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ORIGINAL ARTICLE

Distal humerus fractures in patients over 65: Complications



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KEYWORDS

Distal fracture of the Humerus;
Internal fixation;
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Summary

Introduction: Fractures of the distal humerus in patients over the age of 65 remain a therapeutic challenge. Treatment options include conservative treatment, internal fixation or total elbow arthroplasty. The complications of these different treatment options were evaluated in a multicentre study.

Materials and methods: Four hundred and ninety-seven medical records were evaluated. A retrospective study was performed in 410 cases: 34 received conservative treatment, 289 internal fixation and 87 underwent total elbow arthroplasty. A prospective study was performed in 87 cases: 22 received conservative treatment, 53 internal fixation, and 12 underwent total elbow arthroplasty. Patients were evaluated after at least 6 months follow-up.

Results: The rate of complications was 30% in the retrospective study and 29% in the prospective study. The rate of complications in the conservative treatment group was 60%, and the main complication was essentially malunion. The rate of complications was 44% in the internal

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fixation group and included neuropathies, mechanical failure or wound dehiscence. Although complications only developed in 23% of total elbow arthroplasties, they were often more severe than those following other treatments.

Discussion: Complications develop in one out of three patients over 65 with distal humerus fractures. Three main types of complications were identified. Neuropathies especially of the ulnar nerve, especially during arthroplasty, must always be identified, the nerve requiring isolation and transposition. Bone complications, due principally to mechanical failure, were found following internal fixation. Despite technical progress, care must be taken not to favor excessive utilization of this treatment option in complex fractures on fragile bone. Although there were relatively fewer complications with total elbow arthroplasty they were more difficult to treat. Ossifications were frequent whatever the surgical option and can jeopardize the functional outcome.

Level of evidence: Level IV.

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Introduction

Treatment of fractures of the distal humerus after the age of 65 involves fragile bone that is difficult to access. These articular fractures are also difficult to reconstruct and the surgeon may hesitate between conservative treatment, internal fixation and arthroplasty. Whatever the solution, the goal is to obtain a painless but well functioning elbow (hand to mouth, hand to buttocks). To choose the best therapeutic option, the limits, risks and specific complications of each of these solutions over time need to be evaluated in a similar population. We report the results of our analysis of complications following treatment of fractures of the distal Humerus based on the retrospective and prospective SOFCOT 2012 series as well as studies in the literature, and we recommend good practices to be followed to avoid them.

Complications of surgical treatment in the literature

There are no in depth studies in the literature of complications of distal humerus fractures. We identified 32 studies [1–31] of these fractures in patients over 65 until June 2012 including SOO [18], which is the largest series to date (Table 1). There were 17 studies on internal fixation [1–17] including 333 cases evaluated after a mean 2.8 years follow-up. Complications occurred in 31% (37% in the SOO series). Fourteen studies evaluating arthroplasty [19–31] including 236 cases after a mean follow-up of 2 years reported complications in 19% (14% in the SOO series).

The five most common types of complications involved the nerves, bone, local complications, infections and type 1 complex regional pain syndromes (algodystrophy). Nerve complications usually involved the ulnar nerve. Bone complications included secondary displacement, malunion, non-union, mechanical failure and ossifications. Local complications included hematomas and wound dehiscence. None of the complications was clearly defined as “post-traumatic arthritis”, “revision surgery”, or “prosthetic loosening”.

Complications in the double SOFCOT 2012 series

The incidence of complications was similar in the two SOFCOT series. It was 30% in the retrospective series ($n=410$) and 29% in the prospective series ($n=87$) (Table 2). This double series is the largest published series to date. Analysis of the rate of complications for each type of treatment provides further useful information.

Complications, mainly malunion in a “previously unoperated” elbow, developed in 60% of the patients who received conservative treatment ($n=56$). This treatment option was adopted for specific situations and indications (fractures with very little displacement and/or in patients who could not be operated on). There were no studies in the literature specifically evaluating complications following this type of treatment.

The rate of complications with internal fixation ($n=342$) reached 44% and included, in particular, neuropathies, mechanical failures and wound dehiscence, often requiring revision surgery.

