Monteggia fractures in adults. Review of 54 cases

Les lésions de Monteggia chez l’adulte. Étude de 54 cas

M. Llusà Perez *, C. Lamas, I. Martínez, G. Pidemunt, X. Mir

Department of orthopaedic surgery, autonomous university of Barcelona, Vall Hebrón hospital, Barcelona, Spain

Abstract

Introduction: We present a review of Monteggia fractures treated in our hospital between 1992 and 1998.

Patients and methods: Fifty four patients with a Monteggia fracture were treated in our hospital with an average follow-up of 24 months (12–48 months). The average age was 41 years (18–81 years). According to the classification of Bado, there were 24 type I, 20 type II, 6 type III and 4 type IV. The etiology was in 27 cases a motor-vehicle and motorcycle accident, five a pedestrian struck by a car, 21 by a casual fall and only one by a direct hit by an iron bar in an assault. In 56% of the patients, the lesions were associated with polytrauma. In all the cases, treatment consisted of open reduction and internal fixation of the ulnar fracture using different methods of osteosynthesis (3.5 mm DCP, 3.5 mm reconstruction plates, 6.5 mm cancellous screw, tension band technique with Kirschner wires, and one-third tubular plates). Initial treatment of the radial head dislocation was attempted by closed reduction and verification under fluoroscopy. Subsequent open reduction and osteosynthesis were performed in 10 cases, and resection of radial head was necessary in three cases as the initial treatment. There were six open fractures with one case developing chronic infection.

Results: Results were evaluated according to the criteria of Anderson (union fracture, elbow and wrist flexion/extension). The results were excellent in nine patients (17%), satisfactory in 33 (61%), unsatisfactory in nine (17%) and failure in three (5%). Complications could be attributed to the severity of injury, type of fixation and errors in technique (four non-union, three failure of one-third tubular plates, one distal radioulnar instability) and to some features peculiar to this lesion (five nerve injuries, three redislocations of the radial head and four radioulnar synostosis). We needed to perform 14 reoperations to resolve some of the above mentioned complications. © 2002 Éditions scientifiques et médicales Elsevier SAS. All rights reserved.

Résumé


Méthode : Cinquante-quatre patients présentant une fracture de Monteggia ont été opérés dans notre hôpital. L’âge moyen était de 41 ans (18–81 ans). En utilisant la classification de Bado, 24 fractures sont de type I, 20 de type II, 6 de type III et 4 de type IV. L’étiologie était pour 27 patients un accident de voiture ou de motocyclette, 5 piétons ont été renversés, 21 patients ont chuté et dans un il s’agissait d’un coup de baton. Cinquante-six pour cent de ces lésions étaient dans le cadre d’un polytraumatisme. Le recul moyen était de 24 mois (12–48 mois). La technique opératoire employée a été une ostéosynthèse par plaque vissée (à compression dynamique 3,5 mm, reconstruction, et plaque tubulaire) de la fracture du cubitus, cerclage en Hauban et vis axiale de 6,5 mm. Le traitement de la tête radiale a été la réduction orthopédique et nous avons vérifié cette réduction avec l’amplificateur de brillance. Le traitement chirurgical par ostéosynthèse a été nécessaire chez 10 patients, et la résection de la tête radiale dans 3 cas. Six fractures étaient ostéosynthèses et une a développé une infection chronique.

Résultats : L’évaluation des résultats en utilisant les critères d’Anderson (consolidation, flexion/extension du coude et du poignet). Les résultats sont excellents pour 9 patients (17 %), satisfaisants pour 33 (61 %), moyens pour 9 (17 %) et mauvais pour 3 (5 %). Les complications ont été en rapport avec la sévérité de la lésion, la méthode d’ostéosynthèse ou une erreur de technique (4 pseudarthroses, 3 échecs des plaques tubulaires et un cas d’instabilité radiocubitale inférieure). Les complications particulières à ce type de

* Corresponding author. Hospital universitario de traumatología, C.S. Valle Hebrón, Paseo Valle Hebrón 119-129, 08035, Barcelona, Spain.
E-mail address: mllusa@cs.vebron.es (M. Llusà Perez).

