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Surgical Approach in Difficult Tibial Pilon Fractures

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Rezumat

Abordul chirurgical în fracturile complexe ale pilonului tibial

Obiective: Scopul studiului este evidențierea momentului oportun de rezolvare și a modului de abordare a unor fracturi complexe ale pilonului tibial și a complicațiilor acestora.
Material și metode: Am investigat și tratat 7 pacienți, cu fracturi complexe ale pilonului tibial, cu tendință la complicații. Conform clasificării AO am înregistrat 4 fracturi 43C2/AO, 2 fracturi 43C3/AO (cu o fractură deschisă tip IIIA/Gustilo) și 1 fractură 43B3/AO. După statusul țesuturilor moi, tratamentul chirurgical s-a realizat prin abordul în 1 sau 2 etape.
Rezultate: Toate fracturile au consolidat după un interval mediu de 13,6 săptămâni (limite 8-28 săptămâni) înregistrându-se o întârziere în consolidare. Fractura deschisă s-a complicat cu artroză posttraumatică. Nu s-au înregistrat infecții sau deteriorări ale montajului. Evoluția obiectivă și subiectivă, conform scorului Ovadia a evidențiat rezultate bune în 5 cazuri, 1 rezultat excelent și 1 rezultat modest.
Concluzii: Tipul fracturii și statusul țesuturilor moi sunt cruciale pentru rezultatul tratamentului fracturilor operate. Aceste considerente determină aplicarea tratamentului în 1 sau 2 timpi, ca și alegerea implantului optim.

Cuvinte cheie: platou tibial, abord chirurgical uni/multi stadial, artroscopie, artrodeză

Abstract

Aim: The aim of the present study is to emphasize the optimal moment and approach for tibial pilon complex fractures and their complications.
Material and methods: We have investigated and treated 7 patients with complex fractures of the tibial pilon with tendencies to complications. According to AO classification, we have recorded 4 fractures type 43C2/AO, 2 fractures type 43C3/AO (with one open fracture type IIIA/Gustilo) and 1 fracture type 43B3/AO. According to soft tissue status, surgical treatment was performed by a one-step or two-step approach.
Results: All fractures healed after an interval of 13.6 weeks (range 8-28 weeks) with one delayed consolidation. The open fracture was complicated by posttraumatic arthrosis. No infections or implant failures were recorded. According to Ovadia score, objective and subjective evolution showed good results in 5 cases, one excellent result and one poor result.
Conclusions: Fracture type and the soft tissue status are crucial for the results of operated fractures. These arguments determine the application of one-step or two-step surgical procedure as well as optimal implant choice.

Key words: tibial pilon, a one-step/two-step surgical approach, arthroscopy, arthrodesis

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Introduction

Distal tibial fractures, and mainly those associated to the tibial pilon, are some of the most demanding in respect to the orthopaedic surgeon (1-4). Soft tissue associated lesions are usually more important than the fracture type (5). Early treatment and the uppermost decisions must rely first on the soft tissue lesions rather than on the bone injury type. Early radiologic evaluation involves standard articular and tibial radiographies (6). Computer tomography examination (CT) can be postponed until limb length reestablishment (7). Ankle arthroscopy can be useful either for reduction and fixation check during definitive surgery or for the treatment of some frequent complications of tibial pilon fractures (as stiffness and arthrosis) (8,9). The aim of the present work was to emphasize the optimal surgical moment and the approach regarding complex fractures of the tibial pilon, as well as their most frequent complications.

Material and Methods

We have investigated an experimental group of 7 patients, with complex fractures of the tibial pilon, with a trend on complications; in this group, we have observed 4 fractures type 43C2/AO, 2 fractures type 43C3/AO (one open fracture type IIIA/Gustilo) and 1 fracture type 43B3/AO.

Surgery was performed in a single step procedure for 2 cases (one fracture type 43B3/AO and one fracture type 43C2/AO), while for the other cases a two-step procedure (external fixation followed by plate insertion) was chosen.

Results

All fractures healed within a mean time of 13.6 weeks (limits 8-28 weeks), only one presenting delayed consolidation. We have recorded no infections or implant failures. From the 7 considered fractures, 6 were closed and one was open type IIIA which generated the posttraumatic arthrosis complications. Objective and subjective patient evolution was evaluated according to Ovadia scoring system (10,11). In 5 cases we have noticed good results; in 1 case the results were excellent while in 1 other case the results were poor.

Among the investigated cases, two of them showed important clinical and evolution distinctiveness.

