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A prospective study of functional outcome of surgical management of type III radial head fractures treated by radial head arthroplasty

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Abstract
Objectives: To study functional outcome in patients treated with Radial head arthroplasty for type III radial head fracture. To assess the time period required for the patient to gain pain free range of movements following Radial head arthroplasty (RHA).
Materials and Methods: Data collected from patients presenting with Type III radial fracture operated with metal prosthesis uncemented in patients between 20-50 years of age, admitted in Sanjay Gandhi Institute of Trauma and Orthopaedics, Bangalore, from November 2018 -May 2020.
Results: There were 30 patients with type III radial head fractures. The mean follow up period of 6th week, 12th week, 24th week was assessed with Mayo elbow performance score with statistics suggestive of 83.33% effectiveness.
Conclusion: Radial head arthroplasty has become an accepted treatment option for unreconstructible radial head fractures Type III radial head fractures, especially those with associated ligamentous and/or bony injuries, and for treatment of complications after failed internal fixation or radial head excision. Use of anatomical radial head implant leads to good functional recovery even in severely communited elbow. So we conclude in the modern highly demanding era, the technically superior method of doing radial head replacement in type III radial head fractures, is definitely having excellent functional outcome.

Keywords: Radial head fractures, radial head arthroplasty, internal fixation, Mayo elbow performance score.

1. Introduction
Radial head fractures are the most common fracture around the elbow, with an incidence of 30 per 100,000 persons per year, accounting for 1% to 5% of all long bone fractures and 20% of proximal forearm fractures. The radial head provides stability around the elbow and forearm in two ways [1]. First, it serves as a secondary stabilizer to valgus instability of the elbow, with the primary stabilizer being the medial collateral ligament (MCL). Second, the radial head also provides stability to the distal radial ulnar joint to assist the forearm in resisting axial forces and enhancing grip strength. Unreconstructable radial head fractures treated with radial head resection can often result in progressive valgus instability, potential radial migration, secondary ulnocarpal injury which may be potentiated with the addition of altered elbow biomechanics resulting in degenerative osteoarthritis [2].
Speed in 1941 first proposed prosthetic replacement of the radial head using a ferrule cup over the neck of radius. Since then, the use of acrylic, silicone, vitallium, and other metallic radial head prostheses has been reported, each with varying results. Radial head arthroplasty is an alternative when osteosynthesis is futile and also allows for maintenance of the stability of the elbow joint [2, 6]. The goal of treatment is to regain function as soon as possible, with minimal pain or complications. The purpose of this study was to evaluate our experience in the treatment of Masons type III radial head fractures with Radial head metal prosthesis.

Aims and Objectives
To study functional outcome in patients treated with Radial head arthroplasty for type III radial head fracture. To assess the time period required for the patient to gain pain free range of movements following Radial head arthroplasty (RHA).

Methodology

Study Design: prospective study

Inclusion Criteria:

1. Patients in >20 years of age.
2. Patient with Mason's Type III Radial head fracture.
3. Neglected Radial head fracture not more than 2 weeks old.
4. Ability to understand the content of the subject information / informed consent form and to be willing to participate in the clinical investigation.

Exclusion Criteria

1. Patients in the age group of <20years
2. Patients with mason's type I, type II and type IV Radial head fractures.
3. Open Radial head fracture
4. Presence of any infection.
5. Associated injuries

- Lateral collateral ligament injury
- Essex lopresti injury
- Coronoid and Olecranon fractures
- Terrible triad

Materials and Methods

A prospective study of 30 patients presenting with Type III radial head fracture in the department of orthopedics, Sanjay Gandhi Institute of Trauma and Orthopaedics, Bangalore between November 2018 to September 2020.

After obtaining the institutional ethics committee clearance and written informed consent (Annexure 1), the in-patients in the Department of Orthopaedics fulfilling the inclusion criteria will be enrolled in the study.

Each patient will be given a unique identity number. Demographic data, medical history, concomitant medications, physical examination, clinical examination including recording of vital signs, details of surgery and details of the implant will be recorded in the study proforma and relevant radiological investigations as mentioned in the assessment tools will be done at baseline visit. All patients presenting with Type III radial fracture were operated with metal prosthesis uncemented.

After discharge, patients were advised to review in ortho OPD for follow up after 6 weeks 12 weeks and thereafter every 3 months. The results were assessed every 3 months after the procedure. In each follow up a detailed clinical examination was done and patients were assessed subjectively for the symptoms like pain, swelling and restriction of joint motion. Patients were instructed to carry out physiotherapy in the form of active flexion- extension and pronation-supination movements using CPM. The functional assessment of the patient was done according to Mayo Elbow Performance Score.

