

Noninfected Atrophic Tibial Pseudoarthrosis Threatened With Ilizarov External Fixation And With Autogenous Intramedullary Spongionoplasty

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Abstract

We report a case report of a tibial aseptic, atrophic pseudoarthrosis. The patient was treated with immobilization of the lower extremity with a long-leg cast for a period of two and a half months. This treatment was interrupted because the patient developed thrombophlebitis of the affected leg. Possible reasons for the pseudoarthrosis were: short period of immobilization, alcoholic malnutrition, and cigarette smoking. When the thrombophlebitis was cured, closed intramedullary fixation of the pseudoarthrosis was planned. The operation was converted later on to external fixation of the pseudoarthrosis according to Ilizarov, because it was not possible to introduce the intramedullary nail to the distal bone fragment with a closed technique, and because the surgical incision had to be made on the place where the pseudoarthrosis was. Second reason for the conversion to Ilizarov external fixation was the bad condition of the skin around the pseudoarthrosis. After the operation was finished, an idea for pseudoarthrosis spongionoplasty with spongiosis from crista iliaca, together with fibular resection of one inch length, as a second surgical intervention came into mind. There was a pleasant surprise, because on the following x - ray six weeks after the fixation, there was a calus where during the operation the guide wire for the intramedullary nail could not passed to the distal tibial fragment and was going outside. Maybe, during the unsuccessful attempts to pass the intramedullary nail's guide wire, collateral autogenous intramedullary spongionoplasty was made, i.e. spongiosis was brought (transplanted) with the guide wire from the proximal part of the tibia distally to the place of pseudoarthrosis. Three and a half months later the pseudoarthrosis of the tibia was cured and the Ilizarov external fixator was removed. The result of the operation was good. The patient was happy and he could walk normally without subjective difficulties. There was only discrete contracture of the left talocrural joint.

INTRODUCTION

Pseudoarthrosis is a fracture of a bone which can not be cured in a period of nine months from the time of injury, and when there is no x - ray progress in the healing in the last three months of the treatment.

Almost half of all psudoarthroses (35% – 62%) concern the tibia.[1,2] Cigarette smoking, diabetes mellitus and malnutrition are main systemic factors.[2,3]

Local factors are: infection, the energy of the mechanical force leading to fracture, anatomical location of the fracture, and mechanical factors and the structure of the fracture (mobility of the fragments, inadequate fixation, lack of physiological bone strain).

There is a well-known algorithm for therapy of this kind of pseudoarthrosis [4].

Figure 1

Treatment algorithm for tibial nonunions:
Tibial nonunion-Infection?

(A) Infected

- Excision of infected bone
- Removal of infected hardware
- Antibiotic beads/nail
- Acute shortening - Ilizarov
- IM nail (post antibiotic)
- Bifocal treatment (shortening and lengthening at different sites)
- Bone transport

(B) Not infected

- 1) Hypertrophic - Alignment - Acceptable - Length - Normal - Compression Plate
IM Nail
Ilizarov compression
- Unacceptable - Acute correction -Short - Lengthening over nail
Gradual correction - Compression Plate
IM Nail
Ilizarov distraction

2) Atrophic (as above add) - Excise sclerotic bone

- Rigid internal fixation - Compression Plate
- IM Nail
- Ilizarov compression
- Biology
- Bone graft
- Autologous (open posteromedial)
- bone marrow
- DBM (demineralized bone matrix)
- BMP (Bone Morphogenetic Protein)

CASE REPORT

A 56 years old man injured himself falling from bicycle. He suffered a torsion tibial fracture of the left leg, type 42B1 according to the AO classification.[5](Fig.1)

Figure 2

Fig.1



Figure 3

Fig.2



Because the patient refused operative treatment, the fracture was reposed and immobilized in a cast boot above a knee. During castostomy a correction of the tibial axis in antero-posterior position was made. Satisfactory tibial axis position was achieved and confirmed with antero-posterior and lateral views. (Fig.2)

The patient negated any illnesses, was a heavy cigarette smoker (more than 30 cigarettes per day), and consumed alcohol from 200 ml brandy to one liter of wine per day. There were days when he did not consumed alcohol, but there were days when he consumed much more then usually.

The treatment was conservative with cast immobilization at home. Two and a half months later he developed thrombophlebitis on the left leg and was admitted to the hospital. The cast immobilization was removed. Heparine was introduced in continuous intravenous infusion. The dose of heparine was determined daily according to activated partial thromboplastine time. After the thrombophlebitis was cured, he was treated with oral anticoagulant Acenocumarol and discharged home.(Fig.3)

Figure 4

Fig.3 X-Ray after removal of Long-leg cast



Six months from the beginning of the thrombophlebitis surgical treatment was proposed to him after consultation with a transfusiologist. This time he accepted it.

