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Original Research

Postoperative Radiographic and Clinical Assessment of the Treatment of Posterior Tibial Plafond Fractures Using a Posterior Lateral Incisional Approach

Huang Ruokun, MD, Xie Ming, MD, Xiao Zhihong, MD, Fang Zhenhua, MD, Zhao Jingjing, MD, Xiao Kai, MD, Li Jing, MD

Department of Foot and Ankle Surgery, Wuhan Puai Hospital, Wuhan, China

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ABSTRACT

The purpose of the present study was to evaluate the postoperative radiographic and functional outcomes of reduction and fixation of a posterior plafond fracture using a posterolateral approach. We included 38 patients with a tibial plafond fracture. Fixation was most commonly performed using screws, T plates, or meta plates. The average follow-up period was 38 (range 25 to 72) months. The clinical outcomes of these patients were evaluated using the American Orthopaedic Foot Ankle Society score. The radiographs of the included patients were evaluated twice within 2 months by 3 experienced orthopedic trauma surgeons, who performed the retrospective radiographic review. Articular step off measures included the radiographic appearance of the reduction using picture archiving and communication system measurement tools. All 32 patients showed radiologic evidence of bony union at the follow-up visit; 6 patients were lost to follow-up. The American Orthopaedic Foot Ankle Society average score was 92 points; 21 patients (93.7%) had excellent scores (90 to 100 points), 9 patients (28.1%) had good scores (80 to 89 points), and 2 patients (6.2%) had fair scores (<80 points). Excellent to good outcomes were noted in 93.7% of the patients. One patient developed a superficial infection. Another patient experienced a sural cutaneous nerve injury. The radiographic articular step off was measured as 1 mm or less in 29 patients (90.6%) and 1 to 2 mm in 3 patients (9.4%). One patient (3.1%) developed symptomatic post-traumatic arthritis. The posterolateral approach allowed for good exposure and buttress fixation of the posterior plafond fractures with few local complications. The anatomic repositioning and stable fixation resulted in good functional and subjective outcomes.

The indications for using a particular technique to fix posterior plafond fractures have become clearer owing to the biomechanical studies of stability and joint reaction forces (1–5). Distinctions exist among pilon, posterior tibial plafond, and posterior malleolar fractures. Pilon fractures occur with standard high-energy axially loaded forces (AO Foundation/Orthopaedic Trauma Association [AO/OTA] classification 43). The posterior tibial plafond fracture includes the posterior malleolar fracture and posterior pilon fracture (AO/OTA classification 44). The most common posterior malleolar fracture involves the posterolateral corner and results from an avulsion force created by the posterior inferior tibiofibular ligament after a rotational ankle injury (6). In contrast, the posterior pilon fracture is caused by a combination of axial loading and posterior shearing forces of the ankle mortise, such as can be seen in posterior or posteromedial dislocation, and creates a large fracture fragment. The main fracture line will lie in the coronal plane. This fracture typically involves the entire posterior plafond and exits at the medial tibial cortex, producing impaction of the joint surface. These injuries can result in worse long-term outcomes than the posterior malleolar fracture type likely related to a combination of instability and post-traumatic osteoarthritis (7–10).

Most investigators have recommended fixation when the fracture comprises more than 25% to 30% of the articular surface with a displacement of more than 2 mm (1,11). However, recent biomechanical research has shown that when the fracture fragment after the ankle fracture is 10% or more of the distal tibial articular surface, open reduction and internal fixation should be performed. Otherwise, the incidence of traumatic arthritis will increase, resulting from a change in the original articular contact stress (12–14). Langenhuijsen et al (9) also found that ankle fractures will have significantly worse outcomes when joint congruity has not been restored, in particular, in fractures involving more than 10% of the articular surface. However, the indications for operative treatment of the posterior plafond

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Address correspondence to: Huang Ruokun, MD, Department of Foot and Ankle Surgery, Wuhan Puai Hospital, 473 Hanzheng Street, Wuhan, China.
E-mail address: whfoot@gmail.com (H. Ruokun).

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fragment remain controversial (3,15). A number of surgeons have agreed that smaller fragments (<25%) tend not to alter the biomechanics of the joint, and a step defect of more than 2 mm does not appear to change the functional results (7,11,16,17). Those patients in whom the posterior malleolar fragment was fixated did not have a statistically significant better outcome than the patients in whom the fragments were not fixated. No significant correlation was found between the outcomes and the size of the unfixated fragments (8,18).

A fracture should be reduced and fixation applied if it affects more than 10% of the articular surface or if it is the cause of any instability. Treatments have ranged from indirect reduction techniques to direct reduction using an open ankle approach. The posterolateral approach through a natural intertendinous approach to the fibula and posterior tibia will provide excellent visualization of the entire posterior malleolar fragment and access to the joint surface. This approach does not lead to increased problems with wound healing and stiffness. The purpose of the present study was to describe and report the functional outcome of treatment using the posterolateral approach for the reduction and fixation of posterior plafond fractures.

