Function after early radial head resection for fracture

A retrospective evaluation of 15 patients followed for 3–18 years

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ABSTRACT – We reviewed the results of early radial head resection in 15 patients after fracture of the radial head or neck: 4 Mason's type II fractures and 11 Mason's type III fractures. The average age at operation was 41 years and the patients were reexamined after mean 10 (3–18) years. Only 5 patients had no pain and all patients had reduced elbow power, in several of them a substantial loss.

Radial head resection is an alternative treatment for a displaced fracture of the radial neck or a comminuted fracture of the radial head (Mason 1954, Johnston 1962, Bakalim 1970, Stephen 1981, Hotchkiss and Green 1991). However, various long-term problems, such as symptomatic proximal translation of the radius, decrease in strength, degenerative changes in the wrist and the elbow, and cubitus valgus have been reported after radial head resection (Radin and Riseborough 1966, Morrey et al. 1979, Mikic and Vukadinovic 1981, Goldberg et al. 1986, Sowa et al. 1995). These reports have suggested that indiscriminate radial head resection may be inappropriate as a primary treatment for a radial head fracture. Some authors have had satisfactory results with internal fixation (Poulsen and Tophøj 1974, Sanders and French 1986, McArthur 1987), or primary radial head prosthetic replacement (Swanson et al. 1981, Nonnenmacher and Schurch 1985), even if the fracture is severely displaced or comminuted. Bromberg and Morrey (1986) reported that delayed resection of the radial head is a viable option when primary management fails.

We evaluated the long-term outcome after early radial head resection in 15 patients with severely comminuted radial head fractures. Since there are few reports about measurement of power after radial head resection, we used Cybex testing to evaluate the strength.

Patients and methods

15 patients (mean age 41 (25–70) years, 11 men) who sustained a comminuted radial head fracture or a displaced fracture of the radial neck were treated by radial head resection between 1975 and 1998 (Table). The right side was involved in 9 patients. The fracture type was classified according to the Mason classification, as modified by Hotchkiss and Green (1991): type I, nondisplaced or minimally displaced fracture of the head or neck; type II, displaced (more than 2 mm) fracture of the head or neck; type III, severely comminuted fracture of the radial head and neck. 4 patients had a type II fracture and 11 had a type III fracture.

All patients had a resection of the radial head mean 11 (1–14) days after the injury. Postoperative treatment consisted of immobilization in a plaster cast for mean 8 (3–16) days.

The duration of follow-up was mean 10 (3–18) years. The examination included a subjective assessment of pain, range of motion of the elbow, forearm and wrist, and grip-strength. Bilateral anteroposterior and lateral radiographs of the wrists and elbows were done. The carrying angle was measured from the long axes of the humerus and forearm. The ulnar variance was measured from

Data on 15 patients with radial head resection

Case no.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Age, years	25	51	36	26	30	46	52	40	31	46	37	38	41	49	70
Sex	M	M	F	M	F	M	F	M	M	M	M	M	M	M	F
Fracture type	II	II	II	II	III	III	III	III	III	III	III	III	III	III	III
Time from injury to operation, days	1	14	2	10	5	8	7	1	10	14	14	14	9	14	5
Follow-up, years	17	18	5	4	14	5	6	14	8	7	17	17	7	8	3
Pain [a]	N	N	E, U	N	F, E	F, E	W	W	W	F, E	N	E, U	E,U	N	E
Motion, degrees															
Flexion	120	125	145	135	135	134	110	135	128	135	130	140	132	140	130
Extension	–10	–10	–5	–10	–25	–40	–45	–15	–5	0	–17	0	–10	–10	–15
Pronation	90	85	85	80	70	85	30	90	85	85	80	80	80	85	85
Supination	85	85	85	85	80	85	70	90	85	80	80	80	80	85	80
Grip-strength, % [b]	98	89	100	92	94	62	57	80	94	59	85	93	91	85	72
Increase in carrying angle, degrees	7	6	7	14	0	9	10	6	7	8	4	20	8	8	10
Increase in ulnar variance, mm	2	0	4	2	2	2	2	1.5	2	0.5	1.5	1	2	1.5	1
Osteoarthrosis [c]															
Wrist	2	2	1	1	1	1	2	1	1	2	1	1	1	1	1
Elbow	2	2	2	1	3	1	3	1	1	2	3	2	2	2	1
Power, % [d]															
Flexion	94	92	70	82	76	92	59	79	86	76	94	78	88	82	58
Extension	94	56	82	73	64	54	70	71	67	56	65	77	72	68	65
Pronation	84	66	76	73	67	72	33	76	57	50	93	73	64	75	42
Supination	67	42	33	52	49	67	35	52	52	86	48	61	49	63	35
Elbow evaluation score, points [e]	76	76	83	76	75	71	60	74	76	79	87	75	78	76	74

[a] N none, E elbow pain, W wrist pain, F forearm pain, U ulnar nerve symptoms.
[b] Grip-strength expressed as a percentage of uninjured side.
[c] Grade of osteoarthrosis (Swanson et al. 1981).
[d] Power expressed as a percentage of peak torque of uninjured side. The peak torques of flexion and extension of the elbow at 60°/sec and pronation and supination of the forearm at 30°/sec were measured using Cybex testing.
[e] Elbow evaluation score developed by Japanese Orthopaedic Assossiation.

