

Full Length Research Paper

Results of treatment of tibial plafond fractures with articulated external fixation

Reşit SEVİMLİ^{1*}, M. Fatih KORKMAZ¹ and MD Ökkeş BİLAL²

¹Department of Orthopedic and Traumatology, Medical Faculty, İnönü University, 4400 Malatya/Turkey.

²Department of Orthopedic and Traumatology, Medical Faculty, Sütçü imam University, 4600 Kahramanmaraş/Turkey.

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The aim of this study is to assess the tibial pilon fractures treated primarily with results of the articulated external fixation. The study included 24 patients (18 male, 6 female) with mean age of 26 ± 4.2 (range 18-51). According to the classification of AO/OTA, 6 cases were diagnosed as Type A, 4 cases as Type B and 14 cases as type C. Also, according to the Gustilo and Anderson method four of the cases were classified as grade I, two grade II and six grade III open fracture. For eight cases only the articulated external fixation was used, and for sixteen of the cases who have fibula injury at the syndesmosis level both articulated external fixation and plate-screw osteosynthesis for the restoration of the fibula was performed. While the articulated external fixation duration ranged from 8 to 14 weeks (10 ± 3.2 SD); follow up period was between 7 and 32 months (25 ± 4.6 SD). The results were evaluated according to the Teeny and Wiss criteria. The operation results of the patients were as follow: excellent for three, good for four, moderate for three, and poor for two of them. The complications encountered were bulla skin lesion for two of the cases at post-operative third day and non-union for one of the patients. There was no bone or soft tissue infection. The open tibial pilon fractures result from high-energy trauma; carry risk of serious injuries, loss of the range of the motion and infection can be safely treated with external fixation technique.

Key words: External fixators, tibial fractures, intra-articular fractures.

INTRODUCTION

Fractures of the tibial pilon fractures, representing 1% of the lower extremity distal to the articular surface of the tibia metaphyseal extension and internal fixation techniques indicate and commonly used in the treatment of a fracture of the classic traditional type (Taylor, 1992). These fractures, low energy and they occur, not cause injury to surrounding soft tissue sheath is an important, high-energy injuries, associated soft tissue problems and intra-articular fractures are prone to trouble because it is a multi-part fracture. Pilon fractures of the metaphyseal

fragments with high energy trauma are multiple, it is associated with the articular surface of the displaced fragments often. As a result of severe compression of the joint surface, oppression and violent fragmentation of the articular surface causes. Not created at the time of the trauma due to the anatomical joint surface cartilage and early osteoarthritis is an inevitable occurrence.

Pilon fractures with severe soft tissue damage can be seen. The amount of soft tissue injury associated with significant complications. Excessive edema is caused by

*Corresponding author. E-mail: resitsevimli@mynet.com, Tel: +90 5345738724.

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the formation of bulla on the skin. Appropriate radiological evaluation is very important in determining the properties of the fracture. Anterior-posterior and lateral radiograph of the ankle mortis must also be drawn in addition to X-rays. The main purpose of treatment, open reduction and re-creation of the joint surface, good to a solid early action to detect and identify the sound to start (Bottlang et al., 1999). High-energy pylon fractures with soft-tissue loss and with fracture split is attempted to be treated the same way, a serious infection, wound problems and complications such as nonunion becomes inevitable to encounter (Dichristina et al., 1996). Recent studies noting the importance of treatment of tibial pilon fractures, external fixation techniques, study platform tibial pilon fractures were treated with external fixation evaluated the results of early motion. So the aim of this study is to assess the results of the primarily treated tibial pilon fractures with articulated external fixation.