Mayo Elbow Performance Score

Table 1: Table showing Mayo elbow performance score.

MAYO ELBOW PERFORMANCE SCORE

Adapted from: Gill DR, JBJS 1998;80A:1327

Criteria	Points	Patient Score
Pain (45 points)		= 45
None	45	
Mild	30	
Moderate	15	
Severe	0	
ROM		
>100 degrees	20	= 20
50-100 degrees	15	
<50 degree	5	
Stability (10 points)		= 10
Stable	10	
Moderate instability	5	
Gross instability	0	
Daily function (25 points)		= 25
Combing hair	5	
Feeding oneself	5	
Hygiene	5	
Putting on shirt	5	
Putting on shoes	5	
	Patient Score=	100

> 90 points = excellent, 75 to 89 points = good, 60 to 74 points = fair, and less than 60 points = poor

Stable = no apparent varus-valgus laxity clinically, moderate instability = less than 10 degrees of varus-valgus laxity, and gross instability = at least 10 degrees of varus-valgus laxity.

Results

In this study among 30 patients 50% of patients are in 41-50 age group. This study includes 57% male patients and 43% Female patients.

Table 2**:** table showing distribution of age group

Age distribution among study patients			
Variable	**Category**	**n**	**%**
	21-30 yrs.	11	36.7%
	31-40 yrs.	4	13.3%
	41-50 yrs.	15	50.0%
		Mean	SD
	Mean & SD	36.97	10.12
	Range	18 - 50	

Table 3: table showing distribution of gender

Gender distribution among study patients			
Gender	Males	17	56.7%
	Females	13	43.3%

Right side involved in 60% of patients & left side involved in 40% of patients. Majority of patients (67%) had history of accidental fall. Most of the patients operated with in 7days after injury

Table 4: table showing distribution of mode of injury.

Distribution of injury characteristics among study patients			
Variables	**Category**	**n**	**%**
Mode of injury	RTA	20	66.7%
	SELF FALL	10	33.3%

At 6 weeks of follow up 15 (50%) patients had good Mayo elbow score, 15 (50%) patients had fair Mayo elbow score.
At 12 weeks of follow up 15 (50%) patients had fair Mayo elbow score, 5 (16.6%) patients had good mayo elbow score, 10 (33.33%) patients had excellent Mayo elbow score.
At 24 weeks of follow up 1 (3.33%) patients had fair Mayo elbow score, 4 (13.33%) patients had good mayo elbow score, 25 (83.33%) patients had excellent Mayo elbow score.

Table 5: table showing functional outcome.

Follow up	No of cases with fair mayo score	No of cases with good Mayo Score	No of Cases With Excellent Mayo Score
6 Weeks	15	15	0
12 Weeks	15	5	10
24 Weeks	1	4	25

Complications

Table 6: Table showing complications

Distribution of Injury Site Characteristics among study patients			
Variable	Category	n	%
PIN Palsy	Positive	1	3.3%
	Negative	29	96.7%
Elbow Stiffness	Positive	5	16.7%
	Negative	25	83.3%
HT Calcification	Positive	2	6.7%
	Negative	28	93.3%

Among 30 patients 5 (16.7%) patients developed elbow stiffness, 1 (3.3%) patient developed PIN palsy which spontaneously recovered after 3 weeks and 2 (6.7%) patients developed heterotrophic ossification.
None of them had implant loosening or capitio humeral arthritis during the one year follow up.

Discussion

The radial head is an important secondary stabilizer to valgus stress. Because of the high incidence of injury to the lateral collateral ligament complex, radial head replacement is most often used in the treatment of comminuted radial head fractures. Most currently used radial head prostheses are metal, which have been reported to be durable and help to maintain valgus stability of the elbow after radial head replacement. Radial head implant may be indicated to stabilize the elbow joint and allow range-of-motion exercises to begin early.
This study was conducted in Sanjay Gandhi Institute of Trauma and Orthopaedics, Bangalore from November 2018 to May 2020. 30 patients with type III closed radial head fractures were only included in this study. No patients had associated injuries. None of them had fracture related pre-operative nerve injuries. None of them had pre existing elbow problems

Age of The Patient

In our study patients age group ranged from 20 to 50 years, out of which11(36.7%) patients were of age group 21-30 years, 4 (13.3%) were of age group 31-40 years, 15 (50%) were of age group 41 -50 years. Mean age group was 37 years.

