# Should we fix small posterior malleolar fragments in the setting of trimalleolar ankle fractures?

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## Background

Trimalleolar fractures make up 7% of all ankle fractures and the presence of a posterior malleolar fragment (PMF) is associated with worse outcomes. However, indications for posterior malleolar fixation remain unclear.

The purpose of this study was to evaluate indications and outcomes for PMF fixation in the setting of trimalleolar ankle fracture with an additional focus on small PMFs <25% of the articular surface.

## Methods

A retrospective review identified 79 trimalleolar ankle fractures over a 35-month period.

Medical records and CT scans were reviewed for patient/injury characteristics, including demographics, PMF size/displacement, and need for syndesmotic fixation. Intraoperative measures included estimated blood loss (EBL) and operative/tourniquet time. Postoperative measures included complications.

## Tables/Figures

**Table 1: Posterior Malleolus Fixation vs. Control Group Characteristics**

| | Full Cohort, PMF Fixation vs Control Groups | | | | PMF 11% to 25% Cohort, PMF Fixation vs Control Groups | | | |
|---|---|---|---|---|---|---|---|---|
| | Difference, 95% CI | Univariate P-value | Multivariate P-value | Odds Ratio (95% CI) | Difference, 95% CI | Univariate P-value | Multivariate P-value | Odds Ratio (95% CI) |
| *Fragment Size Percentage (%) ϕ | 12.4%, 8.4% to 16.4% | **<0.0001** | **0.048** | **1.11 (1.00 to 1.23)** | 1.2%, -1.3% to 3.7% | 0.3289 | | |
| *Fragment Height (mm) | 10.4, 6.7 to 14.2 | **<0.0001** | **0.028** | **1.10 (1.00 to 1.20)** | 7.0, 3.0 to 12.0 | **0.0002** | **0.0044** | 1.19 (1.03 to 1.38) |
| *Fragment Displacement (mm)ϕ | 1.5, 0.5 to 2.6 | **0.004** | 0.454 | 1.12 (0.83 to 1.50) | 0.4, -1.0 to 1.7 | 0.5613 | | |
| **Fragment/ Plafond Area Percentage (%) | 9.3%, 4.8% to 14.0% | **<0.0001** | 0.302 | 1.06 (0.95 to 1.18) | 3.5%, 1.0% to 8.0% | **0.0209** | 0.7199 | 1.02 (0.92 to 1.12) |

**Table 2: Posterior Malleolus Fixation vs. Control Group Outcomes**

| | Full Cohort, PMF Fixation vs Control Groups | | PMF 11% to 25% Cohort, PMF Fixation vs Control Groups | |
|---|---|---|---|---|
| | Difference, 95% CI | P-value | Difference, 95% CI | P-value |
| Postoperative Joint Step Off (mm) | 0, -1.1 to 0 | 0.08 | 0, -1.2 to 0 | 0.3237 |
| Postoperative Concentric Reduced Joint Space (n (%)) | 14.0%, -8.0% to 34.6% | 0.21 | 5.9%, -24.1% to 35.4% | 0.7100 |
| Syndesmosis Fixation (n (%)) | -44.6%, -61.8% to -23.0% | **<0.0001** | -23.0%, -50.2% to 8.4% | 0.1520 |
| Estimated Blood Loss (mL) | 20, 0 to 40 | **0.017** | 15.0, -5.0 to 50.0 | 0.2276 |
| Operative Time (min)ϕ | 53.0, 35.9 to 70.1 | **<0.0001** | 44.5, 17.0 to 69.0 | **0.0017** |
| Tourniquet Time (min) | 26, 4 to 33 | **0.002** | 22.1, 4.3 to 39.8 | **0.0184** |
| Complications | 26.9%, 6.3% to 44.8% | **0.014Å** | 24.2%, -7.2% to 57.9% | 0.1276 |

(CI – Confidence Interval)

- *Measured using sagittal CT scan
- **Measured using axial CT scan
- ϕAll parametric continuous variables are presented as mean (95% CI)
- Remaining continuous variables were nonparametric and are presented as median (interquartile range)
- Mean difference for parametric continuous data, median difference for nonparametric continuous data, and proportional difference for nominal data
- All 2-way testing
- **P-values less than 0.05 were considered statistically significant**
- **ÅPost hoc analysis demonstrated a significant difference between groups on wound complications (proportional difference: 26.5%, 95% CI: 6.9% to 43.6%, p=0.009)**

## Results

Among all 79 fractures, the PMF was fixated in 48.1% of patients (n=38). PMF fixation was associated with larger fragment size and height **(Table 1)**. The fixation group had a reduced need for syndesmotic fixation and an increased EBL, operative time, tourniquet time, and wound complications **(Table 2)**.

15 (29%) out of the 52 patients with PMFs <25% underwent fixation. Small PMFs (11-25%) that were fixed, compared to those that were not fixed, had a similar fragment size/displacement, EBL, need for syndesmotic fixation, and complication/reoperation rate. Fixated small PMFs did have a greater fragment height and operative/tourniquet times **(Tables 1 and 2)**.

## Conclusions

PMF fixation resulted in a higher rate of wound dehiscence, operative time, and blood loss while not eliminating the need for syndesmotic fixation or improving reduction quality. The benefits of fixing small PMFs should be weighed against potential risks.

## References

[1] Court-Brown CM, McBirnie J, Wilson G. Adult ankle fractures--an increasing problem? Acta Orthopaedica Scandinavica 1998;69:43–7.
[2] Bartoníček J, Rammelt S, Tuček M, Naňka O. Posterior malleolar fractures of the ankle. European Journal of Trauma and Emergency Surgery 2015 41:6 2015;41:587–600.
[3] Jaskulka RAM, Ittner GM, Schedl RM. Fractures of the posterior tibial margin: their role in the prognosis of malleolar fractures. The Journal of Trauma 1989;29:1565–70.
[4] Gardner MJ, Streubel PN, McCormick JJ, Klein SE, Johnson JE, Ricci WM. Surgeon Practices regarding Operative Treatment of Posterior Malleolus Fractures: Foot & Ankle International 2011;32:385–93.
[5] McDaniel JWM, Wilson FCM. Trimalleolar fractures of the ankle. An end result study. Clinical Orthopaedics and Related Research 1977:37–45.