Patients and Methods

A retrospective analysis was performed of consecutive patients who had sustained an ankle fracture with a posterior plafond fragment and had been treated from October 2004 to January 2008. All patients gave their informed consent, and the institutional review board approved the study. The exclusion criteria were pathologic fractures, tibial pilon fractures, and an inability to bear weight for reasons other than post-traumatic complications of the affected ankle. A total of 38 patients met the inclusion criteria, but 6 patients were lost to follow-up. Thus, 32 patients were able to be located and evaluated. The mean age at surgery was 48 (range 21 to 63) years; 23 patients were males and 15 were females. The cause of injury was a ground-level fall for 13 patients, a traffic accident for 22, and falling from a height for 3 patients. According to the AO/OTA classification, 18 fractures (47%) were type 44B and 20 (53%) were type 44C (Table). The AO/OTA classification only emphasized the treatment of external ankle by the level of the fracture of the distal fibula. All patients had a posterior plafond fracture, with an additional distal fibula fracture in 27 patients and a medial malleolus fracture in 13 patients. Also, 3 patients in our series had other concurrent orthopedic injuries requiring treatment; 2 involved the ipsilateral lower extremity. None of the patients had pre-existing ankle arthritis. One patient had type 2 diabetes mellitus. Four patients were smokers. The lateral malleolar fractures were treated with tubular or compression plates. The posterior plafond fractures were fixated using screws in 17 patients and meta plates or T-plates in 21 patients. The interval between injury and surgery was 24 hours for 3 patients, 7 to 14 days for 33 patients, and within 24 hours for 2 patients with open fractures.

Closed reduction and splint application was first used to treat the fracture dislocation. Careful attention must be given to the distal blood supply to prevent complications such as compartment syndrome. To further clarify and determine the fracture type (in particular, any fractures related to the articular surface), computed tomography and 3-dimensional reconstruction should be performed in all patients (Fig. 1). At the same time, a careful assessment of the condition of soft tissues should be conducted. Some of our patients were admitted for blister care. When the blisters had resolved, the skin had a wrinkled appearance. Surgical treatment should be performed within 2 weeks.

For those patients with medial malleolus fractures, the patient was placed in the "lazy lateral position." A bump was placed under the contralateral hip. The fibula and posterior plafond fracture were reduced and fixation applied. Next, the patient was placed supine to reduce the medial malleolar fracture. The patients without medial fractures were placed prone, with a bolster underneath the distal lower leg to allow the foot to hang freely and allow the talus to be reduced spontaneously. The posterolateral approach was used as a

Table
Patient data

Patient No. (sex)	Age (y)	Mechanism	AO Classification	Dislocation*	PTLF Size	Follow-up (mo)	AOFAS Score
1 (F)	42	MVA	44C2	No	15	52	94
2 (M)	38	GLF	44B3	Yes	22	30	88
3 (F)	46	MVA	44C2	No	29	40	88
4 (F)	55	MVA	44B3	No	15	34	96
5 (F)	21	GLF	44C2	No	13	25	98
6 (F)	27	MVA	44B3	No	20	38	97
7 (F)	61	GLF	44B3	Yes	20	25	89
8 (M)	59	MVA	44B3	Yes	32	28	88
9 (M)	43	MVA	44C2	Yes	32	34	97
10 (F)	58	MVA	44B3	Yes	25	36	89
11 (M)	62	MVA	44B3	No	22	42	97
12 (F)	56	MVA	44C1	No	24	36	98
13 (F)	53	MVA	44C2	Yes	20	25	96
14 (M)	57	GLF	44B3	Yes	15	42	98
15 (M)	52	GLF	44C2	No	20	48	98
16 (M)	56	GLF	44B3	No	18	36	98
17 (F)	38	MVA	44C2	Yes	18	48	79
18 (F)	46	MVA	44B3	No	16	25	96
19 (F)	63	MVA	44C2	No	18	36	88
20 (M)	37	GLF	44C1	No	15	25	97
21 (F)	45	MVA	44C2	No	12	36	79
22 (F)	49	GLF	44B3	Yes	10	42	96
23 (M)	59	FFH	44C2	No	15	36	97
24 (M)	54	MVA	44B3	No	10	48	89
25 (F)	50	MVA	44C2	Yes	18	36	96
26 (F)	36	MVA	44B3	Yes	24	36	97
27 (F)	38	GLF	44C2	Yes	18	72	88
28 (M)	46	FFH	44C2	Yes	22	36	96
29 (F)	46	GLF	44B3	No	20	36	97
30 (F)	49	GLF	44C1	No	18	48	89
31 (M)	50	MVA	44C2	Yes	20	50	97
32 (F)	42	MVA	44B3	No	15	48	98
33 (F)	34	GLF	44C1	No	20	—	—
34 (F)	28	FFH	44C2	Yes	24	—	—
35 (M)	48	MVA	44B3	Yes	22	—	—
36 (M)	59	MVA	44B3	No	14	—	—
37 (F)	59	GLF	44C2	No	18	—	—
38 (M)	60	MVA	44B3	Yes	25	—	—

Abbreviations: AOFAS, American Orthopaedic Foot and Ankle Society; F, female; FFH, fall from height; GLF, ground-level fall; M, male; MVA, motor vehicle accident; PTLF, posterior tibial lip fragment in percentage of the sagittal computed tomography scan diameter.

* Fracture with posterior dislocation at first presentation.