Arthroscopic radial head excision in managing elbow trauma

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Abstract

Purpose This study describes a case series of 15 patients with radial head fractures who underwent radial head excision using an arthroscopic technique.

Methods Over a four year period, 15 patients (average age 49.6 years) who had sustained a radial head or radial neck fracture underwent an arthroscopic excision of the radial head. Four patients had an unreconstructable comminuted fracture (early group; EG) and 11 patients had pain and loss of motion with an associated non- or malunion (late group; LG).

Results The mean time to surgery following injury was three weeks (one to five) for the EG and 27 weeks (eight–58) for the LG. The average visual analogue scale (VAS) was 1.7 (zero to four), and the average Quick Disabilities of the Arm, Shoulder and Hand (Quick-DASH) score was 24.7 (16–44). At final follow-up, average supination was 62.0° (range 45–75°) and pronation was 63.3° (range 45–75°). There were no complications.

Conclusion This series demonstrates that arthroscopic excision of fractures of the radial head and neck is reliable, reproducible and safe, with similar results to open excision. There may also be additional benefits in the short term with regards to speed of healing and rehabilitation.

Introduction

Fractures of the radial head and neck account for 1.5–4 % of all fractures [1]. Undisplaced or minimally displaced fractures can usually be managed nonoperatively with satisfactory results, whereas displaced or comminuted fractures often require operative intervention [2]. With advances in operative technique and implant technology, the majority of these cases can now be treated with operative fixation. However, in circumstances in which the fracture configuration is too comminuted for fixation or presentation is delayed, excision of the radial head maybe indicated.

Excision of the radial head is usually undertaken as an open procedure with excellent results [3]. An open approach to the radial head carries the risk of damage to the annular ligament, the lateral stabilisers of the elbow and the posterior interosseous nerve. Undertaking this procedure using an arthroscopic approach can potentially allow for an accelerated postoperative recovery. Here we report results of a case series of patients with radial head fractures who underwent radial head excision using an arthroscopic technique. Our hypothesis is that the results of arthroscopic radial head excision are comparable with those of open radial head excision.

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Methods

Between February 2005 and March 2009, we undertook excision of the radial head in 15 patients with a radial head fracture using an arthroscopic technique. The fractures were classified according to the Broberg and Morrey modification of the Mason classification [4]. All 15 patients sustained a radial head fracture (three Mason type II, 11 Mason type III, one Mason type 4, with associated dislocation and instability and two also having an associated radial neck

fracture). All patients sustained an isolated elbow injury. Inclusion criteria for surgery were an unreconstructable, comminuted radial head fracture [early group (EG)] and pain, with loss of motion and an associated radial head/neck malunion or nonunion following an adequate period of rehabilitation [late group (LG)]. Essex–Lopresti lesions of the wrist were excluded clinically and radiologically. There were four patients in the EG and 11 in the LG (one malunited radial head fracture, eight nonunions of a radial head fracture and two nonunions of a radial neck fracture). All patients were evaluated postoperatively using the Quick Disabilities of the Arm, Shoulder and Hand (Quick-DASH) score [5] and the visual analogue scale (VAS) for pain [6]. Patients were also asked to report on satisfaction and perceived success of the procedure. All patients reported being satisfied with the procedure.

Arthroscopic technique (Figs. 1, 2, 3, 4)

The procedure was undertaken using general anaesthetic and regional axillary nerve block. The patient was placed in the lateral decubitus position with the arm over an elbow prop. The limb was exsanguinated in all cases and surgery performed under tourniquet control. An initial examination under anaesthesia (EUA) was performed to document pre-operative range of motion and to identify any lateral, medial or rotatory instability, which would preclude excision of the radial head (Figs. 5, 6, 7, 8).

A 2.7-mm, 30° arthroscope and fluid management system with a pressure of 30 mmHg was used in all cases to

Fig. 1 Patient positioning for arthroscopic elbow procedure. Patient is on the side, supported with props, and the elbow is placed over L-shaped prop

Fig. 2 Prepped elbow prior to surgery illustrating bony landmarks

start the procedure. The elbow joint was initially entered through the posterior portal and a posterolateral instrument portal then established under direct vision. Once a good view had been obtained, a 4.5-mm, 30° arthroscope was inserted to provide a greater field of view and increased fluid flow. A thorough washout of the fracture haematoma was carried out prior to performing a standard elbow arthroscopy to determine the extent of bone and associated