Preoperative radiography was made, where atrophic pseudoarthrosis of the left tibia was visible.(Fig.4)

Figure 5

Fig.4 X-Ray control before surgery



Intramedullary tibial fixation was planned before the operation.

The operation was performed in epidural anesthesia on 20.09.2010. Anteromedial approach of the upper tibial epiphysis was made. After the initial preparation, the guide wire for the medullary nail was introduced in the tibial canal. The idea was to make closed fixation of the tibial fragments with the intramedullary nail. But, several consecutive attempts for introducing the guide wire in the distal bone fragment were unsuccessful. In those circumstances it was necessary to make surgical incision at the place where pseudoarthrosis was. Concerning the bad skin condition, conversion to external fixation according to Ilizarov was done instead.(Fig. 5, 6)

Figure 6

Fig.5 First X-Ray control after surgery

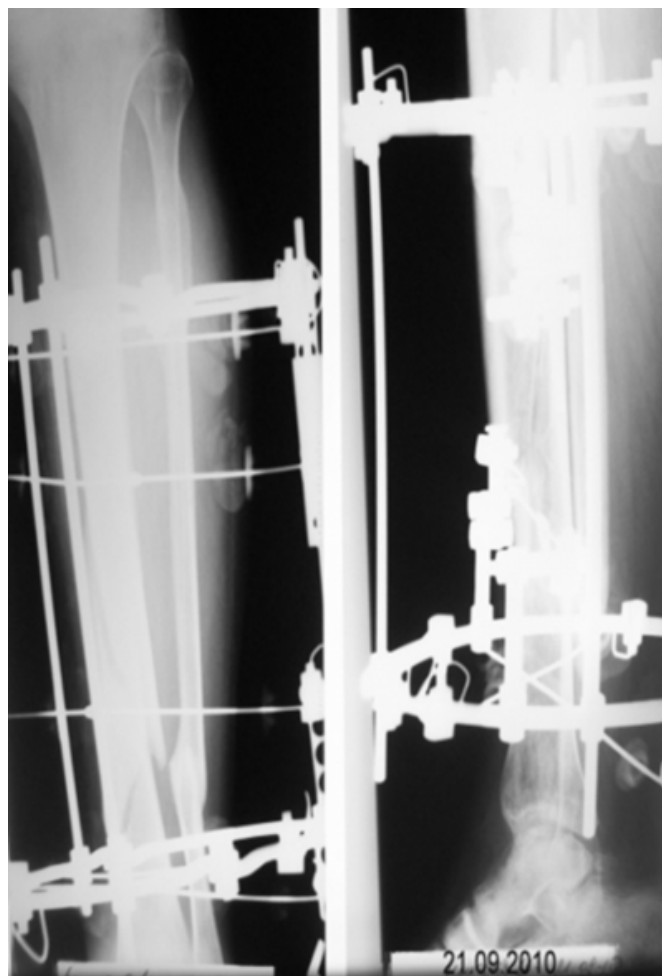


Figure 7

Fig.6 Six weeks later



The Ilizarov external fixator was left in place for three and a half months. The first X-Ray control showed a pleasant surprise for us because a calus was visible on the place where several times the guide wire went out in the unsuccessful attempts to introduce it in the distal bone fragment. Following radiographies showed that calus with a good dynamic has been forming. Ilizarov external fixator was finally removed (Fig.7)

Figure 8

Fig.7 X-Ray control after six weeks



One month later the patient could walk normally, he could stand on the left leg and strain it. He complained of pain and edema in the left ankle after long walking and standing still. There was a contracture of the left ankle. Physiotherapy was proposed and carried out.

Figure 9

Fig.8 Last X-Ray control



The last X-Ray control was made for the insurance company purposes. The patient walked normally, but the left ankle contracture was still present.(Fig.8)

The patient was very happy because he could dance the national Macedonian dance “teshkoto”(Fig.9, 10)

Figure 10

Fig. 9



Figure 11

Fig.10 Teshkoto



DISCUSSION

The role of the spongionasty is to initiate the biologic reaction and to cure the atrophic psudoartrosis, as well as to fill in the bone defects up to 6 cm in the fracture`s region.(6)

When the pseudoarthrosis is treated with metal plate the use of spongiosis is frquent.(2)

When the pseudoarthrosis is treated with intramedullary nail the use of spongiosis is very rare.(7)

When Ilizarov external fixator is applied, than the use of spongiosis is possible as an adjunctive bone grafting in the second operation.

