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Original Article

Evaluation of Mid-Term Results of Radial Head Resection and Lateral Collateral Ligament Repair in the Terrible Triad of the Elbow

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Abstract

Introduction: Radial head resection has been necessary in cases of radial fragmentation. We assessed the results of radial head resection in patients with the terrible triad.

Method: Thirteen patients with terrible triads who had undergone radial head resection and lateral collateral ligament (LCL) repair by a single surgeon from 2004 to late 2020 were studied. Patients were followed for one year and evaluated in terms of the range of motion (ROM), the efficiency of the relevant organ, and radiological factors in patients who could not visit in person; the evaluations were performed using the software. Movements were evaluated with a metal goniometer, and the efficiency was measured using the disability of the arm, shoulder, and hand (DASH), the Mayo elbow performance (MEPS), and the visual analog scale (VAS) scores. The patient's radiography was evaluated for the elbow joint's instability and degree of osteoarthritis.

Results: The mean duration of injury to surgery was 7.30 ± 2.15 days, and the mean follow-up period was 35.19 ± 2.85 months; the mean ROM (Pas, Act) rate was equal to 126.33 ± 10.49 degrees. None of the patients met the criteria for joint instability; of 13 patients, seven were completely satisfied with the surgery, and two returned to their previous jobs. The mean total pain score according to the VAS criteria was 2.6.

Conclusion: Radial head resection and LCL repair in the terrible triad of the elbow led to the individual's improved performance and the patient's reduced pain severity and satisfaction.

Keywords: Terrible triad, Elbow joint, Radial head resection, Lateral collateral ligament repair.

Introduction

Radial head fracture is one of the most common fractures in young people. The mechanism of this fracture is falling in a position in which the person falls on his/her hand [1]. By hitting the palm to the ground, a large amount of force is imposed upwards through the forearm and firmly strikes the radial head into the outer condyle of the humerus, thereby breaking the radial head [2].

Sometimes the fracture is minimal and in the form of a vertical slit in the head of the bone. Sometimes, a slice of the head of the bone is torn off like a slice of cake and moved, or the head of the bone is completely crushed and broken into pieces. During severe fractures, radial head cartilage and the capitulum are severely damaged, too[3]. In radial head fracture, the patient complains of pain in the outer part of the elbow joint. Elbow movements, especially rotational ones, are painful, and pressing a finger on the radius increases pain [4].

There is not much swelling in the elbow area. Forearm rotation may be limited and locked. The final diagnosis is simple using radiography. Of course, radiography may be needed to see the fracture line from specific directions of the elbow joint [5]. If radial head fracture in the elbow area is treated correctly, the patient can

regain his/her elbow performance with the least possible complications [6].

A terrible triad is one of the most complex elbow injuries, including a combination of radial head fracture, coronoid appendage fracture, and ulnohumeral joint dislocation. Its historical naming is due to the poor treatment outcomes of the terrible triad injuries. However, in the last decade, this perception has changed due to understanding the pathophysiology of injury and also the advancement in the treatment of this injury [7, 8]. The classic approach to treating terrible triads currently involves open reduction and fixation of the fracture or prosthesis implantation based on the bone fracture severity [9-11]. Following the restrictions, radial head prosthesis implantation has become problematic in Iran and Shohada Educational and Medical Center (Tabriz, Iran). As a result, radial head resection has been mandatory in cases of radial fragmentation. These marginal issues have provided an exceptional opportunity to study the results of radial head resection in patients with the terrible triad, which will be reported in this study.

Methods

Study protocol

This study is a descriptive retrospective study performed in 2004, using the record information of patients (13 patients) who had undergone surgery from the beginning of 2004 to late 2020 in Shohada Hospital (Tabriz University of Medical Sciences, Iran) as the census method.

