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Research Article

Functional Postoperative Outcome for Mason type II and III radial head fractures treated with excision and fixation

Erfanul Huq Siddiqui[1*], Sheikh Forhad[2], Jannat Sultana[3], Shah Muhammad Aman Ullah[4], A. K. Al Miraj[5]

[1]Medical Officer, Department of Orthopaedic Surgery, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh
[2]Medical Officer, Department of Orthopaedic Surgery, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh
[3]Medical Officer, Department of Paediatric, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh
[4]Medical Officer, Department of Burn and Plastic Surgery, Dhaka Medical College Hospital (DMCH), Dhaka, Bangladesh
[5]Research Assistant, Department of Vascular Surgery, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh

***Corresponding author**
Erfanul Huq Siddiqui

Abstract: ***Introduction:*** Fractures of the radial head constitute approximately one-third of all elbow fractures. Management of Mason type III fractures is equally controversial, with management options including conservative management, simple excision, prosthetic implant replacement, and open reduction and internal fixation. With improvised surgical procedures and availability of highly sophisticated implants and instruments, open reduction and internal fixation (ORIF) of these fractures has become more common. However, the associated complications and outcome of elbow function for both radial head excision and ORIF in managing Mason type II and type III fractures remain yet to be systematically evaluated. ***Methods:*** A retrospective study was initiated in the Department of Orthopaedic Surgery, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh from July 2011 to December 2012. The study sample included 24 patients with age group ranging from 20 to 66 years and already diagnosed with acute closed uncomplicated Mason type II and type III fractures of radial head. Equal number (n=12) of males and females were selected. ***Results:*** The study comprised of 24 patients with Mason type II and type III acute fractures of the radial head. Their age group ranged from 20 to 66 years. They were grouped into two categories viz., 12 patients who had their radial heads removed (Group I) and 12 patients who had ORIF with Herbert screws/ mini-plates (Group II). During final follow-up, range of motion, radiographic and complications data were collected from patients and functional outcome measures of the elbow were estimated. The rating system of Broberg and Morrey was used to evaluate elbow function. It was observed that the functional rating score averaged 84 points in Group I and 96 points in Group II. Hence, we conclude that the patients who received ORIF had better functional outcome than those who received excision. After radial head excision, the complications recorded were proximal radial migration (n=2) and peri- articular ossification (n=2). When compared with radial head excision treatment, ORIF was found to be better management procedure in terms of adequate joint motion, better function and more strength. ***Conclusion:*** These findings suggest the use of ORIF as a more efficient therapeutic option for Mason type II and III radial head fractures.
Keywords: Fractures of Radial Head, Herbert Screws, Excision, Fixation.

INTRODUCTION

Fractures of the radial head constitute approximately one-third of all elbow fractures. Management of Mason type III fractures is equally controversial, with management options including conservative management, simple excision [1], prosthetic implant replacement [2,3], and open reduction and internal fixation [4]. Women between 50-60 years and men between 30-40 years have been found to have a greater rate of these injuries [5]. Four categories of radial head fractures were described by Mason according to their severity [6]. Un-displaced or mildly displaced fractures were classified as Mason type I. Although previous guidelines suggested that Mason type II fractures with the fracture fragment involving more than 25% of radial head were best treated by reduction and fixation [4], indications for fixation have evolved [7] and opinions differ as to the best method of fixation [7]. Radial head fracture is a very attractive option because of it ease, shorter duration of surgery, and absence of any

implant related complications. But more and more surgeons are now opting for osteosynthesis, especially for Mason type III fractures, due to the availability of newer implants and understanding of biomechanics. Due to the complexity and comminution of some Mason type III injuries, we hypothesized that difficult Mason III injuries might be better managed with resection rather than reconstruction. Fractures involving displacement, depression, or angulation>2mm were classified as Type II injuries. Comminuted fractures of the entire radius head are included in Type III and radial head fracture along with dislocation of the elbow joint are included in Mason type IV. In the past, when nonsurgical care for elbow fractures failed, radial head excision surgery was adopted for Mason type II & III fractures. However, with the advent of improved sterile surgical procedures and instruments Open reduction and internal fixation (ORIF) of type II and type III injuries are becoming more prevalent [8,9]. For management of Mason type I fractures of radial head the conservative method of using a splint or sling for a few days [10] is the treatment of choice. In Mason type II radial head fractures minimally, invasive treatment is done by intramedullary pinning. ORIF exhibited more complications and its superiority to conservative therapy for partially displaced radial head fractures was doubtful [11]. There is still insufficient data to determine which type of radial head fracture care is preferable [12]. Favorable results were also obtained related to ORIF for comminuted complications of radial head fractures [9]. Radial head arthroplasty was observed to have better functional outcome than open reduction internal fixation [13]. The present study examines the problems that occur in the treatment of Mason type II and type III radial head fractures, with radial head excision and ORIF methods using Herbert bone screws and mini-plates followed by the evaluation of the outcomes of elbow function.