© 2002 Éditions scientifiques et médicales Elsevier SAS. All rights reserved.

PH: S 1 2 9 7 - 3 2 0 3 ( 0 2 ) 0 0 1 2 6 - 9
1. Introduction

In 1814, G.B. Monteggia described a fracture of the proximal third of the ulna with a concomitant anterior dislocation of the radial head. In 1967, Bado classified the Monteggia lesion into four types plus two types of equivalent lesions, depending on the direction of the dislocation of the radial head and the angulation of the fracture in the ulna [1]. In the type 1 lesion, the direction of the dislocation and angulation is anterior; in type 2, posterior; and in type 3, lateral. A type 4 lesion is defined as a fracture of both forearm bones with a dislocation of the radial head. Bado has described several type 1 equivalent injuries, having in common a mechanism of extension and pronation of the forearm. The most common equivalent injuries are a fracture of the ulnar diaphysis and fracture of the diaphysis or the neck of the radius proximal to the ulnar fracture without dislocation of the radial head; a fracture of the ulnar diaphysis, combined with a fracture of the olecranon and an anterior dislocation of the radial head; and a posterior dislocation of the elbow and a fracture of the ulnar diaphysis with or without a fracture of the proximal radius. The Bado classification was used by several investigators, most of whom found that it had no significant prognostic value [1-3].

The purpose of our study is the clinical and radiological analysis of the fracture-dislocation of Monteggia and the discussion of the complications.

The fracture-dislocation of Monteggia is a high-energy fracture in adults and usually is associated with other injuries. In this series, 30 patients (56%) had associated injuries and the most common were head and chest trauma.

2. Patients and methods

Between 1992 and 1998, 54 cases of Monteggia fractures in adults were treated in our hospital with an average follow-up of 24 months (12–48 months). There were 37 men (68.5%) and 17 women (31.5%) and the average age was 41 years (18–81 years). The etiology was in 27 patients (50%) a motor-vehicle accident and motorcycle accident, five (9.2%) a pedestrian struck by a car, 21 (38.9%) by a casual fall and only one (1.9%) by a direct hit by an iron bar in an assault. In 56% of the patients, the injury was part of a polytrauma. One patient died of a head and chest injury after the fractures were treated.

According to the classification of Bado and Boyd (1967) [1,2], there were 24 type I (44.5%) fractures (Fig. 1), 20 type II (37%), six type III (11.1%) and four type IV (7.4%). In six patients (11.1%), there was an open fracture and these were classified according to the classification of Gustilo and Anderson [4]: two cases (33%) grade I, three (50%) grade II and one (17%) grade III.

The treatment was early surgical in all the cases.

The ulnar osteosynthesis was 3.5 mm DCP in 35 patients, 3.5 mm reconstruction plate in 11 cases, one-third tubular plate in three cases, tension band wire in three cases, 6.5 mm cancellous bone screw in one and external fixator in one case. In five patients, ulnar bone grafting was necessary. Treatment of the radial head dislocation was by closed reduction and verification under fluoroscopy in 31 patients (57.4%). Open reduction and osteosynthesis were performed in 10 cases (18.5%), and resection of radial head was necessary in three cases as the initial treatment (5.5%).

Bone union was achieved in 50 patients (92.6%) at an average time of 14 months (8–22 months). In the remaining four cases, there was an ulna non-union (7.4%).