Inclusion and Exclusion Criteria

Inclusion criteria included obtaining an ethics code from Tabriz University of Medical Sciences (IR.TBZMED.REC.1398.1052); complete information in the record; patients with fractures and elbow dislocations, including the non-repairable radial head fracture, fracture of the coronoid appendage, elbow dislocation, and lateral collateral ligament (LCL) rupture; and patients who had a fracture with displacement and elbow instability after dislocation reduction and had been in trauma up to six weeks after the surgery. Exclusion criteria included patient dissatisfaction with participation in the study; patient non-cooperation; patient unavailability; and patients who had undergone medial collateral ligament (MCL) repair simultaneously.

Procedure

From the beginning of 2004 to the end of 2020, 25 patients with elbow fractures and dislocations had undergone radial head resection, dislocation reduction, and LCL repair by a single surgeon. All records of eligible patients (25 records) were reviewed, and only 13 records that met the inclusion criteria were included in the study. Using the contact numbers in the records, patients were contacted by telephone. The minimum follow-up period was one year, and patients were examined for at least one year. It should be noted that the examiner (the dissertation owner resident) did not contribute to the treatment of patients. Plain radiography and computed tomography (CT) scans in the record were archived, and the electronic files were extracted.

Coronoid fractures were classified using the Regan-Morrey classification system, and the radial head fractures were classified using the Mason classification system. Subjective measurement of results was performed by the visual analog scale (VAS) for pain (from zero (painless) to 10 (severe pain)). The efficiency rate was investigated via the Mayo elbow performance (MEPS) (for stability, a score of ten and less than ten was the instability degree of the varus-valgus instability, the score of five and more than ten was the instability degree of varus-valgus the score zero was considered). The disability of the arm, shoulder, and hand (DASH) criterion was also evaluated for all patients. The evaluation of posterolateral instability was assessed in telephone interviews using a chair pushup test/standup, which was considered positive if elbow pain occurred along with fear of dislocation. Patients'Patients' satisfaction with surgery was assessed. The measurement of objective results was performed using a metal goniometer. In patients who did not refer in person, the results were measured using Angulus software, whose efficiency has been confirmed in previous studies [12,13]. The amount of flexion, flexion arc, supination, supination arc, pronation, pronation arc, extension, and extension arc was measured. In the case of an extension, the degree was considered harmful; in the case of aligning the arm

and the forearm, a zero, and in the case of extension lag, a dash was drawn in place. The flexion should be subtracted from the flexion arc range to calculate the extension lag.

To evaluate the posterolateral instability, the lateral pivot shift/apprehension test was used in which the forearm was placed in a supination state next to the body in flexion of 20-30 degrees, and the supination and valgus forces were imposed on the elbow with axial force. The feeling of clunk and fear of dislocation indicated the posterolateral instability, and in the case of further flexion of the elbow, the reduction was seen or touched. A negative test was shown with 0, and positive cases were shown with 1.

The varus stress test was used to evaluate the LCL instability, and the valgus stress test was used to evaluate the MCL instability. To perform this test, the patient sits and opens the elbow completely, and the examiner holds the patient's arm with one hand and presses the patient'spatient's forearm inward with the other hand. Care should be taken during the examination for any pain or abnormal movement relative to the healthy elbow. A score of zero was assigned to the stable elbow, a score of one to 10 > laxity (mild laxity with suitable endpoint), a score of two to 10 < moderate laxity with no endpoint, and a score of three to clear instability.

Squeeze Test

This test was used for assessing the Essex-Lopresti lesion after surgery. In the case of pain, when pressing the radius and ulna together and tenderness, the distance between the bone and the tenderness became positive.

Surgery Technique

For patients, elbow front and side views and CT scans were performed to detect the fracture pattern. It should be noted that most patients underwent a closed reduction in other centers (other nearby cities). A closed reduction was performed for other patients in the emergency room under general anesthesia, and long-arm splints were implanted. The supine position was given in the operating room. Half to one hour before surgery, two grams of cefazolin were administered. The tourniquet was tied to the patient'spatient's arm. The Kocher surgery approach was performed to access the radial head and the coronoid appendage. First, type II and III coronoid appendages were fixed; then, if the radial head was unstable, it was resected. Due to the unavailability of the prosthesis in Iran, the radial head was not implanted.

