ISSN No:-2456-2165

Tibial Pilon Fractures Treated by Percutaneous Screw Fixation with Plaster Cast Immobilization: Analysis of a Series of 13 Cases

Samir Ben Salah[1,2*], Ayman Ben Abdallah[1,2], Adnane Lachkar[1,2], Hicham Yacoubi[1,2], Najib Abdeljaouad[1,2]
[1] Orthopedic trauma department, Mohammed VI university hospital, Oujda, Morocco.
[2] Faculty of medicine and pharmacy of Oujda, Mohammed first university of Oujda, Morocco

Abstract- Fractures of the tibial pilon remain a complicated situation, due to their articular location in the majority of cases, whose reconstruction in case of fracture of a correct tibioastragalar articular surface constitutes a great challenge for the surgeon. The thin and fragile skin covering the distal part of the tibia further complicates the therapeutic strategy for these fractures, since it is the site of progressive suffering that may require the open site to be removed. In this sense, the treatment of tibial pilon fractures by closed focus osteosynthesis (percutaneous screw fixation more or less pinning on demand or external fixation) has an important place in the therapeutic management of this type of fracture (especially when they are open or associated with significant skin damage). Closed focus osteosynthesis, regardless of the technique used, allows preservation of the skin, but does not allow reduction of the fracture as is obtained with open focus osteosynthesis. In this work, we report our experience with a series of 13 patients with a tibial pilon fracture treated with percutaneous screw fixation more or less pinning on demand associated with plaster cast immobilization for 3 to 4 weeks. This approach allowed us to obtain anatomical reduction of the fracture in 80% of cases, and satisfactory reduction (contact of more than 70% on either side of the fracture site as well as reconstruction of a correct tibiotalar articular surface) in 20% of cases. Thus, this approach allowed us to obtain consolidation for 12 cases of fractures in an average of 4 months with a good functional result (average AOFAS score is 87.2).

Keywords:- *Tibial pilon; fracture; percutaneous screw; plaster cast immobilisation.*

I. INTRODUCTION

Tibial pilon fractures are fractures in which the line is located in the metaphyseal and epiphyseal region of the lower end of the tibia. The degree of comminution of the fracture site, the involvement of the articular surface and the condition of the skin opposite determine the degree of complexity of management of this type of fracture, as well as the prognosis of these fractures [1]. Fractures of the tibial pilon are due in the majority of cases to a high energy trauma (road accident remains the first etiology in Morocco). The mechanism essentially associates an axial compression force with accessory forces (dorsal or plantar hyperflexion, adduction or forced abduction); all of which result in depression at the point of impact and associated lesions (fracture of the external malleolus, the talus, skin lesions...). Fractures of the tibial pilon are among the therapeutic emergencies that must be managed as soon as possible before the aggravation of skin damage that is characterized by the evolutionary even in case of immobilization of the fracture [2].

II. MATERIALS AND METHODS

In this work, we report the experience of the department of traumatology and orthopedics CHU Med VI of Oujda with a series of patients made of 13 cases having been admitted in the department for the management of a tibial pilon fractures over a period of 7 years spread out between the years 2015 and 2021. The treatment of which was made by percutaneous screwing more or less pinning on demand associated with an immobilization by a posterior splint or a plastered boot during 3 to 4 weeks. All patients underwent a complete clinical examination with a standard radiograph of the ankle in front and side view and a radiograph of the homolateral knee in front and side view. Thus, 70% of the cases benefited from a CT scan of the ankle with three dimensional reconstruction. For therapeutic management, all patients were admitted to the operating room under spinal anesthesia and fluoroscopic control, with reduction of the fracture by external maneuvering (reduction was stabilized by percutaneous screw fixation more or less pinning on demand with plaster cast immobilization). A standard postoperative radiograph of the ankle in front and side view checked the assembly.