MATERIALS AND METHODS

Working with sufficient follow-up and platform ankle fixator was performed on 24 patients treated with tibial pilon fractures. Included in the study 24 patients (18 males, 6 females) average age of 26 ± 4.2 (min: 18, max: 51), respectively. Broken cause a traffic accident in 16 cases, 4 cases of gunshot wounds and 4 had a fall from height. Fractures, 16 right leg, and 8 left leg respectively. According to the classification of AO/OTA, 6 cases were diagnosed as Type A, 4 cases as Type B and 14 cases as Type C. Also, according to the Gustilo and Anderson method four of the cases were classified as grade I, two grade II and six grade III open fracture. Fractures with the first day of the period between the 9th day of surgery ($3.5 \pm 3SS$) and, 12 patients with open fractures were the first responders in the emergency department, patients with grade III open fracture wounds were washed with saline solution for at least 10 L. Cut-off bone chips removed cleaned of soft tissue foreign bodies. Open fractures brought closer to becoming partially closed with interrupted sutures, fixation during the implementation of the second debridement was performed. A single dose of tetanus immunoglobulin for prophylaxis and for the prophylaxis of infection 1 week cefazolin sodium 3 g/day and 5 days 200 to 400 mg/day was used netilmicin. Temporary limb with skeletal traction splint or calcaneus were passed. Before the procedure, all patients with informed consent forms after obtaining permission from the nine patients with spinal anesthesia, general anesthesia applied to three patients were operated on with the supine position, and fluoroscopy. In all cases, C-arm monolateral articulated external fixator bridging the ankle (Biomet) was used. One of the distal fixation screws schanz to kalkaneus, placing one of the talus, the fracture surface of the proximal anteromedial tibial screw placed at the transmigrate articulated external fixator placed together in all cases sufficient enough distraction and reduction of Type III patients is also confirmed under fluoroscopy after fixation in neutral ankle was stabilized.

A 38-year-old man had a traffic accident cases, preoperative tibial pilon fractures, tibial joint on the crash and the displacement is evident on radiographs AO/OTA classified as Type C fractures according to the classification (Figure 1a and b). With articulated external fixator with distraction and reduction of post-operative articular surface of the tibia and fibula restored and made repairs syndesmosis AP-Lateral radiograph of the same patient (Figure 1c).

Only four of the cases articulated external fixation, fibula injury at the level of the eight patients syndesmos articulated external fixator

with the plate-screw osteosynthesis of fibula made for the restoration of the ankle joint in neutral while the screw syndesmoz applied parallel to the face. If syndesmosis leave the tibia we must restoration this area. For restoration of syndesmosis we use only plate and screw. Outside of three cases we do not use multiple incision. AO/OTA two cases of Type C according to the classification of Type III open fractures closed reduction was performed in all patients except one case.

Cases of compartment syndrome in the early postoperative period and were closely monitored for infection. Radiographic checks every two weeks, transmission case was dressing daily. In all cases, passive ankle range of motion was started after the third week after surgery, radiographic union fixators were removed after being identified. X-ray anatomic alignment check first month of the same phenomenon seen enough and started fracture union (Figure 2a and b). The mean duration of external fixation platform for ten weeks (8 to 14 weeks), mean follow-up period was twenty-five months (7 to 32 months).

Evidences

All patients with grade I or II according to the criteria of Paley pin tract problems, but it was enough to remove the screw schanz grade III infection was observed. Schanz three pin tract infections nail care and resolved with oral antibiotics. Teeny results were evaluated according to the criteria (Table 1). In 6 cases excellent, good in 8 cases, 6 cases moderate, poor results were obtained in 4 cases. In all cases, the ankle range of motion was measured immediately after removal of the fixation. Close to normal in all patients except 4 cases ROM's angle values were obtained. Complications in the early postoperative period in two of the cases were blisters on the skin. Nonunion was seen in one patient.

A 42-year-old male patient traffic accidents in the first week of postoperative partial necrosis of the skin and skin integrity is seen from the front and sides appears to be a complete and good circulation (Figure 3a to c). There was no bone or soft tissue infection. Complaints resolved with oral anti-inflammatory treatment in patients with pain, while a single case was ankle arthrodesis. After releasing the first month after the operation the patient started articulated external fixation apparatus passive ankle range of motion exercises and be seen (Figure 4a and b).

