Risk Factors for Medial Impingement after Total Ankle Replacement

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INTRODUCTION:
Postoperative impingement is a painful and limiting complication after total ankle arthroplasty (TAA) and can detract from the outcome of what would otherwise be a successful TAA. Accordingly, impingement is among the most common causes of reoperation following TAA, but there is limited evidence regarding potential risk factors. Furthermore, no evidence-based analysis has been conducted to assess the role of these factors in the development of medial or lateral impingement post-TAA. This study sought to identify the risk factors associated with reoperation for medial impingement post-TAA. We hypothesized that elevated joint line height, internal rotation of the implant, and medial talar translation in the mortise would increase the risk of medial impingement while downsizing the talar component size relative to the tibial component would be protective.
METHODS:
A case-control study was conducted from a registry of 1133 patients from 2013-2022 undergoing primary TAA with any implant and minimum 1-year radiographic follow-up. A total of 34 cases of reoperation for medial impingement post-TAA were identified and matched by simple random sampling to a control group of 115 patients. Demographics, surgical data, and radiographs were reviewed. Radiographic parameters included pre- and post-TAA coronal alignment, post-TAA talar center of migration ratio (TCMr – a measure of talar translation in the mortise relative to the tibial axis), the joint line height ratio (JLHR–a measure of joint line level), and absolute talar component rotation on weight-bearing CT scans. Variables were compared between cohorts using the Mann-Whitney U test for continuous and Fisher's exact test for categorical variables. Logistic regression was used to investigate the association of medial impingement with postoperative coronal alignment, talar component downsizing, TCMr, and postoperative JLHR using odds ratios(OR).
RESULTS:
The mean postoperative JLHR was significantly more elevated in cases (1.63±0.36) than in controls (1.49±0.21, P=0.037), indicating a more elevated joint line in the medial impingement cohort. There was no significant difference in postoperative coronal alignment between cases (91.2°±3.0°) and controls (90.5°±1.9°, P=0.16). Cases of medial impingement had a significantly greater TCMr compared to controls (11.9%±13.7% vs. 6.5%±15.2%, *P*=0.015), suggesting a more medially translated talus. Similarly, the cases also had a significantly greater internal rotation of the talar component (2.9°±2.7° vs. 0.2°±3.3°, *P=0.07).* Regression modeling determined that joint line elevation was a significant risk factor for postoperative medial impingement (OR[SE]=1.6[0.08],*P*=0.01), while downsizing of the talar component resulted in a 48% reduction in odds of postoperative medial impingement (OR[SE]=0.52[0.42], *P*<0.05).
DISCUSSION AND CONCLUSION:
In this study, an elevated joint line level (JLHR) was identified in the regression model as a significant risk factor for post-TAA medial impingement. With each 0.2 unit increase in the JLHR, there was a 60% increase in the odds of developing medial impingement after TAA. Therefore, downsizing of the talar component should be considered in cases where re-establishing the physiologic joint line is not possible due to long-standing deformity. In addition, great care should be taken when aligning the prosthesis to ensure proper axial rotation and coronal translation of the components to avoid excessive internal rotation and medial translation.

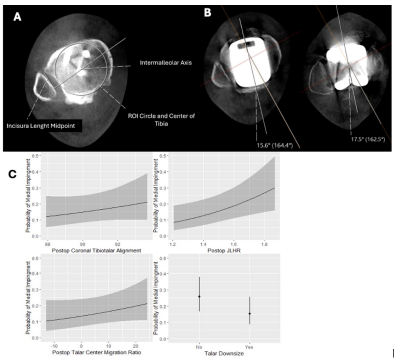

Fig. 1a: The transmalleolar axis is a line that passes through the center of the tibial plafond and the center of the incisura fibularis. This line can be identified on an axial cut from a WBCT scan taken at the level of the distal tibiofibular joint by marking these two points and connecting them with a straight line.

Fig. 1b: Tibial and talar component rotation.
The tibial and talar component rotations were measured with respect to a line perpendicular to the transmalleolar axis. The absolute talar component rotation was obtained by subtracting the tibial rotation from the talar component rotation. Absolute talar rotation was considered positive (+) if it occurred medially and negative (-) if rotated laterally.

Fig. 1c: Partial logistic regression plots with postoperative medial impingement as the outcome. Increased odds of developing postoperative medial impingement after TAA were significantly associated with a higher joint line height ratio (JLHR – a measure of the joint line level) (OR [SE] = 1.6 [0.08], *P*=0.01). Conversely, downsizing of the talar component relative to the tibial implant at the index surgery was identified as protective (OR [S.E] = 0.52 [0.42], $P < 0.05$). In the regression model, postoperative coronal alignment and medial translation of the talar component were not associated with higher odds of medial impingement after TAA.