III. RESULTS

For gender, 61.5% of the patients were males and 38.5% were females. 100% of the patients were admitted in the context of a public road accident of which 80% were motorcycle accidents and 20% were domestic accidents. In our series, 100% of the fractures were closed fractures, for which the degree of skin damage was assessed by the Tscherne classification (69.2% stage 0, 30.7% stage 1 and 0% stage 2). For the radiological assessment, all patients had a standard radiograph of the ankle in front and side view with front and side view radiograph of the homolateral knee. In our patients, 84.6% of the tibial pilon fractures were associated with a fracture of the lateral malleolus. The different types of fractures were classified according to the AO classification **(Figure 1,2,3).**

ISSN No:-2456-2165

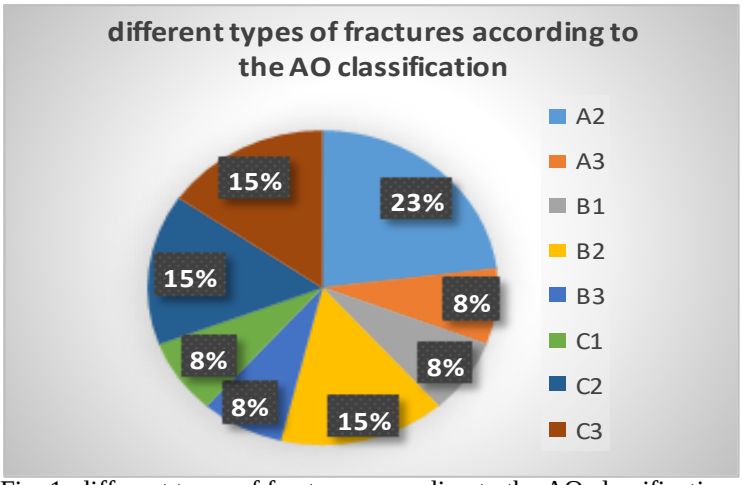

Fig. 1: different types of fractures according to the AO classification.