MATERIALS AND METHODS

After receiving institutional ethical approval and after obtaining informed consents from all patients, a retrospective study was initiated in the Department of Orthopaedic Surgery, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh from July 2011 to December 2012.

Study population

The study sample included 24 patients with age group ranging from 20 to 66 years and already diagnosed with acute closed uncomplicated Mason type II and type III fractures of radial head. Equal number (n=12) of males and females were selected. The study excluded patients with Mason type I and IV fractures and also patients with head injuries, solid organ injuries, ipsilateral upper limb injuries, pathological fractures, skeletal immaturity, osteoarthritis of the elbow or concomitant neurovascular injuries and also those who refused to participate. Two groups of patients were created. The Group I included 12 patients who underwent radial head excision, whereas the Group II included 12 patients who underwent ORIF with Herbert screws/ micro-plates.

Operative procedure

The benefits and drawbacks of both treatments were thoroughly presented to the patients, taking into account the nature of injury, degree of displacement and comminution, day-to-day activities, professional position and financial status among other factors. After obtaining medical fitness details, preoperative antibiotics were administered six hours prior to surgery. Under general anaesthetic or brachial block, the patient was placed in supine position on the orthopaedic table with the elbow kept in 90- degree flexion, shoulder in internal rotation, and forearm in mid- pronation. Both the surgical procedures used a lateral Kocher's approach (fig. 1) to the proximal radius, where the intermuscular plane between the extensor carpi ulnaris and the anconeus muscle was made [14-16].

(a) **(b)**

Figure 1: Radial head exposure using Kocher's approach for (a) excision (b) fixation with Herbert screws

For patients in Group I, the displaced and comminuted fragments were carefully removed without further damage, and using an osteotome the radial head was osteotomized (fig. 1a). In Group II the fragments were reduced and stabilized with k wires and fixation was done using Herbert screws/ mini-plates [17] (fig. 1b). Postoperatively, a plaster of paris slab was placed above the elbow and left in place for three weeks.

Intravenous antibiotics were administered until the third postoperative day, after which oral antibiotics were administered until the sixth postoperative day. On postoperative day 12, the sutures were removed and the patient was discharged. The removal of slab was performed after 3rd week and beginning of elbow rehabilitation was observed afterwards.

Evaluation

Postoperative reviews were carried out during final follow-up. The range of motion (flexion, pronation and supination) was documented using photographs and using the Broberg and Morrey scoring system, evaluation of patients elbow function were rated [18]. Final X-ray evaluations were also carried out to assess the fracture healing as shown in figs. 2 - 4.

