

Study of Functional Outcome of Total Elbow Replacement Using Semi Constrained Elbow Prosthesis

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ABSTRACT

Background: When there is disabling arthritis of the elbow, Total Elbow Replacement is considered. commonest etiology being responsible for this arthritis is Rheumatoid Arthritis. Other etiologies are, post traumatic arthritis, tumor affection of elbow, rarely haemophilic arthritis. Indications also include distal humerus fractures/ nonunion in select elderly patients.

Methods: 6 patients of Elbow arthritis were operated for Total Elbow Arthroplasty at our institute between, 2022-2023. There were 3 males and 3 females in our study. Prosthesis implanted in all our patients was Baksi sloppy hinge prosthesis.

Results: Evaluation of patients was done at 2, 4th months and final evaluation was done at 6 months in all our patients. Significant improvement in functional score, stability and range of movement was documented. Total elbow replacement is not a routine surgery in itself and has a steep learning curve that is a technical challenge. In our study no major complication was noted.

Conclusion: Total Elbow Replacement provides a stable and painless elbow with a functional range of movement and negligible complications if carried out with technical expertise.

Keywords: Study of functional outcome, elbow replacement, elbow prosthesis. non inflammatory, elbow arthritis

INTRODUCTION

In the past four decades total elbow replacement (TER) has emerged as a viable surgical option for advanced elbow disease.

Elbow arthroplasty is less commonly performed as knee arthroplasty or hip arthroplasty, due to higher incidence of complications. However in the last 15 years rate of complications has decreased due to better available prosthesis^[1]. Proper selection of patients is important in elbow arthroplasty.

Dee introduced the first 'Modern' constrained total elbow prosthesis using cement in 1972. Loosening rates were extremely high due to high stress levels at the bone-cement interface with Dee's prosthesis despite good initial clinical outcomes. Non-constrained (Resurfacing) and semiconstrained prosthesis were then developed to overcome the problem.

The original Baksi's rigid hinge prosthesis was designed in 1977 (Indian Patent No.146175, dated 11.8.1978) and has been used in clinical practice since 1977^[2]. Its physical properties were extensively studied with the help of a newly designed Elbow Joint Simulator during the period from 1978 to 1983. This study concluded that if 7 0 -10 0 laxity is added in the hinge section, that will reduce the metal dust liberation and hinder the strain of loosening in the bone cement

interface^[3,4]. On the basis of these facts, the original rigid hinge prosthesis was redesigned into sloppy hinge elbow prosthesis in 1983 (Indian registered design no 161541).

MATERIALS AND METHODS

Six patients of Elbow arthritis underwent TER (Total elbow Replacement), between 2022-2023

94 patients with posttraumatic arthritis were evaluated in the orthopaedic opd. 08 patients having post-traumatic arthritis of elbow who fit in the inclusion criteria were advised for surgery. Out of 08 patients, 4 patients finally consented for surgery.

3 cases of comminuted Distal Humerus Fractures in the Elderly were advised for replacement, however only 1 patient agreed for total elbow replacement.

4 cases of Distal Humerus Nonunion were advised replacement out of which 1 patient agreed.

Thus, 6 patients were operated and reviewed over a period of 6 months.

Small sample size for total elbow replacement can be attributed to:

As Elbow dysfunction does not directly interfere with locomotion so it's sometimes tolerated by the patient and the patients only comes for surgical treatment the morbidity becomes worse so as to adversely affect the activities of daily living. Other studies also reported small sample size for example, Kumar et al. reviewed 11 cases operated over a period of ten years [5], Hildebrand et al. reviewed 47 cases operated over a period of 7 years [6].

Elbow replacement is not a routinely performed procedure and the incidence of elbow arthritis is not very frequent. It is a technical challenge to perform this procedure because of the small sample size and steep learning curve.

Inclusion Criteria were

- Osteoarthritis.
- Poor results from previous elbow surgery
- Complex fracture of the elbow, even in the elderly.
- Severely damaged or torn soft tissues in the elbow, resulting in instability.

Exclusion Criteria were

- Medically compromised patients- ASA(American Society of Anesthesiologists) grade IV & V
- Extensor mechanism discontinuity
- Deformity secondary to muscular weakness.
- Recent or current elbow sepsis.
- Presence of painless, well functioning Elbow arthrodesis
- Medical condition that compromise patient's ability to withstand anaesthesia.
- Patients with skin diseases in operative field.
- Patients presenting with recurrent cellulitis, venous stasis disease, morbid obesity, urinary tract infection, arthrosclerotic diseases, and patients with history of osteomyelitis in and around elbow joint are excluded from undergoing the procedure.

