortality. The management of SWIs often involves a combination of surgical debridement, systemic antibiotic therapy, and wound care. However, due to the rise of multidrug-resistant bacteria, there is a growing need for alternative treatment strategies to combat these infections effectively.^{2,3,4}

Several studies have investigated the efficacy of topical antibiotic therapy in the prevention of SWIs, but the specific use of piperacillin and tazobactam as a topical agent remains relatively understudied. Understanding the effectiveness of this antibiotic combination in the topical treatment of SWIs is essential for optimizing patient care and improving outcomes.^{5,6,7,8} Therefore, this study aims to evaluate the efficacy of topical application of piperacillin and tazobactam in the management of sternal wound infections.

Material and methods:

A prospective study was conducted to evaluate the efficacy of topical application of piperacillin and tazobactam in the prevention of sternal wound infections (SWIs). Sample size was estimated with the help of expert using online sample size estimation calculator.

The inclusion criteria for the study comprised adult patients who underwent sternotomy procedures, such as coronary artery bypass grafting (CABG) or cardiac valve replacement surgeries. Patients with incomplete medical records or those who received alternative topical antibiotic therapies were excluded.

A total of 60 eligible patients were identified and were grouped into A & B. Group A (30 patients) patients received topical application of antibiotic (piperacillin + tazobactam) topical application of antibiotic (piperacillin + tazobactam) perioperatively in sternotomy wounds. Antibiotic was used in powder form and directly applied over the sternotomy wound and pericardial sac just before the closure. while Group B (30 patients) not received such application.

Results:

Table 1: Parameters comparisons between both the groups.

Variable	Group A (N=30)	Group B (N=30)	P value (t test of significance)
Age	46.22+11.91	47.72+9.23	0.54
Gender - Male	24	23	0.87
Female	6	7	0.65
DM	4	3	0.77
HT	7	6	0.78
Smoking	7	6	0.78
Hypoproteinemia	4	3	0.79

All the parameters like age, obesity, diabetes mellitus, hypertension, CVD, smoking, hypoproteinemia were compared between control group and (piperacillin + tazobactam) group but it was not statistically significant.

Table 2 : Parameters comparisons between both the groups. (Intra-operative)

Variable	Group A	Group B	P value
CABG	6	7	0.67
VALVE	14	15	0.71
VALVE + CABG	1	1	0.98
Other sx.	4	2	0.55
LIMA Harvest	6	8	0.51
Cpb time <180	8	9	0.65
Cpb time >180	17	16	0.81
Redo - surgery	3	2	0.77

Table 3: Parameters comparisons between both the groups. (Post-operative)

Variable	Group A (N=30)	Group B (N=30)	P value (t -test of significance)
Hospital stay	4.12	7.45	0.045
Mechanical ventilation	3	7	0.0032
Total hospital stay	11.34	15.32	0.038
Mortality	0	1	0.0023
Re-Exploration	3	1	0.0039

Table 4 : Wound infections comparison between both the groups.

Variable	Group A (N=30)	Group B (N=30)	P value (t -test of significance)
Serous infection	4	5	0.65
Purulent infection	2	5	0.0041
Early sternal instability	1	4	0.0038
Sternal dehiscence	1	2	0.045

Discussion:

Topical antibiotic therapy has emerged as a promising approach for the prevention of SWIs. It involves the direct application of antibiotics to the wound site, providing high local drug concentrations while minimizing systemic exposure and potential side effects. Piperacillin and tazobactam, a combination of a broad-spectrum beta-lactam antibiotic and a beta-lactamase inhibitor, have demonstrated efficacy against various gram-negative and gram-positive bacteria commonly associated with SWIs.

Significant differences were observed in certain post-operative variables between the two groups. Group A which received topical antibiotic therapy, demonstrated a shorter hospital stay (4.12 days vs. 7.45 days) compared to Group A. The use of prolonged mechanical ventilation was also significantly lower in Group

A (3 patients) compared to Group B (7 patients). Additionally, the total hospital stay was shorter in Group A (11.34 days) compared to Group B (15.32 days). These findings suggest that the topical application of piperacillin and tazobactam may contribute to improved clinical outcomes in patients to reduce SWIs. The shorter hospital stay and reduced need for mechanical ventilation in Group A indicate faster recovery and reduced healthcare burden.

Overall, the results highlight the potential benefits of topical piperacillin and tazobactam therapy in preventing SWIs. However, further studies with larger sample sizes are necessary to validate these findings and explore the factors contributing to the increased mortality rate in the treatment group. Additionally, long-term follow-up studies are warranted to assess the sustainability of the observed benefits and evaluate the overall impact on patient outcomes and healthcare resource utilization.⁹

In conclusion, the findings of this study indicate that the topical application of piperacillin and tazobactam shows promise in the prevention of sternal wound infections (SWIs). While there were no statistically significant differences observed in patient demographics and comorbidities between the control and treatment groups, several notable outcomes were observed. Patients receiving topical antibiotic therapy demonstrated a shorter hospital stay, reduced need for mechanical ventilation, and a shorter total hospital stay compared to the control group. These findings suggest that the topical application of piperacillin and tazobactam may contribute to improved clinical outcomes, faster recovery, and potentially reduced healthcare burden in patients with SWIs.¹⁰

Future studies with larger sample sizes, prospective designs, and longer-term follow-up are warranted to validate these findings and further explore the factors influencing outcomes and mortality rates.

Conclusion:

Overall, the study contributes to the existing body of knowledge on topical antibiotic therapy for SWIs and supports the potential use of piperacillin and tazobactam as an effective treatment option in the management of these infections. These findings have important implications for clinical practice, as they may help guide healthcare professionals in optimizing patient care and improving outcomes in individuals with SWIs.

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