Sex of the patient

Out of 30 cases there were 17 (56.7%) were males and 13 (43.3%) were females.

Side of the patient

In our present study, the injury was predominantly, 18 (60%) cases were operated on right side where as 12 (40%) cases were operated on left side.

Mode of Injury

The most common Mechanism of injury was RTA in 20 (66.7%) patients and self fall in 10 (33.3%) patients.

Surgery Interval

In our study group, 9 (30%) cases were operated between 1-3 days after injury, 12 (40%) were operated 4-6 days after injury, 9 (30%) cases were operated 7-10 days after injury.
ALL of the patients were operated with radial head replacement with bone cementing. No one developed intra operative complications
Average surgical time was 60 mins ranging from 45 minutes to 90minutes.

Complications

Among 30 patients 5 (16.7%) patients developed elbow stiffness, 1 (3.3%) patient developed PIN palsy which spontaneously recovered after 3 weeks and 2 (6.7%) patients developed heterotrophic ossification.
None of them had implant loosening or capitio humeral arthritis during the one year follow up.
NO patients was lost for follow up.
At 6 weeks of follow up 15 (50%) patients had good Mayo elbow score, 15 (50%) patients had fair Mayo elbow score.
At 12 weeks of follow up 15 (50%) patients had fair Mayo elbow score, 5 (16.6%) patients had good mayo elbow score, 10 (33.33%) patients had excellent Mayo elbow score.
At 24 weeks of follow up 1 (3.33%) patients had fair Mayo elbow score, 4 (13.33%) patients had good mayo elbow score, 25 (83.33%) patients had excellent Mayo elbow score.
The many types of radial head implants now available have evolved from a monoblock design to modular prostheses, some of which incorporate bipolar features and different materials that may lessen the likelihood of capitellar wear from the prosthesis. Rahul R *et al* conducted a prospective study on 30 cases of type III and IV radial head fractures treated with modular radial head prosthesis. (7) Post operative assessment done using MEPI score. 20 cases had excellent results, 7 cases had good results and 2 cases had fair results and 1 case had poor result. In terms of complications 1 case had infection and 1 case had implant failure. Unlike from our study where no cases of infection and implant failure was reported in our study.

In a retrospective study conducted by El sallakh *et al*, out 12 patients with Mason type III injury treated with modular anatomical radial head prosthesis all patients had good or excellent results comparable with our study [8].

There was no evidence of elbow arthritis or implant loosening similar to our study. In a retrospective study conducted by L Tarallo *et al*, 31 patients with mason type III fractures were treated with radial head replacement [9]. Based on MEPI excellent results were achieved in 24, good in 3, fair in 4. Resembling our study heterotrophic ossification was noted in 8 cases. In a retrospective study conducted by Jonathan P *et al*, fifty-five patients with unreconstructible radial head fractures treated acutely with a smooth-stemmed modular metallic radial head implant were reviewed. At 2 years of follow up 17 patients had excellent, 10 had good, 5 had fair and 1 had poor outcome [10]. Heterotrophic ossification and elbow stiffness complications were similar to our study.

Conclusion

The radial head plays an important role as secondary stabilizer to valgus force. Radial head arthroplasty has become an accepted treatment option for unreconstructible radial head fractures Type III radial head fractures, especially those with associated ligamentous and/or bony injuries, and for treatment of complications after failed internal fixation or radial head excision. Use of anatomical radial head implant leads to good functional recovery even in severly communited elbow.

So we conclude in the modern highly demanding era, the technically superior method of doing radial head replacement in type III radial head fractures, is definitely having excellent functional outcome.

Patient 1

Fig 1: preoperative AP and lateral view showing type III radial head fractures.

Fig 2: Post-operative radiograph of same patient

Fig 3: Functional outcome at 6 months follow up:

