

HK44 - Is there a role for the use of a computed tomography scan for the diagnosis of periprosthetic joint infection?

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Response/Recommendation:

Based on available data, a computed tomography (CT) scan alone has no role in the diagnosis of periprosthetic joint infection (PJI).

Level of Evidence: Moderate

Delegate Vote:

Rationale:

Achieving an accurate preoperative diagnosis is crucial for surgical planning and managing patient expectations. Diagnosing peri-prosthetic joint infections (PJI) and related implant infections poses major challenges. While the presence of clear signs such as draining sinuses or exposed implants may simplify diagnosis, differentiating between septic and aseptic implant failures can be highly complex. This difficulty often arises when patients present with nonspecific symptoms like pain and reduced function, or when laboratory tests yield inconsistent results. The utility of computed tomography (CT) in the preoperative diagnosis of PJI remains a contentious issue. To explore this further, a comprehensive literature search was conducted using PubMed and Embase. Initially, 780 potentially relevant studies were identified. Following a detailed screening of titles and abstracts by two independent reviewers, five studies and two guidelines were selected for an in-depth review and data extraction. Quality was assessed using the QUADAS-2 tool.

In a study of moderate quality conducted by Cyteval et al. 2002 (1), the diagnostic accuracy of CT for detecting infections at the site of hip prostheses was assessed among 65 patients. Patients underwent helical CT scans before their surgical revision, where the presence of infection was confirmed through the detection of the same bacterium in multiple deep-tissue biopsies. The CT scans were assessed for several diagnostic markers, including joint distention, fluid-filled bursae, and fluid collection in muscles and perimuscular fat. The results indicated varying diagnostic accuracy across different CT measures. The study found that CT may be useful for confirming infection, with specificities ranging from 89 to 100% for soft tissue abnormalities and 30 to 100% for bone abnormalities or asymmetric position of the femoral head. There were six of the 10 CT measures that had specificities above 89%. These measures included joint distention, fluid-filled bursae, fluid collections in muscles and perimuscular fats, periostitis, iliopsoas involvement, and involvement around the greater trochanter. The four CT measures with specificities below 77% were focal low attenuation (77%), bone abnormalities (30%), non-focal low attenuation (53%), and asymmetric position of the femoral head (72%). While the study found that CT may be useful for confirming infection, eight of the 10 measures had sensitivities ranging from 8 to 42%, indicating that CT has a poor ability to rule out PJI when the test is negative. Only two measures demonstrated moderate to high sensitivity: bone abnormalities at 75% and joint distention at 86%. Despite the valuable insights provided by the study, it

is essential to consider the inherent limitations of CT imaging, such as the potential for metallic artifacts that can degrade image quality. These artifacts can obscure critical details necessary for accurate diagnosis, which underscores the importance of using CT in conjunction with other diagnostic modalities. Furthermore, the small sample size of 65 patients may constrain the generalizability of the findings of the latter study. Additionally, the study does not specify whether the assessment of the CT scans was conducted in a blinded manner, which could impact the objectivity of the results.

Isern-Kebschull et al. (2) evaluated the diagnostic accuracy of CT-guided joint aspiration in 164 patients with suspected prosthetic hip infections referred for CT-guided aspiration. The results of cultures obtained from CT-guided aspirations performed in the radiology department were compared with intraoperative culture results. Specific CT measures varied in sensitivity and specificity: soft-tissue accumulation (sensitivity of 80%; specificity of 57.4%); acetabular malposition (sensitivity 20%; specificity 85.2 %); periarticular calcification (sensitivity 20%; specificity 78.7%); and enlarged lymph nodes (sensitivity 74.3%; specificity 78.7%). Despite its rigorous methodology, which included blinded imaging assessments and a robust sample size, the study identified potential improvements in specificity for certain CT findings. It highlighted inherent limitations of CT imaging, such as the risk of overlooking small foci of osteolysis or isolated enlarged lymph nodes, often obscured by metallic artifacts. The study underscores the nuanced role of CT in the diagnostic process for PJIs, emphasizing its valuable application in CT-guided aspirations while also stressing the necessity of careful CT scan interpretations to prevent diagnostic errors.

Furthermore, the accuracy of CT-guided joint aspiration was 86.5%, revealing its effectiveness in preoperative diagnostics for suspected PJIs of the hip. This finding aligns with earlier research by Tomas et al. (3) reported an accuracy of 84% for CT-guided aspirations relative to surgical findings in a cohort of 63 prospectively enrolled patients. Both studies illustrate the critical role and potential challenges of utilizing CT in diagnosing PJIs, highlighting the importance of optimizing CT protocols and techniques to enhance diagnostic outcomes.

Both the American Academy of Orthopaedic Surgeons Evidence-Based Clinical Practice Guidelines (4) and a multidisciplinary consensus statement (5) acknowledge that CT's role in diagnosing PJI is limited, primarily serving as a tool for joint aspiration. Recent advancements in CT technology, as demonstrated by Isern-Kebschull et al. 2020 (6) and Cheng et al. 2024 (7), highlight its evolving potential in diagnosing PJI. The former study confirms the efficacy of multidetector CT in differentiating septic from aseptic complications post-hip arthroplasty, while the latter introduces the use of dual-energy CT iodine maps to distinguish between these conditions. Although promising, these findings point to the need for further research to optimize the diagnostic potential of CT technologies in clinical practice.

In conclusion, while the role of CT in diagnosing PJI is not sufficient as a standalone test, it may be a useful additional method when used alongside serological and synovial fluid analysis. To date, only two studies have specifically explored the diagnostic accuracy of CT, and both were limited to THA. Therefore, no definitive conclusions or recommendations can be extended to total knee arthroplasty. Based on the limited evidence available from these studies, CT may serve a supportive role in guiding joint aspirations, but not as a standalone test in the diagnostic workup for PJI.

References:

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