The basis of the surgical treatment was the criteria of Anderson et al. [5]. The treatment was early, with a rigid fixation of ulnar (3.5 plate), accurate reduction of radial head and postoperative immobilization. In all the cases, treatment consists of open reduction and internal fixation of the ulnar fracture using different methods of osteosynthesis: 3.5 mm dynamic compression plates (DCP) (Fig. 2), 3.5 mm reconstruction plates, 6.5 mm cancellous screw, tension band...
technique with Kirschner wires, and the one-third tubular plates which we recognize are not recommended. Treatment of the radial head dislocation was initially by closed reduction and verification under fluoroscopy. Open reduction of radial head was needed because of interposition of the annular ligament in one case (Fig. 3), and an osteosynthesis was performed in 10 cases. Resection of radial head was necessary in three patients as the initial treatment.

3. Results

The results were evaluated according to the criteria of Anderson et al. [5]. These criteria evaluated radiological union and the range of movement at the elbow and wrist (flexion-extension and pronation–supination). We classified as unions those fractures which healed in less than 6 months. Those which required more than 6 months to unite and had no additional operative procedure were classified as delayed unions, and those which failed to unite without another operative procedure were classified as non-unions. The functional results were rated according to the following criteria: (1) excellent, fracture union with less than 10° loss of flexion-extension and less than 25% loss of pronation–supination; (2) satisfactory, union with less than 20° loss of flexion-extension and less than 50% loss of pronation–supination; (3) unsatisfactory, union with more than 30° loss of flexion-extension and greater than 50% loss
of pronation–supination; and (4) failure, non-union with or without loss of motion.

The functional results were evaluated according to the criteria of Anderson et al. [5]. These were excellent in nine patients (17%), satisfactory in 33 (61%), unsatisfactory in nine (17%) and failure in three (5%).

In this study, we found complications in 21 patients (38.9%) and one death in a patient with severe head and chest trauma. There were four ulnar non-unions. In three cases, errors in technique were the apparent reason for non-union. These errors included the use of an inadequate plate and failure of the one-third tubular plate. There was one case of distal radioulnar instability, five patients with nerve injuries, three redislocations of the radial head and four radioulnar synostosis.

Neural injury was noted preoperatively in three cases: a radial nerve lesion in two cases and an anterior interosseous nerve lesion in one case. We found a postoperative neurapraxia of the posterior interosseous nerve in one case.

There were six open fractures with one patient developing chronic infection. We needed to perform 14 reoperations to solve some of the above mentioned complications.

4. Discussion

Our findings of 17% of excellent results and 61% of satisfactory results in the present study illustrate the benefits of anatomical reduction and stable fixation with a plate allowing early active mobilization.

In our series of Monteggia fractures in adults, Bado type I fractures (anterior dislocation of the radial head) were more common than Bado type II fractures (posterior dislocation of radial head). The more complicated Monteggia equivalent lesions showed significantly worse outcomes. The worst results were in the group with an intraarticular fracture of the radial head, causing a significant loss in range of motion. The poor results can be attributed to the severe intraarticular injury. A higher percentage of the fractures were diagnosed as type I equivalent than in the literature, probably because of awareness of the problem. This group of patients had poor results despite an aggressive approach and early surgery [3].

The radial head associated with a Bado type II fracture was comminuted (Mason type III). Good results have been reported following open reduction and internal fixation of fractures of the radial head, but most of these fractures were simple (Mason type II). The results after fixation of Mason type III fractures have been less predictable [6]. The question remains as to whether it is better to treat a severely comminuted fracture of the radial head associated with a Bado type II fracture with simple excision or with prosthetic replacement. Three of the authors’ patients underwent an excision of the radial head, because of a comminuted fracture. There were no complications after the radial head excision.

Complications could be attributed to the severity of injury, type of fixation, and errors in technique (four non-union, three failure of one-third tubular plates, one distal radioulnar instability) and to some peculiar features of this lesion (five nerve injuries, three redislocations of the radial head and four radioulnar synostosis).

