

A Novel Technique for Diagnosing Implant-Implant Impingement After Total Hip Arthroplasty

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INTRODUCTION: Implant-implant impingement in total hip arthroplasty remains a primarily clinical diagnosis, with limited imaging technology available to demonstrate impingement radiographically beyond cross-table lateral x-rays. The purpose of this study was to determine the effectiveness of external rotation stress computed tomography (CT) scans in evaluating for impingement in patients with painful total hip prostheses.

METHODS: Sixty-seven patients evaluated by two high-volume arthroplasty surgeons who underwent CT-IMA (Implant Movement Analysis) scans between May 2021 and May 2024 were identified. All patients received appropriate work-up for pseudotumor and infection as indicated. Plain radiographs were reviewed to assess acetabular cup abduction. External rotation CT IMA scans were analyzed to measure acetabular component version and the distance between the femoral neck and acetabular component. Patients were divided into impingement (IMP) and non-impingement (NON-IMP) groups based on clinical or intraoperative findings. A receiver operating characteristic (ROC) curve evaluated sensitivity and specificity of implant-implant distances, and statistical comparisons were made for cup version, abduction, and implant-implant distances between groups.

RESULTS: Mean follow-up was 15.2 ± 10.1 months, with an average patient age of 59.4 ± 12.2 years. Twenty-nine patients were diagnosed with impingement and thirty-eight with alternative causes of hip pain, including component loosening or periprosthetic joint infection. The ROC curve demonstrated 100% sensitivity and 89% specificity for diagnosing impingement when implant-implant distance was less than 5 mm (area under the curve = 0.98 ± 0.02). Linear regression showed a significant negative correlation ($P = .004$) between cup version and implant-implant distance. There was no significant difference in cup abduction between groups ($P = 0.89$). Implant-implant distance was significantly smaller in the impingement group ($P < .0001$).

DISCUSSION: External rotation stress CT scans demonstrated excellent diagnostic accuracy for detecting implant impingement in total hip arthroplasty, particularly when the implant-implant distance was < 5 mm. The findings suggest that CT-IMA technology provides objective radiographic confirmation of impingement, which has historically relied on clinical evaluation alone.

SIGNIFICANCE/CLINICAL RELEVANCE: External rotation stress CT scans offer a sensitive and specific method to objectively identify implant-implant impingement in painful total hip prostheses, enhancing diagnostic precision and potentially guiding revision decision-making in complex cases.

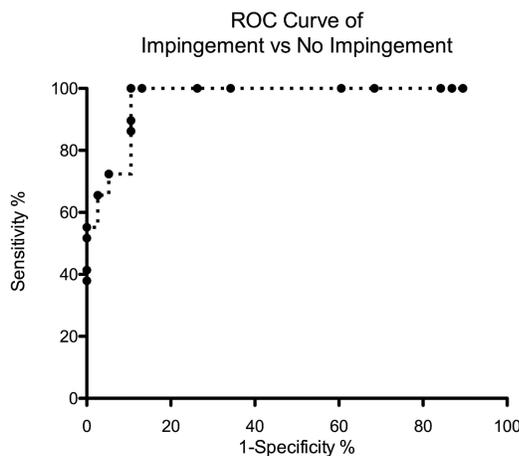


Figure 1. Receiver operating characteristic curve for Implant-Implant distance showing an area under the curve of 0.98 ± 0.02 (95% CI 0.94-1.0; $P < 0.0001$). At less than 5mm of implant-implant distance, there was a 100% sensitivity and 89% specificity for patients having a main clinical diagnosis of impingement.

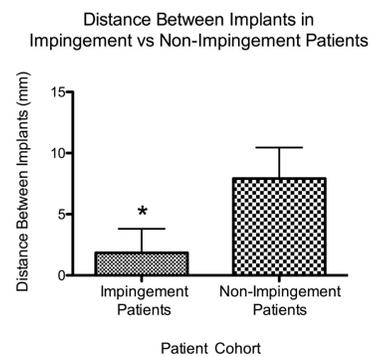


Figure 2. Average implant-implant distance in the impingement and non-impingement patient cohorts. The average implant-implant distance was significantly smaller in the impingement cohort compared to the non-impingement cohort.

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