After radial head resection, a pull test was performed to evaluate the axial instability due to damage to the interosseous membrane and the Essex-Lopresti lesion. The patient'spatient's wrist was dorsiflexed completely to perform the pull test during surgery, and the degree of displacement to the proximal radius in the surgical field was assessed. A displacement greater than six mm to proximal was considered the Essex-Leopresti lesion. The varus-valgus test was then performed to evaluate the residual instability. In all cases, the external lateral ligament was repaired using the suture anchor three or the transosseous method and the firewire two suture using the Kurakov technique. After ligament repair, the stability of the elbow joint was assessed by the gravity extension test. The tissue was anatomically repaired, and a small dressing was performed. For four weeks, the long arm splint was closed in a neutral forearm position and the 90° flexion. The active movement protocol for avoiding varus stress was followed during these four weeks.

Statistical Analyses

Frequency, percentage, mean, and standard deviation were used to assess the data.

Results

The results showed that the mean age of the participants was 35.23 ± 5.19 years and the majority of them were women (n = 7). Most participants were right-handed and in only two individuals, the injury was in the non-dominant hand. The classification of coronoid fractures in seven individuals was in grade one and that of radial head fractures in all individuals was in grade three. The mean duration of injury to surgery was 7.30 ± 2.15 days and the mean follow-up period was 35.19 ± 2.85 months (Table 1). The evaluation of the measured parameters regarding elbow stability showed that the scores obtained in the valgus, varus, and posterolateral rotatory parameters were equal to zero for all patients. Also, regarding strength, by examining the parameters of flexion, extension, pronation, and supination, the obtained scores were equal to 5, and only in the grip strength parameter, different scores were observed in

the participants (most individuals had obtained a score of 4.5) (Table 1). The mean range of motion (ROM) for patients included mean flexion arc = 104, mean pronation arc = 76, and mean supination arc = 70, and three patients had complete elbow extension (extension = 0); the extension score was zero in three patients (Table 2).

Table 1: Basic information of patients participating in the study

Patient No	Age	Sex	Job	Dominant hand	Injured hand	Classification of Coronoid fractures	time between fracture surgery (Day)	Duration of follow-up (Month)	Grip Strength
1	51	Male	Technical	Right	Right	Class I	4	12	**4.5**
2	33	Male	Employee	Right	Right	Class I	30	56	**4.5**
3	48	Male	Representation	Right	Left	Class I	40	170	**4.5**
4	46	Female	housewife	Right	Right	NO	1	41	**4.5**
5	29	Male	Agriculture	Right	Right	Class II	4	12	**4.5**
6	57	Female	housewife	Right	Right	Class II	2	132	**4.5**
7	36	Male	Free	Left	Right	Class I	3	12	**4.5**
8	66	Female	housewife	Left	Right	NO	3	18	**5**
9	57	Female	housewife	Right	Right	Class I	7	12	**5**
10	41	Female	Tailoring	Right	Right	Class I	1	13	**4.5**
11	58	Female	housewife	Right	Right	Class II	3	17	**4.5**
12	57	Female	housewife	Right	Right	NO	15	13	**3**
13	28	Male	worker	Right	Right	Class I	8	14	**4**

Table 2: The evaluation of elbow performance in patients participating in the study