RESULTS

Tibial pilon fractures with metaphyseal defects before applying the external fixation, to facilitate reduction of the articular surface of the distal tibia, fibula and the tibia, fibula osteosynthesis may be necessary to ensure that the actual length (Bourne, 1989). Reduction of capsular not connected to the intra-articular fractures need to be applied to a limited open reduction and minimal osteosynthesis. Also, the joint surface and resulting arthro diastasis ligamentotaxis ensure full tilt and should be identified to avoid the talus do (Fitzpatrick et al., 1995; Russell et al., 1991). This type of joint fractures as early as possible to start the movement of used articulated fixation. Except for those two cases, we do not have any osteoarthritis. In the treatment of tibial pilon fractures, infection and wound problems, are important factors affecting the result. By we if caused by high energy and high rate when treated with conventional methods tibial pilon fractures are at risk of wound problems and secure



(A)

(B)



(C)

Figure 1. A 38-year-old man car traffic accident the patient's preoperative and postoperative radiographs of tibial pilon fractures.



Figure 2. X-ray control the same hospital as the first month.

Table 1. According to Wiss and Teeny clinical evaluation.

Very good	No pain, normal gait, normal ROM, no swelling.
Good	Minimal pain, normal walking, $\frac{3}{4}$ normal ROM, mild swelling.
Medium	By using the pain, normal walking, $\frac{1}{2}$ the normal ROM, moderate swelling of using NSAID's.
Bad	Walking and rest pain, claudication, $\frac{1}{2}$ the normal ROM, swelling.

with hinged external fixator technique can be successfully treated. A longer follow-up studies with larger patient series should be considered.

DISCUSSION

Pilon fractures of the distal articular surface of the tibia into the joint surface with varying degrees of extension fractures with articular disruption. 7% of all fractures of the tibia and comprises 1% of all lower extremity fractures. Pilon fractures of causes in motor vehicle accidents, falls and injuries include gunshot. For the first time since 1979 when the surgical principles were described by Ruedi and Allgower (1979), despite the use of the same techniques different results have been used to explain this phenomenon (Bottlang et al., 1999; Dichristina et al., 1996). Therefore AO/OTA groups,

exploration and use of space to find new treatment methods have been mentioned. The principles used in the treatment of tibial fractures:

(1) Conservative treatment: The unallocated to allow for surgical treatment of fractures, or can be applied in the presence of local or systemic problems (Michelson et al., 2004).

(2) Surgical treatment: (i) Classic open reduction and internal fixation, (ii) Hybrid external fixation, (iii) Percutaneous plating, external fixation, (iv) External fixation and limited internal fixation, (v) Temporary external fixation and open reduction and internal fixation followed by known methods (Borrelli and Ellis 2002; Ebraheim et al., 2000; Fracture and Dislocation Compendium, 1996).

Be successful in the treatment of pilon fractures and



Figure 3. A 42-year-old male patient vehicle traffic accident in the first postoperative week, the front and side view of a partial skin necrosis.



(A)



(B)

Figure 4. After the operation the patient was started in the first month after the passive ankle range of motion exercises.

sufficient for the acquisition of the ankle joint surface anatomy of the function to be restored and the injured soft tissues should heal without complications (Sirkin and Sanders, 2001; Sirkin et al., 1999; Dickson et al., 2001) treatment planning pilon fractures sometimes dramatic situations can not occur below knee amputations, orthopedic surgeons have turned to the search for new solutions to protect the soft tissue (Scheck, 1965; Paley,

1990).

Though the classification presented by Ruedi and Allgower (1979) is still being used, we generally use AO/OTA classification today (Paley, 1990; Ruedi and Allgower, 1979). The AO long bone group universal classification of fractures groups distal tibia fractures as 43. The first sub-grouping is on the degree of continuity between diaphysis and metaphysis (Figure 5).

43A: Extra-articular – most would not recognise these as pilon fractures, although in some series non-articular fractures are included and it can be difficult to tell how many were articular.

43B: Partial articular fractures with some connection between part of the joint surface and the diaphysis - again, some series appear to include these but most do not clearly differentiate between them and those with complete separation between diaphysis and metaphysis. Posterior partial fracture overlap with malleolar fractures with posterior malleolar components (Klammer, 2013), and anterior partial fractures were included by Lauge-Hansen (1950) in his classification of malleolar fractures.

