RETHINKING MYCOBACTERIAL PERIPROSTHETIC JOINT INFECTION: A PRACTICAL FRAMEWORK FOR EARLY DIAGNOSIS AND DECISIVE SURGICAL MANAGEMENT

NARRATIVE REVIEW

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BACKGROUND & RATIONALE

Periprosthetic joint infection (PJI) is a devastating complication of total joint arthroplasty, affecting 1-2% of primary and nearly 20% of revision procedures. Mycobacteria, *M. tuberculosis* complex (MTB) and nontuberculous mycobacteria (NTM), account for approximately 0.5% of PJI.

Delayed recognition: indolent, often culture-negative presentation.

Specialized testing: standard cultures may miss mycobacteria.

Prolonged therapy: treatment lasts months to years.

NTM complexity: species-specific susceptibility is essential.

Surgical uncertainty: no universally superior strategy is established.

METHODS

Narrative review of clinical studies, retrospective cohorts, systematic reviews, meta-analyses, international consensus documents (ICM 2025), and hip and knee case series. Evidence was appraised across six domains: epidemiology, microbiology, diagnosis, surgery, antimicrobial therapy, and outcomes.

EPIDEMIOLOGY & MICROBIOLOGY

M. TUBERCULOSIS COMPLEX (MTB)

Most common mycobacterial PJI in endemic regions.
Reactivation of latent infection or hematogenous spread.
Often presents months to years after arthroplasty.
Draining sinuses and bone destruction may occur in advanced disease.

NONTUBERCULOUS MYCOBACTERIA (NTM)

Environmental exposure; no person-to-person transmission.
M. abscessus, M. fortuitum, M. marinum, M. avium complex, and others.
Rapidly growing mycobacteria may present earlier.
Increasingly reported in immunocompromised hosts.
Predominant species vary by geography.

DIAGNOSIS

WHEN TO SUSPECT

Culture-negative, indolent, or refractory PJI.

Failure of conventional antibacterial therapy.

Immunosuppression, TB exposure, or endemic setting.

Granulomatous histopathology or an unexplained draining sinus.

1. Collect 3-5 synovial/periprosthetic samples → 2. Mycobacterial culture (up to 6-8 weeks) → 3. Histopathology → 4. PCR/Xpert/NGS → 5. Species-directed AST

MOLECULAR & ADVANCED TECHNIQUES

Xpert MTB/RIF rapidly detects MTB and rifampicin resistance; line-probe assays assess first- and second-line resistance; mNGS/tNGS can identify fastidious species; RNA-based assays may improve detection of active bone/joint TB. Molecular assays complement - but do not replace - culture and AST.

SURGICAL MANAGEMENT

TWO-STAGE REVISION

Most frequently reported reconstructive strategy.
Stage 1: explantation and antibiotic spacer.
Sustained antimycobacterial therapy.
Stage 2: reimplantation after infection control.
No comparative trial proves universal superiority.

OTHER STRATEGIES

DAIR - consider only in carefully selected early infections; selected rapidly growing mycobacterial infections may qualify.
One-stage revision - evidence remains limited.
Resection or arthrodesis - options when reimplantation is not feasible.

ANTIMICROBIAL THERAPY

MTB PJI - STANDARD REGIMEN

Intensive phase (2 months): isoniazid + rifampicin + pyrazinamide + ethambutol (HRZE).

Continuation phase (10-16+ months): isoniazid + rifampicin (HR).

Total duration: usually 12-18 months for bone/joint TB.

Drug-resistant TB: full susceptibility-guided regimen is essential.

Monitoring: hepatotoxicity, optic neuritis, and peripheral neuropathy.

NTM PJI - SPECIES-DIRECTED REGIMENS

M. abscessus: amikacin + imipenem + azithromycin (intensive); azithromycin + inhaled amikacin ± clofazimine (continuation).

M. avium complex: macrolide + rifamycin + ethambutol; at least 12 months after culture conversion.

M. marinum: clarithromycin ± rifampicin or ethambutol for 3-6 months.

Rapid growers: combination therapy guided by AST; macrolide susceptibility is pivotal.

Principle: regimens and durations differ substantially from MTB; infectious diseases expertise is essential.

OUTCOMES

Prolonged treatment, substantial morbidity, and often incomplete functional recovery.

Two-stage revision is most often associated with successful reimplantation in reported series.

DAIR carries high failure risk outside selected early NTM cases.

Early microbiological diagnosis improves outcomes; drug resistance worsens prognosis.

CONCLUSIONS & CLINICAL IMPLICATIONS

Suspect mycobacterial PJI in culture-negative, indolent, or refractory infection. Combine accurate species-level diagnosis and AST with individualized surgery and prolonged multidrug therapy. Multidisciplinary care is essential, and standardized multicenter studies are urgently needed.

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CULTURE-NEGATIVE + INDOLENT PJI? THINK MYCOBACTERIA.

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