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Comparison of lateral and posterior surgical approach in management of extra-articular distal humeral shaft fractures

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ABSTRACT

Objective: The objective of this study was to compare treatment results and complication rates between lateral and posterior approaches in surgical treatment of extra-articular distal humeral shaft fractures.
Material and methods: Between June 2008 and May 2012, a total of 68 patients with extra-articular distal humeral shaft fractures were treated by lateral and posterior approaches. Of the patients, 30 were operated by a lateral approach (group I) and 26 patients were operated by a posterior approach (group II). There was no statistical significance between the two groups in sex distribution, age, the mechanism of the injury, injured arms, AO/ASIF (Arbeitsgemeinschaft für Osteosynthesefragen/Association for the Study of Internal Fixation) classification, and the time from injury to surgery ($P > 0.05$). Operation time, intraoperative bleeding volume, hospitalisation, clinical outcomes, and complications were compared between the two groups. The elbow functional results were evaluated by the Mayo Elbow Performance Score (MEPS).
Results: All patients were followed up. The average of follow-up in group I was 15.53 ± 2.636 months (range, 12–22 months), and was 16.12 ± 2.889 months (range, 12–22 months) in group II. There was no significant difference in the operation time, intraoperative bleeding time, and hospitalisation between the two groups ($P > 0.05$). In group I, the mean time of bone union was 12.87 ± 1.852 weeks (range, 10–16 weeks), the mean degrees of elbow flexion was $139.20^\circ \pm 3.274^\circ$ (range, 134–146°), the mean degrees of elbow extension was $4.77^\circ \pm 1.906^\circ$ (range, 0–8°), and the mean points of MEPS was 87.00 ± 7.724 (range, 70–100 points). In group II, the mean time of bone union was 12.96 ± 2.218 weeks (range, 10–16 weeks), the mean degrees of elbow flexion was $137.85^\circ \pm 4.076^\circ$ (range, 130–145°), the mean degrees of elbow extension was $5.15^\circ \pm 2.327^\circ$ (range, 0–9°), and the mean points of MEPS was 86.15 ± 7.656 (range, 70–100 points). There was no significant difference in the bone union, range of elbow flexion, range of elbow extension and MEPS between the two groups ($P > 0.05$). The overall complication rate in group I was lower than that in group II ($P = 0.041$).
Conclusions: Both lateral and posterior surgical approaches acquired satisfied treatment results in the management of extra-articular distal humeral shaft fractures, and there was a lower complication rate using the lateral approach.

Introduction

Fractures of the humeral shaft account for 1–3% of all fractures [1–3]. The incidence of humeral shaft fractures in North America is 20 per 100,000 inhabitants per year, and 20–30% are in the distal third [4].

Although conservative treatment has been used for the management of extra-articular distal humeral shaft fractures successfully [5,6], long term immobilisation in order to achieve bone union and inadequate fixation also cause various complications such as skin problems, mal-union and joint stiffness [6,7]. However, surgical treatment can provide potentially quicker recovery of function and a more predictable alignment [8–10]. Compared to any other surgical method, internal fixation with a plate and screws is more suitable for the management of distal humeral shaft fractures due to secure fixation of the distal fracture fragment [7].

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In order to expose the lateral supracondyle of the humerus and achieve sufficient fixation space using a plate and screws, we can choose either the lateral or posterior approach. These two surgical approaches have been applied successfully in the internal fixation of distal humeral shaft fractures [10–18]. Mills reported that the lateral approach allows extensile identification of the radial nerve and exposes the distal two-thirds of the humerus easily, and muscle splitting is not needed. But plate fixation may be affected by deltoid insertion [16]. Levy presented some advantages of the posterior approach [11]. He thought that a flat posterior surface of the distal humerus is suitable for plating, and the plate can be placed distally permitting more screw placement through direct visualisation, and far distal humeral shaft fractures are more suitable for the posterior approach. However, some authors recognised the exploration of the radial nerve in the posterior approach is difficult due to its anatomical course and because it limits mobility [7,19,20], which can increase the incidence of iatrogenic radial nerve injury during plate fixation. However, to our best knowledge, no comparative study about these two approaches in the management of extra-articular distal humeral shaft fractures has been reported.

The purpose of the study is to compare treatment results and complication rates between lateral and posterior approaches in the management of extra-articular distal humeral shaft fractures.

Material and methods

Between June 2008 and May 2012, 68 patients with extra-articular distal humeral shaft fractures were operated by the lateral or posterior approach at our hospital. The inclusion criteria were: (1) patients of age of 18 years or more, (2) unilateral closed extra-articular distal humeral shaft fractures, and (3) the elbow and injured limbs were normal before injury. The exclusion criteria were: (1) old, open, or pathological fractures, (2) a history of elbow surgery, and (3) complicated by seriously nervous or vascular injury. According to the inclusion and exclusion criteria, 56 patients were included in our study.