43C: Complete articular fractures with no connection between the joint surface and diaphysis – most pilon fractures fall into this group

Tibial pilon fractures treated by conventional methods in the literature complication rate of 0 to 36% have been reported by Akkaya and Okcu (2007). Described by AO/OTA conventional treatment, open reduction fibula, distal tibial articular surface reconstruction, bone grafting of the metaphyseal defect, and with the support plate includes support for the medial tibia (Bayraktar and Yücesir (2010). On the tibial metaphyseal region reductions need to occur when more soft tissue dissection and removal of the external fixation for stabilization of tibial diaphyseal widespread use, this situation, soft tissue tension and displacement of the soft tissue around the ankle and preventing deterioration of nutrition, infection and wound problems, such as severe reduced complications (Atesalp et al., 1999; Kim et al., 1997).

Pilon fractures, fracture stabilization with external fixation of the fracture addition, the metaphyseal region, especially broken fragments, with the reduction of the effect of soft tissue provides ligamentotaxis without stripping (Barbieri et al., 1996; Bourne, 1989). Ligamentotaxis is the period used to emphasize that, for traction to be effective it must be stable by counter traction provided by ligaments and soft tissue surrounding the main bone. The pull and the counter pull restore the length and fracture fragments, which are otherwise difficult to excellent control. This tissue tension can be maintained by external fixator or by a some distractor (Fitzpatrick et al., 1995; Treadwell and Fallat, 1994). Teeny

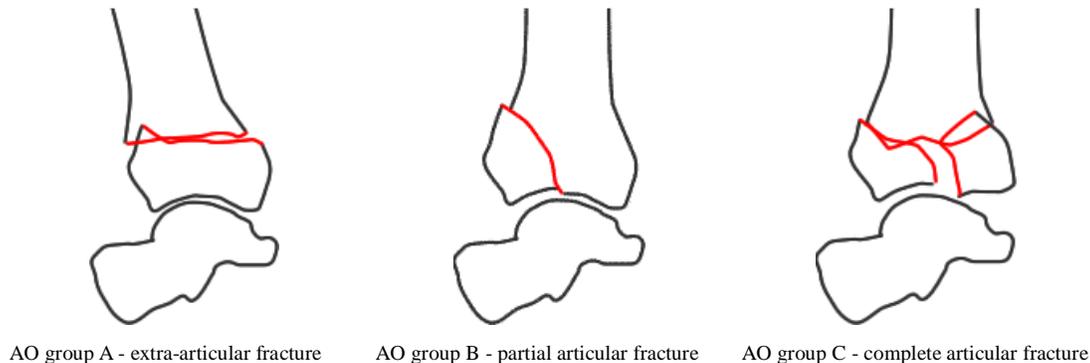


Figure 5. AO/OTA classification.

and Wiss (1993) AO/OTA come into contact with Type A and B fractures, but deep infection developed in 37% of Type C fractures reported (Watson et al., 2000). Depending on the type of soft tissue injury, the severity of fractures and fracture fixation, open reduction and limited open reduction with minimal-just treated with external fixation methods (Saleh et al., 1993; Blauth et al., 2001).

According to AO classification, complete-articular (Type C) fractures are treated with open reduction-minimal osteosynthesis nonunion, malunion, and wound complications than patients treated with external fixation method is much higher than reported (Kapukaya et al., 2005; Oh et al., 2003). Based on this information, the tibial pilon fractures in the region, especially the high-energy trauma, minimal soft tissue dissection and minimal use of material should be obvious (Helfet et al., 1997; Watson et al., 2000). 60% of cases (AO/OTA Type C) with the mechanism of high-energy trauma fractures have occurred, although infection, wound problems, post-surgical edema development of long-term complications, such as the amount of soft tissue is lower than the rate in the literature. This is just a series which this is due to the formation of the patients treated with articulated external fixation. Bonar and Marsh (1994) as well as to ensure ligamentotaxis unilateral external fixation in our application platform talus and calcaneus detected with separate schanz nails (Watson et al., 2000; Bonar and Marsh, 1994).

In our study of high-energy pilon fractures as a result of trauma patients, wound problems, reduce early range of motion, ensuring early return home and bed occupation in order to reduce their daily activities outside the three cases instead of open reduction and fixation with closed reduction and platform ankle and clinically applied method 72% of the cases' part of the results were good (Russell et al., 1991; Aktuğlu et al., 1998).

Conflict of Interests

The authors have not declared any conflict of interests.

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