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RADIAL HEAD RESECTION - IS IT STILL VALUABLE SURGICAL SOLUTION?

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Abstract

The aim of the present study was to review the functional and radiological results following the traditional technique on radial head resection for unreconstructable radial head fractures.

Clinical evaluation included the Disabilities of the Arm, Shoulder and Hand questionnaire. Elbow pain was graded as none, mild, moderate or severe. A visual analogue scale was used for the assessment of patient satisfaction. We assessed the difference in the strength between both sides, valgus laxity of the elbow, posterolateral instability and grip strength. On the basis of the interview and the physical examination, Mayo Elbow Performance S was evaluated. Radiographic review consisted of evaluating for proximal migration of the radius, radial shortening and ulnar variance.

21 patents with a mean age of 36 years at the time of injury that underwent radial head resection were included. The mean value of Visual Analogue Scale satisfaction score was 9 (range 4-10; Std =1.54). Mean range of motion was 9° of extension (range 0° to 32°) and 135° of flexion (range 70° to 145°). Mean total arc was 130° (range 70° to 145°). Eighteen patients (86%) had a functional arc of motion (≤30° to ≥130°). Mean value of MEPS was 95 points (range 60-100 points; Std=8.76). Increased ulnar variance was 17 patients. Three patients had proximal migration of the radius (> 5mm).

Our data suggest that comminuted fractures of the radial head may be treated with radial head excision with satisfactory long-term functional outcome. Despite popularity of radial head prostheses, good functional result can be obtained even without radial head replacement.

Keywords: radial head, fracture, resection, outcom

Introduction

Radial head fracture is a peculiar injury accounting for about 4% of all fractures and less than 50% of all skeletal injuries of the proximal forearm [1,2,3]. It is also considered that less than 10% of radial head fracture are associated with other upper extremity injuries (dislocation and instability of the forearm, another fracture), most of them being isolated radial head fractures [3,4,5]. The role of the radial head in elbow and forearm kinematics continues to be defined, but there is no doubt regarding its importance from biomechanical point of view [6]. Furthermore, anatomical studies have demonstrated that the radial head is not perfectly circular [7,8,9,10] and that its complex anatomy is difficult to be replicated by the prosthesis [11,12]. The studies of Bohl [13] and Vanderwilde [14] reported fragmentation of silicone implants due to destructive synovitis. More rigid prostheses that prevail nowadays [15,16,17] are also associated with complications arising from over-stiffness of the joint [18]. In other words, there are studies that prove that despite great amounts of enthusiasm and its wide popularity, radial head prosthesis could not be a perfect substitute for a fractured radial head.

Fractures of the radial head are commonly classified according to Mason classification [19], which was later modified by Johnston [20]. The classification encompasses four types of fractures that serve as guide to fracture management. However, the decision should not be rigidly based on classification schemes and it is widely accepted that other subtleties that are not taken into account in the classification systems, such as fracture stability, the degree of articular involvement and displacement as well as the presence of associated complex injuries should be appreciated [6]. In other words, much of the debate has been focused on the best treatment for Mason type II and III fractures [19- 30]. There are many reports of favorable outcomes following open reduction and internal fixation of Mason type II fractures [27,31,32,33], which is partially due to the development of the surgical technique, but resection of the radial head is still considered a valuable solution when anatomical osteosynthesis is not possible [34]. On the other hand, it is well documented that Mason type III

fractures are most frequently treated by radial head resection with or without prosthetic replacement [20,22,26,27,28,29,35-40].
The purpose of our study was to review the long-term results following radial head resection of isolated comminuted radial head fractures.

Materials and Methods

The retrospective study was undertaken at the University Clinic for Traumatology, Faculty of Medicine in Skopje. Prior to patients' enrollment, the study was approved by the institutional board review. We searched university hospital database containing patients' data from January 2005 to December 2010. The patients whose charts were incomplete were excluded. Inclusion was limited to the patients treated with primary radial head resection and younger than 55 years at the time of injury. Those in whom delayed resection was performed, or associated elbow fracture, dislocation or instability was present were excluded. Patient characteristics (age, gender), mechanism of injury (low energy trauma, high energy trauma), fracture characteristics (affected side, fracture type according to Mason classification) were recorded.

