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CORR Insights®: What is the Accuracy of Nuclear Imaging in the Assessment of Periprosthetic Knee Infection? A Meta-analysis

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Where Are We Now?

When planning revision surgery, it is important to consider the possibility of infection. Surgeons can make a diagnosis based on a combination of clinical findings, elevated inflammatory markers, and joint aspiration. Joint

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aspiration is the most important diagnostic tool for identifying an infection since it can establish the diagnosis of PJI, detect the causative bacteria, and determine the antibiotic susceptibility [3, 5, 7].

Early and acute periprosthetic joint infections (PJIs) usually generate rather clear findings that rarely warrant further examination for infection. However, diagnosing late and low-grade infections can be challenging. Additional diagnostic methods like nuclear imaging may be helpful [2].

In their study, Verberne and colleagues examined the accuracy and efficacy of nuclear imaging for assessing PJI of the knee and found that, when including studies with wide confidence intervals and incomplete infectiological information, only 288 infected knees could be included in the meta-analysis. They confirmed that standard scintigraphy is insufficiently specific for diagnosing PJI. The authors also found that antigranulocyte

scintigraphy, combined leukocyte and bone marrow scintigraphy, and FDG-PET are the most promising imaging methods because they offer more specificity. Though it should be noted that these methods can also be time-consuming, not broadly available, and rather expensive.

Where Do We Need To Go?

Joint aspiration can miss infections with difficult-to-detect bacteria like *Propionibacterium* and small colony variants, or when a patient is treated with antibiotics [6]. Dry aspirations do not provide material for examination and rarely produce additional information for physicians.

In these cases, novel diagnostic tools that can detect infection would be helpful. Although the alpha-defensin test, biopsies with microbiological and histological examination, and polymerase chain reaction (PCR) tests all can help determine whether a joint is infected, each has its own drawbacks. The alpha-defensin test cannot identify the pathogens or guide antibiotic

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treatment. Biopsies with microbiological and histological examination can add data, but are more-invasive procedures (they require surgery in order to be maximally effective). And while PCR tests can be sensitive and specific [1], they might be difficult to interpret because of contaminants.

As demonstrated by Verberne and colleagues, the role of nuclear imaging for diagnosing and treating PJI remains uncertain; whether and how these tests might be most useful in detecting other causes of painful TKA likewise needs further evaluation.

Some patients with painful TKAs may undergo revision even if an infection has not been diagnosed or definitively excluded before surgery. If a high likelihood of infection is present (even if it has not been diagnosed with certainty), a two-stage exchange is the most secure choice. In such patients, sonication could maximize the diagnostic yield in these challenging situations—though more research on the role and appropriate techniques associated with sonication is still needed.

We need to further examine the sensitivity, specificity, invasiveness, the identification and availability of the causative bacteria and cost-effectiveness for each method suggested to diagnose PJI. From these findings, a diagnostic algorithm to identify the

causative microorganisms or to exclude the differential diagnosis of PJI should be developed.

How Do We Get There?

Since most of the work done on this topic has been (and is likely to remain) case series, researchers should use a uniform definition of PJI [4] in order to obtain more homogeneous, comparable, and reliable data. The diagnosis and treatment of PJI is complex due to the presence of an implant that is covered with a microbial biofilm, and diagnostic principles might be similar for all orthopaedic devices, thus permitting inclusion of more patients. Randomization is difficult to achieve in studies examining PJI treatments. But for the evaluation of new diagnostic tools, randomization is not necessary.

Using low-yield diagnostic modalities increases costs, introduces treatment delays, and can cause confusion in an already-complex scenario. New imaging methods require more testing—particularly for cases of difficult-to-diagnose PJI. Additionally, we should focus on new methods that can provide microbiological information. Antigranulocyte scintigraphy, combined leukocyte and bone marrow scintigraphy, and FDG-PET might be

useful in dry aspirations. But until more data is available, we must continue to use the diagnostic tools based on current guidelines [2, 3].

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