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Original article

Does inter-tibiofibular graft still have a role in the treatment of lower-limb non-union?



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ABSTRACT

Introduction: Tibial non-union is a complication that poses a real challenge for surgeons. Several forms of treatment, depending on the type of non-union, have been described. The present study sought to assess results for treatment of tibial non-union by inter-tibiofibular graft (ITFG).

Material and method: An exhaustive cohort study was performed on the files of 33 patients: 25 male, 8 female; mean age, 44 years. Twenty cases involved high-energy trauma. Twenty-four were open fractures. Twenty-two concerned diaphyseal fracture, 10 of which were complex segmental. Eleven concerned distal fracture, including 4 complete articular fractures. There were 17 cases of septic non-union. There were no cases of severe bone defect. ITFG was performed at a mean 8.7 months post-trauma, as first-line treatment in 30 cases and in second line in 3.

Results: Thirty-one patients showed bone consolidation, at a mean 7.2 months. The 2 failures resulted from technical error. Trauma kinetics emerged as a risk factor for failure.

Discussion: ITFG remains a useful treatment option in tibial non-union, whether infected or not. The present results are comparable with those of the literature. Although the present series comprised only tight non-union, a study of the literature showed that ITFG can treat bone defects up to 4 or 5 cm. Functional results showed tibiotalar joint stiffening, due more to immobilization and non-weight-bearing than to syndesmosis. ITFG thus remains relevant to the treatment of tibial non-union.

Level of evidence: IV, retrospective study.

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1. Introduction

Tibial non-union is a major complication of fracture, concerning 10% of cases free of risk factors [1].

Functional and socio-occupational impact is severe. Management frequently includes revision surgery, with uncertain results. Choice of treatment depends on fracture type, primary treatment, septic status, and presence of bone defect or soft tissue lesions. Revision of osteosynthesis and bone grafting may be required.

Inter-tibiofibular graft (ITFG), first described by Milch [2], enables bone healing, rapid resumption of weight-bearing and resolution of septic non-union. It may also be indicated in bone defect up to 5 cm.

The present study assessed bone healing and functional results in ITFG for septic and non-septic tibial non-union.

2. Materials and method

A retrospective exhaustive historic cohort study was performed on medical records.

2.1. Inclusion criteria

The study included all patients treated by ITFG for tibial non-union in the University Hospital Center of Amiens (France) between 1999 and 2006. ITFG is the institution's reference attitude in tibial non-union, whether septic or not, if inter-fragment distance is ≤ 2 cm.

Patients managed by any other technique were excluded. In case of bone defect exceeding 2 cm, other techniques were used, including vascularized fibular transfer or bone transport; hypertrophic aseptic non-union without bone defect managed by primary osteosynthesis by intramedullary nailing was treated by reaming and secondary nailing. One patient was lost to follow-up and excluded from analysis.

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2.2. Series

The series comprised 33 patients: 25 male, 8 female; mean age, 44 years (range, 16–74 years). Comorbidities included active smoking ($n = 4$), diabetes ($n = 3$), chronic alcoholism ($n = 2$), asthma ($n = 2$) and malaria ($n = 1$). Twenty-two patients were free of comorbidity.

Trauma comprised 25 road accidents, 9 of which involving 2-wheel vehicles, 1 ballistic trauma, 4 falls (2 falling down with osteoporosis, 2 falls of several meters), 2 lawn-mower accidents and 1 skiing accident. Trauma was high-energy in 22 cases. 24 cases concerned open fracture. Fractures were grade 1 on the Cauchois-Duparc classification in 7 cases, grade 2 in 9 and grade 3 in 8. On the AO classification of lower-limb fractures, 22 cases were diaphyseal (type 42), including 10 complex segmental (type 42C), and 11 distal (type 43), including 4 complete articular fractures (type 43C). Primary osteosynthesis was by screwed plate in 1 case, intramedullary nailing in 6 and external fixator in 26; 5 of the 6 cases of intramedullary nailing were revised by external fixator: in 2 cases for axial reduction defect in comminutive fracture, and in 3 cases for secondary skin necrosis. In 6 cases, skin flap graft was performed, 5 using a thin skin graft; 21 of the non-unions were atrophic and 12 hypertrophic. Interfragment distances did not exceed 2 cm. 17 non-unions were septic, defined by intraoperative samples positive for ≥ 1 bacterium.

31 patients showed fibular consolidation; in the other 2, osteosynthesis by screwed plate was performed in the same surgical step as ITFG. ITFG was performed at a mean 8.7 months post-trauma (range, 5–18.5 months). ITFG was first-line treatment in 18 cases, and second-line in 3 cases following failure of debridement graft, or for revision of osteosynthesis with graft or repeat reaming-nailing, respectively.

2.3. Surgical technique

The surgical approach was anterolateral in all cases, and allowed resection of infected tissue. The corticocancellous graft was interposed between tibia and fibula after decorticating the non-union, resecting infected tissue, freshening adjacent cortices and resecting the lateral intermuscular septum so as to position the graft on a muscle bed and impact it stably between tibia and fibula. Osteosynthesis was achieved by tibio-tibial external fixator in all cases. Five surgical samples were systematically taken; if positive, adapted dual antibiotherapy was initiated for 3 months. Weight-bearing was resumed at 8 weeks in all cases.

2.4. Methods of analysis

Surgical data comprised presence and type of immediate post-operative complications, surgical revision, and sequelae. Radiologic consolidation was defined by a bone bridge including 3 of the 4 cortices on at least 2 views. The external fixator was ablated in 2 steps: fixator body, with resumed gait; and pins 1 week later, with radiological and clinical surveillance. Absence of pain and of radiological displacement then defined bone healing. Infection was considered cured in the absence of recurrence of clinical and biological signs at end of antibiotic therapy. Consolidation according to prognostic factors was assessed on Student *t* test, with a significance threshold of 0.05. Functionally, tibiotalar range of motion was assessed on goniometry.

3. Results

Mean follow-up was 11 months (range, 3–84 months). There was no loss to follow-up among included patients.

3.1. Complications

Five patients developed chronic fistulae around the fixator pin orifices; 3 received surgical drainage and curettage of the residual osteitis. The other 2 received local treatment.

There were 2 failures. Retrospective analysis implicated technical error, the grafts being too small to be impacted. Iterative ITFG was performed after consolidation was not achieved by 6 months. Figs. 1–4 illustrate one of these cases in which a second ITFG was needed.

3.2. Functional results

Functionally, 26 patients showed no disabling pain or significant loss of range of motion compared to the contralateral side. Seven showed tibiotalar joint stiffness, with global ankle flexion of 0–5°.



Fig. 1. Example of one case: preoperative control X-ray at 10 months after tibial fracture: absence of consolidation.



Fig. 2. Example of one case: postoperative control X-ray of primary ITFG.

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