The bad side of the intramedullary nails in the surgical therapy of the psudoarthroses is that the close medullary nail introduction very often is impossible. The need for open introduction with surgical incision at the place of pseudoarthrosis is in a range of every second to every third case.(7,8)

There are experimental data showing that during the rimming of the medullary canal damage to the endostal blood supply can occur.(9). Surgical opening of the psudoarthrosis caries the additional risk of periostal blood circulation damage in the conditions of compromised blood supply of the pseudoarthrosis. The bad condition of the skin in the region of pseudoarthrosis expressed as skin atrophy and varicosal syndrome complete the possible risks of surgical opening of the place of the pseudoarthrosis.

It is clear why we made external fixation, when the closed introduction of the medullary nail was not possible, and why we did not make adjunctive bone grafting during this operation or afterwards.

The data in the literature shows that during the rimming of the medullary canal, bone fragments with great biological potential for calus formation are liberated. So during successful intramedullary nailing there is a rare need for additional biological stimulation of the pseudoarthrosis with bone marrow, spongiosis, demineralized bone matrix, or bone protein with morphogenic potential.(9,10)

The surgical approach in our case report was anteromedial at the level of the upper epiphysis of the left tibia. The hole was prepared and the guide wire was introduced in the medullary canal of the tibia. Several attempts were made, but the guide wire could not pass in the distal tibial fragment with closed technique. Later it was recognized that during these attempts, actually autologous intramedullary spongionasty was made inadvertently. During the unsuccessful attempts to pass the guide wire through the distal tibial fragment, actually spongy bone and bone marrow from the tibial metaphysis – the bone region rich in spongy bone and bone marrow - to the psudoarthrosis was transplanted. In our case this was done inadvertently. From

this perspective we would do exactly the same in the similar circumstances in the future. It could be easier and more simple to transplant spongiosis by pushing it from the upper tibial metaphysis region to the pseudoarthrosis region with an instrument especially and purposefully designed for it.

CONCLUSION

There are growing reports in the orthopedic literature describing excellent results when pseudoarthrosis is cured with intramedullary nails. This case report actualizes the following question: should we insist by all means to pass the nail with open technique when the close technique is not possible, or should we choose another surgical technique. It is incorrect and not modest to conclude something new on the basis of only one case report. Anyway the idea for autologous intramedullary spongionasty remains, and we shall do it again, but this time intentionally.

References

1. Boyd HB. Observations on non-union of the shafts of the long bones, with a statistical analysis of 842 patients. J Bone Joint Surg 1961; 43A: 159-168.
2. The Role of Bone Growth Stimulating Devices and Orthobiologics in Healing Nonunion Fractures Prepared by: ECRI Evidence based Practice Center Karen Schoelles, M.D., S.M. David Snyder, Ph.D. Janice Kaczmarek, M.S. Evelyn Kuserk, M.L.S., M.A. Eileen Erinoff, B.A. Charles Turkelson, Ph.D. Vivian Coates, M.B.A. September 21,2005
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540 Gaither Road
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3. Schmitz MA, Finnegan M, Natarajan R. Effect of smoking on tibial shaft fracture healing. Clin Orthop. Aug 1999;184-200. [Medline]
4. Minoo Patel, MBBS, MS, FRACS; Chief editor: Carlos J Lavernia, MD, FAAOS Tibial Nonunions
www.emedicine.medscape.com
5. Muller AO classification of fractures
www.aofoundation.org
6. Matthew J. Weresh, MD. Original author: Peter Cole, MD; March 2004. General principles in the Assesment and Treatment of Nonunions
www.ota.org/res_slide/G18_Malunions.ppt
7. Paraschou S, et al. Results of treatment of aseptic diaphyseal tibial nonunions with locked intramedullary nailing. EEXOT Volume 61, (4): 208-213,2010
8. Megas P, Panagiotopoulos E, Skriviliotakis S, Lambiris E. Intramedullary nailing in the treatment of aseptic tibial nonunion injury, 2001 April; 32(3) :233-9
9. Klein MP, Rahn BA, Frigg R, Kessler S, Perren SM (1990) Reaming versus non-reaming in medullary nailing: interference with cortical circulation of the canine tibia. Arch Orthop Trauma Surg 109:314-316 [PubMed]
10. Wheelless Textbook of Orthopaedics Tibial Nonunions

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