Patient No	Supination ARC	Pronation ARC	Supination	Pronation	Extension ARC	Flexion ARC	Extension	Flexion
1	43	91.4	43	91.4	-	62	-	102
2	56	99	56	99	-	126	-	126
3	70	60	70	60	-	140	-	140
4	68	86	68	86	-	112	-	136
5	48	89	48	89	-	98.3	-	125.4
6	82.5	89.5	82.5	89.5	-	105	-	129.3
7	78.8	46.6	78.8	46.6	-	105.4	-	129
8	70	60	70	60	-	100	0	100
9	80	70	80	70	-	100	0	100
10	51.9	87.9	51.9	87.9	-	101.1	-	122.6
11	70	60	70	60	-	100	0	100
12	33.5	75.9	33.5	75.9	-	80.5	-	120.5
13	39.3	77.5	39.3	77.5	-	120	-	140.9

The mean evaluation rate of an individual regarding his/her postoperative performance was 2.61. The mean postoperative performance results of patients including mean MEPS = 78, mean DASH score = 16.5, and mean DASH work module = 79.19 were calculated for twelve patients due to lack of jobs. The DASH sport/performing art score = 27.6 was calculated for seven patients.

The way to fix coronoid fractures was performed by the suture in three patients and by the screw and plate in three patients, and in four patients, no action was taken. In three patients, the coronoid was healthy, and the elbow joint was

stable in all patients (Table 4). Four of the studied patients still need to return to their previous jobs. The reason for patient number 1 was being an employer and not needing to do manual labor. Patient number 7 was mentioned as being self-employed and not needing manual labor. Patient number 12 was a housewife, and the reason in patient number 13, a garden worker, was unemployed for not returning to their previous job. Finally, the mean patient satisfaction was equal to one (Table 4). None of the patients had proximal migration of the radius and ulnar nerve injury, MCL repair, heterotopic ossification, post-traumatic osteoarthritis, ulnar variance, and proximal radius and ulnar synostosis (Pas-ROM) (Table 4).

The mean total pain severity in patients based on VAS was equal to 4. Five patients had no pain during the day and night, and eight patients reported elbow pain. Five patients reported the site of pain behind the elbow; one reported it inside and outside and in front of the elbow; one mentioned the site of pain in the front and inside, and one reported it in front of the elbow and wrist. In patients with pain, the mean pain at rest was 5, while lifting heavy objects was 4; during repetitive elbow, movements was 4.5; at night was 5, and at worst was 5 (Table 5).

Table 3: Evaluating the results of performance tests of patients participating in the study

Patient No	individual regarding his/her postoperative performance	Sport DASH	Work Module DASH	DASH	Mayo Elbow
1	2.03±0.49	-	56.25	32.5	50
2	2.51±0.41	100	37.5	28.3	70
3	3	0	0	0	100
4	3	-	12.5	2.5	70
5	3	-	25	0.83	95
6	3	0	0	0	100
7	2.09±0.19	-	0	25.8	50
8	3	-	0	0.83	100
9	1.24±0.15	-	75	61.66	40
10	3	0	0	2.5	100
11	3	0	0	6.66	85
12	2.64±0.15	43.75	31.25	18.33	65
13	2.48±0.21	50	-	34.1	85

Table 4: The evaluation of fracture fixation, return to the previous job, and patient satisfaction

Patient No	ROM		Patient satisfaction	Return to previous work	How to fix a coronoid fracture
	Act	Pas			
1	62	62	2	No	Sutur
2	126	126	5	Yes	None
3	110	110	0	Yes	Sutur
4	112	112	2	Yes	None
5	98	98	0	Yes	Screw and Plate
6	105	105	0	Yes	Screw and Plate
7	106	106	5	No	None
8	100	100	0	Yes	None
9	100	100	2	Yes	None
10	122	122	0	Yes	None
11	110	110	0	Yes	Sutur
12	120	120	2	No	Screw and Plate
13	120	120	0	No	None

Table 5: The evaluation of the pain experienced in different states and general pain of patients participating in the study