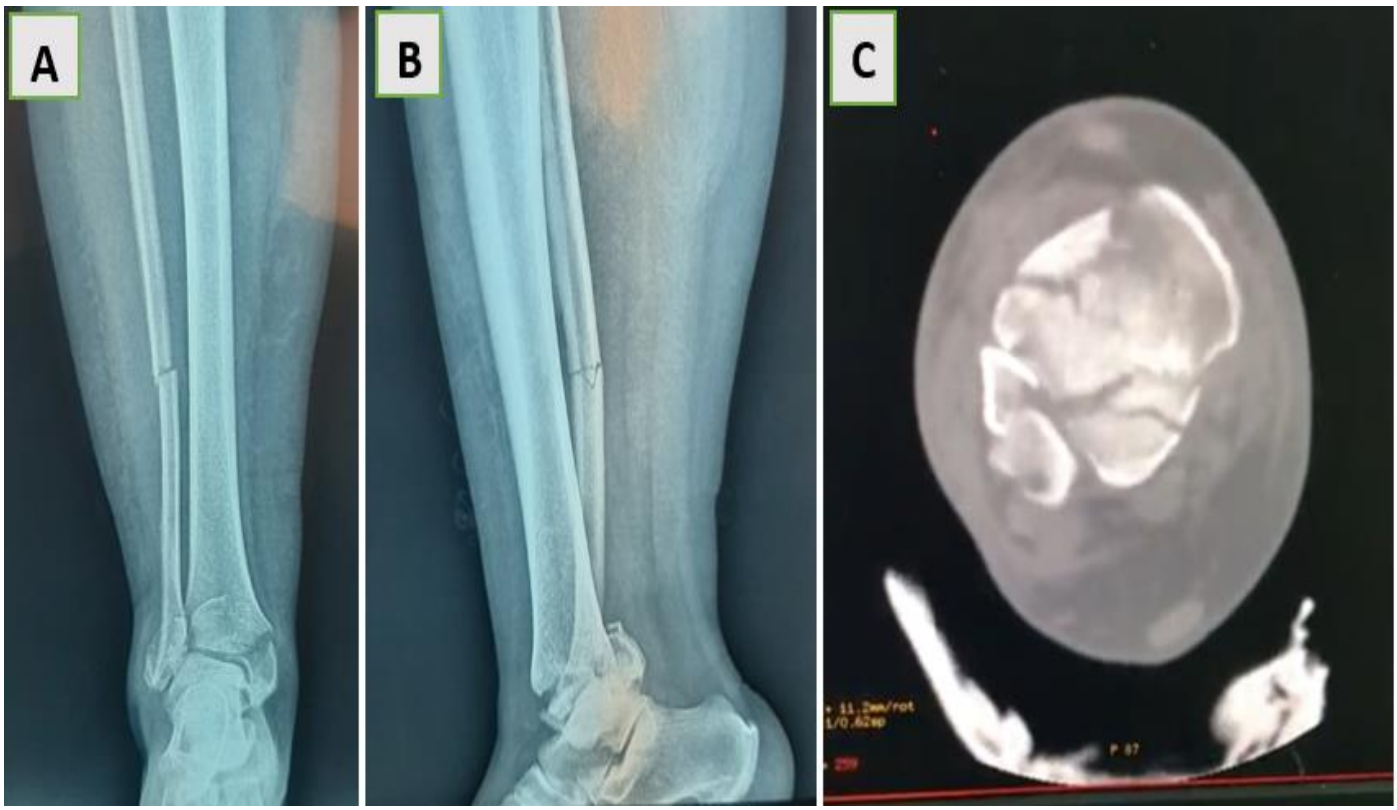

Fig. 2: Initial radiograph (A, B) of a comminuted fracture involving the epiphyseal region of the tibial pilon with a CT image (C) in axial section objectifying the degree of epiphyseal comminution.

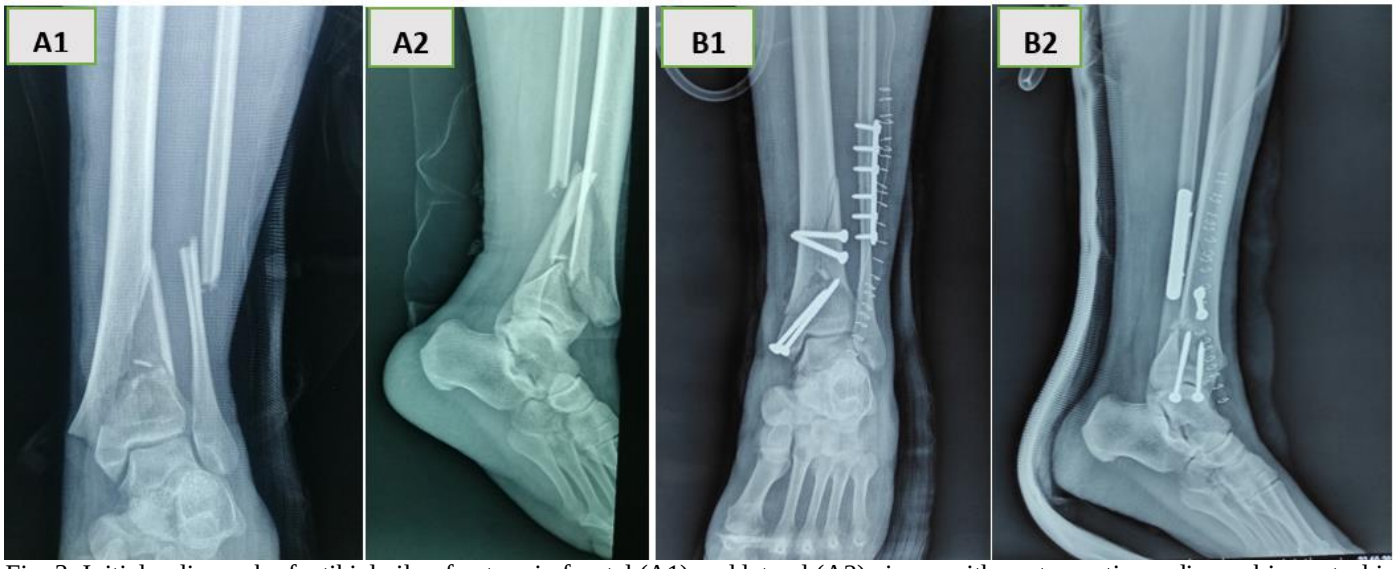

Fig. 3: Initial radiograph of a tibial pilon fracture in frontal (A1) and lateral (A2) views, with postoperative radiographic control in frontal (B1) and lateral (B2) views.