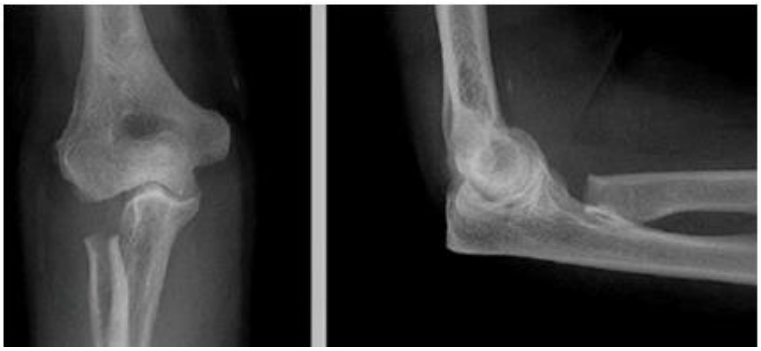

Figure 2: Radiographs at final follow-up of radial head excision

Figure 3: Radiographs at final follow-up of ORIF with mini-plate

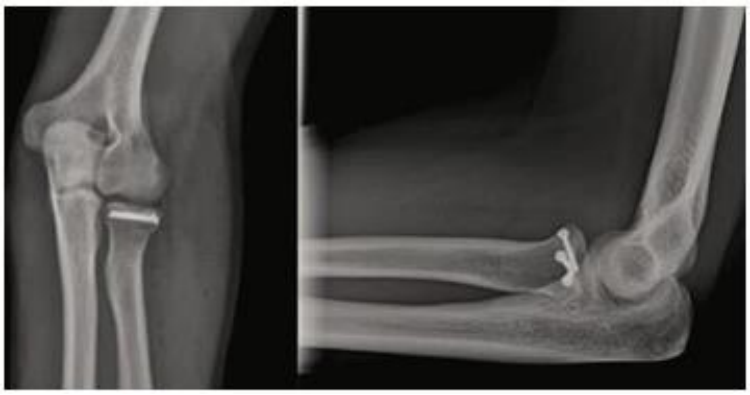

Figure 4: Radiographs at final follow-up of ORIF with Herbert screw

Statistical analysis

The data were analyzed using Microsoft Excel, statistical package for social sciences (SPSS Inc., Chicago, Illinois, USA) version 20 (IBM). Descriptive statistics (mean, standard deviation and proportions) were used to summarize the study variables. The 95% confidence intervals (CI) for difference of mean were used. Range of motion, grip strength, functional stability, and pain are all factors in the Broberg and Morrey system functional evaluation score for the elbow, which ranges from 0 to 100 [18]. A questionnaire survey on pain, impairment, and elbow disability was included in the outcome evaluation. Chi-square test was used to observe an association between the qualitative study and outcome

variables. Unpaired t-test was used for analysis of quantitative data. A two-sided p-value of less than 0.05 was considered statistically significant.

RESULTS

Total 24 patients with age group ranging from 20 to 66 years and already diagnosed with acute closed uncomplicated Mason type II and type III fractures of radial head. Broberg and Morrey's elbow functional evaluation criteria were used to track all of the patients. If the result was good or excellent, it was deemed satisfying; if it was fair or poor, it was regarded unsatisfactory. The typical photographs of range of motion (flexion, pronation and supination) and stability are shown in figs. 5 and 6 for excision and fixation respectively. In Group I (Table 1), the Broberg and Morrey functional rating score averaged 84.4 points (range, 73 to 91 points) while in Group II (Table 2), the score averaged 96.1 points (range, 90 to 99 points) ($p = 0.032$). In Group I, the outcome was graded as good for eight patients and fair for two, according to this rating method.

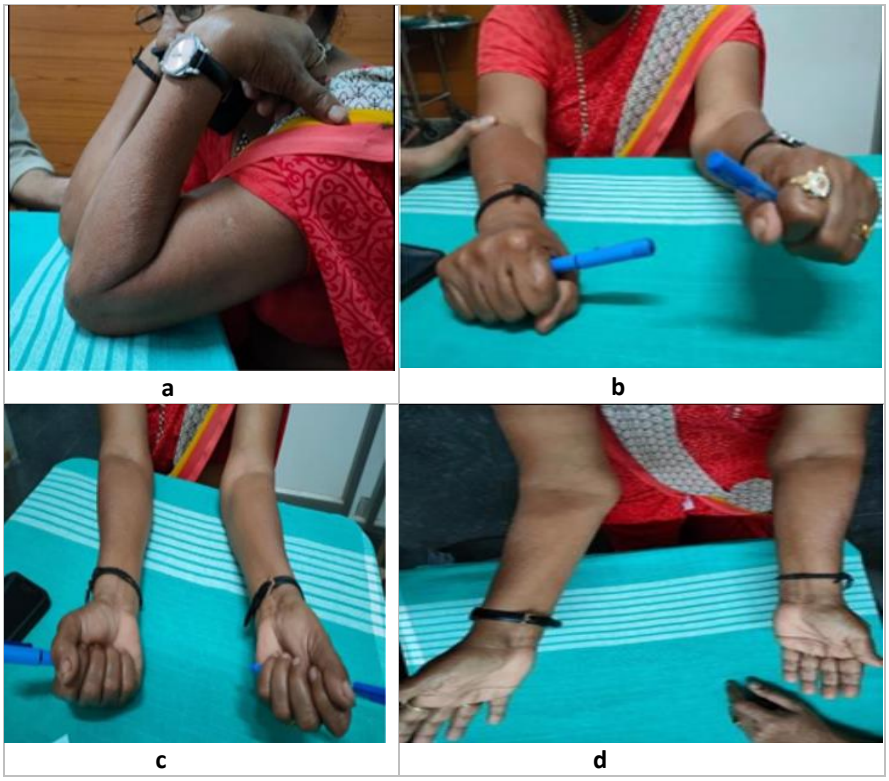

Figure 5: Functional outcomes (a) flexion (b) pronation (c) supination (d) stability during final follow-up of patient 1 of Group I