Patient 2

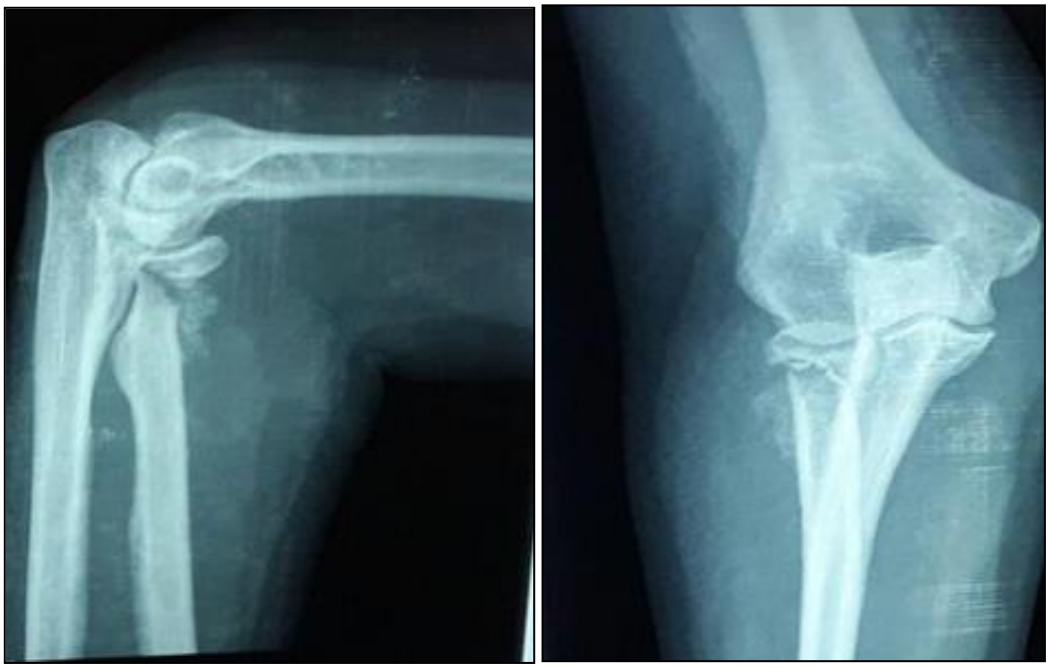

Fig 4: preoperative AP and lateral view showing type III radial head fractures

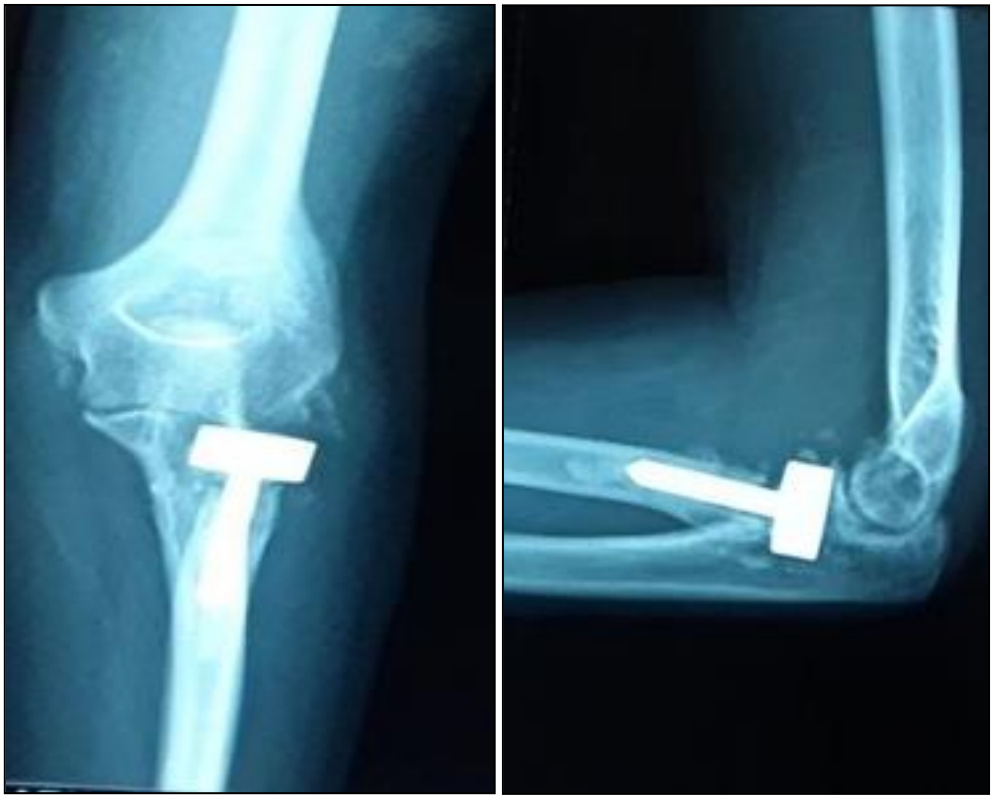

Fig 5: Post-operative radiograph of same patient

Fig 6: functional outcome at 6 months follow up

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