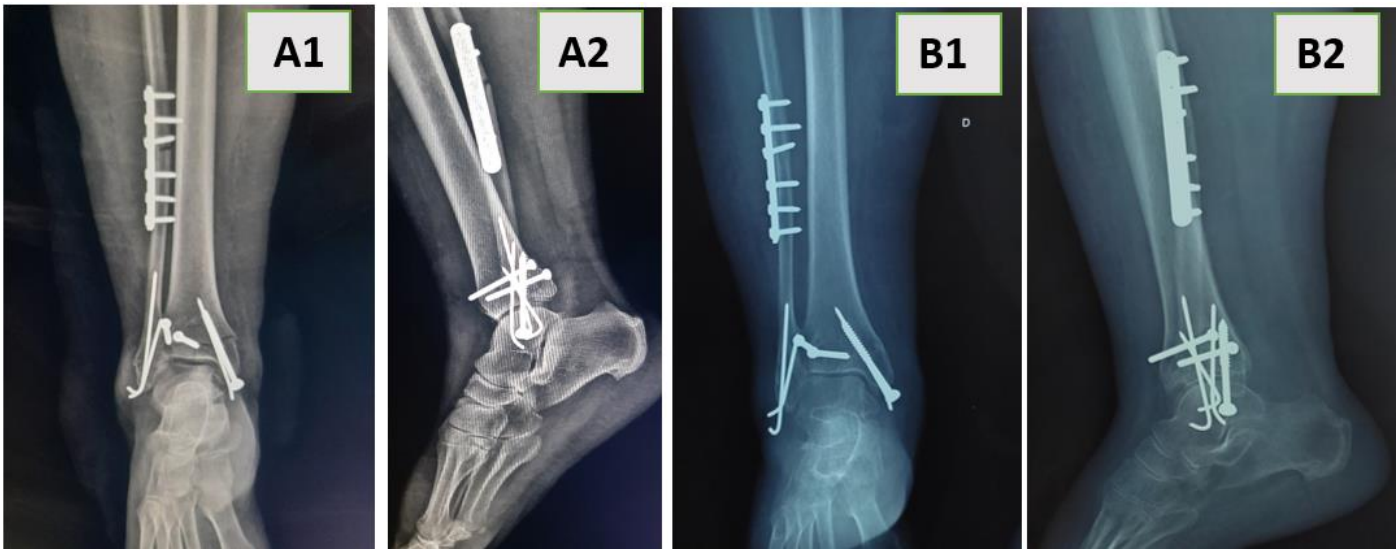

Fig. 4: Immediate postoperative radiographic control (A1, A2) and after 3 months showing fracture consolidation (B1, B2).

For the therapeutic management of our patients, all cases were admitted to the operating room under spinal anesthesia, and under fluoroscopic control underwent reduction of the fracture by external maneuvering (traction with rotational movements) in an attempt to obtain the perfect reduction possible. After reduction, the 13 patients received percutaneous screw fixation (associated with pinning on demand in 38% of cases) followed by immobilization with a posterior splint or boot cast for 3 to 4 weeks. When associated, osteosynthesis of the lateral malleolus was performed in all cases (open osteosynthesis via an external approach to the fibula with placement of a screw plate in 100% of cases). Osteosynthesis of the lateral malleolus was always performed first, in order to restore the correct axis and length (it has been observed that reduction of the fibula first improves the reduction of the pilon). In terms of bone, we were able to obtain an anatomical reduction of the fracture site and of the tibioastragalar articular surface in 80% of cases. In 20% of cases, we did not obtain a perfect reduction (but we accepted the set up allowing contact between the edges on either side of the fracture site of more than 70%, with reconstruction of a correct tibioastragalar articular surface), **(Figures 3,4,5).** Ankle rehabilitation was started immediately postoperatively (without support) in 61.5% of cases, and after the cast was removed in 38.4%. Early support was allowed after 6 weeks. Thus, in the evolution of our patients, 12 cases had consolidation of the pilon after an average of 4 months after the operation **(Figures 4,6).**