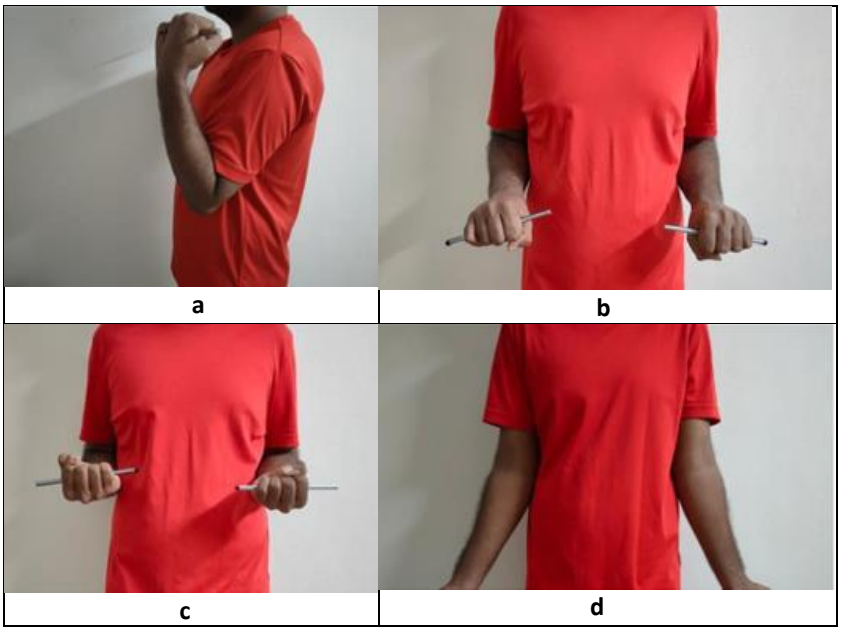

Figure 6: Functional outcomes (a) flexion (b) pronation (c) supination (d) stability during final follow-up of patient 2 of Group II

Table 1: Group I Broberg and Morrey scores

No.	Age (years)	Sex	Type of fracture	Follow up (weeks)	Motion		Strength	Stability	Pain	Total	
					Flexion	Pronation/ supination					
1	50	F	III	351.6	135	50/60	5	2	28	73	FAIR
2	38	F	II	219.4	120	60/60	13	4	35	88	GOOD
3	50	F	III	216.4	135	50/50	20	4	28	89	GOOD
4	44	F	III	195.3	125	50/50	13	4	35	87	GOOD
5	45	F	III	173.5	120	50/60	20	5	28	88	GOOD
6	24	M	III	125.3	135	50/60	13	5	35	91	GOOD
7	31	M	III	112.2	115	40/50	20	4	28	84	GOOD
8	50	F	II	105.1	120	50/50	13	2	28	77	FAIR
9	32	M	III	81.3	125	50/50	13	4	28	80	GOOD
10	35	M	III	115.2	128	50/50	13	4	28	80	GOOD
11	42	F	II	162.2	122	50/50	13	4	35	87	GOOD
12	35	M	II	117.2	125	50/50	13	4	35	87	GOOD
Mean	39.9			169.7	125.5	50/53	14.3	3.8	30.8	84.4	GOOD

