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Early excision of the radial head for fracture

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Abstract The wrists and elbows of 23 patients were examined at a mean follow-up of 5 years (2–10 years) after excision of the radial head for an isolated fracture. Fourteen elbows and 13 wrists were symptomatic. Proximal migration of the radius was seen in 15 cases; the mean distance of migration being 1.4 mm. Osteoarthritis, mostly mild, was seen in 17 elbows and 14 wrists and limited movement of the elbow was a common finding. Excision of the radial head for fracture had a high complication rate.

Résumé Le poignet et le coude de 23 malades ont été examinés à une période de suivi moyenne de 5 années (2–10 années) après une excision de la tête radiale pour une fracture isolée: 13 poignets étaient douloureux; 19 coudes étaient symptomatiques, mais dans la moitié des cas, la douleur était légère. On a constaté une migration proximale du radius dans 15 cas, la distance moyenne de migration étant de 1.4 mm. Une arthrose, généralement légère, fut notée à 17 coudes et 14 poignets. On observa également souvent une limitation de la mobilité du coude. L'excision de la tête radiale en raison d'une fracture entraîne un nombre élevé de plaintes postopératoires. Les indications de cette intervention devraient être relativement limitées.

Introduction

Excision of the head of the radius is commonly performed in patients with comminuted fractures of the radial head [15, 19]. Many authors have, however, reported a high complication rate [2, 6, 7, 13, 21, 22, 26], including pain and instability of the elbow, new bone formation at the site of resection, proximal radial migration and cubitus valgus [10, 20, 27]. Significant wrist symptoms are associated with subluxation of the inferior ra-

dioulnar joint [25]. We analysed the long-term outcome of excision of the head of the radius for fracture.

Patients and methods

Between 1984 and 1992, 44 patients underwent excision of the head of the radius for a closed isolated fracture. At follow-up, 4 patients had died and 17 could not be traced. Thus, 23 patients (9 men and 14 women) with a mean age of 42 years (13–77 years) were available for study at a mean follow-up of 5 years (2–10 years).

The fractures were classified according to Mason [16]: type 1: fracture without dislocation; type 2: fracture with a dislocated margin; type 3: a comminuted fracture; type 4: a comminuted fracture with dislocation.

The follow-up examination consisted of a questionnaire, clinical examination, measurement of the isometric flexion strength of the elbow and X-rays of the elbow and wrist. Pain in the elbow and wrist was evaluated on a 0–3 scale (0 = no pain; 1 = mild pain, with no limitation of recreational activities; 2 = moderate pain with some limitation of recreational but not daily activities; 3 = severe pain with limitation of both recreational and daily activities). The active range of movement of the elbow was measured with a goniometer. Muscle strength was measured with Zadig's dynamometer (Inor, Malmö) [28]. The strength of hand grip and flexion, extension, pronation and supination of the elbow were tested bilaterally. Plain X-rays of the elbow and wrist were taken and degenerative changes evaluated using a 0–3 scale (0 = no arthrosis, 1 = mild arthrosis, 2 = moderate arthrosis, 3 = severe arthrosis). Migration of the head was measured in millimetres. The overall outcome was classified as excellent, good, fair or poor using the criteria of Mikic and Vukadinovic [17].

Results

Six of the fractures were type 2, and 17 type 3. The mean delay from fracture to surgery was 9 days (0–42 days). Four elbows were asymptomatic. The main complaint in the remaining 19 cases was pain on exertion. Thirteen patients had pain on exertion in the wrist (Table 1). The mean elbow flexion was 135° (130°–140°; SD 4). In four elbows flexion was limited compared to the non-involved side by a mean of 6° (5°–10°). The mean extension was 15° (range –10° to 45°; SD 14). Extension was limited in 16 elbows compared to the non-involved side by a mean

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of 21° (5°–45°). The mean pronation was 77° (range 20°–90°; SD 23). Pronation was limited in seven elbows. The mean supination was 75° (40°–90°; SD 17). Supination was limited in 11 elbows. Two patients found the restriction of elbow movement very inconvenient and nine slightly inconvenient. The mean strength of hand grip and elbow flexion was significantly lower on the injured side, while the mean strength of elbow extension, pronation and supination showed no significant difference between the two sides (Table 2). The weakness of the upper limb was a slight disadvantage to 12 patients. Osteoarthritic changes

were found on X-ray in 17 elbow joints, and in 14 wrist joints (Table 1). There was no proximal migration of the radius on X-ray in eight cases, 1 mm migration in seven, 2 mm in five, 3 mm in one, 5 mm in one and 8 mm in one (Fig. 1). The mean distance of migration was 1.4 mm (0–8 mm; SD 1.9). The head of the ulna was prominent in four patients. The distance of migration did not correlate with the outcome. The outcome was excellent in one, good in ten, fair in nine and poor in three patients.

