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QUESTION 6: Can implant factors (i.e., type of bearing) influence the thresholds for serum and synovial markers in acute and chronic periprosthetic joint infections (PJIs)?

RECOMMENDATION: Yes. Different bearing surfaces such as metal-on-metal (MoM), metal-on-polyethylene and dual taper modular stems in the setting of taper corrosion can influence the serum and synovial markers. Metal debris may interfere with automated cell counts. Manual cell counts are preferred when evaluating patients for PJIs who have elevated synovial fluid metal levels. Optimal thresholds for serum and synovial markers for diagnosing PJIs in these settings still need to be established.

LEVEL OF EVIDENCE: Moderate

DELEGATE VOTE: Agree: 97%, Disagree: 1%, Abstain: 2% (Unanimous, Strongest Consensus)

RATIONALE

Implant factors such as bearing surfaces can influence serum and synovial markers when evaluating for PJIs. This has been mostly studied in MoM bearings and dual taper modular stems [1–3]. It can be difficult to discern adverse local tissue reactions (ALTRs) with associated metal ion release from inflammatory response to infection [4,5]. However, it is important to determine the presence of infection as it will alter treatment [6,7]. Serum erythrocyte sedimentation rate (ESR), C-reactive protein (CRP) and white blood cell (WBC) count with differential are important tests in helping determine presence of PJI [8].

There have been various recommendations regarding the parameters for serum and synovial markers for diagnosing PJI in the presence of MoM corrosion, but most studies have demonstrated that the type of bearing surface and other implant factors can affect the thresholds for serum and synovial markers in PJI. Still, no literature has clearly delineated the specific parameters that should be utilized for differing bearing surfaces to diagnose PJI [9,10].

Automated synovial cell counts and differentials in the setting of a failed MoM THA have been reported to be inaccurate [2,3,11]. It has been theorized that the automated cell counting machine may be incorrectly identifying particulate debris and counting it as cellular [2]. As such, many surgeons propose utilizing a manual cell count and differential when analyzing the synovial WBC and differential [1].

Wyles et al. [2] found that the sensitivity of the synovial WBC count could be maintained at 100% while improving specificity to 71% if the cutoff to diagnose infection was moved from >3,000 to >15,000 cells/microliter. Additionally, the authors found the sensitivity of neutrophil percentage could be maintained at 100% and improved specificity to 100% by elevating the cutoff percentage from 82 to 92% neutrophils. Regarding CRP, the authors found that the sensitivity of CRP could be maintained at 75% while improving the specificity of CRP to 97% if the cutoff value of CRP was raised from >8 to >54 mg/L. The authors demonstrated that changing the cutoff value for the ESR did not change specificity as significantly.

In contrast, Yi et al. [3] studied PJI in patients with failed MoM bearing surfaces and after excluding what they deemed to be inaccuracies, recommended a synovial WBC cutoff of 4,350 WBC/microliter with 100% sensitivity and 95% specificity. The authors, however, reported low positive predictive values of 43% and 39% for ESR and CRP, respectively, in the setting of MoM bearings.

Kwon et al. reported that ESR and CRP have a limited value in the diagnosis of PJI in dual taper modular implants with evidence of corrosion, but acknowledged the utility of ESR and CRP in excluding PJI [1]. The authors demonstrated, however, that synovial WBC and differential were useful markers for diagnosing infection. Specifically, the authors demonstrated a sensitivity and specificity of 86% and 80%, respectively, when utilizing a synovial WBC cutoff of 730 cells/microliter. A synovial polymorphonuclear (PMN) % cutoff of 65% yielded a 100% sensitivity and a 70% sensitivity.

Okroj et al. in a multicenter study evaluated the alpha-defensin test to diagnose PJI in the setting of ALTRs. Twenty-six patients were reviewed with one of 26 (3.8%) meeting the MusculoSkeletal Infection Society (MSIS) criteria for PJI. The one patient with PJI had a metal-on-polyethylene bearing surface with head-neck taper corrosion. Of note, there were 8 falsely positive alpha-defensin tests. The authors concluded that in the setting on ALTRs, alpha-defensin testing can lead to a high rate of false positives [12].

Though the exact parameters to diagnose PJI in the setting of different implant factors need further elucidation, given the existing literature, we conclude that various implant factors can influence both synovial and serum markers in the setting of PJI. We strongly urge the orthopaedic community to be cognizant of the influence of bearing surfaces, especially in the setting of MoM implants or potential metal corrosion, and to consider using a combination of diagnostic tests along with manual cell counts as part of their PJI diagnostic workup.

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