



## Infected pseudarthrosis of the leg treated by papineau modified method

L. Unyendje\*, A. Karkazan, A. Zouhair ,M.NKamba, M. Mahfoud, F.Ismael, A. El Bardouni, M. Kharmaz, MY.O.Lamrani, M.Ouadghiri, A. Lahlou, MS. Berrada and M. EL Yaacoubi

Mohammed V University, Faculty of Medicine and Pharmacy, IBN SINA Hospital, Orthopedic Department Rabat-Morocco.

### ARTICLE INFO

#### Article history:

Received: 17 May 2013;

Received in revised form:

14 August 2013;

Accepted: 14 August 2013;

#### Keywords

Infected pseudarthrosis,  
Leg,  
Papineau,  
Modified method.

### ABSTRACT

The authors have treated 29 cases of infected pseudarthrosis of tibia: 12 complications of open fractures of legs with loss bone stabilized firstly by external fixator; 09 closed fractures treated traditionally by jbira seen in pseudarthrosis infected, 05 cases of septic nonunion arising after plate osteosynthesis and 03 cases following centromedullary nailing. In all cases, two stage reconstruction: Initial surgery consisted of soft tissue and bone debridement, external fixation completed by Dressing percutaneous a day by antiseptic and intravenously antibiotic. After any remaining infection, at last 6 to 8 weeks, the reconstruction of the soft tissue with a free microsurgical muscle flap and skin graft. The second stage surgery consisted to replace external fixator by intramedullary nailing and the osseous reconstruction was cancellous or corticocancellous grafting. The final result was obtained after an average of 24 months and was excellent in 15 cases, good in 12 and 02 failures were observed. On the infectious; remaining infection were observed in 02 and required amputation of leg. The modified method of Papineau seems superior to any other method used for treatment of infected pseudarthrosis of tibia.

© 2013 Elixir All rights reserved

### Introduction

The infected pseudarthrosis of the diaphyseal tibia fracture continues to be one of the greatest challenges in orthopedic surgery, its frequency is 5.2% (1), in Europe it is not frequent and varies between 0-2% and when the working conditions are difficult it can reach up to 20% in poor countries (2,3). It defined nowadays no only to the notion of non-union in six months but to the prognosis of fracture and the degree of soft tissue damage (4). The coexistence of non-union, infection and the degree of the loss of skin tissue is the triptych of illness for the patient and the orthopedist surgeon. The method of Papineau was modified to make the bone reconstruction in our own experience; it consisted by debridement of bone and coetaneous tissue infected, followed by an external fixation and dressing percutaneous a day by antiseptic and intravenously antibiotic. The debrided areas will be covered by muscle flap or free vascular transfer. After any remaining infection, at last 6 to 8 weeks the second step of bone reconstruction after recovered skin wound to replace external fixator by intramedullary nailing. The reconstruction graft was usually cancellous or corticocancellous bone alone or associated with a vascularized graft (fibula) reconstruction are the two main stages of treatment. The aim of this study was to describe the technique of Papineau modified and to evaluate the outcome in treatment of infected pseudarthrosis of leg.

### Materials And Method

We reported a retrospective study of 29 cases of infected pseudarthrosis of the leg collected between January 2008 and May 2013 in Orthopedic and traumatology department of Ibn sina hospital. 21 men and 8 women aged 20 to 65(mean, 40.3) who presented 12 complications of open fractures of legs with loss bone stabilized firstly by external fixator(fig.1a,1b), 09 closed fractures treated traditionally by jbira seen in pseudoarthrosis infected(fig.2a,2b), 05 cases of stabilization by plate

osteosynthesis and 03 cases of nonunion following centromedullary osteosynthesis nailing(fig.3). The mean follow-up period was 24 months and the mean bone defect was 4.5 cm (range: 3.5 to 6cm)

### Surgical Technique

The modified method of Papineau has two stage approach: two stage reconstruction: Initial surgery consisted to removal plate or nail maintained infection and of soft tissue debridement, the dead bone is curetted, Placement of external fixation of Hoffman completed by Dressing percutaneous a day by antiseptic and intravenously antibiotic (fig.4). Two consecutive negative wound cultures and normal values of blood cell count, C - reactive protein CRP, and estimated sedimentation rate were obtained. After the eradication of the infection. The debrided areas will be covered by muscle flap or free vascular transfer. The second stage surgery consisted to replace external fixator by intramedullary nailing and the osseous reconstruction was cancellous or corticocancellous grafting ,when the bone loss is less than 5 cm,or associated with a vascularized graft (fibula) when it is exceed 5 cm.The consolidation was on average at 24 months

### Results:

29 patients, aged 20 to 65(mean, 40.3) were followed and the results were analyzed on the consolidation of nonunion, the healing of the infection, limb function and the professional reintegration.