Appropriate clinical and radiological assessments were performed for all patients before a decision of surgical intervention. All fractures were classified according to the AO/ASIF (Arbeitsgemeinschaft für Osteosynthesefragen/Association for the Study of Internal Fixation) classification.

Thirty patients were operated by the lateral approach (group I). There were 16 males and 14 females, with an average of 37.73 years (range, 22–71 years). The mean time from injury to surgery was 38.77 h (range, 24–72 h). Twenty-six patients were operated by a posterior approach (group II). There were 14 males and 12 females, with an average of 38.08 years (range, 20–73 years). The mean time from injury to surgery was 40.08 h (range, 26–70 h). More demographic characteristics data of the two groups are listed in Table 1. There was no statistical significance between the two groups in sex distribution, age, the mechanism of the injury, injured arms, AO/ASIF classification, and the time from injury to surgery ($P > 0.05$, Table 1).

Table 1
Demographic characteristics data of two groups.

Characteristic	Group I	Group II	*P*-value
Sex distribution (male:female)	16:14	14: 12	0.969
Mean age (year)	37.73 ± 10.395	38.08 ± 10.147	0.901
The mechanism of the injury (TA:F)[a]	22:8	17:9	0.519
Injured arms (right arm:left arm)	16:14	10:16	0.266
Classification of AO/ASIF (A:B:C)	5:16:9	6:12:8	0.803
The mean time from injury to surgery (h)	38.77 ± 9.884	40.08 ± 10.488	0.633

[a] TA: traffic accident and F: fall.

Patients in group I underwent a lateral paratricipital approach using the tissue plane between the lateral head of the triceps and the lateral intermuscular septum, and patients in group II underwent a posterior approach by splitting the triceps belly along its fibres. All patients began to perform a full range of flexion–extension exercises at 2–3 days after the operation. The operation time, intraoperative bleeding volume, hospitalisation, bone union time, and complications were recorded. Clinical and radiological evolutions were performed regularly at 2 weeks, 1 month, 2 months, 3 months, 6 months, 9 months, 1 year, and then at 6-month intervals. At 1 year after the operation, the functional results of the elbow were evaluated by the Mayo Elbow Performance Score (MEPS) [21–23]. The data were analysed by SPSS 13.0 software with chi-square and Fisher's exact test in nominal data and independent *t*-test in continuous data.

Results

The mean operation time in group I was 129.40 ± 11.337 min (range, 106–157 min), the mean intraoperative bleeding volume was 290.80 ± 7.797 ml (range, 275–310 ml), and the mean hospitalisation was 7.23 ± 0.898 days (range, 6–9 days). The mean operation time in group II was 132.15 ± 11.845 min (range, 108–153 min), the mean intraoperative bleeding volume was 293.19 ± 8.386 ml (range, 280–310 ml), and the mean hospitalisation was 7.08 ± 0.891 days (range, 5–9 days). There was no significant difference in the operation time, intraoperative bleeding time and hospitalisation between the two groups ($P > 0.05$, Table 2).

All patients were followed up. The average follow-up in group I was 15.53 ± 2.636 months (range, 12–22 months; Fig. 1), and 16.12 ± 2.889 months in group II (range, 12–22 months; Fig. 2). Clinical outcomes were evaluated between the two groups. In group I, the mean time of bone union was 12.87 ± 1.852 weeks (range, 10–16 weeks), the mean degrees of elbow flexion was 139.20° ± 3.274° (range, 134–146°), the mean degrees of elbow extension was 4.77° ± 1.906° (range, 0–8°), and the mean points of MEPS was 87.00 ± 7.724 (range, 70–100 points). According to MEPS, 18 patients had results rated as excellent, nine patients were rated as good, and three patients were rated as fair. In group II, the mean time of bone union was 12.96 ± 2.218 weeks (range, 10–16 weeks), the mean degrees of elbow flexion was 137.85° ± 4.076° (range, 130–145°), the mean degrees of elbow extension was 5.15° ± 2.327° (range, 0–9°; Fig. 3), and the mean points of MEPS was 86.15 ± 7.656 (range, 70–100 points). According to MEPS, 15 patients had results rated as excellent, eight patients were rated as good, and three patients were rated as fair. There was no significant difference in the bone union, range of elbow flexion, range of elbow extension and MEPS between the two groups ($P > 0.05$, Table 3).

There was no failure of internal fixation in either group. One patient in group I had a postoperative superficial infection, which resolved with oral antibiotics. There were three patients who underwent iatrogenic radial palsy in group II, and all the patients were recovered completely within 3 months. Two patients in group II complained of pressure on the overlying skin and the implants were removed. After removal of the hardware, further rehabilitation was performed and the two patients showed good

Table 2
Comparison of operation time, intraoperative bleeding volume, and hospitalisation between two groups.

Indices	Group I	Group II	*P*-value
Operation time (min)	129.40 ± 11.337	132.15 ± 11.845	0.379
Intraoperative bleeding volume (ml)	290.80 ± 7.797	293.19 ± 8.386	0.274
Hospitalisation (days)	7.23 ± 0.898	7.08 ± 0.891	0.517