

SH51. Does the use of CT/SPECT scans help in the diagnosis of shoulder PJI?

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Methodology: A comprehensive literature review was conducted to assess the diagnostic performance of Single Photon Emission Computed Tomography (SPECT) combined with Computed Tomography (CT) in detecting prosthetic joint infections (PJI) of the shoulder. Searches were performed in PubMed, Octopus, Embase, and Google Scholar using the terms (Tomography, Emission-Computed, Single-Photon OR SPECT) AND (Tomography, X-Ray Computed OR CT) AND (Prosthesis-Related Infections OR Periprosthetic Joint Infection) AND (Shoulder Joint OR Joint) AND (Radionuclide Imaging OR Leukocyte Imaging). Studies in English (Levels I-IV evidence) that reported diagnostic accuracy, sensitivity, specificity, or clinical impact of SPECT in shoulder PJI were included. Exclusion criteria consisted of non-English articles, case reports, reviews, and studies with fewer than ten patients.

Seventeen articles met the inclusion criteria and were reviewed. Given the limited number of articles identified with the specified search terms, additional searches were conducted to identify studies on SPECT outside of the shoulder literature.

Answer

Unknown. Based on current literature, there is no conclusive evidence supporting the routine use of SPECT/CT as a primary diagnostic tool for shoulder PJI. However, it may serve as a supplementary test in specific clinical contexts, particularly when specificity is critical or when combined with other diagnostic methods to enhance overall accuracy.

Strength of Recommendation: **Limited** (insufficient evidence to recommend for or against the intervention, with some support from Level III studies).

Rationale:

1. Diagnostic Accuracy of SPECT/CT in Shoulder PJI

a. Sensitivity and Specificity: The combination of labeled leukocyte (WBC) and technetium-99m sulfur colloid bone marrow imaging with SPECT/CT is considered the gold standard in lower limb PJI but has shown mixed results in shoulder infections. Sensitivity for detecting shoulder PJI ranges from 18% to 67%, while specificity remains consistently high (up to 100%) [1, 2, 12].

b. Challenges in Detecting Low-Virulence Infections:

Shoulder PJI often involves low-virulence organisms like *Cutibacterium acnes*, which pose diagnostic challenges due to minimal leukocyte aggregation, limiting SPECT sensitivity [1, 3, 4, 15].

c. Comparison with Other Modalities:

While SPECT/CT improves spatial resolution and anatomical localization compared to planar imaging, its diagnostic performance for shoulder PJI remains inferior to that in lower limb infections [2, 4, 14, 17].

2. Clinical Implications

Preoperative Planning: SPECT/CT can assist surgeons in distinguishing between aseptic loosening and infection, influencing treatment strategies [5, 6, 11].

Infection Classification: The Modified Musculoskeletal Infection Society (MSIS) criteria, which incorporate radionuclide imaging findings, improve diagnostic confidence when clinical signs are ambiguous [6, 7, 10].

Economic Considerations: The high cost, complexity, and labor-intensive nature of SPECT/CT limit its routine use as a screening tool for shoulder PJI, particularly given its low sensitivity in chronic infections [2, 3, 8, 16].

3. Recent Advances

Recent studies highlight advancements in molecular imaging for PJI diagnosis. For example, Palestro et al. (2023) emphasize molecular imaging modalities that target specific infection biomarkers, showing potential in overcoming the limitations of conventional SPECT/CT, particularly for detecting low-virulence infections [9, 10, 13]. Additionally, studies by Signore et al. (2019) and Kampmeijer et al. (2023) explore the role of artificial intelligence and biomarker-based imaging in optimizing nuclear medicine techniques for PJI detection [10, 11, 17].

Study Limitations

Many reviewed studies were retrospective, had small sample sizes, and exhibited significant heterogeneity in imaging protocols. The lack of standardized definitions for shoulder PJI and varying culture protocols further reduced interstudy comparability [1, 4, 8, 16].

Conclusion

The diagnostic performance of SPECT/CT in shoulder PJI remains suboptimal compared to its established role in lower limb infections. While it provides excellent specificity and detailed anatomical localization, its sensitivity in detecting low-virulence infections is limited. Current evidence does not support the routine use of SPECT/CT for screening failed shoulder arthroplasties but suggests a role in complex cases where other diagnostic modalities are inconclusive .

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