Table 2: Group II Broberg and Morrey scores

Age (years)	Sex	Type of fracture	Follow up (weeks)	Fixation material	Motion		Strength	Stability	Pain	Total	
					Flexion	Pronation/ supination					
47	**F**	II	302.4	Mini-plates	135	50/60	20	5	35	91	EXC
27	**M**	II	341.5	Mini-plates	135	60/70	20	4	35	99	EXC
20	**M**	III	164.3	Mini-plates	125	60/60	20	5	28	90	GOOD
44	**M**	II	93	Herbert screw	130	60/60	20	5	35	98	EXC
23	**M**	II	92	Herbert screw	135	50/60	20	5	35	98	EXC
66	**F**	II	62.4	Mini-plates	135	60/60	20	5	35	99	EXC
34	**M**	III	37.4	Herbert screw	135	60/70	20	4	28	92	GOOD
29	**M**	II	133.4	Herbert screw	130	60/60	20	5	35	98	EXC
32	M	II	133.4	Herbert screw	130	60/60	20	5	35	98	EXC
60	F	II	169.2	Mini-plates	130	60/70	20	4	35	98	EXC
36	**F**	III	131.4	Mini-plates	125	60/70	13	5	35	91	GOOD
62	**F**	II	169.2	Mini-plates	130	60/70	20	4	35	98	EXC
38.8			152.7		131.5	58/64	19.3	4.7	33.6	96.1	EXC

In Group II, the outcomes of seven patients were excellent, and for three patients the outcome was good. In Group I Proximal radial migration was observed in two of the 12 patients and also it was observed that two of the ten patients had peri-articular ossification (Table 3). No other complications were observed in Group I patients and Group II patients. During the follow-up no patient was observed to develop osteoarthritis in both groups.

Table 3: Rates of complications in Groups I and II during follow-ups

Difficulties	Excision	Fixation
Proximal radial migration	2	0
Osteoarthritis	0	0
Peri-articular ossification	2	0
None	8	12
Total	**12**	**12**

DISCUSSION

Fractures of the radial head are among the most common elbow fractures in adults [19] and accounts for 15% to 45% of injuries around elbow joint [20,21]. Since 1954, when Mason [22] first provided classification of radial head fractures, the management is still controversial. In earlier times due to lack of fixation techniques, resection was considered as gold standard for type II and type III fractures of the radial head. Mason suggested that 'If in doubt, resect' [22]. In 1962, Johnston mentioned radial head as an important lateral column stabilizer and was in favor of preserving radial head if feasible [19]. With current advances and better understanding of elbow biomechanics and with the advent of new implants, osteosynthesis is emerging as the technique of choice [4]. After radial head excision,

several studies have observed problems such as proximal radial migration and peri-articular ossification [23,24]. In the 1980s when the radial head was found as a secondary stabiliser of the elbow joint, reconstruction of the radial head became popular [25]. As surgical techniques and technology improved in the 1990s, radial head fixation became more important [10]. In the present study, Broberg and Morrey scores of elbow function were compared between the radial head excision (Group I) and ORIF (Group II). Comparative study clearly indicates that the ORIF group had significantly higher Broberg and Morrey ratings than the radial head excision group. Patients who received ORIF of the radial head had relatively better functional outcomes in terms of elbow function. These findings were similar to those of Ikeda et al [26] who found that the Broberg and Morrey functional scoring system averaged 81.4 points in the radial head excision group and 90.7 points in the ORIF group in a series of 28 patients with isolated type III Mason's radial head fractures. Relatively longer immobilization was done in patients of reconstruction group in Mason III to promote fracture healing which might have led to relatively low functional score. Reconstruction of radial head was done using various implants which was decided intraoperatively by chief surgeon depending on pattern of fracture which may have caused bias. Mini plate could not be used because of its poor availability which we think could have aided in early rehabilitation in Mason III and therefore better results. Also, the sample size in our study was low and a power analysis was not done.

CONCLUSION

We conclude that in this study ORIF of Mason type II and type III fractures of radial head have a better functional outcome and lower complication rates. Hence, this procedure is more effective treatment option compared to radial head excision. Our results need to be interpreted with caution because of the retrospective nature and other limitations of the study. Long-term, prospective studies with larger patient groups are required for a definite judgment.

