

Quantitative evaluation of posterior talar subluxation in posterior malleolar fractures: A preliminary study

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INTRODUCTION

Ankle posterior subluxation is one of the major mechanism by which posterior malleolar fractures (PMF) contribute a worse prognosis. However, there is no parameter to address it quantitatively.

Purpose

So, we suggest a method that can evaluate posterior talar subluxation quantitatively in PMF.

MATERIALS & METHODS

We retrospectively analyzed 37 patients with PMFs. The patients were divided into two groups: PMF without posterior talar subluxation (n = 18), and with posterior talar subluxation (n =19) (Table 1). We measured the distance between the arc center of the talus and the anterior tibia (TAD), the percentage of articular involvement of the fracture fragment, the inter-fragment distance (IFD) and articular step-off (Figure 1, 2 and 3). We analyzed significant differences and the correlation between the two groups for each index. The estimated area of the receiver operating characteristics (ROC) curve was calculated, and cutoff values were suggested to discriminate posterior talar subluxation.

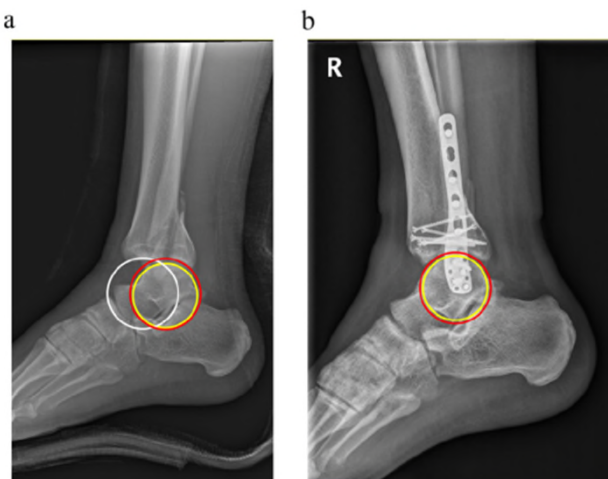


Figure 1

(1a). A posterior malleolar fracture disrupt the posterior portion of the arc, which forms three arcs on the joint surface of the anterior distal tibia, fractured fragment and talar dome

(1b). Anatomical reduction of the PMF could be regarded as a process of restoring the scattered centers of the arcs to their original positions.

Table 1
Demographics and description of study subjects.

	Without posterior talar subluxation	With posterior talar subluxation	p-value
No. of patients	18	19	NA
Age (yrs) *	55.5 ± 14.2	55.4 ± 20.1	0.989
Sex (M:F)	9:9	4:15	0.065
Fracture type			NA
44A3.2	1	0	
44B3.1	6	0	
44B3.2	8	13	
44B3.3	0	1	
44C1.3	2	2	
44C2.3	1	3	

* The values are given as the mean and the standard deviation.

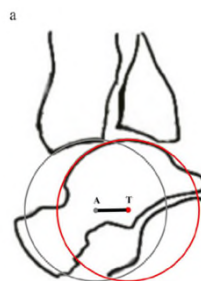


Figure 2.

We used two arcs on the joint surface of the anterior distal tibia and talar dome. The center of the arc containing the talar dome was called T, and anterior distal tibial articular surface was A. We called the distance between the two centers as TAD.



Figure 2.

(2b) The center of each arc was displayed on PACS using a special tool (multiple circle tool) that shows the center of a specific circular arc in lateral ankle radiographs. distance between the center of the third circle and mid-diaphyseal line was defined as the lateral talar station (LTS).

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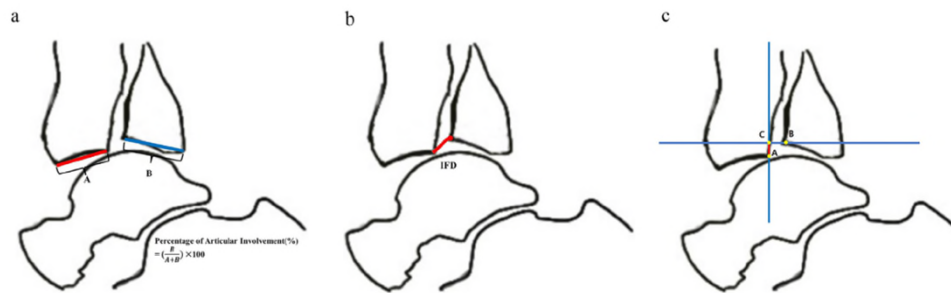


Figure 3.

(3a) The percentage of articular involvement of the fracture.

(3b) The distance between the fracture fragments.

(3c) Articular step-off was defined as the distance between points A and C.

Results

TAD, IFD, and articular step-off were significantly greater in patients with posterior talar subluxation. (TAD: 14.3 vs. 2.8 mm, $p < 0.001$, IFD: 7.8 vs. 4.0 mm, $p < 0.001$, articular step-off: 3.6 vs. 2.0 mm, $p = 0.004$). The ROC curve showed that TAD was most useful to determine cutoff values for posterior talar subluxation. The area under the curve for TAD was 1.000, and the appropriate cutoff value was 5 mm. When a TAD of > 5 mm was used as a threshold, a sensitivity of 100% and a specificity of 100% were achieved in determining the presence of posterior talar subluxation. Also, higher TAD was correlated with IFD and articular step-off.

Table 2

Comparison of four parameters between groups with and without posterior talar subluxation.

	Patients without subluxation (n = 18)	Patients with subluxation (n = 19)	p-value
TAD (mm)	2.8 ± 1.2	14.3 ± 4.7	<0.001
Articular involvement (%)	30.1 ± 11.9	32.2 ± 11.6	0.583
IFD (mm)	4.0 ± 2.3	7.8 ± 3.5	<0.001
Step-off (mm)	2.0 ± 1.4	3.6 ± 1.8	0.004

The values are given as the mean standard deviation.

Table 3

AUC of the ROC curve and 95% confidence interval (CI) of four radiographic parameters for discriminating between groups with and without posterior talar subluxation.

Parameters	AUC	95% CI	p-value
TAD	1.000	1.00–1.00	<0.001
Articular involvement	0.567	0.371–0.764	0.485
IFD	0.836	0.702–0.971	<0.001
Articular step-off	0.782	0.629–0.935	0.003

Conclusion

TAD can be a useful parameter for evaluating the posterior talar subluxation in PMF. It can reflect not only the degree of fracture displacement but also posterior talar subluxation quantitatively.