Fig. 3 Perioperative arthroscopic image of radiocapitellar joint showing malunited radial head

Fig. 4 Perioperative arthroscopic image of radiocapitellar joint after resection of radial head

soft-tissue injury. Due to the initial restrictions in space within the joint, a 3.5-mm minishaver and burr with a rongeur were used to start the bony resection. The anterior aspect of the radial head was initially excised with the shaver in the lateral portal. The cutting surface of the shaver was kept facing in a posterior direction to protect the posterior interosseous nerve, which lies adjacent to the anterior capsule. As the procedure progressed, it was then possible to introduce a more aggressive 5.5-mm burr. Excision was facilitated by supinating and pronating the forearm to improve contact between the radial head and shaver and by switching the arthroscope and shaver between the posterior and the lateral portals. The annular ligament was left intact to maintain stability at the proximal radioulnar joint. At the

Fig. 5 Anteroposterior radiography of the elbow showing nonunion of a radial head fracture

Fig. 6 Lateral radiograph of the elbow showing nonunion of a radial-head fracture

end of the procedure, a thorough washout of any remaining debris was performed, elbow range of motion (particularly pronation and supination) was assessed and stability was documented. An additional anterior capsular release was carried out if required to improve the range of movement in the sagittal plane.

Postoperatively, a bulky bandage and a sling were applied, and active movements were encouraged within 24 h with the help of a physiotherapist. Patients were discharged from hospital the next day, reviewed at six to eight weeks and followed up until full recovery or their recovery reached a plateau. At the final follow-up, functional outcome (range of motion, relief of pain and mechanical symptoms) was assessed. Postoperative radiographs were assessed for

Fig. 7 Anteroposterior radiograph of the elbow following radial head resection

Fig. 8 Lateral radiograph of the elbow following radial head resection

evidence of cubitus valgus, heterotopic ossification and proximal radial migration.

Results

Table 1 illustrates the initial nonoperative treatment and the time to surgery of the 15 patients. The mean time from injury to surgery for EG patients was three (range two to five) weeks and for LG patients 27 (range eight to 58) weeks. Indication for surgery for all patients in the LG was persistent pain and stiffness with no clinical improvement.

Arthroscopy showed no associated chondral injury to the capitellum or lateral collateral ligament. One patient had an

additional anterior capsular release to gain movement in the sagittal plane. Final follow-up was at a mean of 20 (range five–47) months after the procedure. Mean flexion achieved was 138° (range 120–150°) and extension loss was 9° (range zero–25°). Mean supination achieved was 62° (range 45–80°) and pronation was 63° (range 45–90°). Mean gain in flexion/extension was 30° and 21°, respectively ($p < 0.001$), and mean gain in supination/pronation was 12° for both. However, this was not significant ($p > 0.1$). There was no statistically significant difference in range of flexion achieved at final follow-up between groups ($p > 0.3$), although extension achieved in the EG was significantly better than in the LG ($p < 0.04$). The range of pronation/supination was also significantly different between groups ($p < 0.02$), with the EG having an increased arc of motion. None of the elbows was clinically unstable, and there was no evidence of ulnar nerve compression.

All patients reported significant pain relief (decrease of two or more VAS levels) [6], with an average VAS score of 1.7 (range 0–4); all were satisfied with the procedure. Mean Quick-DASH score [5] at the final follow-up was 24.7 (range 7–44). Disability during daily activities was minimal in all patients. Activities most commonly reported to be moderately limited were those where the patient took some force or impact through their arm (such as golf, hammering, or tennis) and activities that required supination against resistance (such as opening a tight jar). There was no statistical significant difference ($p > 0.05$) in VAS and Quick-DASH scores between EG and LG. Postoperative radiographs revealed no cases of heterotopic or myositis ossificans around the elbow. There was no evidence of increased varus or valgus or of an Essex-Lopresti lesion involving the wrist.