Patient No	pain in different situations							
	pain intensity based on VAS	Painful area	At night	Repetitive elbow movements	lifting heavy objects	At rest	Worst case	**Do you have elbow pain?**
1	8	Posterior Elbow	4	10	10	9	7	Yes
2	5	Posterior Elbow	10	2	0	2	2	Yes
3	0	No	10	10	10	10	10	No
4	8	Posterior Elbow	6	4	4	8	6	Yes
5	2	No	10	10	8	10	10	No
6	0	-	10	10	10	10	10	No
7	5	Inside and outside the Anterior elbow	4	5	0	4	6	Yes
8	0	-	10	10	10	10	10	No
9	7	Anterior and inside the elbow	7	0	0	7	7	Yes
10	7	Posterior Elbow	1	2	2	0	1	Yes
11	2	-	10	10	10	10	8	No
12	3	Posterior Elbow	7	7	9	7	8	Yes
13	4	Anterior elbow and wrist	3	6	5	4	2	Yes

Discussion

The mean ROM of patients included mean flexion arc = 104, mean pronation arc = 76, and mean supination arc = 70, and three of the 13 patients had complete elbow extension; these results are comparable to the results of a study by Yaiza Lopiza (2016), who examined 25 patients, and flexion and extension in their study were 105.2 ± 15 [14].

In a review article by Swensen et al. (2019) entitled ""Maximum Improvement in the Treatment of Radial Head Fractures,"" it was shown that the radial head played a critical role in elbow stability and ROM. Therefore, surgery was usually performed through a lateral approach. Joint stiffness is commonly seen after the injury to the radial head. If an early aggressive ROM is performed, it can prevent joint stiffness, and the ability to perform intense premature movements stems from elbow stability. Radial head resection leads to posterolateral rotatory instability due to the loss of contact of the anterior lateral edge of the radial head with the capitulum and the reduction of LCL extension. If the LCL is healthy, the radial head will be less critical for maintaining posterior lateral stability, indicating that LCL repair is essential for maintaining overall elbow stability [15].

In F. Najd Mazhar's study, as a retrospective study with the participation of 44 patients, the results of radial head resection of the split fracture were compared in two groups, including patients without prosthesis implantation (15 patients) and patients with radial head prosthesis implantation (29 patients). The number of women in the group with radial head implantation was 6 (40%), and in the resection group was 10 (34.5%). The mean age in the resection group was 40.7 years (SD = 13.6), and in the implantation group was 36 years (SD = 9.4). The mean follow-up period of patients (SD = 12) in the resection group was 24.4 months, and in the prosthesis implantation group was equal to 45.8 months (SD = 6.8). Based on the results, the two groups' mean ranges of flexion, extension, supination, pronation, VAS, MEPS, and DASH were not statistically significant. In the last examination, the elbow was stable in all patients. The Essex-Lopresti lesion was not observed in any of the patients. Osteoarthritis grade one (5 patients) and grade two (3 patients) were observed in

the resection group, and osteoarthritis grade one (4 patients) and grade two (one patient) were observed in the prosthesis implantation group. This study concluded that the results of terrible triad treatment were the same, whether the treatment was performed with radial head resection or with radial head prosthesis implantation. Mean performance results based on mean MEPS = 78 and mean DASH score = 16.5, being comparable to the findings of the study mentioned above, include mean VAS (SD) = 1.76 (0.8), mean MEPS (SD) = 91.7 (9.5), and mean DASH (SD) = 9.5 (7.1). In the present study, in addition to the total DASH score, work DASH score was performed for 12 patients to evaluate the patient's performance quality and level, whose mean was 19.8. The sport/arc performance DASH score was performed for seven patients with a mean score of 27.6, indicating that this method was satisfactory [16].

In Ahmad Afifi et al. research (2020) as a prospective cohort study aiming to compare the fixation of radial head fractures and radial head prosthesis implantation in 30 patients from 2016 to 2019, it was found that the rate of quick-DASH in these patients was equal to 5 ± 2.3 and that of MEPS was equal to 93.6 ± 8.6 one year after surgery in the bone fixation group. Also, the rate of MEPS was 90.9 ± 9.4, and that of quick DASH was 7.1 ± 7.1 one year after surgery in the radial head implantation group, which is comparable to the results of the present study [17].

