

Fixed intramedullary nailing and percutaneous autologous concentrated bone-marrow grafting can promote bone healing in humeral-shaft fractures with delayed union

Christos Garnavos*, Georgios Mouzopoulos, Emmanouil Morakis

Orthopaedic Department, Evangelismos General Hospital, Athens, Greece

ARTICLE INFO

Article history:

Accepted 3 August 2009

Keywords:

Humerus
Delayed union
Nonunion
Intramedullary nailing
Stem cells
Bone marrow
Bone graft
Minimally invasive technique
Percutaneous technique

ABSTRACT

Treatment of humeral diaphyseal nonunion can be difficult and usually requires an extensive approach to the humerus with bone grafting, a procedure that could result in a lengthy operation with significant morbidity for the patient. The purpose of the present study is to describe a novel minimally invasive technique for the treatment of humeral-shaft fractures that do not demonstrate union progress within 16–24 weeks of injury. Fixed intramedullary nailing with percutaneously harvested and introduced autologous concentrated bone-marrow cells (mixed with demineralised bone matrix putty) was successfully used to treat five patients who had delayed union of a humeral-shaft fracture. The procedure was minimally invasive with no complications and resulted in sound union of all cases within 20 weeks.

© 2009 Elsevier Ltd. All rights reserved.

The terms delayed union and nonunion are not precisely defined in the English literature regarding the time scale of the retarding process of bone healing in humeral-shaft fractures. However, it would be commonly accepted that, when dealing with diaphyseal humeral fractures, the term delayed union should define the absence of progress in bone healing as seen on plain radiographs 10–24 weeks following injury. If the fracture remains unresolved for more than 24 weeks from injury, it is considered as nonunion. According to the literature, nonunion occurs in 2–10% of conservatively treated and up to 15% of surgically treated diaphyseal humeral fractures.^{20,24,31,37}

Although many strategies have been described for the management of nonuniting fractures of the humeral shaft, compression plating and autologous bone grafting appears the most popular despite the drawbacks of the procedure being an extensive and demanding surgical technique as well as having a prolonged operating time along with potential problems and complications that can occur from both the humerus and the bone-graft donor site.^{1,2,7,10,13,16,21,26,30–32}

The purpose of the present preliminary report is to describe a novel minimally invasive procedure, involving the use of closed, fixed intramedullary nailing and percutaneously harvested and

introduced concentrated autologous bone-marrow cells that could lead a nonuniting humeral-shaft fracture to a sound union.

Patients and methods

Based on the hypothesis that the course of a humeral-shaft fracture towards nonunion could be reversed to union if a relatively stable environment could be provided to the fracture site with the addition of a strong biological stimulus and all these with a minimally invasive procedure that could significantly reduce the risk of complications and theatre time, we prospectively used the proposed method for the management of humeral-shaft fractures that do not demonstrate signs of union progress 10–24 weeks following accident. Closed fixed intramedullary nailing provides the necessary stability with minimal surgical exposure (the term fixed defines the humeral nailing technique that uses locking bolts for the distal interlock).⁹

Between April 2006 and October 2008, three female and two male patients of ages from 30 to 75 years were admitted at our level 1 trauma centre for the management of delayed union of their humeral-shaft fractures (Table 1). Four patients were initially treated with functional bracing while one female patient who was suffering from generalised bone dysplasia with short stature and normal mentality had been operated with a retrograde intramedullary nail. One patient was a heavy smoker and one was overweight. Two patients sustained the fracture after a motor vehicle accident, while the other three fractured their humeri after

* Corresponding author at: 5 Poseidonos St., Glyfada 16674, Athens, Greece.
E-mail address: cgarn@otenet.gr (C. Garnavos).

Table 1
Patients' characteristics.

PTS	Sex	Age	Type of trauma	Type and location of fracture	Time from injury to definitive treatment (weeks)	Initial treatment
1 (Figs. 1 and 2)	F	75	Fall	Spiral, proximal-middle	14	Functional bracing
2	M	42	MVA	Bending wedge, middle	23	Functional bracing
3 (Figs. 3 and 4)	F	30	MVA	Transverse, middle-distal	16	Retrograde IMN
4	F	65	Fall	Oblique, middle	20	Functional bracing
5	M	50	Fall	Transverse, middle	18	Functional bracing

MVA: motor vehicle accident; IMN: intramedullary nailing.

a simple fall. Inclusion criteria for the suggested treatment were (a) diaphyseal location of the fracture, (b) not more than 24 weeks since the accident and (c) patients' consent for the procedure after a clear explanation that they would undergo a novel treatment with minimal morbidity that could save them from a much more extensive and lengthy operation, if successful. All patients, who fulfilled the first two inclusion criteria and presented within the study period, consented for the proposed treatment. Patients with established humeral nonunions (of more than 24 weeks of duration) were not included in the study.

All fractures were closed and the time from injury to the definitive operation (intramedullary nailing and bone-marrow grafting for the four who were treated conservatively initially and bone-marrow grafting for the one who was treated initially with retrograde nailing) ranged from 14 to 23 weeks. At the time of the definitive treatment, there was no sign of callus formation around the fracture site in any case (atrophic appearance).



Fig. 1. Spiral nonunited fracture in a 75-year-old female, heavy smoker, 14 weeks from injury.



Fig. 2. The fracture illustrated in Fig. 1, 20 weeks post-nailing and concentrated bone marrow grafting.

Intramedullary nailing with antegrade/unreamed technique was performed in the four cases that were treated conservatively initially. In the case of the 30-year-old female patient, who was suffering from generalised bone dysplasia and there were no signs

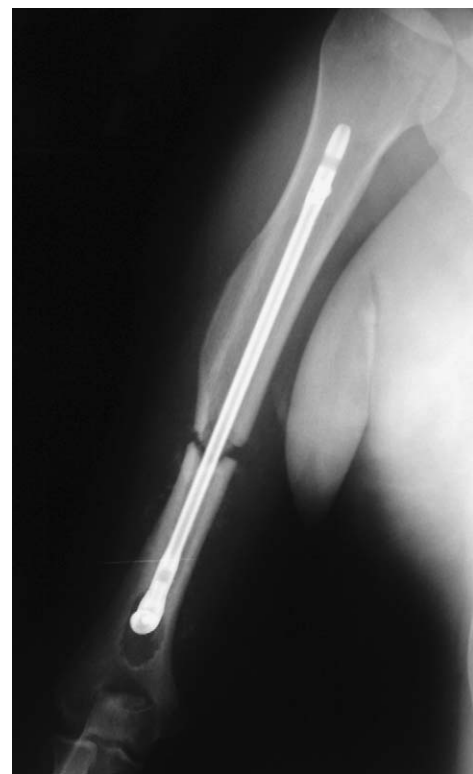


Fig. 3. Transverse fracture of the humeral diaphysis in a 30-year-old female patient with generalised bone dysplasia of 15 weeks after retrograde intramedullary fixed nailing.

Download English Version:

<https://daneshyari.com/en/article/3240971>

Download Persian Version:

<https://daneshyari.com/article/3240971>

[Daneshyari.com](https://daneshyari.com)