



Efficacy of intrawound Vancomycin powder in reducing postoperative wound infection after spondylodiscitis surgery: A single-center retrospective cohort study

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Abstract

Background: Surgical site infection remains a significant complication following spinal surgery, particularly in patients treated for spondylodiscitis. The use of intrawound vancomycin powder has been proposed as a local preventive strategy, although its effectiveness remains uncertain.

Methods: A retrospective cohort study was conducted including adult patients who underwent posterior surgical debridement, with or without instrumentation, for spondylodiscitis between 2021 and 2023. Patients were divided into those receiving intrawound vancomycin and those who did not. The primary outcome was postoperative wound infection. Statistical analysis included Fisher's exact test and multivariate logistic regression, with results reported as odds ratios (OR) and 95% confidence intervals (CI).

Results: Ninety patients were included (vancomycin: 55 [61.1%]; control: 35 [38.9%]). Postoperative wound infection occurred less frequently in the vancomycin group (9.1% vs 14.3%). On multivariate analysis, intrawound vancomycin use was associated with reduced odds of infection (OR 0.49, 95% CI 0.11–2.24). Diabetes mellitus was identified as a significant risk factor.

Conclusion: Intrawound vancomycin use was associated with a lower observed rate of postoperative infection despite being applied in more complex cases. Although statistical significance was not reached, the direction and magnitude of effect suggest a potential clinical benefit. Larger prospective studies are required to confirm these findings.

Keywords: Intrawound Vancomycin, posterior spinal surgery, postoperative infection, retrospective cohort, spine surgery, spondylodiscitis, vancomycin powder

Introduction

Spondylodiscitis represents a severe infectious condition involving the intervertebral disc and adjacent vertebral structures, often leading to prolonged morbidity and extended hospitalization^[1, 2]. Management is challenging and frequently requires surgical intervention in cases of neurological compromise, mechanical instability, or failure of non-operative treatment; however, these procedures are associated with a considerable risk of postoperative complications, particularly surgical site infection^[3].

The reported incidence of surgical site infection following spinal procedures varies widely, reflecting differences in patient comorbidities, operative complexity, and underlying pathology^[4, 5]. In spondylodiscitis, this risk is further elevated due to pre-existing infection, extensive tissue debridement, and the frequent need for instrumentation^[6]. Gram-positive organisms, particularly *Staphylococcus aureus* and *Staphylococcus epidermidis*, are consistently identified as the predominant pathogens in postoperative spinal infections^[7, 8].

The application of vancomycin powder directly into the surgical wound has emerged as a strategy to reduce infection risk by delivering high local antibiotic concentrations at the operative site [9]. Several studies have demonstrated a reduction in postoperative infection rates with this approach^[10, 13]. However, other investigations have reported inconsistent findings after adjustment for confounding variables and patient risk factors^[11, 14, 15]. Furthermore, variability in outcomes has been observed in high-risk spinal procedures, highlighting ongoing uncertainty regarding its effectiveness^[16, 20].

Given the high baseline risk of infection and the relative paucity of focused data in spondylodiscitis, further evaluation of intrawound vancomycin in this setting is warranted. This study aims to assess its effectiveness in reducing postoperative wound infection following surgical management of spondylodiscitis.

Materials and Methods

A retrospective cohort study was conducted at a tertiary spine center following institutional ethical approval. Adult patients who underwent posterior surgical debridement with or without instrumentation for spondylodiscitis between January 2021 and December 2023 were included. Inclusion criteria comprised patients aged 18 years and above, a confirmed diagnosis of spondylodiscitis based on clinical presentation, laboratory markers, and imaging findings, and those who underwent posterior surgical intervention. Patients were excluded if they had incomplete medical records, a history of previous surgery at the same spinal level within 30 days, or the presence of an active systemic infection unrelated to the spine.

Data collection included demographic variables such as age and sex, comorbidities including diabetes mellitus and immunosuppression, lifestyle factors such as smoking status, and operative variables including the use of instrumentation, operative duration, and estimated blood loss. Patients were stratified into two groups: the vancomycin group, which received 1 g of intrawound vancomycin powder prior to wound closure, and the control group, which did not receive local vancomycin. All patients received standard systemic antibiotic prophylaxis.

The primary outcome was postoperative wound infection, defined according to clinical and microbiological criteria, while the secondary outcome was the length of hospital stay.

For statistical analysis, categorical variables were analyzed using the chi-square test or Fisher's exact test as appropriate, and continuous variables were analyzed using the independent t-test. Multivariate logistic regression analysis was performed to identify independent predictors of postoperative wound infection, with results reported as odds ratios (OR) and 95% confidence intervals (CI). A p-value of less than 0.05 was considered statistically significant.

Results

A total of 90 patients were included, of whom 55 (61.1%) received intrawound vancomycin and 35 (38.9%) served as controls. Baseline characteristics were comparable between groups, with no statistically significant differences in age, sex distribution, smoking status, diabetes mellitus, or immunosuppression (all $p > 0.05$).