Table 1 Follow-up signs and symptoms in 23 patients with excision of the radial head

Sign and symptoms	No (n)	Mild (n)	Moderate (n)	Severe (n)
Elbow pain	4	9	7	3
Wrist pain	9	9	3	1
Osteoarthrosis of the elbow	6	10	6	1
Osteoarthritis of the wrist	9	13	0	1

Fig. 1 A Anteroposterior and **B** lateral roentgenograms of the right wrist obtained 2 years after excision of the radial head showing 8 mm migration of the radius

Discussion

The ideal treatment for Mason type II and type III fractures of the head of the radius remains controversial. Early excision has been favoured by a number of authors [2, 11–13, 16, 19], but delayed excision has also been advised [4]. Mason [16] reported satisfactory results in 23 patients despite some long-term abnormality of the elbow. Radin and Riseborough [19] presented excellent or good results in 19% of their patients, fair in 64% and poor in 17%; but recommended excision despite the number of unsatisfac-

Table 2 Mean (SD) muscle strength (kg) of hand grip and elbow flexion, extension, pronation and supination (n=23; ns not significant)

Functions	Injured mean (SD)	Uninjured mean (SD)	% difference mean (SD)	P	95% CI
Hand grip	23.0 (10.2)	31.0 (11.2)	23.4 (19.4)	<0.001	–10.1, –4.4
Elbow flexion	18.2 (8.7)	23.2 (10.7)	19.0 (14.7)	<0.001	12.1, 25.8
Elbow extension	16.2 (7.7)	16.9 (7.6)	–3.0 (28.6)	ns	–16.4, 10.4
Elbow pronation	7.0 (5.1)	7.4 (6.3)	–0.4 (30.9)	ns	–14.8, 14.1
Elbow supination	6.0 (3.6)	6.9 (5.5)	1.9 (25.2)	ns	–9.9, 13.7

tory results. Morrey et al. [18] reported the outcome following excision to be usually satisfactory. Wening et al. [27] reported good results in 23% of their patients, fair in 64% and poor in 13%. In the present study, early radial head excision resulted in a satisfactory outcome in 48% of the patients. There are only a few reports on the outcome of delayed excision of the head of the radius. According to Broberg and Morrey [4] delayed excision yielded satisfactory results in 70% of the patients.

There is a high complication rate following excision of the head of the radius [2, 3, 6, 7, 13, 21, 22, 26]; including pain, instability, new bone formation at the site of resection, proximal radial migration and cubitus valgus [10, 20, 27]. Jensen et al. [14] indicated that the head of the radius acts as a stabiliser of the elbow joint in forced varus and external rotation and that excision leads to changes in the kinematics of the elbow. Adler and Shaftan [1] reported unsatisfactory results in 36% of patients following excision of the head of the radius and stated that conservative treatment gave better results. Some authors have suggested that excision should be reserved for patients who have an unacceptable outcome after conservative treatment [9, 10].

Proximal migration of the head of the radius was first described by Brockman [5]. Morrey et al. [18] reported the mean distance of migration to be 1.9 mm at an average of 20 years after excision of the head of the radius, while Stephen [23] reported a slightly higher value, 2.3 mm, 13 years or more after excision. The mean distance of migration was shorter in the present study. The migration however did not correlate with the outcome, as was also reported by Stephen [23]. Other pathological findings, such as arthrosis of the elbow and/or wrist, limited movement of the elbow and weakness of flexion and extension of the elbow, were also common findings in this study.

Internal fixation of fractures of the head of the radius may give good results. Fractures associated with dislocation of the elbow, ulnar collateral ligament injury, proximal ulnar fracture and ipsilateral wrist injury are relative indications for operative treatment with preservation of the head of the radius [8, 10]. This is demanding surgery, and the complications include failure of fixation, impingement, heterotopic ossification and infection. This surgery is facilitated by improved techniques, including bioabsorbable pins, mini plates and screws and Herbert screws [10]. Radial head arthroplasty is technically easier. Acrylic, stainless steel, silastic and articulating CoCr prostheses have been developed and a variety of results have been reported [10, 24]. The complications associated with arthroplasty include subluxation or dislocation, painful loosening, implant impingement and fracture of the prosthesis. No controlled, randomised studies are available to compare radial head arthroplasty, excision of the head of the radius and open reduction and internal fixation.