There were four ulnar non-unions. In three cases, errors in the technique were the apparent reason for non-union. These errors included the use of an inadequate plate and failure of the one-third tubular plate. We removed these implants and used a dynamic compression plate applied to the dorsal surface of the ulna in association with bone graft, and ulnar union was achieved in all the cases. We recommend fixation of the ulnar fracture with a stout plate, such as 3.5 mm dynamic compression plate, applied to the posterior surface of the ulna; semitubular and one-third tubular plates and tension band-wire constructs may not be rigid or strong enough.

A few cases of neurologic complications were reported by previous authors. In our series, there was neural injury preoperatively in three cases: a radial nerve lesion in two cases and an anterior interosseous nerve lesion in one case. We noted a postoperative neurapraxia of the posterior interosseous nerve in one case. All these lesions resolved spontaneously by the time of the follow-up examination.

The mechanism of traumatic neuropathies of the radial and ulnar nerves that are associated with Monteggia lesions has been documented and discussed. Spar [8] reviewed the mechanisms of posterior interosseous nerve palsy following Monteggia fractures: (1) direct trauma; (2) compression of the nerve in the arcade of Frohse; (3) entrapment between the radius and ulna; (4) stretching by the laterally dislocated radial head; (5) tardy palsy due to scarring from an old unreduced radial head; and (6) displacement of the nerve around the neck of the radius during attempted closed reduction.

Lichter and Jacobsen [9] reported a case of a tardy palsy of the posterior interosseous nerve, and Morris [10] described an irreducible dislocation of the radial head caused by an entrapment of the nerve between the radial head and the ulna.
The compressive neuropathy of the anterior interosseous nerve is characterized by partial or total paralysis of the flexor pollicis longus, the flexor digitorum to the index finger, and the pronator quadratus, with no loss of sensation. The etiology of the palsy has been ascribed to the damage caused by stretching or direct compression [11]. A possible mechanism for the anterior interosseous palsy observed by Engber and Keene [12] with type 1 Monteggia lesion includes compression neuropathy between the humeral and ulnar heads of the pronator teres and/or traction neuropathy. The results of a cadaveric dissection of a simulated type 1 lesion suggest that traction neuropathy, due to stretching of the tethered anterior interosseous nerve over the anteriorly angulated fracture, is the most probable mechanism.

The series of Stein et al. [13] included three patients with high ulnar nerve lesions associated with posterior interosseous nerve palsy. In two patients, the ulnar nerve was explored at the elbow. Both of these had constriction of the nerve by the fibrous aponeurosis between the two heads of the flexor carpi ulnaris and a soft pseudoneuroma proximal to the site of constriction. Stein et al. concluded that the etiology of the ulnar neuropathy with a Monteggia lesion was a compression neuritis. In our series, we did not find any case of ulnar nerve lesion.

In the series of Givon et al. [3], there were four cases of neurologic lesions, two in the posterior interosseous nerve and two in the ulnar nerve. All these lesions resolved spontaneously and Givon and other authors suggested that the nerves should be explored only in cases of irreducible dislocation.

A posttraumatic proximal radioulnar synostosis developed in four patients in the present study. This disabling complication led to a poor result in all the four patients, although the result was upgraded to good in one patient after successful resection of the synostosis. In the series of Jupiter and Ring [14], operative treatment of posttraumatic proximal radioulnar synostosis led to good results despite the lack of adjuvant radiation therapy or anti-inflammatory medication. A number of etiologic factors have been implicated in the formation of extensive heterotopic ossification around the elbow and cross-union between the forearm bones, including, high-energy trauma, infection, multiple trauma associated with cranioencephalic trauma, delayed internal fixation, non-anatomic reduction with narrowing of the interosseous space and onlay bone graft. In the series of Reyniers et al. [15], open reduction of the radial head with reconstruction of the annular ligament was cited as a major cause in the development of a proximal cross-union between the forearm bones. We did not show this association. Recommendations for limiting the risk of synostosis include the avoidance of simultaneous exposure of both bones and the encouragement of early active mobilization.

References