the distance between the line drawn perpendicular to the longitudinal axis of the radius at the distal ulnar aspect of the radius and the end of the ulna on an anteroposterior radiograph of the wrist in supination. Arthrosis in the wrist and elbow was graded as: grade 1, few, if any, osteophytes and joint narrowing; grade 2, moderate–prominent osteophytes and joint narrowing; grade 3, severe–gross deformity using the criteria of Swanson et al. (1981). The strength of flexion and extension of the elbow and pronation and supination of the forearm were evaluated with the Cybex 340 (Lumex, Ronkonkoma, New York). The peak torques of flexion and extension of the elbow and pronation and supination of the forearm were measured at 60 degrees/sec and 30 degrees/sec, respectively. The results were expressed as a percentage of the value on the uninjured side. The overall results were assessed with the Elbow Evaluation Score (max 100 points) developed by the Japanese Orthopaedic Association (Onomura and Ishii 1992).

Differences in values between injured and uninjured sides were analyzed with the Wilcoxon signed-ranks test.

Results

Pain

Degree and area of pain varied (Table). 5 patients (cases 1, 2, 4, 11 and 14) had no pain or only occasional pain with weather changes. 4 patients (cases 7, 8, 9 and 15) had mild pain in the wrist or the elbow at rest and complained of weakness during heavy labor. 3 patients (cases 5, 6 and 10) had

mild pain along the lateral side of the elbow with prolonged heavy use which required rotation of the forearm. 3 patients (cases 3, 12 and 13) complained of a dull ache and numbness along the ulnar side of the forearm which suggested ulnar nerve involvement.

Motion

The mean flexion of the elbow was 132°, similar to the uninjured side. The mean extension of the elbow was –14°, a decrease of 20° or more, compared to the uninjured side ($p < 0.01$). The mean pronation and supination were 80° and 82°, respectively, and the mean reductions in pronation and supination were 9° and 6°, respectively. No significant differences were noted in pronation and supination or in flexion and extension of the wrist between the injured and uninjured sides.

Strength

The mean reduction in grip-strength was 17%, but this was not statistically significant different from the uninjured side. The mean values with Cybex 340 testing were 80% in flexion ($p < 0.01$), 69% in extension ($p < 0.01$), 66% in pronation ($p < 0.01$) and 52% in supination ($p < 0.01$). Peak torques for pronation and supination were more affected than for flexion and extension.

Radiography

The mean increase in the carrying angle was 8 (0–20)°, compared with the uninjured side ($p < 0.01$).

The mean ulnar variance was + 1.6 (0–4) mm on the injured side, an increase of about 2 mm relative to the uninjured side ($p < 0.01$).

All patients showed degenerative elbow changes, from mild to severe, while degenerative changes in the wrist were absent or mild.

The mean Elbow Evaluation Score was 76 (60–87) points.

Discussion

Many authors have reported satisfactory results, with excellent elbow motion after radial head resection for a comminuted fracture, such as a Mason's type III fracture (Johnston 1962, Bakalim 1970, Poulsen and Tophøj 1974, Stephen 1981, Broberg and Morrey 1987). However, Goldberg et al. (1986) have cautioned against radial head resection after a radial head fracture, because of the risk of symptomatic proximal translation of the radius. In most reports, this proximal translation of the radius has been up to 2–3 mm and generally asymptomatic. Sutro and Sutro (1985), Edwards and Jupiter (1988) and Sowa et al. (1995) have recognized that symptomatic proximal translation of the radius can result from an acute disruption of the distal radioulnar joint accompanying a fracture of the radial head. They advocated internal fixation of the fracture or the use of a radial head prosthesis to provide contact support between the radiohumeral joint. Currently, there is no standard treatment for a Mason's type III fracture, because internal fixation is difficult.

Satisfactory range of motion of the elbow has been reported after radial head resection, although Stephen (1981), Goldberg et al. (1986) and Coleman et al. (1987) have reported substantial loss of extension. In our series, loss of extension averaged 25°. The loss in range of motion was not related to the length of follow-up.

Disabling pain and loss of strength after radial head resection have been attributed to proximal translation of the radius, which subsequently induces distal radioulnar dissociation or ulnocarpal impingement. Radin and Riseborough (1966) and Mikic and Vukadinovic (1981) have found a correlation between the severity of osteoarthrosis, increased ulnar variance and carrying angle, and loss of motion, but these did not correlate to pain. Pain occurred in 10 of our 15 patients. We did not find severe wrist osteoarthrosis in our patients. Nor did we find an obvious correlation between the pain and degree of osteoarthrosis of the elbow, which was a subsequent change in the joint instability. The degree of pain also was not related to the length of follow-up. Severe osteoarthrosis of the elbow was commoner in patients with a longer follow-up period after radial head resection.

There are few reports as regards the loss of power after radial head resection. A 10–20% loss of power has been reported in flexion of the elbow, and an approximately 20% loss of power in pronation and supination (Stephen 1981, Coleman et al. 1987). We found more loss of strength, especially as regards supination. Although most of our

patients had a score of more than 70 points, corresponding to an acceptable result, all of them had varying loss of power. In our study, patients who complained of disability had pain in the wrist, forearm and elbow associated with loss of power, even though the pain was rated as mild or occasional. Thus we conclude that early radial head resection cannot be recommended for patients who engage in prolonged heavy use of their upper extremities, such as heavy manual laborers or athletes.

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