There was only one case of mechanical pseudarthrosis (surgical revision performed after 1 year in open surgery through an anterointernal approach to the ankle with revival of the fracture site, re permeabilization of the centro medullary canal with placement of a corticospongy graft from the anterior iliac crest). In terms of septic complications, there were no cases of infection, and the same was true for the skin (no cases of skin necrosis).

ISSN No:-2456-2165

The functional outcome of our patients was evaluated by the AOFAS score (the American Foot and Ankle Score), it is a score based on the analysis of:

- Pain.
- The function of the ankle.
- The degree of difficulty of walking according to the surface (regular surface, stairs, uneven ground...).
- Lameness.
- Ankle mobility in the sagittal plane.
- Mobility of the hind foot (eversion, inversion).
- Forefoot/hindfoot alignment.

In our series, we obtained a mean AOFAS score of 87.2

IV. DISCUSSION

Fig. 5: Initial radiographs with frontal and lateral views (A1,A2) and CT images of the tibial pilon in axial (B3), sagittal (B2) and three-dimensional (B1) sections, with postoperative radiographic control of the face (C1) and profile (C2).

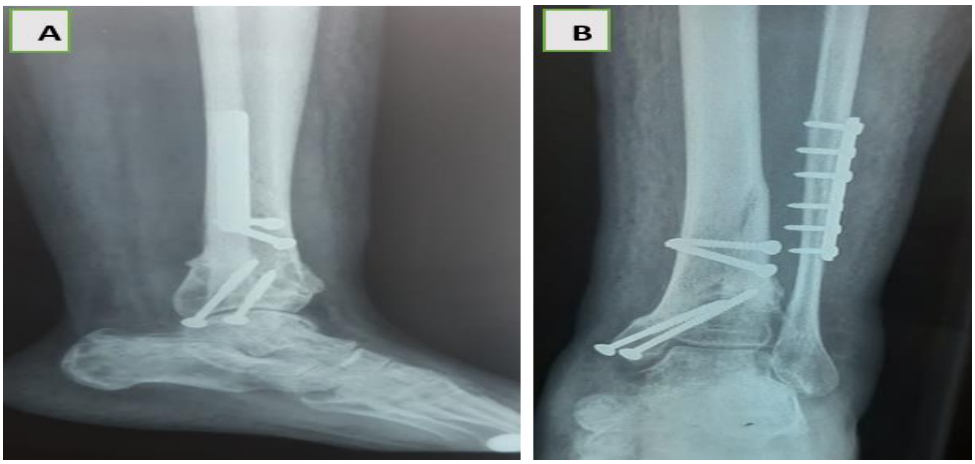

Fig. 6: Control radiograph after 3 months of surgery in front (A) and side (B) views showing fracture consolidation

ISSN No:-2456-2165

Despite the progress that has revolutionized trauma and orthopedic surgery (in terms of diagnostic, therapeutic, and postoperative physical therapy, which determines the outcome of the treatment), tibial pilon fractures remain among the metaphyseal and epiphyseal fractures that pose real therapeutic difficulties. This difficulty is linked not only to the epiphyseal location of this type of fracture, with all the problems encountered in reconstructing the articular surface, which in most cases evolves into osteoarthritis, but also to the soft tissue representing the envelope of the distal leg, which is thin and fragile, and which suffers significantly in the majority of distal tibia fractures, and which determines the therapeutic method, which must never aggravate this suffering [5].