### The consolidation and infection On average at 24 months

27 patients had been drained and consolidated. 2 patients were amputated following defects consolidation and recurrent infections (fig.3). At 4 months the bone graft showed radiological consolidation (fig.4) and the result was excellent in 15 cases, good in 12 and poor in 2 cases

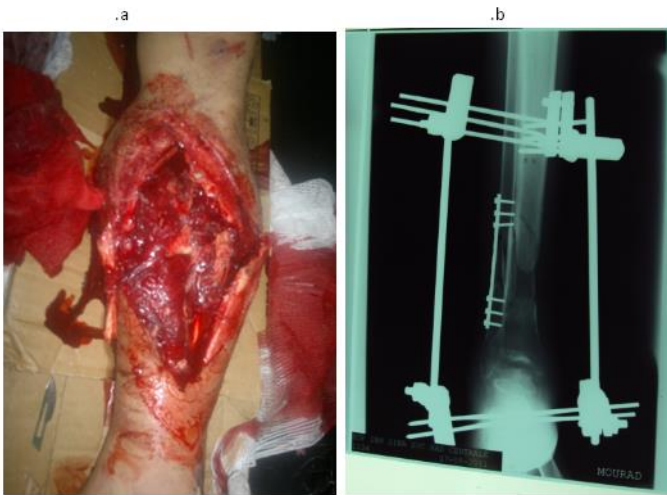
**Functional results:**

The deformity and length inequality were corrected successfully on the majority of the patients. (27/29) had a normal walking, but we noted an average shortening of 2 cm observed in patients with bone loss superior 4 cm. Varus and hyperextension in three cases was well tolerated by patients. Only 6 patients had dorsiflexion to 20 °and plantar flexion to 30°. Knee and ankle mobility was not limited in all cases. The functional result was excellent in 16 cases, good in 8 cases, fair in 3 cases and poor in 2 cases. We noted long-term hospitalizations: 9 months on average and multiple interventions on average three interventions per patient. So most of the patients had returned to their daily activities.

**Different stages in reconstruction of infected Pseudarthrosis in developed countries**

**I. Septic nonunion of leg:**

**1. With loss of bone in open fracture stage III according to Cauchoix and Duparc (a, b), fixed firstly by external fixator of Hoffmann.**



**2. Closed fractures treated traditionally by jbira seen in pseudarthrosis infected (a, b)**

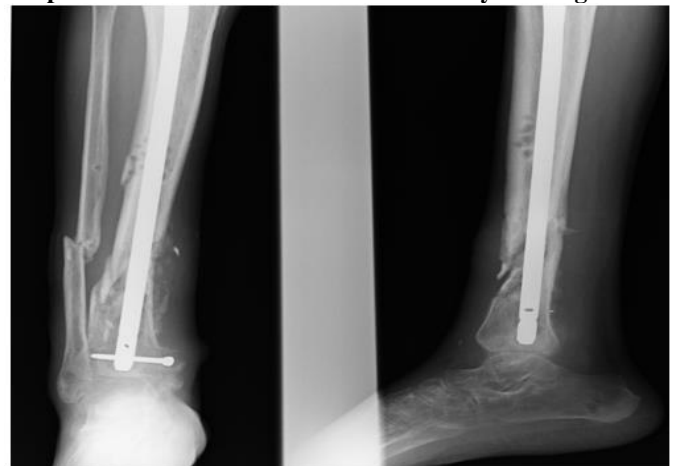


**Discussion**

The infected pseudarthrosis of the diaphyseal tibia fracture continues to be one of the greatest challenges in orthopedic surgery whatever the surgical technique described in the literature, the results of the treatment of septic nonunion are still