Surgical procedure was undertaken during the first 48 hours post-injury. All procedures were performed in general anesthesia with the arm placed on an arm table. We exposed the radial head through the extensor-splitting incision. Once the radial head was exposed, the resection was performed at the head-neck junction. We carefully evaluated forearm rotation in order to check for impingement of the ulna with the proximal radial stump.

Postoperative care consisted of splint application until stitches were removed. Following wound healing, the patients were encouraged to start physiotherapy and exercises for regaining elbow range of motion as soon as possible. Regular outpatient check-ups were undertaken at 4 weeks, 3 months, 6 months and 12 months post-procedure.

Clinical review. A total of 27 patients who met the enrollment criteria were sent a letter in which the nature of the study was explained and date and time of outpatient clinic check-up was proposed. Twenty-one of them (77%) agreed to take part in the study and returned for a formal clinical and radiological examination. Fifteen patients (71%) were male, while 6 were female (29%). Mean age of the patients at the time of injury was 36 years (range 19-48 years). In more than half of the patients (14 patients - 67%) the dominant arm was injured. Seventeen patients sustained the injury while falling from a standing height, three patients in a bicycle accident and one patient in a motorcycle accident. Minimum follow-up period was 1o years post-index procedure. Clinical evaluation included the Disabilities of the Arm, Shoulder and Hand questionnaire (DASH) which is a validated thirty-item self-reported outcome instrument that assesses symptoms and physical function in patients with upper extremity musculoskeletal disorders. The score is scaled between 0 and 100, with higher scores indicating worse upper extremity disability. Elbow pain was graded as none, mild (pain only during activity, no need for medication), moderate (pain during and after any activity) or severe (pain at rest, with the need for constant medication). Additional information was collected regarding the presence of wrist pain or ulnar nerve symptoms. A visual analogue scale (VAS) was used for the assessment of patient satisfaction. Patients were also asked to give a verbal categorical rating of their degree of satisfaction as very satisfied, satisfied or unsatisfied. We measured flexion and extension with the forearm in neutral position, while pronation and supination were measured with the elbow at 90 degrees. The difference in the strength between both sides in elbow flexion and extension against resistance was estimated on the basis of subjective comparison between the elbows and was categorized as normal, mild loss (not limiting, 80% of that of the contralateral side), moderate loss (limiting some activities, measuring 50% compared to contralateral side) or severe loss (limiting everyday tasks) [41].
We assessed Valgus laxity with the elbow in 20 degrees of flexion and with the forearm in pronation.

Posterolateral rotatory instability was assessed with the pivot-shift test [42] and the posterolateral drawer test [43].

Grip strength was measured with a Jamar Dynamometer. The changes in strength on the operatively treated side were expressed as the percentage of reduction from the strength on the normal side.

On the basis of the interview and the physical examination, Mayo Elbow Performance Score (MEPS) [44] was evaluated. MEPS consists of evaluation of the pain (maximum score 45 points),

motion (maximum score 20 points), stability (maximum score 10 points) and daily functional activities (maximum score 25 points). The results were classified as excellent (90-100 points), good (75-89 points), fair (60-74 points) or poor (<60 points). The result was considered satisfactory if an excellent or good rating was attended.

Radiographic review consisted of evaluating for proximal migration of the radius, radial shortening and ulnar variance. For that purpose, we ordered radiographs of both elbows with inclusion of the forearm and wrist in supination in two directions. Zero rotation radiographs of the wrist were used in order to evaluate radial shortening, ulnar variance and proximal migration of the radius. We expressed proximal migration of the radius as the difference in ulnar variance between two wrists. Ulnar variance itself was measured as a distance between a line drawn perpendicular to the long axis of the radius at the distal ulnar aspect of the radius and the end of the ulna.

Statistical analysis of all the collected data was made using the SPSS (version 20, IBM, Chicago, IL, USA) software.

Results

Subjective outcome: None of the 21 patients who took part in the present study was a subject of additional surgery concerning radial head fracture. The examination of the medical records revealed postoperative complications (superficial wound infection) in two patients (9%) that were treated with a short course of antibiotic therapy.