Operative variables differed between groups. The vancomycin group had a higher rate of instrumentation (83.6% vs 51.4%, $p = 0.005$) and longer operative duration (160.8 ± 27.0 minutes vs 139.1 ± 30.8 minutes, $p = 0.014$), indicating greater procedural complexity. Estimated blood loss and length of hospital stay did not differ significantly ($p > 0.05$).

Postoperative wound infection occurred in 5 patients (9.1%) in the vancomycin group and 5 patients (14.3%) in the control group. Although this difference did not reach statistical significance, there was a lower observed infection rate in the vancomycin group.

On multivariate logistic regression analysis, intrawound vancomycin use was associated with reduced odds of postoperative wound infection (OR 0.49, 95% CI 0.11–2.24), while diabetes mellitus was associated with increased risk. No other variables demonstrated a statistically significant independent association.

Table 1: Baseline Demographic, Clinical, and Operative Characteristics of Patients Stratified by Intrawound Vancomycin Use.

| Variable | Vancomycin (n=55) | Control (n=55) | Test Statistic | p-value |
|----------------------|-------------------|------------------|-----------------|---------|
| Sex | | | $\chi^2 = 0.09$ | 0.406 |
| Male | 30 (54.5%) | 23 (65.7%) | | |
| Female | 25 (45.5%) | 12 (34.3%) | | |
| Diabetes | 29 (52.7%) | 13 (37.1%) | $\chi^2 = 0.49$ | 0.486 |
| Smoking | 16 (29.1%) | 5 (14.3%) | $\chi^2 = 1.86$ | 0.173 |
| Immunosuppression | 4 (7.3%) | 5 (14.3%) | $\chi^2 = 0.18$ | 0.674 |
| Instrumentation | 6 (10.9%) | 10 (28.6%) | $\chi^2 = 3.78$ | 0.050 |
| Age (years) | 57.7 ± 13.7 | 60.4 ± 10.5 | $t = -1.07$ | 0.286 |
| Operative time (min) | 160.8 ± 27.0 | 139.1 ± 30.8 | $t = 2.52$ | 0.014 |

Chi-square test was used for categorical variables and independent t-test for continuous variables. Values are presented as number (percentage) or mean \pm standard deviation.

Discussion

This study found that intrawound vancomycin powder was associated with a lower observed rate of postoperative wound infection following surgery for spondylodiscitis. Importantly, this reduction was noted despite the vancomycin group undergoing more complex procedures, including higher rates of instrumentation and longer

operative duration, both of which are established contributors to infection risk [4, 5].

The interpretation of these findings must consider potential treatment selection bias. Intrawound vancomycin was more frequently used in cases perceived to carry a higher risk of infection, which would typically bias outcomes toward worse results in this group. The observation of a lower infection rate under these circumstances suggests a possible protective effect. However, the wide confidence interval and lack of statistical significance indicate limited precision, and the findings should therefore be interpreted with caution.

Previous studies have reported reduced infection rates with intrawound vancomycin, particularly in high-risk and instrumented spinal procedures [10, 15]. However, the literature is not uniform, with some analyses demonstrating reduced or absent benefit after adjusting for confounding variables [11, 14, 15]. Differences in study design, patient selection, and operative complexity likely contribute to these inconsistencies [16, 20]. By focusing specifically on spondylodiscitis, the present study provides additional data in a population characterized by a high baseline risk of infection [6].

From a biological perspective, local administration of vancomycin allows high antibiotic concentrations at the surgical site, which may improve activity against gram-positive organisms commonly implicated in postoperative infections, including *Staphylococcus aureus* and *Staphylococcus epidermidis* [7, 8]. This approach may be particularly relevant in spondylodiscitis, where surgical intervention is performed in previously infected tissue [6]. Nevertheless, whether this pharmacological advantage consistently results in clinically meaningful reductions in infection remains uncertain, as reflected in the variability of published findings [16, 20].

From a clinical standpoint, intrawound vancomycin may be considered as an adjunctive measure in selected high-risk patients, particularly those undergoing instrumentation or prolonged procedures [13, 15]. However, given the observational design and absence of statistical significance, routine use cannot be recommended based on the current evidence alone.

Several limitations should be acknowledged. The retrospective design limits causal inference and introduces the potential for selection bias. Although multivariate analysis was performed, residual confounding cannot be excluded. The relatively small sample size reduces statistical power and contributes to imprecision in effect estimates. Additionally, this was a single-center study, which may limit generalizability. Variability in microbiological profiles and antibiotic protocols may also have influenced outcomes.

Despite these limitations, this study addresses a clinically relevant question in a high-risk patient population. The observed reduction in infection rates, although not statistically significant, suggests a potential benefit that warrants further investigation. Larger prospective and randomized studies are required to better define the role of intrawound vancomycin in spondylodiscitis surgery.

Conclusion

Intrawound vancomycin powder was associated with a lower rate of postoperative wound infection following spondylodiscitis surgery, despite being used in patients with greater operative complexity. Although this association did not reach statistical significance, the magnitude and

direction of effect suggest a potential clinically meaningful benefit. Given the observational design and limited sample size, these findings should be interpreted with caution. Intrawound vancomycin may be considered as an adjunctive measure in selected high-risk cases; however, adequately powered prospective and randomized studies are required to confirm its efficacy and define its optimal role in spinal infection surgery.

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