a problem for long periods of hospitalization, recurrent infections, and multiple interventions on average 3 per person interventions. The infectious loss of bone is treated by amputation or reconstruction .With limb salvage always preferable, surgeon rely on already established technique such us grafting and distraction osteogenesis to avoid amputation and ideally restore structure and function. The modified method of Papineau with two stage approach in our own experience is an effective method of the bone reconstruction and limb salvage. It can reduce the duration of the eradication of the infection to 6 weeks, and the bone reconstruction by autograft does nothing require to the patient but Silber (5) reported acute and chronic complications of donor sites. The presence of fistula and the anteroposterior and lateral radiographs may be sufficient in the diagnosis of septic nonunion (6). The multiple and profound preoperative samples, culture and antibiogram are realized for the bacteriological diagnosis and microbial poly forms are seen in 1/3 cases (7). Staphylococcus aureus was frequent (8) or associated with Escherichia coli were in 09 cases treated traditionally by jbira, an association of Klebsiella and Pseudomonas aeruginosa in 3. Wichou in Casablanca (9) has found that the germs were isolated in 6/22 cases with predominance of pseudomonas aeruginosa in 5 cases and an association Klebsiella-aeruginosa in one case. Moyikoua (10) in a series of 10 was isolated germs in 7/10; the Staphylococcus aureus in 3/7 cases, followed by pseudomonas in 2/7 and an association of Klebsiella and cytotacter in 2/7. Patrick (11) reported some difficult for healing infection in osteosynthesis material.

**3. Septic nonunion followed centromedullary nailing**



**II: Soft tissue debridement, the dead bone curetted, Placement of external fixation of Hoffman completed by Dressing percutaneous a day by antiseptic**



### III. Reconstruction of the soft tissue with a free microsurgical muscle flap and skin graft 4 weeks later



### IV. External fixator changed by intramedullary nailing and grafting cancellous or corticocancellous.



All patients had received dressing percutaneous a day by antiseptic and intravenously antibiotic after antibiogram for 6 to 8 weeks. The persistent infection was in 2 cases leading to amputation. For nonunion with loss lower than 3 cm substance cortical cancellous autograft taken at the anterior iliac crest or posterior was used. The consolidation was in 27 cases with a mean of 2 years and the dorsal and plantar flexion of the ankle joint were respectively 20° and 30° in 23 cases. Moyikoua (10) obtained a limitation of dorsiflexion of the ankle in 8/10 patients. Vidal (12) reported failures in 13/47 case with GITP caused to a technical operator error and recommended a recovery by iterative GITP using anterior diaphyseal graft. When the bone loss is large, Bumbic (13) preferred in some cases to use the contra lateral fibula.

- Merle d'Aubigné (14) in 1960 proposed to placed a cortico-cancellous graft externally wich will cause a tibiofibular synostosis (GITP)

- In 1970 Burri had focused on cancellous graft open (GSCO) it is the method of Papineau who has two approach principles: firstly excision and stabilization without closing skin and proceed to bone reconstruction in the 15th day. Papineau thought that bone graft would taken even pus (15).The best results at the femoral level were obtained by retaining the nail in situ but at the tibia level, retention of the nail was rarely followed by bony union(16).

-Reconstruction by transfer bone free vascularized (Tolv) (17): This method is very complex and requires a good preoperative planning,

-In 1980 The Ilizarov reconstruction method or segmental bone transport using a circular external fixator to provide distraction osteogenesis and bone transport segment (18).

Reconstruction-cancellous graft supported by the fibula (GSAP) (15), this method requires an environment of soft tissue alive and retro position of the bone graft.

-Reconstruction by fibula pro tibia (19): This is a simple, classic and effective technique is to translate the fibula.

Recently, Alain Charles Masquelet (20) proposed a two-stage technique: first debridement and filling of bone loss with an acrylic spacer, second bone reconstruction by filling with cancellous bone in the space left free.

For to prevent complications of septic nonunion in case of loss of posttraumatic bone type III of open fractures, Garbuio (21) preferred in emergency an intramedullary nailing followed by bone and skin graft at the same time, and the results were excellent in 3/5.

