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Original article

The role of total elbow arthroplasty in traumatology

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ABSTRACT

Fractures of the distal humerus account for 5% of osteoporotic fractures in subjects older than 60 years. A history of osteoporosis, co-morbidities, and joint comminution make their management difficult. The therapeutic options are limited to functional treatments, osteosynthesis, or either partial or total arthroplasty. Functional treatment of distal humerus fractures in the elderly subject provide inconsistent results, often with persistence of pain with a stiff or unstable elbow. Osteosynthesis remains the reference treatment for these fractures, following the principle of stable and rigid osteosynthesis allowing early mobilization. However, joint comminution and a history of osteoporosis occasionally make it impossible to meet this objective, with a considerable rate of complications and surgical revisions. Total elbow arthroplasty remains an alternative to osteosynthesis with very satisfactory immediate results restoring a painless, stable, and functional elbow. These results seem reproducible and sustainable over time. The complication rate is not uncommon with an approximately 10% surgical revision rate. Elbow hemiarthroplasty remains to be validated in this indication.
Level of evidence: V.

1. Introduction

The goal of an elderly patient presenting distal humerus fracture is to rapidly recover a painless, stable, and functional elbow so as to resume daily activities and maintain autonomy. However, treatment of these fractures is often difficult and compromised by poor bone quality and periarticular tissue involvement [1,2]. Osteosynthesis in these patients results in a 2–10% non-union rate often related to material failure[3]. In 1997, total elbow arthroplasty was presented as an alternative to osteosynthesis to treat distal humeral fractures in elderly subjects [4]. Since this study, several series have been published that have allowed identification of the ideal patient for this treatment and prediction of the expected results.

2. Background

The goal of treatment is to restore the elbow's rotational axis while providing joint stability despite loss of bone stock and mediocre bone quality. Unlinked implants have been used in this situation, but linked implants and semi-constrained implants make it possible to obtain better joint stability.

Different linked implants exist, but the most widely used implant is the Coonrad-Morrey® (Zimmer, Warsaw, IN, USA). It restores the elbow's rotational axis even when the fracture extends up to the roof of the olecranon fossa. It can restore the length of the humerus with the anterior flange of the humeral implant, which will resist rotational forces and anteroposterior stresses. Different sizes are available, which allow surgeons to manage most clinical situations.

In a traumatology patient, total elbow arthroplasty should not be performed in an emergency setting. The skin should be in good condition, and if dermabrasions or hematomas are present, it is preferable to wait a few days before performing surgery. The patient must understand the type of surgery to be performed and its demands, as well as the postoperative protocol.

Indications for total elbow arthroplasty in traumatology:

- fracture that cannot be fixed;
- osteoporosis;
- inflammatory rheumatism;
- patient older than 70 years;
- sedentary.

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Contraindications for total elbow arthroplasty in traumatology:

- infection;
- cutaneous lesions;
- neurological involvement;
- noncompliant patient;
- dementia.

3. Presentation, work-up, and therapeutic options

Total elbow arthroplasty is reserved for patients with osteoporosis who are older than 70 years, presenting a distal humerus fracture. However, in presence of inflammatory rheumatism, severe osteoporosis, or reduced life expectancy, the prosthesis can be proposed to younger patients if the fracture cannot be fixed.

The mechanism of injury is generally a fall. The patient presents an edematous, painful, and disabled elbow. Mobilization of the elbow exacerbates pain. The clinical examination includes an evaluation of the cutaneous cover and the neurovascular status. The standard radiographic work-up is essential to classify the fracture. However, it minimizes the degree of comminution. A CT work-up with 3D reconstruction can provide a more accurate assessment of the fracture, its degree of comminution, and the joint injury, allowing a more reliable therapeutic decision.

4. Alternatives to arthroplasty

The functional treatment of fractures of the distal humerus in elderly subjects gives inconsistent results often with persistence of pain on a stiff or unstable elbow. Although this treatment can be acceptable in debilitated patients, Lecestre et al. showed that this therapeutic option provides satisfactory results in less than 40% of cases [5].