Table 1 Initial management and time to surgery

Age (years)	Mason classification	Initial treatment	Injury–excision time (weeks)	Postoperative Quick-DASH score
37	2	ROM exercise	5	16/100
57	3	ROM exercise	3	22/100
51	3	ROM exercise	5	21/100
34	3	ROM exercise	12	35/100
39	3	ROM exercise	20	28/100
41	2	ROM exercise	58	22/100
42	3	ROM exercise	54	32/100
49	3	ORIF ulna	28	18/100
51	4	ROM brace 6/52	8	41/100
58	3	ROM exercise	11	33/100
73	3	ROM exercise	20	44/100
52	2	ROM exercise	45	18/100
72	3	ROM exercise	18	7/100
51	3	ROM exercise	5	9/100
47	3	ROM exercise	36	24/100

ROM range of motion, ORIF open reduction internal fixation, DASH Disabilities of the Arm, Shoulder and Hand

Discussion

Whereas advances in implant technology and surgical technique have resulted in successful operative treatment of the vast majority of complex radial head and radial neck fractures, there are still certain fracture configurations and situations in which radial head excision is indicated. Open excision of the radial head following trauma is a well-established and well-tolerated procedure with good to excellent results. Late excision for posttraumatic degenerative changes is well described. Goldberg et al. [7] reported satisfactory function in >90 % of patients treated with radial head excision for isolated Mason types II and III fractures with an average follow-up of >16 years. Rosenblatt et al. described results of open excision of 61 radial head fractures with an average follow-up of 18 years. As in our study, their patients were divided into two groups: 43 had primary excision (one to six weeks) and 18 had a delayed procedure (two–238 months). There was no statistically significant difference in symptoms and range of movement between groups. No patients required a secondary operation [8].

The standard surgical approach for resection of the radial head is usually an arthrotomy using the Kocher lateral or posterior approach, allowing exposure of the radial head and capitellum and subsequent excision of the radial head [9]. There is a risk of injuring the annular and lateral collateral ligaments as well as the posterior interosseous nerves during surgical dissection. There is also a risk of infection and an extensive scar [10]. The arthroscopic technique described in this article decreases the risk of these complications.

Lo et al. first described arthroscopic radial head excision for degenerative disease in a case report in 1994 [11]. Menth-Chiari et al. followed this in 1999 describing arthroscopic radial head excision in a technical note [12]. Since then, two published series describe arthroscopic radial excision for treating a degenerate radiocapitellar joint or changes secondary to rheumatoid arthritis. The first, by Menth-Chiari in 2001 [13] describes 12 patients. As with Lo et al., that report pertains to radial head excision for posttraumatic osteoarthritis. The second series, by McLaughlin et al. in 2006, details 36 procedures [14]. Both studies demonstrated arthroscopic radial head excision as a safe and reliable procedure. To date, no publications describe the use of arthroscopic radial head excision in trauma.

Following our retrospective study, we describe a case series of patients undergoing radial head excision following trauma using an arthroscopic technique. Elbow instability in these patients was excluded by performing an EUA prior to performing the arthroscopic resection. None of the patients regained a full range of motion, but the deficit was not severe enough to limit activity. Pain was absent in ten patients. The upper-extremity-associated disability was absent or minimal according to the Quick-DASH questionnaire [5]. These results

are similar to those previously reported for both early and late open radial head excision [2–4].

The potential advantages of excising the radial head using an arthroscopic approach over an open approach are that there is minimal further capsular and ligamentous trauma. It allows excellent access without muscle or tendon detachment. This can then allow for early and aggressive rehabilitation, including immediate range of motion and strengthening [15]. The mean increase in elbow movement after late open radial head excision has been reported as 36° [4]. The mean range of extension/flexion in our cohort of patients was 9.2–138.0° and this was more than that reported by Rosenblatt et al. [8] for the open procedure. This may be attributable to decreased soft-tissue morbidity associated with arthroscopy, allowing for less scar formation and contracture. The technique also allows for a more complete visualisation of the radial head fracture and associated articular surface chondral lesions on the capitellum [16].

There is a potential risk of neurovascular damage, particularly to the radial and posterior interosseous nerves, when establishing arthroscopic portals, particularly when the anatomy of these structures may be altered in the context of fracture. Also, some authors have expressed concern regarding irrigation fluid extravasation perioperatively secondary to the ruptured capsule in the acute situation [17]. In our series of patients, we had no neurovascular complications and no problems with fluid extravasation in the four acute cases. Operating time using the arthroscopic compared with the open technique may also be increased initially, particularly due to its high learning curve.

Conclusion

To our knowledge, the use of arthroscopy for excising acute or delayed radial head fractures has not been previously described. The technique is safe and effective and has similar results to open excision but with the additional short-term benefits of decreased surgical morbidity, permitting earlier healing and an accelerated rehabilitation. Our study demonstrates that arthroscopic radial head excision in the context of trauma has some potential benefits and supports the hypothesis that the results are comparable with the open technique. Its limitations are that there was only a small cohort of heterogeneous patients and an absence of long-term follow-up.

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