Baksi sloppy hinge prosthesis was used in all our cases.

All preoperative workup was done prior to subjecting them for surgery.

All patients were operated in supine position which is the preferred position of the senior author. General anesthesia was administered and Bryan Morrey approach was used for exposure. Depending on the involvement radial head was excised or left intact. Bony cuts were identified and taken. After appropriate broaching the humeral and ulnar components were fixed with

cement to the humerus and ulna respectively. Link pin was fixed and the coupling screw was tightened.

Thorough lavage was done and meticulous closure of the extensor apparatus was done after keeping romovac closed suction drain no. 14.

Post operative limb was kept in extension with back slab. First check dress was done on day-2 of surgery (not counting day of surgery), along with drain removal. Second check dressing was done on day -5 post operative. Further sutures were removed around 13-15 days post operative. Gentle passive flexion was begun around day-8 post op, which was increased as tolerated by the patient. By end of 4-6 weeks target of 90 degrees flexion was achieved in most of the patients. Slab was removed after 4 weeks. Patients were discharged on day 15 after suture removal and called for further opd evaluation after 2, 4 and 6 months.

Antibiotic policy of the senior author is as follows. Vancomycin 1gm infusion iv one hour prior to surgery. Cefuroxime 1.5 gm iv at the start of procedure and given twice daily for 5 days. Amikacin 500mg twice and metrogyl 500mg twice for 5 days.

RESULT

Results were analysed on basis of Functional outcome, Radiographic analysis, Complications and overall patient satisfaction with postoperative results.

There was a significant improvement in the functional scores six months post-operatively. The mean scores for stability six months post-operatively were significantly improved. No specific criteria were used for radiographic analysis but radiolucent lines and region of lucency were noted. Progression of the lucent lines was also recorded.

A total of 2 patients were not satisfied with the outcome three months post-operatively; all of these patients subsequently became satisfied after six months post-operatively.

There were no dislocations reported in this study.

No patient presented with any infection postoperatively.

Table 1: Age wise distribution of cases in study group

Age	Frequency	Percent
50 to 60	3	50
60 to 70	2	33
70 to 80	1	17
Total	6	100.0

Table 2: Sex wise distribution of cases in study group

Sex	Frequency	Percent
Female	3	50
Male	3	50
Total	6	100.0

Table 3: Comparison of flexion between pre op baseline and post op 6mths in study group

Parameter	Flexion		t Value	P Value
	Mean	SD		
Pre op baseline	109.64	6.805	-	-
Post op 6 months	128.47	5.864	12.789	<0.0001

Table 4: Comparison of extension deficient between pre op baseline and post op 6mths in study group

Parameter	Extension deficit		t Value	P Value
	Mean	SD		
Pre op baseline	38.88	10.295	-	-
Post op 6 months	12.94	3.561	10.985	<0.0001

Table 5: Comparison of range of motion between pre op baseline and post op 6mths in study group

Parameter	Range of motion		t Value	P Value
	Mean	SD		
Pre op baseline	80.00	14.093	-	-
Post op 6 months	113.82	8.575	10.629	<0.0001

Table 6: Comparison of pronation between pre op baseline and post op 6mths in study group

Parameter	Pronation		t Value	P Value
	Mean	SD		
Pre op baseline	64.29	11.450	-	-
Post op 6 months	82.06	8.671	11.950	<0.0001

Table 7: Comparison of supination between pre op baseline and post op 6mths in study group

Parameter	Supination		t Value	P Value
	Mean	SD		
Pre op baseline	52.35	11.629	-	-
Post op 6 months	75.00	12.119	13.340	<0.0001

Table 8: Comparison of stability between pre op baseline and post op 6mths in study group

Parameter	Stability		t Value	P Value
	Mean	SD		
Pre op baseline	0.24	0.437	-	-
Post op 6 months	1.76	0.437	12.257	<0.0001

Table 9: Improvement at 6 months followup

	Preoperative baseline	Post op 24months
Flexion	109.64	125.76
Extension deficient	38.88	12.94
Rom	80	113.82
Pronation	64.29	82.06
supination	52.35	75.00