#### Conclusion:

The infected pseudarthrosis of the diaphyseal tibia fracture continues to be one of the greatest challenges in orthopedic surgery, whatever the surgical technique described in the literature; the modified method of Papineau is a therapeutic arsenal unaffected and cheap adapted on the countries with low wages.

#### References

1. Moyikoua A., Kaya J.M., Ondzoto J.M., Pena-Pitra B. Complications septiques des ostéosynthèses des membres ; Médecine d'Afrique noire. 1993 : 40(12)
2. Evrard J., Mazas F., Flamant R., Acar J., et les membres du GETPIA. L'antibiothérapie préventive en chirurgie orthopédique. Sppl II, rev. Chir. Orthop. 1981, 67: 56-59.
3. Bouger D., Dukuly L., Doucloyer Ph. Antibiothérapie préventive et infection postopératoire en chirurgie orthopédique. Med. Afr noire 1989, 36, 369-374
4. Medjahed M. Khaznadar MS. Traitement des pertes de substances osseuses étendues des membres inférieurs selon de procédé séquentiel d'Alain Charles Masquelet. 17è Congrès national de la SACOT. Dec 2010
5. Silber JS, Enderson DG, Daffner SD, Brislin BT, Leland JM, Hilibrand AS, Vaccaro AR, Albert TJ: Donor site morbidity after anterior iliac crest bone harvest for single-level anterior cervical discectomy and fusion spine, 2003; 28: 134-9.
6. Trigaux JP, Malguem J, Denespeleux JF et al. L'imagerie médicale dans les pseudarthroses tibiales. Acta orthop gelg 1992 :58, suppl. 1.
7. Toumi A, Dhn A, Bemmer P, Bernard L; Diagnostic des ostéites chroniques: Journal des anti- infectieux. Vol 13, issue 3, Pages 145-153
8. Hernigou p. Autogreffe de moelle osseuse dans les pseudarthroses et de retard de consolidation : 28è journée d'orthopédie de fort de France 2008 :42
9. Wichou M. Haddoun AR., Moujtahid M., Bennouna D., Nechad M., Fadili M., Zryouil B. Les pseudarthroses septiques de jambe : Rev. Marocain de chir orthop traumatol. 2006 ; 28 :20-24
10. Moyikoua A., Pena-Pitra B. Greffe intertibia-péronière dans le pseudarthrose infectée de jambe ; Médecine d'Afrique noire. 1991; 38: 8-9
11. Patrick Mamoudy. Infection ostéo-articulaire : Groupe hospitalier diaconesses croix saint-Simon-Paris 2010 P: 1-3
12. Vidal J., Bouscayret CH., Finzi M., Melka J. La greffe intertibia-péronière dans le traitement des retards de consolidation jambier. Rev. Chir. Orthop. 1982, 68, 123



13. Bumbic S.: Pseudarthrose ostéomyélique avec perte de substance, traitée par greffon du péroné opposé. Clin. Pédiatr.1986, 27, 356-358.
14. Merle d'Aubigné: Traitement des pseudarthroses diaphysaires. Rev.Chir.Orthop.1963, 49,1-15.
15. Jacob L. Pseudarthroses infectées ; 13è congrès de la SACOT 2006. 16.Lortat-Jacob A, Surtour JM, Beaufils P. Infection following centro-medullary nailing of diaphyseal femoral and tibial fractures. Rev chir orthop reparatrice appar mot.1986;72(7):485-94.
17. Taylor I, Townsend P., Corlett R.: Superiority of the deep circumflex iliac vessels as the simply for free groin flaps. Plast. Reconst.Surg.1979, 64:745-759
18. Rigal S., Tripon P ; Reconstruction par transfert osseux segmentaire : Ann Orthop. Ouest.2005, 37 : 163-165
19. Burdin P, Favard L, les pseudarthroses de jambe. EMC, 1992 : 44875, 6P
20. Masquelet AC, Flittoussi F., BegueT., Miller GP. Reconstruction of the longs bones by the induced membrane and spongy autografts. Ann Chir Plast esthet. 2000; 45: 346-353
21. Garbuio P., Tropet Y ; Fractures ouvertes de jambe type III avec perte de substance osseuse : Intérêt de la greffe osseuse en urgence contemporaine de la fixation interne du squelette et de la couverture ; Maitrise orthopédique. Oct. 1999, N°87.