REFERENCES

1. Bakalim G. Fractures of radial head and their treatment. Acta Orthopaedica Scandinavica. 1970;41(3):320–31. doi: 10.3109/17453677008991518.
2. Galindo Martens E, Fernández Domingo A, Sainz Lozano FJ, Sánchez Moreno J. Indicaciones y resultados quirúrgicos de las fracturas de la cabeza radial. Rev Esp Cir Ortopédica Traumatol. 2006;50(1):14–21.
3. Kaas L, Jupiter JB, van Dijk CN, Eygendaal D. Management of radial head fractures: current concepts. Shoulder & Elbow. 2011;3(1):34–40
4. Müller ME, Allgöwer M, editors. Manual of internal fixation: techniques recommended by the AO-ASIF group. Springer Science & Business Media: 1991.
5. Kaas L, van Riet RP, Vroemen JP, Eygendaal D. The epidemiology of radial head fractures. Journal of shoulder and elbow surgery,2010:19(4):520-523.
6. Iannuzzi NP, Leopold SS. In brief: The Mason classification of radial head fractures. Clinical Orthopaedics and Related Research,2012:470:1799-1802.
7. Rosenblatt Y, Athwal GS, Faber KJ. Current recommendations for the treatment of radial head fractures. Orthop Clin North Am. 2008;39(2):173–85.
8. Nalbantoglu U, Kocaoglu B, Gereli A, Aktas S, Guven O. Open reduction and internal fixation of Mason type III radial head fractures with and without an associated elbow dislocation. The Journal of hand surgery,2007:32(10):1560- 1568.
9. Pearce MS, Gallannaugh SC. Mason type II radial head fractures fixed with Herbert bone screws. Journal of the Royal Society of Medicine,1996:89(6):340P-344P.
10. Kodde IF, Kaas L, Flipsen M, van den Bekerom MPJ, Eygendaal D. Current concepts in the management of radial head fractures. World journal of orthopaedics,2015:6(11):954.
11. Yoon A, King GJ, Grewal R. Is ORIF superior to nonoperative treatment in isolated displaced partial articular fractures of the radial head? Clinical Orthopaedics and Related Research,2014:472:2105-2112.
12. Struijs PAA, Smit G, Steller EPh. Radial head fractures: effectiveness of conservative treatment versus surgical intervention. Archives of orthopaedic and trauma surgery,2007:127(2):125-130.
13. Sun H, Duan J, Li F. Comparison between radial head arthroplasty and open reduction and internal fixation in patients with radial head fractures (modified Mason type III and IV): a meta-analysis. European Journal of Orthopaedic Surgery & Traumatology,2016:26(3):283-291.
14. Tejwani NC, Mehta H. Fractures of the radial head and neck: current concepts in management. JAAOS-Journal of the American Academy of Orthopaedic Surgeons,2007:15(7):380-387.
15. Rosenblatt Y, Athwal GS, Faber KJ. Current recommendations for the treatment of radial head fractures. Orthopedic Clinics of North America,2008:39(2):173-185.
16. Capo JT, Dziadosz D. Operative fixation of radial head fractures. Techniques in Shoulder & Elbow Surgery,2007:8(2):89-97.
17. Wu PH, Dixit A, Kiat Tan DM, Shen L, Chee YH. Prospective study of surgical fixation of radial head fractures using cannulated headless compression screws for simple and complex radial head fractures. Journal of Orthopaedic Surgery,2017:25(2):1-8.
18. Broberg MA, Morrey BF. Results of delayed excision of the radial head after fracture. The Journal of bone and joint surgery. American,1986:68(5):669-674.

19. Johnston GW. A follow-up of one hundred cases of fracture of the head of the radius with a review of the literature. Ulster Med J. 1962;31:51–6
20. Jones SG. Fractures of the Head and Neck of Radius—Separation of Upper Radial Epiphysis. New England Journal of Medicine. 1935;212(20):914–7.
21. Murray R. Fractures of the head and neck of the radius. British Journal of Surgery. 1940;28(109):106–18.
22. Mason ML. Some observations on fractures of the head of the radius with a review of one hundred cases. Br J Surg. 1954;42(172):123–32.
23. Catellani F, De Caro F, De Biase CF, Perrino VR, Usai L, Triolo V, Ziveri G, et al. Radial head resection versus arthroplasty in unrepairable comminuted fractures Mason type III and type IV: a systematic review. BioMed research international, 2018.
24. Hildebrand AH, Zhang B, Horner NS, King G, Khan M, Alolabi B. Indications and outcomes of radial head excision: a systematic review. Shoulder & elbow,2020:12(3):193-202.
25. O'Driscoll SW, Jupiter JB, King GJW, Hotchkiss RN, Morrey BF. The unstable elbow. JBJS,2000:82(5):724.
26. Ikeda M, Sugiyama K, Kang C, Takagaki T, Oka Y. Comminuted fractures of the radial head: comparison of resection and internal fixation. JBJS,2006:88(1):11-23.