Osteosynthesis remains the reference treatment in these fractures, based on the principle of stable and rigid osteosynthesis to allow early mobilization. However, joint comminution and osteoporosis do not always allow for a stable fixation, requiring additional interventions that are a source of elbow stiffness. Lecestre et al. demonstrated that osteosynthesis provided satisfactory results in 61% of cases [5]. In 2002, Bonnevialle and Ferron found 25% loss of function in the upper limb in elderly subjects after fracture of the distal humerus [6]. Kocher et al. reviewed the results of 169 patients treated for fracture of the distal humerus, 32 of whom were over 65 years of age (mean, 78 years). Satisfactory results were obtained in 75% of the cases [7]. In their meta-analysis, Helfet and Schmeling found 25% unsatisfactory results [8], and in a population of subjects aged more than 75 years, John et al. found 20% unsatisfactory results [9]. One-third of the patients presented persistent pain. Pereles et al. demonstrated that only 25% of the patients were without pain [10]. More recently, Pajarinen and Bjorkenheim found that patient age and osteoporosis were the determinant prognostic factors in obtaining unsatisfactory results. Srinivasan et al. reported their experience in the use of osteosynthesis in 21 patients with a mean age of 85 years (range, 75–100 years) and found poor or fair results in 43% of the cases [11,12]. In 2007, Proust et al. operated on 34 patients (36 fractures) whose mean age was 78 years using osteosynthesis to treat AO type C fractures [13]. A mean of 35 months of follow-up, only 58% of the patients presented a satisfactory result. The mean range of motion in extension/flexion varied from 38° to 116°. The complication rate was 56%, with nine cases of non-union and four material failures. In Toulouse, 53 patients were operated on for a fracture of the distal humerus. The Mayo Elbow Performance Score (MEPS) reached 86 points for the overall group, 79 points for patients who were older than 65 years, and 76 points for patients older than 65 years with an AO type C fracture.

Fig. 1. Patient installation.

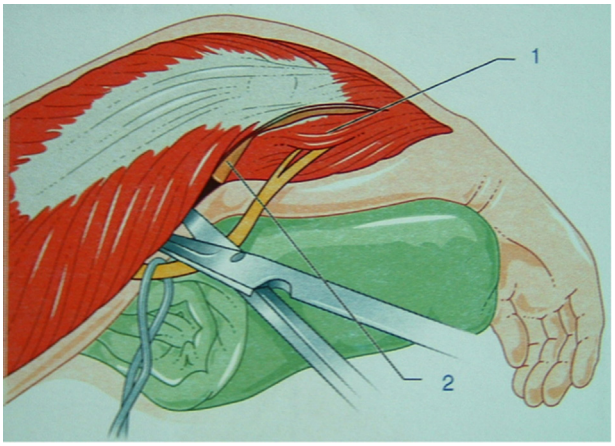

Fig. 2. Ulnar nerve dissection.

5. Surgical technique and rehabilitation [14,15]

The patient is installed in the dorsal decubitus position with the forearm placed on the abdomen. An 18-cm posterior incision is made slightly laterally in relation to the summit of the olecranon (Fig. 1). The ulnar nerve is identified and released up to the division of its first motor branch (Fig. 2). The extensor apparatus is then detached from the olecranon and pulled away medially and laterally, progressively dislocating the elbow (Fig. 3). The triceps can be left intact on the olecranon and by excising the fractured fragments through lateral-tricipital openings.

Preparation of the humerus is simple. The fractured fragments are excised (Fig. 4). The humeral canal is prepared with the different rasps. The depth that the humeral implant is inserted is guided by the anterior keel of the implant, which is blocked by the roof of the olecranon fossa.

The ulna is then prepared with the adapted rasps. To facilitate this preparation, the summit of the olecranon must be resected, which also provides direct access to the axis of the ulna's medullary canal. The top of the coronoid process must be resected to prevent any impingement in flexion with the anterior flange of the humeral implant.