Thus, the degree of fracture comminution and the associated bone lesions (fracture of the lateral malleolus and the talus) guide the choice of the therapeutic attitude, which must ensure a normal axis and languor and eliminate all rotation disorders. All these factors involved in the management of tibial pilon fractures constitute a challenge for the surgeon who must ensure a reduction with the most anatomical reconstruction of the tibiotalar articular surface possible without aggravating skin suffering, and for this the surgeon will be obliged to initiate external fixation whenever possible with or without minimal osteosynthesis depending on the type of the fracture. Osteosynthesis of the tibial pilon remains a mission that is not easy from a technical point of view for the traumatologist and that depends to a large extent on the experience and habit of the surgeon who must in all cases put before him all the possible therapeutic modalities. In this series, we adopted a somewhat unusual therapeutic approach (percutaneous screw fixation more or less pinning on request) which respects the fragile envelope of the ankle, and in fact, we won the challenge of not aggravating the skin suffering (0% skin necrosis). Thus, in terms of complications, there was only one case of mechanical pseudarthrosis. In the literature, there are not many studies on series that have adopted this therapeutic approach, especially for type C fractures, where percutaneous screw fixation is not widely used. The rate of pseudarthrosis reported in the published series is variable; Bastias [2] did not note any pseudarthrosis when using internal osteosynthesis. On the other hand, Pugh [4] obtained a significantly higher number of pseudarthrosis in his patients treated with external fixators compared to those treated with internal fixation. In addition, there were no cases of postoperative infection in any of the 13 patients.

A study of a series of 36 patients with pilon fractures treated by combined internal and external fixation revealed a rate of 8% of septic complications [6,7,8,9,10,11,12,13,14], another series of 127 cases of tibial pilon fractures treated by external fixator with minimal fixation revealed a rate of 0-4% of infectious complications [15,16,17,18,19,20,21,22], and this confirms the advantage of the closed approach, which always gives a lower rate of septic complications than the open approach. The AOFAS score in our series found a mean of 87.2. These results are consistent with the results found in the literature. Encinas, Ullan [1] found a mean AOFAS score of 84.9 points, Bastias [2] had a mean score of 89 Kao [3] also obtained a mean score of 87.3. In our African context, we are almost limited by the lack of means (low socioeconomic level), and we do not have a large series of patients.

V. CONCLUSION

In conclusion, the treatment of tibial pilon fractures by percutaneous screw fixation more or less pinning associated with plaster cast immobilization for 3 to 4 weeks that we performed on this series of 13 cases has proven its advantages, firstly on the cutaneous level (since it is done at closed focus it preserves the fragile envelope of the distal tibia and it can be used whatever the degree of cutaneous suffering), the same result for the septic complications. This closed focus did not prevent us from obtaining a perfect reduction of the fracture site and the repair of a correct tibiotalar articular surface, and finally the functional result obtained (average AOFAS score of 87.2) confirms the interest of this attitude.

ACKNOWLEDGMENT

I want to thank all the medical and paramedical staff of the Mohammed VI University Hospital who helped to complete this work.

REFERENCES

[1.] Encinas-Ullán CA, Fernandez-Fernandez R, Rubio-Suárez JC, Gil-Garay E. Medial versus lateral plating in distal tibial fractures: A prospective study of 40 fractures. Rev Esp Cir Ortopédica Traumatol Engl Ed. 2013 Mar-Apr;57(2):117–22. Epub 2013 Feb 22.

[2.] Bastias C, Henríquez H, Pellegrini M, Rammelt S, Natalio Cuchacovich, Leonardo Lagos, et al. Are locking plates better than non-locking plates for treating distal tibial fractures? Foot Ankle Surg. 2014 Jun;20(2):115–9.

[3.] Kuo Feng Kao, Peng Ju Huang, Ying Wang Cheng, Lin SY, Ko SH. Postero-medio-anterior approach of the ankle for the pilon fracture Injury. 2000 Mar;31(2):71–4.