For severe complications, we have noticed a 27-year-old patient, victim of a road-traffic accident, with a tibial pilon fracture, type 43C2/AO (*Fig. 1 A-G*). At 2 days from admission, surgery was performed (*Fig. 2*), by close reduction for the tibial pilon fracture (assisted by fluoroscopic control) and minimally invasive plate osteosynthesis (MIPO) by a premolded plate type Waldemar-Link on the medial tibial surface (4+3 screws); fibula fixation was performed by a 1/3 tubular plate; to reduce tibio-fibular diastasis, a tricortical screw was inserted through the plate (*Fig. 1 B, C*). At 30 days postoperatively, the cast shank splint (recommended at discharge from hospital) was removed and a functional rehabilitation schedule was initiated for the ankle. Incipient radiologic callus was observed at 6 months from surgery (*Fig. 1 D, E*). The patient was allowed to walk with partial load-bearing on the operated limb (around 20 kg). Further controls revealed a union delay, generating stiffness and arthrosis in the operated ankle and leading to another surgical

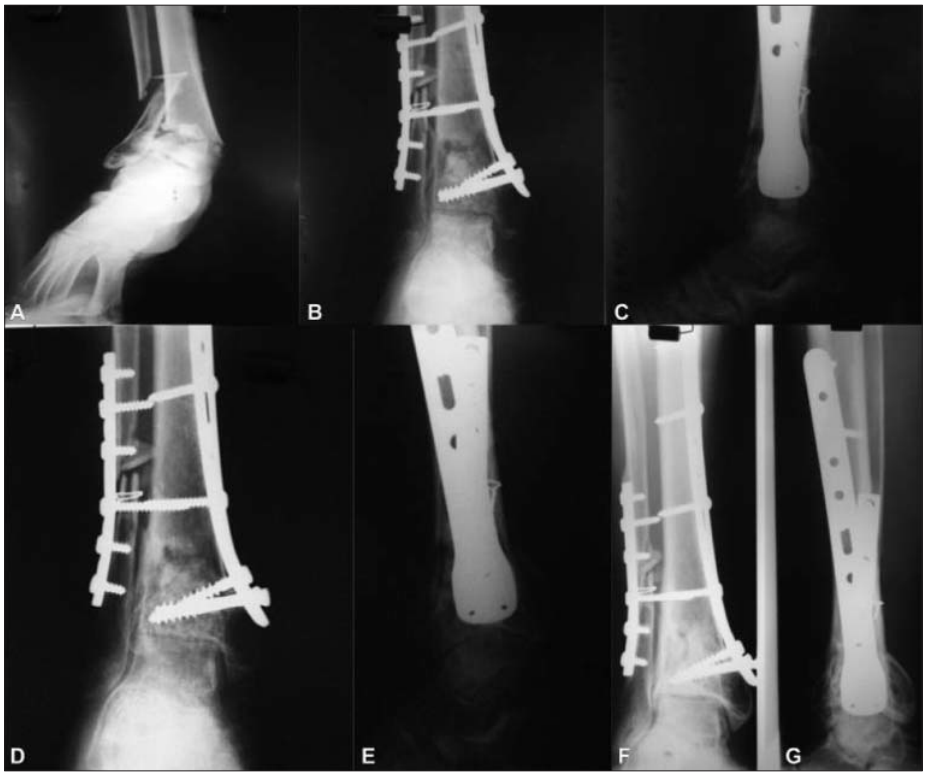

Figure 1 (A-G). *(A) Tibial pilon fracture type 43C2/AO;*
(B,C) Osteosynthesis by anatomically molded plate on the medial tibial surface and 1/3 tubular plate on the fibula;
(D,E) RX control at 6 months postoperatively;
(F,G) RX control at 13 months postoperatively

Figure 2. *Intraoperative aspects, minimally invasive plate osteosynthesis (MIPO) by medial approach*

procedure to remove the implant; in the second step, an ankle arthroscopic procedure was performed for joint trimming (*Fig. 3 A-K*) and to improve ankle function. Further evolution was favorable, with the patient gaining force, amplitude and mobility in the operated ankle (*Fig. 4*).