There were fewer complications (23%) in patients who underwent arthroplasty ($n=99$) but they were more difficult to treat. Analysis of the SOFCOT 2012 study and other published studies showed five frequent complications whatever the type of treatment: 2 frequent complications that are difficult for the surgeon to control, not dependent upon the treatment chosen and difficult to correlate with the functional outcome: malunion (30%) and ossifications (30%); and 3 severe complications that surgeons try to avoid because they result in sequellae or require revision surgery. These were ulnar neuropathies (7%), bone complications with mechanical failure (7%) and hematomas/infections (1–4%).

How can these complications be prevented?

Nerve complications

Neuropathies were identified in between 3 and 12% of cases and involved the ulnar nerve [1–31]. It was not always easy to differentiate between preoperative injury (present before treatment) and surgery-induced injury in

Table 1 Complications identified in the literature after surgery [1–31].

Type of treatment	Internal fixation		Arthroplasty	
No. of studies analyzed	17 studies [1–17]	<i>SOO Study [18]</i>	14 studies [19–31]	<i>SOO Study [18]</i>
Total no. of patients	333	155	236	36
No. of patients per study	42 (11–45)		31 (4–48)	
Age	74.8 years old (68–80)	77	75.6 years old (67–84.6)	81
Follow-up	2.8 years		2 years	
MEPS: Mayo Elbow Performance Score	84 (73–95)	77	90.2 (79–95)	84
Mean range of motion F/E		91°		97°
Complications	31%	37%	19%	19%
Ulnar injury	8% (9 studies)	6%	3% but in 5 studies 2 studies with complications in 50% ... (6-15%)	
Mechanical failure	7% 6 studies including 4 before 2005 (7–27%)	16%	2% but in 3 studies (3–9%)	11%
Non-union	7%	9%		
Ossifications	6%			
Infection	3%	5%	4% but in 7 studies (5–10%)	6%

SOO: Société orthopédique de l'Ouest. Italic concern the SOO serie.

Table 2 Complications in the SOFCOT 2012 series according to the type of treatment.

TT	Conservativen = 56 (%)	Internal fixationn = 342 (%)	Arthroplastyn = 99 (%)
<i>Nervous</i>	0	11	8
<i>Bone</i>	60	25	18
Fracture per op			6
<i>Displacement</i>			
Malunion	70–80	50	
Non-union	10.5	8	
Mechanical failure		12	
Ossification	64	20	30
<i>Local</i>	12	20	7
Hematoma			
Dehiscence	10		
<i>Infections</i>	0	4	1
<i>CRPS1</i>	1	3	2
<i>Arthritis/Revision</i>	5–25	12	9
<i>Loosening</i>			2

TT: treatment. Bold concern the results of the seven most frequent complications.

the literature. In a study of 117 AO type C fractures the incidence of preoperative nerve dysfunction was 24.8%. A randomized comparison of simple in situ decompression of the ulnar nerve and anterior subfascial transposition in these patients with pre-existing nerve dysfunction confirmed the interest of the latter in these cases with 80% good results compared to 50% with simple decompression [32]. The incidence of ulnar neuropathies was 38% in a study analysing 24 fractures treated by internal fixation with no difference between in situ release and anterior transposition [33]. In the SOFCOT symposium in 2004 on elbow arthroplasty, Alnot and Lille identified postoperative ulnar neuropathy in 10% of the cases of arthroplasty for rheumatoid arthritis [34]. Based on these results the authors recommend repair of the ulnar nerve and anterior transposition as long as a Bryan-Morrey surgical approach is used. Chen et al. identified 4 times more

cases of ulnar neuritis with systematic ulnar nerve transposition during open reduction and internal fixation in a study comparing transposition to in situ decompression in 89 patients [35].

