Radiographic and Clinical Outcomes of SER-IV Bimalleolar vs. Deltoid Variant Ankle Fractures and the Impact of Fibular Fixation Constructs

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INTRODUCTION:

Supination external rotation type IV (SER-IV) ankle fractures include bimalleolar fractures and deltoid variants (isolated deltoid ligament injury without medial malleolar fracture). The role of deltoid repair and optimal fibular fixation constructs in these injuries remains debated. This study aimed to (1) compare clinical and radiographic outcomes of bimalleolar versus deltoid variant fractures without syndesmotic injury, (2) assess alignment changes with deltoid non-repair, and (3) evaluate differences in outcomes across fibular fixation types. We hypothesized that deltoid variant and bimalleolar fractures would have similar outcomes and alignment, that not repairing the deltoid ligament would not affect final postoperative alignment, and that tubular and anatomic plates would yield comparable radiographic alignment and low incidence of revision

METHODS: A retrospective review of 132 patients with SER-IV fractures (89 bimalleolar, 43 deltoid variant) treated between 2011 and 2024 was conducted, excluding those with syndesmotic injury. A secondary cohort of 365 patients with lateral ankle fractures was analyzed to compare fibular fixation constructs. Demographic, surgical, and radiographic data (medial clear space [MCS], superior clear space [SCS], tibiofibular clear space [TFCS], talocrural angle) were collected. Outcomes were analyzed using t-tests and chi-square tests.

RESULTS:

Radiographic outcomes showed preserved alignment regardless of deltoid repair. In the bimalleolar group, final MCS did not increase and went from 3.0 ± 0.8 mm to 2.6 ± 0.7 mm ($p = 0.009$), and in the deltoid variant group from 3.2 ± 1.1 mm to 2.7 ± 0.7 mm ($p = 0.016$). SCS also did not increase in both groups (bimalleolar: 3.4 ± 0.8 mm to 2.9 ± 0.5 mm, $p < 0.001$; deltoid variant: 3.7 ± 0.8 mm to 2.9 ± 0.6 mm, $p < 0.001$). TFCS remained stable across both groups (bimalleolar: 5.3 ± 1.4 mm to 5.3 ± 1.4 mm; deltoid variant: 5.1 ± 1.3 mm to 5.6 ± 1.5 mm). Changes in MCS (−0.4 mm vs. −0.5 mm, $p = 0.097$), SCS (−0.5 mm vs. −0.8 mm, $p = 0.112$), and TFCS (0.0 mm vs. 0.5 mm, $p = 0.887$) from initial postoperative imaging to final postoperative imaging were not significantly different between groups. Complication rates (18.0% [16/89] vs. 11.6% [5/43], $p = 0.33$) and secondary surgeries (15.7% [14/89] vs. 9.3% [4/43], $p = 0.29$) rates were also comparable. There were no differences in Takakura arthritis score between the groups as well (bimalleolar: 1.3 ± 0.5 vs. deltoid variant: 1.2 ± 0.4, $p = 0.43$)

Anatomic locking plates and tubular plates showed no differences in final postoperative MCS, SCS, or TFCS, revision surgery rates, and Takakura arthritis score. Among fibular fixation methods (n=365), fibular nails had the highest revision burden. Revision surgery was required in 2 of 12 patients (16.7%) treated with fibular nails, 2 of 282 patients (0.7%) with tubular plates, and 2 of 60 patients (3.3%) with anatomic locking plates. Conversion to arthoplasty occurred in 1 of 12 fibular nail patients (8.3%; p =), and 0 patients in the fibular nail and tubular plate groups. Conversion to fusion was seen in 1 of 11 patients (9.1%) treated with screw fixation, 1 of 60 (1.7%) with anatomic plates, and 0 patients in the fibular nail and tubular plate groups.

DISCUSSION AND CONCLUSION: Patients with both SER-IV bimalleolar and deltoid variant fractures exhibit comparable clinical and radiographic results. In SER-IV fractures patients with deltoid injury without repair, alignment is maintained through follow up, and there was no difference in clinical or radiographic outcome. This suggests that repair of deltoid ligament in these ankle fractures may not be necessary. Anatomic and tubular plates achieve similar alignment and no differences in revision rates. Fibular nails may carry elevated complication risks, likely due to selection of patients with higher comorbidity burden. Prospective trials are needed to guide fixation strategy and confirm these findings.