Another situation was mentioned for the surgical procedure

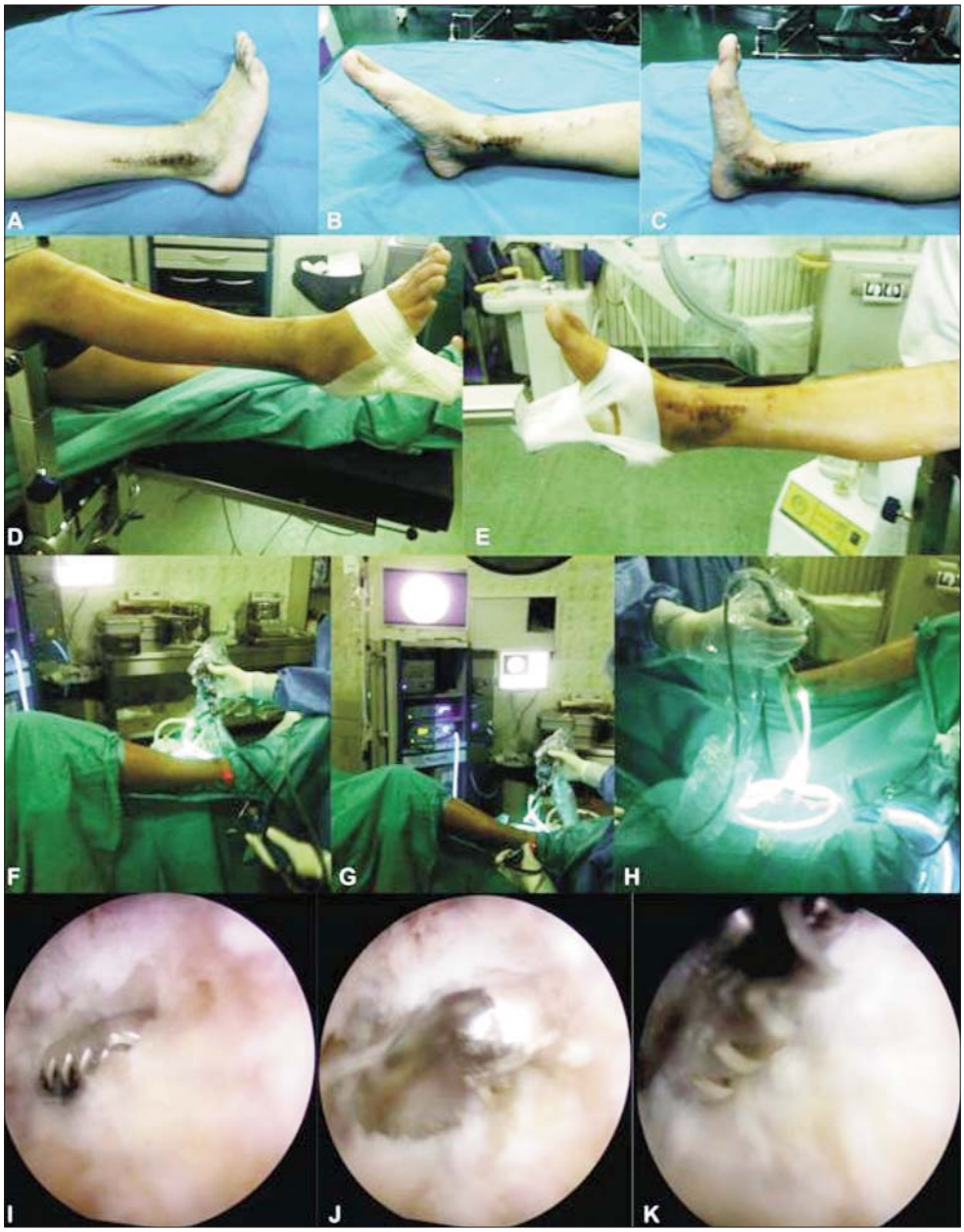

Figure 3. ***(A-K)*** *Images from ankle arthroscopy during joint trimming for arthrosis*

Figure 4. *(**A-E**) Clinical post-operative control, with amplitude and mobility improvement*

regarding a 59-year-old patient, victim of a fall from height accident and diagnosed with polytrauma and tibial pilon fracture type 43C3/AO (*Fig. 5 A, B*) (12), with soft tissue lesions type IIIA (*Fig. 6*). Surgical procedure included wound debridement and stabilization by a bi-plane external fixator; at the same time, open reduction for fibular fracture was performed followed by osteosynthesis by a 3-mm Kirschner wire. Radiologic control showed a good reduction for the fibular fracture, with tibial length and axis conservation (*Fig. 7 A-F*). In fractures with massive articular loss, primary arthrodesis becomes elective treatment (13-16), while in our clinical case, due to the open fracture type IIIA and also to relative delay of the surgical procedure, this technique was postponed for the second operative step. In the second operative step, at 2 months from the first admission (*Fig. 8 A,B*), a tibio-talar arthrodesis with fibular osteotomy was performed together with articular surface preparation and bone substitute grafting (*Fig. 9 A-G*). Intramedullary fixation was applied by a locked nail, by retrograde insertion (*Fig. 9 H.I*). Postoperative radiologic control showed a good alignment of the articular surfaces, a good tibial axis reestablishment and an accurate placement of the implant (*Fig. 10 A,B*).