In Ferdinand Nyankue Mebuinz's research (2020), which was a retrospective descriptive study conducted on 11 patients aiming to evaluate the results of elbow performance after radial head resection, 11 patients (3 women and eight men) who had undergone radial head resection from 2008 to 2018 were evaluated by the Mayo Elbow Performance Index (MEPI). The mean follow-up period was 47.6 months, and the mean age was 41 ± 10.3 years. The results showed that nine patients had stable and painless elbows; the mean flexion-extension arc was 97.73 ± 16.03. The mean pronation and supination were equal to 76.8 and 74.5 degrees, and the mean MEPI was 83.2. Overall performance return was achieved in 81% of patients. Poor performance was observed in one out of 10 cases. This study concludes that radial head resection returns elbow performance in 81% of patients and is associated with good performance results in patients. These results are comparable to the results of the present study [18].

In Weijun Guol's study (2020), 166 patients were evaluated as a systematic review since 2004 with the review of related articles. This study reviewed all studies on injuries that had undergone conventional surgery, and the performance results were summarized. They hypothesized that conventional surgical protocols would improve clinical outcomes and reduce complications. However, risks remained, and new challenges emerged and affected the prognosis. The score of the ROM and complications evaluated the results. Eleven studies with 166 patients were included in the research. The mean follow-up period was from 14.8 to 41 months. The mean flexion arc ranged from 99 to 127 degrees, and the mean forearm rotation was 80 to 156 degrees. The mean MEPS score was 78 to 96. The mean Broberg-Morry score was also equal to 76-90. The most common complications were heterotopic ossification (0-31%), post-traumatic osteoarthritis (0-38%), neurological complaints, dislocations, partial dislocations, and joint stiffness. The researchers concluded that the performance results after the terrible triad surgery indicated that the surgery protocols had made the terrible triad of the elbow so-called less terrible, that is, had improved it. However, surgeons should consider unrelated cases and prosthesis-related complications to improve the results [19]. Although with the prosthesis implantation, the ROM of the elbow is relatively improved, the above-mentioned prevalent complications can be a challenge for the widespread use of radial head prostheses. The above complications are less in radial head resection.

In Ayush Singh's research (2019), as a retrospective descriptive study, 32 patients aged 22 and 60 years with Mason type II/III radial head fractures were evaluated based on Mayo elbow scoring in two groups of radial head resection group and radial head replacement group. After six months, radial head arthroplasty gained perfect results in two patients, good in 5 patients and poor in eight. Eighteen months later, two out of 17 patients gained perfect results in the arthroplasty group, and two gained poor results. In the group undergoing radial head resection, out of 15 patients, seven (46.7%) gained perfect results, and seven gained good results. Six patients (35.3%) gained poor results in the arthroplasty resection group. In the sixth month of the follow-up, the mean and standard deviation of scores by Mayo score was 86.82 ± 18.66 in the arthroplasty group and 85.66 ± 10.66 in the resection group. In the 18th month of the follow-up, this value was 75 ± 14.89 in the arthroplasty

group and 90.66 ± 7.98 in the resection group. The difference between the results was statistically significant (P <0.001). This study concludes that radial head resection's short-term and long-term results are practically better compared to arthroplasty in split radial head fracture based on Mayo elbow scoring. The finding of the Mayo scoring in this study is comparable to the finding of the present study [20].

