

Improved Reduction of Posterior Malleolus Fractures with Open Fixation Compared to Percutaneous Treatment

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Purpose: The purpose of this study is to compare radiographic and patient reported outcomes between percutaneous and open fixation of posterior malleolus fractures. We also aimed to identify factors associated with malreduction. We hypothesized that open reduction would lead to improved quality of reduction.

Methods: Operatively managed ankle fractures that included posterior malleolus fixation from 2010-2018 were reviewed. Fracture characteristics were determined on preoperative CT scans. Intraoperative radiographs were used to measure reduction of the posterior malleolus articular surface and graded as satisfactory (<2 mm step-off) or malreduced (>2 mm step-off). Postoperative PROMIS (Patient-Reported Outcomes Measurement Information System) scores and complications were recorded. Outcomes were compared between percutaneous and open fixation cohorts. A multivariate stepwise regression model was used to evaluate predictors for malreduction.

Results: A total of 120 patients met inclusion criteria (91 open and 29 percutaneous). Outcomes are detailed in Table 1. There were no significant differences in complication rates or final PROMIS scores between groups (P>0.05). Malreduction of the posterior malleolus was present in 11.7% of patients. Malreduction rates were significantly higher after percutaneous fixation than open (24.1% vs 7.7%; P = 0.02). Multifragmented fractures (31.3% vs 6.0%) and those with ≥5 mm of displacement (55.6% vs 10.6%) demonstrated significantly higher malreduction rates with percutaneous vs open reduction (P <0.05) while single fragments and those with <5 mm of displacement experienced similar malreduction rates with percutaneous or open fixation. Initial displacement of the posterior malleolus ≥5 mm (relative risk [RR] = 3.8, 95% confidence interval [CI] = 1.2-11.5, P = 0.02) and percutaneous treatment (RR = 4.1, 95% CI = 1.6-10.5, P<0.01) were independent risk factors for malreduction.

Conclusion: Open fixation of the posterior malleolus leads to improved fracture reduction compared to percutaneous techniques without an increased complication rate. Open fixation significantly improves fracture reduction when multiple fragments or ≥5 mm of displacement is present. Single fragment fracture and those with <5 mm of displacement are able to achieve similar reductions with percutaneous or open fixation.

Table 1*

	Percutaneous (N=29)	Open (N=91)	†p-value
Age (Mean ± SD, years)	56.4 ± 17.3	49.1 ± 17.1	0.046
Sex (n)			0.34
Male	27.6% (8)	37.4% (34)	
Female	72.4% (21)	62.6% (57)	
Multifragmented (n)	55.2% (16)	55.0% (50)	0.98
Interposed Fragment (n)	41.4% (12)	50.5% (46)	0.39
≥ 25% Articular Involvement (n)	65.5% (19)	62.6% (57)	0.78
Initial Displacement ≥ 5mm (n)	31.0% (9)	51.7% (47)	0.053
Final PROMIS Scores (Mean ± SD)			
Physical Function	41.9 ± 7.7	43.0 ± 6.9	0.56
Pain Interference	53.8 ± 10.1	54.7 ± 7.9	0.68
Depression	47.1 ± 11.6	48.6 ± 10.5	0.60
Complications (n)	10.3% (3)	18.7% (17)	0.40
Malreduction Rate (n/N)			
Overall	24.1% (7/29)	7.7% (7/91)	0.02
Multiple Fragments	31.3% (5/6)	6.0% (3/50)	0.02
Single Fragment	15.4% (2/13)	9.8% (4/41)	0.62
Large Articular Fragment (≥25%)	26.3% (5/19)	8.8% (5/57)	0.11
Small Articular Fragment (<25%)	20.0% (2/10)	5.9% (2/34)	0.22
Displaced Fractures (≥5mm)	55.6% (5/9)	10.6% (5/47)	<0.01
Mild Displacement (<5mm)	10.0% (2/20)	4.6% (2/44)	0.58
Interposed/Incarcerated Fragment	33.3% (4/12)	10.9% (5/46)	0.07
No Interposed/Incarcerated Fragment	17.7% (3/17)	4.4% (2/45)	0.12

SD = Standard deviation

***Boldface** indicates statistical significance.

†p-values calculated using independent t-tests (continuous) and chi square analysis or Fishers exact test (categorical)

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