Pre and Post Op Mayo Score

	Preop	postop
Pain (no. of elbows)		
None	03	03
Mild	02	02
Moderate	03	01
Severe	03	00
Mean range of motion (degrees)		
Extension	33	31
Flexion	115	134
Pronation	50	65
Supination	49	6
Stability (no.of elbows)		
Stable	2	6
Moderately stable	3	0
Grossly unstable	5	0
Mean score for daily function (points)	15	20
Mean elbow performance scored (points)	46	90

DISCUSSION

In our study we have included osteoarthritis patients as due to advances in the medical management of RhA have led to a decrease in joint destruction and, together with advances in implant design, TER is now often used in post-traumatic conditions and in patients with primary OA^[7,8]. Gill and Morrey reported prosthesis survival at 10 years as 92%, with 86% having good or excellent results in 78 elbows with the Coonrad-Morrey prosthesis^[9]. Shi et al. reported a post-operative mean MEPS of 84 for primary implants^[10]. In a long-term study by Aldredge et al. with a follow-up duration of 10-31 years, the mean MEPS for the CoonradMorrey prosthesis was 91 in 41 elbows^[11].

The most important finding in our study was that No specific factor had an impact on loosening and failure of the prosthesis, which is found to be most important factor in our study, as loosening can be caused by a variety of factors including biomechanical instability, deep infection and periprosthetic fracture. The rate of deep infection in literature ranges from 0% to 9%^[12] and the incidence of intraoperative condylar fracture from 0% to 4%^[12, 13, 14]. The peculiar bone cut required during the preparation of the humerus and the sub-optimal quality of bone in inflammatory arthritis are probably responsible for this complication. Deep infection and fractures are common in elderly patients with rheumatoid arthritis^[15]. This is probably because such patients have immune system dysfunction and a compromised soft tissue cover.

In our study no ulnar nerve palsy, which is one of the most important complication and its incidence palsy in literature ranges from 0% to 26%^[12, 14, 15, 16, 17], While in similar studies it was recorded as a well recognised complication of TER and the reported incidence varies from 1.7% to 28%.^[18] Transient median nerve palsy has also been reported in few studies^[19].

Approach used in all our cases was Bryan-Morrey approach. Meticulous dissection and isolation of the ulnar nerve is required to minimize the occurrence of ulnar nerve palsy. Literature suggests that despite these precautions nerve palsies can occur in stiff elbows that regain a considerable range of motion after surgery^[20]. Anterior transposition of the nerve may be considered in such elbows based on the intraoperative increase in range of movement achieved. A minimum of 100° of range of movement is required in the flexion extension axis (range 30-130° of flexion) and the pronation/supination axis (pronation 50° and supination 50°) to perform

most activities of daily living^[21] and this functionally useful range of movement was achieved in all cases in our series. This puts forward the view that the biomechanics and functional result of the TER is conducive to the performance of most activities of daily living. This is also the case in other series in literature^[12, 13, 17].

The failure rate of primary TER in literature has ranged from 0% to 31.7%^[12, 13, 16]. The 5-year survivorship of primary TER ranges from 68% to 100% in the literature^[13, 22, 23]. The survivorship of our primary TER series was at the higher end of this spectrum at 6 months. The original Coonrad prosthesis (Type I), introduced in 1973, had high molecular weight polyethylene bushings and a varus-valgus laxity of 2-3°. It was associated with an unacceptable rate of aseptic loosening in rheumatoid arthritis^[23]. Our findings confirm that TER improves the function of the elbow and reduces pain, and overall patient satisfaction is high. The mean range of movement obtained was similar to that with other commonly used TERs, Acclaim (De Puy Orthopedics Inc, Warsaw, Indiana)^[24] Souter-Strathclyde (Stryker Howmedica Osteonics, Limerick, Ireland)^[25, 26] and Kudo (Biomet Inc, Warsaw, Indiana).^[5-6]

CONCLUSION

To conclude, Total Elbow Replacement surgery provides significant pain relief, stability and a functionally useful range of movement in elbows affected by non inflammatory arthritis. The surgery accomplishes all the aims of elbow reconstruction with good functional outcome and survivorship and significantly reduces the disability of the patient.

Total elbow Replacement is an effective procedure for the treatment of patients with non inflammatory arthritis. Surgery in longterm is cheaper and better and is associated with less complications than going for other modalities of treatment. As such, the information regarding TEA utilization, demographics, cost and complications are limited. The average hospital stay is 15 days with a total cost of 30,000- 40,000 /- per case.

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