Figure 5. *(**A-B**) Tibial pilon fracture, type 43C3/AO Early radiographies (front/side)*

Discussions

Current trends in tibial pilon fractures (17-19) support a delay for the definitive surgical procedure in order to surpass the acute trauma stage. Thus, it is recommended to stabilize the fracture by an external fixator placed on the medial tibia surface and then to proceed to a second step after 7-21 days. Then, definitive surgical procedure is performed for tibia osteosynthesis by an individual approach for each fracture type (medial, anterior, antero-lateral) using MIPO technique (20).

Figure 6. *Tibial pilon fracture, type 43C3/AO, with soft tissue lesions type IIIA*

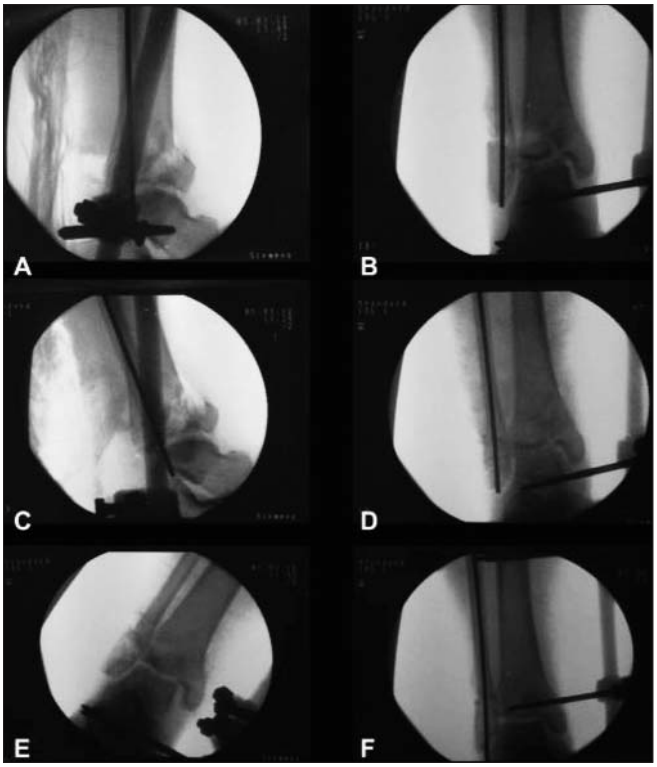

Figure 7. ***(A-F)*** *Tibial pilon fracture, type 43C3/AO. Postoperative radiologic control, following stabilization with external fixator on tibia and Kirschner wire on fibula*

Figure 8. ***(A-B)*** *Tibial pilon fracture, type 43C3/AO. X-ray at 2 months postoperatively (external fixation)*

For the patient with the fracture type 43 C2/AO, we have performed a single step surgical procedure, considering the age and the loco-regional functional status; however, the complications developed required a preoperative planning that finally led to the standardization of the two-step operative procedure. Complex fractures with an extended comminution in the joint usually develop complications such as the post-traumatic arthrosis.

