Distinct Clinical Presentations of Trunnionosis and Gross Trunnion Failure Following Mechanically Assisted Crevice Corrosion in Total Hip Arthroplasty

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INTRODUCTION: Total hip arthroplasty (THA) is among the most successful procedures in modern orthopaedics; mechanically assisted crevice corrosion (MACC) represents a rare but devastating complication following THA. The purpose of this retrospective review was to evaluate differences in symptoms and clinical presentation between trunnionosis and gross trunnion failure (GTF), both associated with MACC in THA.

METHODS: This IRB-approved retrospective cohort study examined patients who underwent revision THA performed by a single, senior surgeon at our institution. The cohort included 73 patients (82 hips) who underwent revision THA due to MACC from the Accolade I femoral stem and low friction ion treatment (LFIT) Cobalt-Chromium (CoCr) femoral head. Patients were categorized into trunnionosis or GTF groups based on radiographic and intraoperative findings. Baseline patient demographics, implant characteristics, intraoperative findings, and postoperative outcomes were compared. Continuous variables were analyzed using Mann-Whitney U tests, and categorical variables were compared using chi-square or Fisher's exact tests, with significance set at $p < 0.05$. Qualitative data was collected from clinic notes to evaluate how patients described their symptoms preoperatively.

RESULTS SECTION: Overall, patients with GTF were more frequently male (77% vs. 44%, $p = 0.038$), taller (177.2 vs. 171.0 cm, $p = 0.019$), and had a longer time from primary to revision surgery (10.0 vs. 7.2 years, $p = 0.002$). GTF patients also reported shorter symptom duration prior to revision (3.1 vs. 8.9 months, $p < 0.001$) and were less likely to experience chronic pain (38% vs. 97%, $p = 0.0012$). Four GTF patients were entirely asymptomatic before catastrophic failure. Our qualitative review demonstrated that patients with trunnionosis most often described their pain as "aching" or "radiating", while GTF patients described it as "sharp" or "deep". Preoperative serum cobalt levels were significantly higher in the GTF group (15 vs. 6.4 ng/mL, $p = 0.014$), although serum chromium levels and Co:Cr rations were not significantly different between groups. GTF patients had larger acetabular cup sizes (57.1 vs. 55.1 mm, $p = 0.0089$), but no other significant differences in implant sizes were found. Post-operative follow-up duration was comparable between groups: 5.4 years for trunnionosis patients and 3.8 years for GTF patients. Re-revision rates were low in both groups: 4 hips (5%) in trunnionosis and 1 hip (7%) in GTF. Post-operative HOOS JR and HSV scores significantly improved in both groups compared to pre-operative scores, and serum metal ion levels trended toward normal after revision.

DISCUSSION: These findings demonstrate distinct clinical presentations, suggesting that GTF and trunnionosis represent separate entities rather than points along a single MACC spectrum. The male predominance and greater height among GTF patients likely reflect higher mechanical loads and greater lever arm stresses at the trunnion, supporting the concept that GTF is primarily a mechanically driven failure. The longer interval from primary to revision in GTF patients suggests years of silent corrosion culminating in abrupt mechanical failure, rather than progressive pain. GTF patients had shorter symptom duration and a lower prevalence of chronic pain, suggesting that pain is an unreliable early indicator of gross trunnion failure, unlike in trunnionosis. Notably, some GTF patients were entirely asymptomatic prior to catastrophic failure. Encouragingly, both groups demonstrated low re-revision rates and substantial functional improvement, reinforcing that timely recognition and revision can effectively address both corrosion and mechanically driven failure modes.

SIGNIFICANCE/CLINICAL RELEVANCE: Trunnionosis and GTF represent distinct clinical entities with different patterns of presentation. Because GTF patients present with chronic pain less often, alternative indicators such as elevated serum metal ion levels or radiographic changes should be considered. Surgeons should maintain heightened vigilance for GTF, particularly in taller patients, male patients, and those with larger acetabular components, where mechanical stresses at the head-neck junction are greatest. Recognizing these clinical presentations of both trunnionosis and GTF can help improve surgical outcomes through more targeted surveillance and timely revision.

IMAGES AND TABLES:

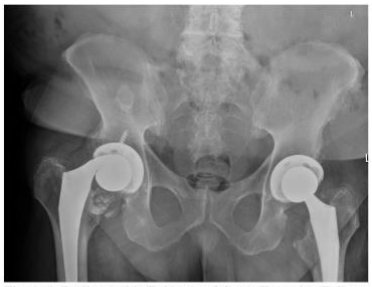

Figure 1. Radiographic Evidence of Gross Trunnion Failure. Macroscopic notching of the right femoral neck shown; image taken after admission to the emergency department.

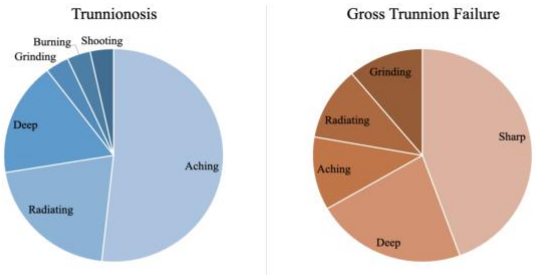

Figure 2. Descriptions of Pain for Trunnionosis and Gross Trunnion Failure Groups. The Trunnionosis group commonly described their pain as "Aching" and "Radiating", while the Gross Trunnion Failure Group commonly described their pain as "Sharp" and "Deep".

Table 1. Baseline Patient Information and Implant Characteristics

Characteristics	Trunnionosis (n=69) (Mean, ±Standard Deviation) [a]	Gross Trunnion Failure (n=13) (Mean, ±Standard Deviation)	p-value
Age at Revision THA (years)	66.9 (10.5)	68.5 (9.3)	<0.01*
Height (cm)	171.0 (11.8)	177.2 (7.4)	0.019*
Sex (n, %)			
Female	39 (56%)	3 (23%)	0.038*
Male	31 (44%)	10 (77%)	
Time to Revision (years)	7.16 (3.1)	10.05 (2.6)	<0.01*
Duration of Symptoms (months)	8.93 (6.8)	3.08 (4.33)	<0.01*
Type of Symptoms [b,c] (n, %)			
Chronic Pain (>1 month)	67 (97%)	5 (38%)	<0.01*
Instability	3 (4%)	3 (23%)	0.32
Weakness	1 (1%)	1 (7%)	0.43
Median Preoperative Cobalt levels (ng/mL)	6.4	15.0	0.014*
Primary Implant Sizes			
Stem Size	3.2 (1.1)	3.5 (0.89)	0.36
Headball Size (mm)	35.4 (1.9)	35.3 (1.5)	0.97
Headball Length (mm)	3.4 (2.6)	3.7 (2.1)	0.36
Cup Size (mm)	55.1 (2.9)	57.1 (1.5)	<0.01*

*Denotes significance

a. Unless otherwise noted
b. Multiple symptoms noted if simultaneously present
c. Notably, 4 patients later identified has having gross trunnion failure, did not experience any symptoms