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Intramedullary nailing of humeral shaft fractures

Accepted: 22 January 2002 / Published online: 26 March 2002
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Abstract From 1996 until 2000 we treated 52 humeral shaft fractures with AO unreamed nailing. Mean patient age was 35.8 years and the average follow-up 29.6 months. There were 31 type A fractures, 15 type B, and 6 type C. Closed retrograde nailing was performed in 46 cases and open nailing in six. Functional results were excellent in 48 cases, moderate in three, and poor in one.

Résumé De 1996 jusqu'à 2000 nous avons traité 52 fractures humérales par enclouage sans alésage. L'âge moyen était 35.8 années et la suite moyenne 29.6 mois. Il y avait 31 fractures type A, 15 type B et 6 type C. L'enclouage fermé rétrograde a été exécuté dans 46 cas et l'enclouage ouvert dans 6 cas. Les résultats fonctionnels étaient excellents dans 48 cas, moyens dans trois et mauvais dans un.

Introduction

The objective of this study was to evaluate the results of retrograde intramedullary nailing of humeral shaft fractures using AO humeral nail.

Patients and methods

We performed a retrospective study of 52 patients with humeral shaft fractures treated surgically with unreamed intramedullary nailing, in the Department of Orthopaedic Surgery, Hospital del Trabajador Concepción, Chile, between March 1996 and February

Statement on conflict of interest: No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article

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2000. The average follow-up was 29.6 (6–54) months. There were 42 males and nine females with a mean age of 35.8 (15–79) years. Fourteen fractures were caused by vehicular collisions and 12 by falling from heights.

Fractures were classified according to the AO classification. Thirty-one were type A, 15 type B (Fig. 1) and six type C. Fourteen patients were multi-injured. In six cases there was an associated radial nerve palsy and in one case a lesion of the brachial plexus. There were five open fractures and five cases with atrophic nonunion (Fig. 2). In all cases we used retrograde intramedullary nailing with the patient in a prone position [13]. In 46 cases we were able to perform closed reduction; in six cases open reduction was necessary.

Results

All fractures united. Union of the closed fractures took place within 8.4 (6–12) weeks and open fractures within 12 (10–14) weeks. Fractures with atrophic nonunion united within an average of 13.6 (10–16) weeks.

Functional results were evaluated using the contralateral extremity for comparison [12]. Results were considered excellent when the restriction in the range of shoulder and elbow motion was less than 10°. They were considered moderate when there was a restriction between 10° and 30°, and poor when greater than 30° of any one of the movements in the shoulder or elbow. Forty-eight cases had excellent results, three moderate, and one poor (Table 1).

Complications were one additional fracture of the shaft and one hematoma of the iliac crest after bone graft removal. There were no additional cases of neurological damage. The six patients with palsy of the radial nerve and the brachial plexus recovered completely. There were no infections.

Discussion

Intramedullary nailing is well established in the treatment of shaft fractures of femur and tibia [3]. However, its application in humeral fractures is controversial since these fractures can be managed successfully conservatively.



Fig. 1 a Type B2 fracture. b Fracture union 3 months after surgery



Fig. 2 a Non-union after 9 months of conservative treatment in a 77 years old woman. b Union 5 months after nailing

Nevertheless, conservative management requires strict and frequent controls, as well as patient comprehension and collaboration [4, 14]. Also, high-energy trauma produces severe soft tissue damage, impacting negatively on bone healing.

Internal fixation with plate and screws is an established treatment for humeral shaft fractures. This method, however, often presents complications such as radial nerve lesions, infection, and delayed union [6, 11]. External fixation is used primarily for managing open fractures. Transfixation of the muscles can hinder the free movement of shoulder and elbow, and pin tract infections are often seen [8].

Table 1 Functional results

Fractures	Excellent	Moderate	Poor	Total
Closed	35	0	0	35
Closed + neurological damage	6	1	0	7
Open	4	1	0	5
Nonunion	3	1	1	5
Total	48	3	1	52

For the above mentioned procedures intramedullary nailing has been developed as a method of stabilization of humeral shaft fractures, overcoming the inherent difficulties associated with their use. The flexible nails of Ender [15] and Hackethal [5] allow for closed stabilization of humeral fractures, either using retrograde or antegrade insertion. They provide good axial alignment but are vulnerable to rotational stability. These implants will therefore often require a complementary brace. Their inherent tendency to migrate can also restrict the appropriate mobility of neighboring joints.

The development of interlocking nails has given an important impetus to the surgical treatment of humeral shaft fractures. The most commonly accepted indications for their use are in the multi-injured patient, the patient with head trauma associated with agitation, spine injuries, thoracic and abdominal trauma, and burns of the upper extremity or of the thorax [2, 6]. Other indications are humeral shaft fractures with other concomitant fractures in the ipsilateral upper extremity (especially if they generate a floating elbow [11]); bilateral fractures of the humerus; open fractures type II and III [8]; fractures with vascular lesions [4]; fractures with primary radial palsy or brachial plexus injury [1, 6]; pathologic fractures [7, 10]; transverse, segmental, or long spiroid fractures (especially in the absence of bony contact due to interposition [6]); and cases of delayed union and nonunion [9].

Elderly patients, the obese, alcohol or drug addicts, and those who do not collaborate or do not tolerate conservative treatment, constitute a group in which the indication for this procedure is relative. Our results are comparable with other series, and we consider intramedullary nailing an effective method for stabilization of humeral shaft fractures.

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