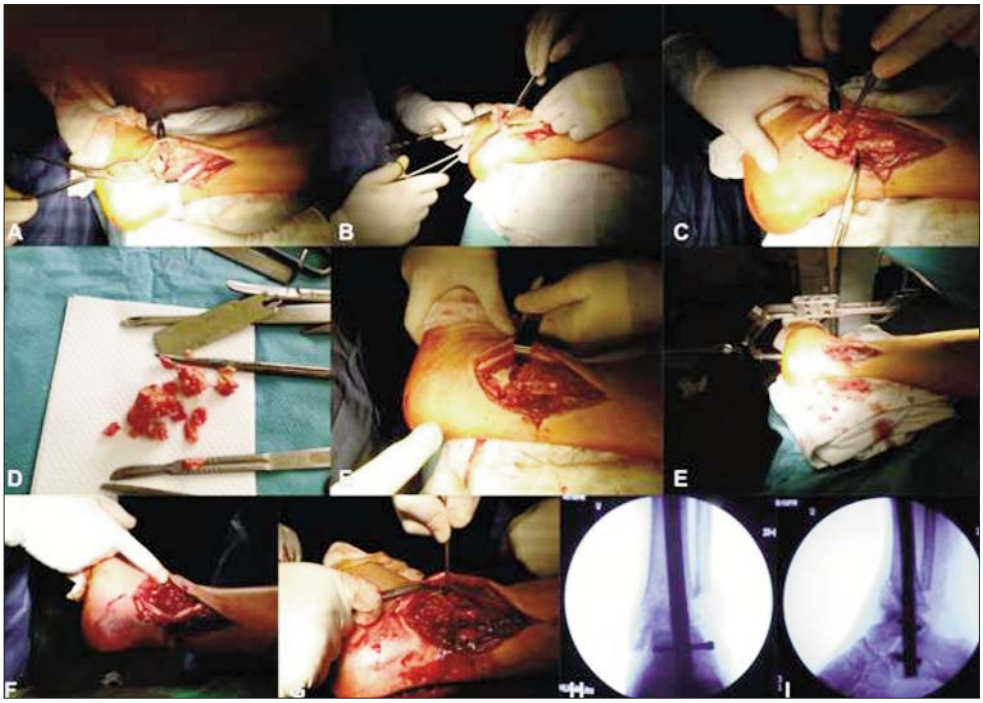

Figure 9. ***(A-I)*** *Intraoperative aspects of the tibio-talar arthrodesis* ***(A-G)****; definitive fixation by intramedullary nail with retrograde insertion* ***(H,I)***

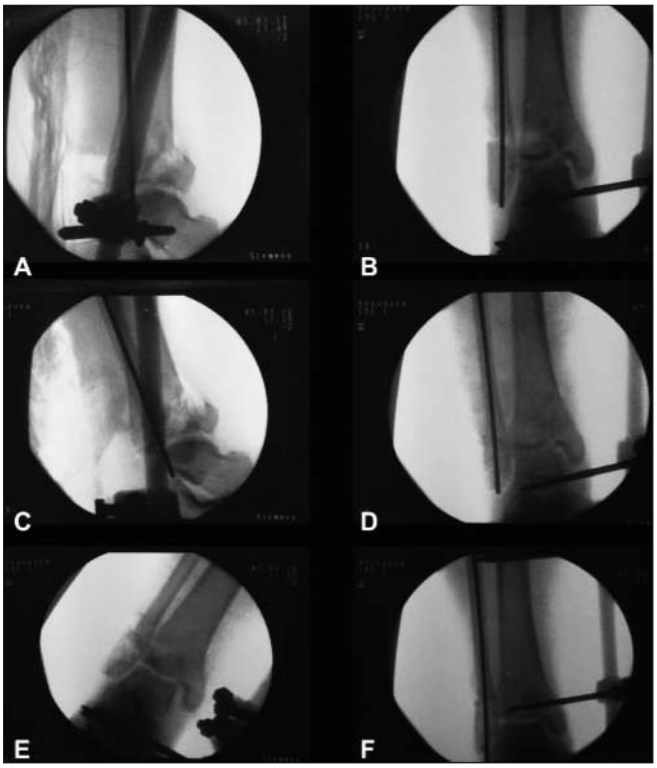

Figure 10. *(A-B) Postoperative radiographic control, following tibio-talar arthrodesis and final fixation by intramedullary nail*

Any digression from the optimal treatment for each type of tibial pilon fracture (AO) may lead to severe complications as nonunions, malunions with varus tibial displacement, implant degradation, pseudarthrosis, stiffness and ankle arthrosis with evolution towards spontaneous arthrodesis or even necrosis and deep infections.

If plate osteosynthesis in tibia cannot be performed due to extended soft tissue lesions, the tibia can be fixed temporary or permanently by an intramedullary XS-nail (21). This method is however reserved to minimally displaced ankle fractures, to simple metaphyseal fractures (tip A) or to articular fractures that can be reduced and fixed percutaneously by threaded nails.

European trends regarding tibial pilon fractures advocate CT usage following external fixator application as a standard, in order to perform a direct three dimensional visualization of the fracture fragments realignment; thus, intraoperative decisions can be performed faster, improving further clinical evolution.

Conclusions

The authors recommend the avoidance of any digression from standard approach in these fractures due to possible severe complications.

For tibial pilon fracture management, it is important to follow the fracture type (according to AO) and the soft tissue status at this level in order to apply the optimal treatment. Implants must be adapted not only to the fracture type but also to the association between fracture and soft tissue lesions.

Current trends in tibial pilon fractures advocate the two-step surgical management: application of the external fixator followed by definitive implantation of locked anatomical plates. To preserve soft tissues, the optimal approach will be minimally invasive, using MIPO or percutaneous MIPO techniques (MIPPO).

However, despite an excellent preoperative plan, a good soft tissue management and a successful surgical procedure, some results may be poor due to primary joint cartilage impairment at the time of the injury.

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