Is there a Role for Local Antibiotic Cement Bead Application in Improving Outcomes After Debridement?

Dr Harvinder Singh Chhabra
Director and Chief Spine and Rehabilitation
Sri Balaji Action Medical Institute
New Delhi

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Dr Dilip Chand Raja Soundararajan

Dr Ajoy prasad Shetty

Dr J Naresh Babu

Dr Elar Cari

Why is this topic Important

- **High burden of surgical site infections (SSI)**

  SSIs after spine surgery occur in up to 10% of cases and can lead to hardware failure, multiple revision surgeries, prolonged hospitalization, and increased morbidity and mortality—highlighting the need for improved local infection control strategies

- **Limitations of systemic antibiotics**

  Achieving effective antibiotic concentrations at the site of infection through systemic therapy alone can require high doses that risk systemic toxicity, whereas antibiotic-loaded cement beads provide sustained, high local drug levels with minimal systemic exposure

- **Challenges with traditional PMMA carriers and the promise of bioabsorbable alternatives**

  Permanent PMMA beads may elute subtherapeutic antibiotic levels long-term—potentially fostering resistance—and require removal; bioabsorbable carriers like calcium sulfate and phosphate overcome these issues by delivering antibiotics efficiently and negating the need for bead extraction

Literature Review/ Process

PubMed

Clarivate Web of Science™

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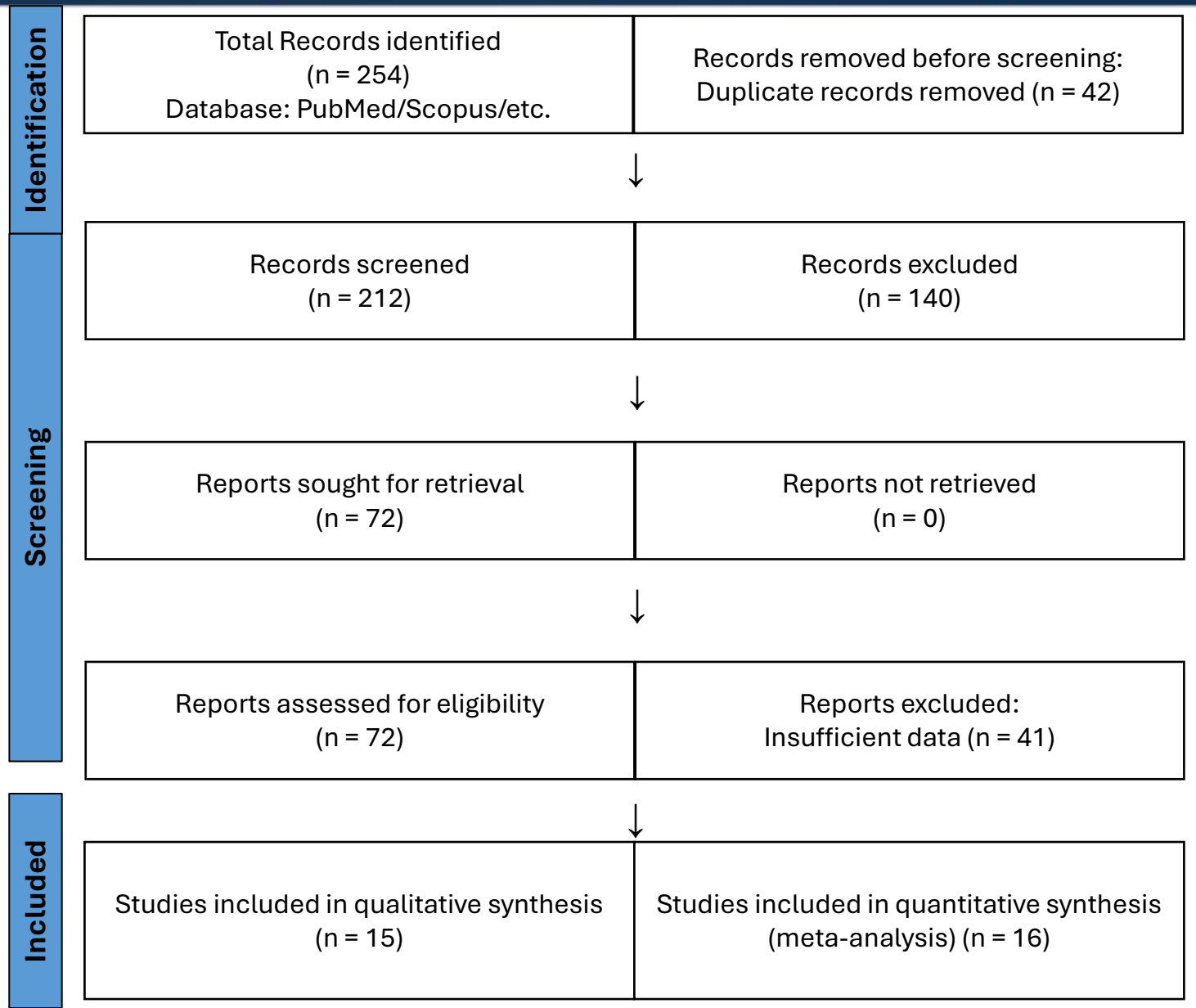
Scopus



Findings from Literature

- High local antibiotic delivery achieves concentrations at the debridement site that systemic therapy can't, significantly lowering spinal SSI recurrence and need for hardware removal
- **PMMA vs. bioabsorbable carriers:** PMMA beads provide prolonged release but often require surgical removal and risk subtherapeutic elution; bioabsorbable options (calcium sulfate, phosphate, hydrogels) elute rapidly and obviate extraction
- Optimized elution kinetics depend on bead porosity, solubility, tortuosity, diameter, and antibiotic heat stability—favoring agents like vancomycin and tobramycin for PMMA
- **Enhanced tissue healing:** beyond infection control, antibiotic beads foster a conducive environment for bone regeneration and soft-tissue repair, improving postoperative recovery
- **Reduced systemic toxicity and resistance risk:** bioabsorbable carriers limit prolonged sub-MIC antibiotic release—minimizing nephrotoxicity, neurotoxicity, and the emergence of resistant organisms
- Antibiotic cement beads are only an adjuct to a good surgical debridement and systemic antibiotic therapy

- **Beyond infection control, antibiotic-loaded beads create a favorable microenvironment for bone regeneration and soft-tissue repair, while controlled elution minimizes systemic toxicity (nephrotoxicity, neurotoxicity) and the emergence of resistant organisms**

- **Release kinetics are governed by bead porosity, solubility, tortuosity, diameter, and antibiotic heat stability—favoring agents like vancomycin and tobramycin for sustained local concentrations without systemic peaks**

- **Bioabsorbable materials (e.g., calcium sulfate, calcium phosphate, hydrogels) deliver rapid antibiotic elution and eliminate the requirement for bead extraction, overcoming long-term resistance and nidus formation issues seen with PMMA**

Question:

Is there a Role for Local Antibiotic Cement Bead Application in Improving Outcomes After Debridement?

Response:

- When used alongside with thorough debridement and systemic antibiotics, local antibiotic cement beads reduce spinal surgical site infection recurrence.

❖**Vote:** **Agree – 60.6%, Disagree – 12.1%, Abstain – 27.3% (Moderate Consensus)**