In conclusion; excision of the head of the radius cannot be considered ideal treatment for isolated fractures; the head of the radius should be preserved whenever technically possible and replaced when necessary.

References

- Adler JB, Shaftan GW (1964) Radial head fractures. Is excision necessary? *J Trauma* 115–121
- Arner O, Ekengren K, Schreer T von (1957) Fractures of the head and neck of the radius. A clinical and roentgenographic study of 310 cases. *Acta Chir Scand* 112:115–134
- Bakalim G (1970) Fractures of the radial head and their treatment. *Acta Orthop Scand* 41:320–331
- Broberg MA, Morrey BF (1986) Results of delayed excision of the radial head after fracture. *J Bone Joint Surg [Am]* 68:669–674
- Brockman EP (1930) Two cases of disability of the wrist joint following excision of the radius. *Proc Roy Soc Med* 24:904–905
- Charnley J (1961) The closed treatment of common fractures, 3rd edn. Williams and Wilkins, Baltimore
- Cutler CW (1926) Fractures of the head of neck of the radius. *Ann Surg* 83:267–277
- Esser RD, Davis S, Taavao T (1995) Fractures of the radial head treated by internal fixation: late results in 26 cases. *J Orthop Trauma* 9:318–323
- Faraj AA, Livesly P, Branfoot T (1999) Nonunion of fracture of the neck of the radius: a report of three cases. *J Orthop Trauma* 13:513–515
- Furry KL, Clinkscales CM (1998) Comminuted fractures of the radial head. *Clin Orthop* 353:40–52
- Goldberg I, Peylan J, Yosipovitch Z, Tiqva P (1986) Late results of excision of the radial head for an isolated closed fracture. *J Bone Joint Surg [Am]* 68:675–679
- Hresko MT, Rosenberg BN, Pappas AM (1999) Excision of the radial head in patients younger than 18 years. *J Pediatr Orthop* 19:106–113
- Jacobs JE, Kernodle HB (1946) Fractures of the head of the radius. *J Bone Joint Surg* 28:616–622
- Jensen SL, Olsen BS, Sojbjerg JO (1999) Elbow joint kinematics after excision of the radial head. *J Shoulder Elbow Surg* 8:238–241
- Keon-Cohen BT (1966) Fractures of the elbow. *J Bone Joint Surg [Am]* 48:1055–1064
- Mason ML (1954) Some observations on fractures of the head of the radius with a review of one hundred cases. *Br J Surg* 42:123–132
- Mikic ZD, Vukadinovic SM (1983) Late results in fractures of the radial head treated by excision. *Clin Orthop* 181:220–228
- Morrey BF, Chao EY, Hui FC (1979) Biomechanical study of the elbow following excision of the radial head. *J Bone Joint Surg [Am]* 61:63–68
- Radin EL, Riseborough EJ (1966) Fractures of the radial head. *J Bone Joint Surg [Am]* 48:1055–1064
- Rodriguez-Merchan EC (1995) Controversies on the treatment of irreducible elbow dislocations with an associated nonsalvageable radial head fracture. *J Orthop Trauma* 9:341–344
- Sever JF (1925) Fractures of the head and neck of the radius. A study of end-results. *J Am Med Assn* 84:1551–1555
- Speed K (1924) Fracture of the head of the radius. *Am J Surg* 38:157–159
- Stephen IBM (1981) Excision of the radial head for closed fracture. *Acta Orthop Scand* 52:409–412
- Swanson AB, Jaeger SH, La-Rochelle D (1981) Comminuted fractures of the radial head. The role of silicone-implant replacement arthroplasty. *J Bone Joint Surg [Am]* 63:1039–1049
- Taylor TKF, O'Connor BT (1964) The effect upon the inferior radioulnar joint of excision of the head of the radius in adults. *J Bone Joint Surg [Br]* 46:83–88
- Vertongen P (1961) Displaced fractures of the head of the radius. In *Proceedings of the Netherlands Orthopaedic Society*. *J Bone Joint Surg [Br]* 43:191–192
- Wening JV, Wobig B, Jungbluth KH (1993) Resection of the radius head in multiple and comminuted fractures. Clinical results and critical evaluation compared with the literature. *Unfallchirurgie* 19:175–182
- Zadig A (1963) Objektiv mätning av muskelkraft med en ny dynamometer. *Läkartidn* 60:2937–2952