In the Nestorson Jens's study (2017), 18 patients with Mason IV dislocation fractures with a mean age of 56 years (19-79 years) who had undergone radial head arthroplasty at Linköping Hospital, and 14 patients with a mean age of 50 years (29-70 years) with the same injury who had undergone radial head resection at Malmo Hospital, were evaluated. At the mean two-year follow-up, performance results were assessed by MEPS, DASH, and ROM, as well as instability and plain radiography. This study concluded no significant difference between the MEPS, DASH, and ROM groups. The re-surgery rate was higher in the arthroplasty-treated group. Olenohumeral osteoarthritis was evident in the resection group; the follow-up time was longer. Performance and ROM results were much better in line with previous reports. In short, researchers concluded that the performance results between radial head resection with arthroplasty and LCL repair were the same. However, changes in osteoarthritis in the group treated with radial head resection were more incredible. The performance results of radial head resection and LCL repair in this study on 14 patients included the mean MEPS equal to 100, with perfect results in 9 patients, good results in two patients, fair results in one patient, and poor results in two patients. The mean DASH score was 12, and there was no statistically significant difference in MEPS and DASH scoring performance measurement. The above findings are comparable to the findings of the present study [21].

Peter G. FizGibbons' study (2014), which was a retrospective study carried out over seven years on 11 patients over 18 years of age with the terrible triad of the elbow, radial head fixation was performed on some of them. Some underwent radial head replacement and the repair of anterior capsules or the coronoid head fracture fixation and LCL repair. The follow-up period was 38 months. The mean arc of motion was 112, the mean DASH score was 19.7, and the mean VAS was 2.2. In the mentioned study, grip strength was measured with the pound unit (Ib) and compared with the DASH value with the opposite upper limb that had not undergone surgery and was healthy. None of the patients had joint instability, comparable to the present study's findings. It is noted that the study's authors did not have access to two patients, so they sent the DASH and VAS questionnaires to them by email [22].

In a systematic review by Hong Wei Chen (2014) involving 312 patients performed, aiming to sum up the performance results of remaining complications after the surgery of the terrible triad of the elbow, all retrospective and prospective studies published in English were examined. Sixteen studies were entered into the study. The mean follow-up period of patients was 25 to 30 months. The mean MEP score ranged from 78 to 95. The mean DASH score ranged from 9 to 31. The number of patients who needed pre-surgery due to complications was in the range of 0 to 54.5% (70 out of 312 patients-22.4%). The most common complications were joint stiffness, instability, and ulnar nerve injury. The highest complications that did not need re-surgery were heterotopic ossification in 39 out of 312 patients (12.5% of patients) and arthritis in 35 out of 312 patients (11.2%). In this study, none of the patients complained of devices, joint stiffness, joint instability, and ulnar nerve injury. Improper osteogenesis and arthritis were not observed. None of the patients required re-surgery. In general, the performance results of the present study are consistent with the systematic review results. In the present study, in evaluating the Essex-Lopresti lesion, only one of the patients had wrist pain that was not found in the examination. All patients were satisfied with the surgery. Patients' activity was satisfactory after surgery. All patients had good muscle strength and could pick up shopping items [12].

The small size of the examined samples due to the low prevalence of the fractures of the terrible elbow triad and the lack of engagement of fracture mechanism were some limitations of this study. Limited access to patients and the use of telephone interviews and video interviews were among other limitations of this study. On the other hand, limited access to radial head prosthesis was another limitation of the present study. It is recommended that the limitations of this study be resolved in future studies and that the method used in this study be used in treating patients.

Conclusion

The mid-term results of radial head resection and

LCL repair in the terrible triad of the elbow led to individual improved activity and patients' reduced pain severity and satisfaction.

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Conflict of Interest Disclosures

None.

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Vice presidency for research at Tabriz University of Medical Sciences

Authors' Contributions

All authors contributed equally in the study.

Ethical Statement

Before any action, this project was approved by the ethics committee of Tabriz University of Medical Sciences; informed consent was then obtained from all patients; the aims of the study were explained in simple words to all patients so that they enter the study with full awareness. The researchers adhered to all the standards of the Helsinki Declaration.

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