Histological Analysis of Early Osteolysis in Total Ankle Arthroplasty
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Introduction/Purpose: The purpose of this study was to perform a histological comparative analysis of tibiotalar joint samples taken from areas of osteolysis adjacent to total ankle arthroplasties vs control synovial specimens to determine the reaction to and presence of polyethylene (PE) particles.

Methods: A total of 57 pathology samples were identified in the osteolysis group, while 11 were identified in the control group. For each sample, hematoxylin and eosin, Oil Red O (ORO), and macrophage marker CD163-stained slides were created. Polarized light and ORO stain were used to identify PE particles. The presence of metal particles and giant cell reaction to PE particles were also scored.

Results: Macrophages, PE particles, metallosis, and foreign body giant cell reaction scores were significantly higher in the osteolysis group compared with the control group. In the osteolysis group, ORO staining was positive in 93% (53/57), birefringent material was present in 96.5% (55/57), and macrophage infiltrates were present in 96.5% (55/57). Foreign body giant cell reaction with giant cells surrounding PE particles was present in 49.1% (28/57) of osteolytic specimens. The presence of foreign body giant cell reaction was associated with significantly higher macrophage, ORO, and polarizable material scores. The average time to surgery for osteolysis from the index ankle replacement was 6.0 (range, 0-15) years for the 57 patients in the osteolysis group.

Conclusion: This study is the largest ankle arthroplasty histological analysis to show that areas of osteolysis consist of abundant polyethylene wear particles, present both intracellularly and extracellularly. Furthermore, these areas were associated with a CD163+ macrophage infiltrate and frequently a foreign body reaction with giant cells engulfing PE particles. It is likely that implant wear particles play a significant role in osteolysis based on the histopathology.

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