Seventeen patients (81%) had no pain in the elbow. Mild pain in the elbow was present in 3 out of 21 patients (14%) and one patient (5%) complained on a severe elbow pain.

Wrist pain was reported by 3 patients (5%). In all of them, wrist radiographs revealed proximal migration of the radius.Ulnar nerve irritation was present in 3 patients (5%).

The mean value of Visual Analogue Scale satisfaction score was 9 (range 4-10; Standard Deviation=1.54). According to the Verbal categorical rating, 16 patients (76%) were very satisfied, 3 patients (14%) were satisfied and 2 patients (10%) were not satisfied. In those who were not satisfied, VAS counted less than 5, they both complained on a moderate pain and instability was also present.

The mean value of the DASH score counted 6 (range 0-27).

Objective outcome: The mean range of motion was 9° of extension (range 0° to 32°) and 135° of flexion (range 70° to 145°). The mean total arc was 130° (range 70° to 145°).

Eighteen patients (86%) had a functional arc of motion (≤30° to ≥130°).

The mean pronation was 82° (range 40° to 90°) while the mean supination was 85° (range 60° to 90°).

Posterolateral rotator instability was present in one patient. Increased Valgus laxity was present in 2 patients. They both had no functional limitations. However, in one patient, instability of the distal radioulnar joint was present. It was associated with the proximal migration of the radius.

The mean value of MEPS was 95 points (range 60-100 points; Standard Deviation=8.76). The results were excellent in 16 patients (76%), good in 4 patients (19%) and fair in one patient (5%). Overall, the result was satisfactory in 19 patients and unsatisfactory in 2 patients.

Radiographic outcome: Increased ulnar variance was 17 patients. Three patients had proximal migration of the radius (> 5mm).

Discussion

Radial head fractures represent the most common fracture of the adult elbow [45][46]. The radial head is an important stabilizer for valgus, axial and posterolateral rotational forces [47]. Although radial head was considered to be expendable in the past, it is well recognized as an important stabilizer of the elbow and forearm nowadays. It is also widely accepted that radial head excision alters elbow stability [48,49]. Some authors reported association of radial head resection with pain, instability, proximal migration of the radius, loss of strength, osteoarthritis or cubitus Valgus. Even more, there are biomechanical studies that described altered biomechanical features of the elbow following radial head resection despite intact ligaments around the elbow [50].

There are many studies that report conflicting long-term results following radial head resection. While some have reported good results with minimum functional limitations [41,51-57], others have reported high proportion of unfavorable results [58,59,60]. However, much of them have analyzed heterogeneous group of patients regarding their age, mechanism of injury and the presence of

concomitant injuries around the elbow. Our study was focused on patients with isolated radial head fracture.

In the present study, seventeen patients (81%) had no elbow pain after minimum follow-up period of 10 years. More than three quarters of the study population were very satisfied with the overall outcome following their injury and were able to perform all daily activities at the same level as before their elbow injury. Similarly, Herbertsson *et al.* [57] reported that only two out of forty-nine patients who sustained Mason type II or III fracture had a severe pain following radial head resection in a mean follow-up period of eighteen years. Even more, in the study of Coleman *et al*. [53], all sixteen patients had a good result after radial head resection at a minimum follow-up period of eight years.

The range of elbow motion was slightly reduced. However, this finding did not correlate with any functional restrictions. Posterolateral rotatory instability was present in one patient. The conjunction between radial head resection and posterolateral rotatory instability was recently recognized by Hall and McKee 4/28 who reported seven cases. They thought that instability could be due to the unrecognized ligamentous injury at the time of the injury, which could also be case in our patients.

Our study was limited by its small number of patients from a single hospital. The evidence from the operative protocols regarding concomitant ligamentous injuries were somehow sparse. However, the study population was homogeneous regarding demographic characteristics and the follow-up period was long enough to specifically analyze the functional results.

In conclusion, our data suggest that comminuted fractures of the radial head may be treated with radial head excision with a satisfactory long-term functional outcome. Despite popularity of radial head prostheses, a good functional result can be obtained even without radial head replacement.

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