[4.] Pugh KJ, Wolinsky PR, Mcandrew MP, Johnson KD. Tibial pilon fractures: a comparison of treatment methods. J Trauma. 1999 Nov;47(5):937–41.

[5.] Plaweski S, Huboud-Peron A, Faure C et Merloz P. Fractures du pilon tibial. Encycl Méd Chir (Elsevier, Paris), Appareil locomoteur, 14-087-A-10, 1999, 15 p.

[6.] Tornetta P, Weiner L, Bergman M. Pilon fractures: treatment with combined internal and external fixation. J Orthop Trauma 1993;7:489–96.

[7.] Salton HL, Rush S, Schuberth J. Tibial plafond fractures: limited incision reduction with percutaneous fixation. J Foot Ankle Surg 2007;46:261–9

[8.] Carr JB, Trafton PG. *Medial Malleolar and Soft Tissue Injuries of the Ankle* Philadelphia, PA: Saunders; 2003.

[9.] Sommer C, Chen MS, Espinoza K, Joeris A, Voegtli D , Stoffel K. *The influence of initial cartilage damages in pilon fractures on the development of osteoarthritis and functional outcomes: A prospective multicentre case series.* J Musculoskelet Surg Res. 2019;3:334-41.

[10.] Moreland JR, Bassett LW, Hanker GJ. *Radiographic analysis of the axial alignment of the lower extremity*. J Bone Joint Surg Am. 1987;69:745-9.
[11.] Ruedi TP, Allgower M. *The operative treatment of intra-articular fractures of the lower end of the tibia.* Clin Orthop Relat Res. 1979;138:105-10
[12.] Harper MC, Keller TS. *A radiographic evaluation of the tibiofibular syndesmosis.* Foot Ankle. 1989;10:156-60.
[13.] Sommer C, Nork SE, Graves M, Blauth M, Rudin M, S toffel K. *Quality of fracture reduction assessed by radiological parameters and its influence on functional results in patients with pilon fractures a prospective multicentre study.* Injury. 2017;48:2853-63.
[14.] Ramappa M, Bajwa A, Singh A, Mackenney P, Hui A, Port A. *Interobserver and intraobserver variations in tibial pilon fracture classification systems.* Foot. 2010;20:61-3.
[15.] Kreder HJ, Hanel DP, McKee M, Jupiter J, McGillivar y G, Swiontkowski MF. *X-ray film measurements for healed distal radius fractures.* J Hand Surg Am. 1996;21:31-9.
[16.] Paley D, Herzenberg JE, Tetsworth K, McKie J, Bhave A. *Deformity planning for frontal and sagittal plane corrective osteotomies.* Orthop Clin North Am. 1994;25:425-65.
[17.] Tile M, Steele-Scott C, Gollish JD, Begg R. *Fractures of the ankle clinical and biomechanical considerations.* J Bone Joint Surg Am. 1977;59:510.
[18.] Gaudinez RF, Malik AR, Szporn M. Hybrid external fixation in tibial plafond fractures. Clin Orthop Relat Res 1996;329:223–32.
[19.] Bacon S, Smith WR, Morgan SJ, Hasenboehler E, Philips G, Williams A, et al. A retrospective analysis of comminuted intra-articular fractures of the tibial plafond: open reduction and internal fixation versus external Ilizarov fixation. Injury 2008;39:196–202.
[20.] Kapoor SK, Kataria H, Patra SR, Boruah T. Capsuloligamentotaxis and definitive fixation by an ankle-spanning Ilizarov fixator in high-energy pilon fractures. J Bone Joint Surg Br 2010;92:1100–6
[21.] Endres T, Grass R, Biewener A, Barthel S, Zwipp H. Advantages of minimally invasive reposition, retention, and Illizarov – hybrid fixation for pilon tibial fractures with particular emphasis on C2/C3 fractures. Unfallchirurg 2004;107:273–84
[22.] Kim HS, Jahng JS, Kim SS, Chun CH, Han HJ. Treatment of tibial pilon fractures using ring fixators and arthroscopy. Clin Orthop Relat Res 1997;334: 244–50.