Determining Optimal Empiric Antibiotic Regimens for Adults with Vertebral Osteomyelitis: A Systematic Review and Network Meta-Analysis to Inform Management of Culture-Negative Cases

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INTRODUCTION: Vertebral osteomyelitis is a severe spinal infection associated with significant morbidity and prolonged treatment. While antibiotic therapy is central to management, optimal regimens—particularly in culture-negative cases—remain unclear. This systematic review and network meta-analysis aims to evaluate the clinical effectiveness of various antibiotic therapies in treating vertebral osteomyelitis, with an emphasis on informing empiric treatment strategies.

METHODS: This review adhered to PRISMA guidelines and included randomized controlled trials and observational studies evaluating antibiotic therapy in adults (≥18 years) with vertebral osteomyelitis. A comprehensive search across six databases identified eligible studies. Clinical success (defined as infection resolution without recurrence) and treatment failure were the primary outcomes. A random-effects network meta-analysis was performed using odds ratios (OR) with 95% confidence intervals (CI) to assess the comparative effectiveness of antibiotic regimens.

RESULTS: Eighteen studies met the inclusion criteria. Sixteen reported clinical success rates exceeding 80%, and only two documented failure rates above 20%. Quantitative synthesis included 15 studies involving 1,329 patients: 1,092 (82.2%) achieved clinical cure, while 237 (17.8%) experienced treatment failure. Overall, antibiotic therapy was associated with significantly improved clinical outcomes (OR 24.03, 95% CI 12.13–47.57). Among agents analyzed, rifampin, vancomycin, and teicoplanin were the most effective, followed by linezolid, cephalosporins, and daptomycin.

DISCUSSION AND CONCLUSION: Antibiotic therapy demonstrates high efficacy in treating vertebral osteomyelitis, with most patients achieving clinical resolution. Rifampin, vancomycin, and teicoplanin appear to be the most effective options and may guide empiric treatment in culture-negative cases. Further research is warranted to refine treatment protocols in the absence of pathogen identification.
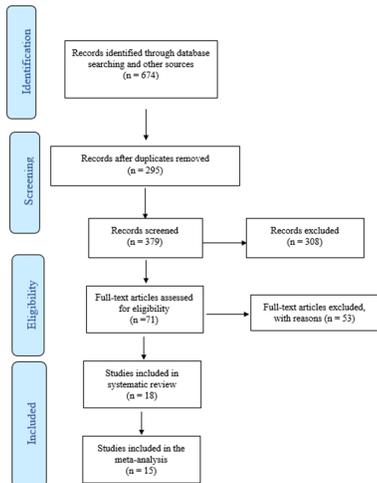
Figure 1. Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) flow chart.