Locked intramedullary nailing versus dynamic compression plating for humeral shaft fractures

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ABSTRACT

Purpose. To compare functional outcomes, union and complication rates in patients treated with locked intramedullary nailing or dynamic compression plating for humeral shaft fractures.

Methods. 32 men and 2 women with humeral shaft fractures were randomised to undergo locked antegrade intramedullary nailing (IMN, n=16) or dynamic compression plating (DCP, n=18). Patients with pathological fractures, grade-III open fractures, neurovascular injury, or fractures for more than 2 weeks were excluded. Fractures were classified according to the AO classification system (one in A1, 6 in A2, 12 in A3, 6 in B1, and 9 in B2). 28 were injured in road traffic accidents. The functional outcome (according to the American Shoulder and Elbow Surgeons [ASES] score) and rates of union and complication of the 2 groups were compared.

Results. All patients were followed up for a minimum of 24 months. In the respective IMN and DCP groups, the mean ASES scores were 45.2 and 45.1 (p=0.69), the complication rates were 50% and 17% (p=0.038), and the non-union rates were 0% and 6% (p=0.15). In the IMN group, 2 sustained iatrogenic fractures during nail insertion; 2 had transient radial nerve palsies; one underwent nail removal for shoulder impingement; and 3 had adhesive capsulitis. In the DCP group, one underwent re-operation for implant failure; one had a superficial infection; and one developed adhesive capsulitis.

Conclusion. The complication rate was higher in the IMN group, whereas functional outcomes were good with both modalities.

Key words: bone plates; fracture fixation, intramedullary; humeral fractures

INTRODUCTION

Uncomplicated humeral shaft fractures are usually treated conservatively. The humeral shaft is covered with muscles and well vascularised. Slight malunion
is functionally and cosmetically tolerated. Plate fixation results in high union rates,1–3 but requires extensive dissection and stripping of soft tissues from the bone, with a higher risk of radial nerve damage.4 Intramedullary nailing avoids all these problems and is biomechanically stronger (a load-sharing device). The most frequent indication for operative treatment is the presence of associated multiple injuries.2,5 Other indications include open or segmental fractures, vascular injury and failed conservative management. We compared functional outcomes, union and complication rates of the 2 fixation methods.

MATERIALS AND METHODS

Between 2000 and 2003, 32 men and 2 women with humeral shaft fractures were randomised to undergo locked antegrade intramedullary nailing (IMN, n=16) or dynamic compression plating (DCP, n=18). Patients with pathological fractures, grade-III open fractures, neurovascular injury, or fractures for more than 2 weeks were excluded. The ethics committee of the hospital approved the study, and each subject gave written informed consent. All operations were conducted by consultants or registrars familiar with both procedures. Fractures were classified according to the AO classification system (one in A1, 6 in A2, 12 in A3, 6 in B1, and 9 in B2). 28 were injured in road traffic accidents. The associated injuries were fractures of theacetabulum (n=5), pelvis (n=5), femoral shaft (n=10), tibia (n=6), ipsilateral forearm causing a floating elbow (n=2), splenic rupture (n=2), and chest injury with hemopneumothorax (n=4).

In the IMN group, a 7-mm (n=14) or an 8-mm (n=2) AO unreamed humeral nail (AO-UHN, Synthes, Paoli [PA], US) was used. The mean patient age was 36 (range, 23–84) years. One patient had open type-1 injury (according to the Gustilo classification). Distal locking was performed in all except 2 patients. In the DCP group, an AO 4.5-mm DCP was used via a posterior (n=12) or an anterolateral (n=6) approach. The mean patient age was 39 (range, 22–65) years. There were no open fractures.

Rehabilitation started with active hand, wrist and elbow mobilisation with gentle pendulum exercises of the shoulder for 2 weeks, followed by active, assisted exercises for 4 weeks and resisted shoulder exercises at week 8. The patients were followed up at week 6 and month 3, 6, 12 and 24. Functional outcomes (according to the American Shoulder and Elbow Surgeons [ASES] score) between the 2 groups were compared using a 2-tailed t test. The union and complication rates in these 2 groups were compared using the Pearson Chi squared test. A p<0.05 was considered statistically significant.

RESULTS

All patients were followed up for a minimum of 24 months. In the respective IMN and DCP groups, the mean ASES scores were 45.2 and 45.1 (p=0.69), the complication rates were 50% and 17% (p=0.038), and the non-union rates were 0% and 6% (p=0.15).

In the IMN group, no patient had non-union or infection. Two had transient radial nerve palsy and recovered by 10 days and 7 weeks. One had nail breakage at an unlocked distal hole, but the bone continued to unite at 12 weeks. One underwent nail removal for shoulder impingement and abduction improved from 40° to 100°. Three had adhesive capsulitis. 13 had mild pain which subsided by one year. During nail insertion, one patient had a minimally displaced fracture of the greater tuberosity and another had a comminution at the fracture site attributed to hoop stress.

In the DCP group, one patient underwent re-plating and bone grafting for a hypertrophic non-union with implant failure, attributed to the patient starting bodybuilding at week 4. No patient had radial nerve palsies. One developed a superficial infection which resolved with antibiotic treatment, and one developed adhesive capsulitis.

DISCUSSION

In the respective IMN and DCP groups, non-union rates have been reported to be 0 to 8%6–9 and 2 to 4%,2,10,11 whereas rates of iatrogenic radial nerve palsy were 2.6 to 14.3%4 and 2 to 5%.2,10,11 Reported rates of iatrogenic comminution during nail insertion were 7.7% to 10%,4,8 and the re-operation rate was higher in patients undergoing IMN fixation.5,12 In our study, both groups were comparable in terms of functional outcomes and rates of union. The complication rate was higher in the IMN group (mostly pertaining to shoulder pain).

Seidel’s interlocking nailing has yielded good results,13 but the shoulder function was not assessed.14 Persistent shoulder pain is common.8,15–17 The cause of pain could be disruption of the rotator cuff in its avascular zone (within 1 cm of its insertion to the greater tuberosity), leading to poor healing.18 Antegrade insertion may cause adhesive capsulitis and shoulder pain, but does not affect long-term function.
REFERENCES