To minimize ulnar neuritis it is important to identify the nerve by performing decompression. This identification-release is the first surgical manoeuvre when a posterior approach is used. Surgery-induced injuries are often caused by compression from a retractor or direct, reduction-induced damage. Transposition is logical during arthroplasty but is not essential during internal fixation. The nerve may be damaged if fixation material migrates. If accidental perioperative nerve injury occurs and is recognized, the nerve should be repaired and wrapped with anterior transposition. It is difficult to define a practical approach to postoperative neuropathy. The real question is whether the nerve has

been accidentally placed under a plate. Imaging techniques can sometimes help the surgeon decide whether there is an indication for revision.

Bone complications

Mechanical failure of internal fixation materials must be avoided to prevent bone complications. The quality of the bone and the complexity of the fracture must therefore be determined, which is possible on CT Scan. When internal fixation is planned in patients over 65, a prosthesis should also be available in the operating room. Material failures occurred in between 7 and 27% of patients in studies in the literature but were more frequent before 2005 [1–18]. The rate of non-union (7–9%) is mostly due to olecranon non-union following olecranon osteotomy rather than to distal Humerus non-union. The role of anatomically shaped plates or locking screws was not evaluated in the SOFCOT series. These two recent innovations give the surgeon a feeling of security, manageability and ease during the procedure but the level of evidence confirming the superiority of these systems is weak. Positioning of so-called anatomical plates can be performed in a perpendicular or parallel configuration. In a cadaver study, Penzkofer et al. showed that these 2 types of fixation provided enough mechanical resistance for rapid mobilization but that the parallel configuration was more resistant in extension [36]. Shin et al. did not find any difference in functional outcome in a comparison of the two configurations in a clinical series but non-union was slightly more frequent in the perpendicular plating group [37]. Mechanical failure of internal fixation often requires surgical revision and placement of prosthesis because an unstable elbow is functionally disabling.

Mechanical failure was less frequent in arthroplasty studies (3–9%) [18–31]. Although it is rare, there is a risk of perioperative fracture during arthroplasty. To prevent this, the bone to be reconstructed should be sufficiently exposed and fluoroscopy should be used if there is the slightest doubt or feeling of resistance: wrong directions are a risk in fragile bone. In case of perioperative fracture, the surgeon may hesitate between internal fixation and arthroplasty with a long stem component. Although the surgical route does not influence the functional outcome, olecranon osteotomy screws are painful to the patient. Although an olecranon osteotomy provides access to very distal lesions, an imprint of the trochlea to be reconstructed can no longer be obtained.

Besides mechanical failures, non-union and perioperative fractures, ossifications were frequent and occurred in between 20 and 30% of the patients in the symposium series but were not regularly reported in the literature (7%). Abrams et al. reported ossifications in up to 45% of distal fractures of the humerus with no associated criteria (age, gender, surgical approach) [38]. In this large clinical study in 159 patients, the absence of ossifications after postoperative week 2 was predictive of an absence of ossifications.

Infectious and soft tissue complications

Infectious complications are rare but always severe, especially since the prosthesis may have to be removed to

eradicate infection, resulting in an unstable elbow. Simple rules must be followed when performing this procedure which usually lasts between 2 and 3 h: respect the delay before performing the incision following prophylactic antibiotics, use a sterile tourniquet, change gloves and irrigate the surgical field every hour.

Conclusion

Complications developed in one out of three patients over 65 with distal fractures of humerus. There were three main types of complications in these cases. Neuropathies were common, especially of the ulnar nerve, which must always be identified, isolated and transposed, especially during arthroplasty. Bone complications occurred due to material failure, especially following internal fixation. Even if anatomical plates are now used during surgery, the technical progress proposed by industrials (locking screws) and surgeons (parallel configuration) cannot control all situations: care must be taken not to over-prescribe internal fixation for this complex fracture in fragile bone and to make sure a prosthesis is available in the operating room when performing internal fixation. There were fewer complications with arthroplasty, but they are more difficult to treat. Ossifications were frequent, whatever the surgical treatment, and can worsen the functional outcome. The use of a sterile tourniquet is a simple, not frequently recommended step, but it is a reminder of the necessity of being extremely rigorous when treating this complex fracture.

Disclosure of interest

The authors declare that they have no conflicts of interest concerning this article.

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