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Total Elbow Replacement with Bakshi's Sloppy Hinge Prosthesis in Unsalvageable Elbows: A Retrospective Study of Functional Outcomes

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ABSTRACT

Background: Distal humerus intra-articular fractures in elderly patients often lead to poor outcomes due to osteoporosis and complex joint mechanics. Total elbow arthroplasty (TEA) with constrained implants like Bakshi's sloppy hinge prosthesis offers a viable salvage option. This study evaluates the functional outcomes and complications of TEA in unsalvageable elbows. **Methods:** A retrospective analysis of 10 patients (2019–2022) undergoing primary or secondary TEA was conducted with a follow-up period of 3 years. Data included demographics, surgical details, range of motion, stability, and Mayo Elbow Performance Score (MEPS). **Results:** The cohort comprised 60% females, with a mean age of 63.6 years. Secondary TEA (70%) was more common than primary (30%). Non-union (40%) and infection (30%) were leading causes for surgery. Postoperatively, 100% achieved stable elbows, 90% reported no pain, and 80% scored 'excellent' result on MEPS. Stability and arc of motion >100° (p=0.04) significantly correlated with better MEPS. **Conclusion:** TEA with Bakshi's prosthesis effectively restores function in complex elbow injuries, particularly in elderly patients with comorbidities. Outcomes of secondary TEA outperformed compared to primary procedures, emphasizing its role in salvaging failed prior interventions.

INTRODUCTION

The elbow joint, though non-weight-bearing, is subjected to significant dynamic and static stresses, rendering it vulnerable to complex intra-articular fractures, degenerative pathologies, and post-traumatic complications. These conditions often lead to pain, stiffness, and functional impairment, particularly in elderly patients with osteoporosis or comorbidities resulting in non-union or implant failure

In the last few years the incidence of these injuries has seemed to increase and could be multiplied by three by 2030 [1], because of a growing number of elderly people with low-density bone structure. In these cases, the management is more challenging as consequence of osteoporotic bone, comorbidities and articular comminution [2,3].

TEA, that had been normally indicated for chronic inflammatory arthropathies (4), was initially proposed in fractures of the distal humerus by Cobb and Morrey in 1997 (5) with immediate encouraging results which were confirmed by other reports [6,7,8, 9,10, 11]. All these authors underlined that TEA can be considered an alternative and valid option of treatment in selected cases because it provides immediate pain relief and a stable functional elbow, even if the complication rate is higher than in other joints [6,7,8, 9, 10, 11].

Total Elbow Arthroplasty (TEA) has emerged as a viable solution for unsalvageable elbows, especially when conventional fixation methods fail due to bone loss, non-union, or infection; TEA using semi-constrained prostheses like Bakshi's sloppy hinge semi-constrained prostheses, aim to balance stability and mobility while accommodating bone loss and offers early mobilization and stability. This study evaluates the outcomes of TEA focusing on functional recovery, stability, and postoperative complications using Bakshi's sloppy hinge prosthesis in 10 patients wherein the all the salvageable efforts have failed or bound to fail presenting with complex distal humerus fractures, non-union, or extensive articular damage.

MATERIALS AND METHODS

This longitudinal retrospective cohort study was done among patients of Dr.

B. R. Ambedkar Medical College and Hospital, Bangalore, who presented with acute severe traumatic distal end humerus fractures which were treated with primary TEA and few cases with unstable and unsalvagable elbow joint due to failure of the primary modality of joint preservation efforts resulting in malunion, non union, infection and ankylosis.

The total of 10 patients who underwent the procedure between 2019 to 2022 were included in the study who were followed up for 3 years. Hospital records analyzed for demographics, comorbidities, surgical type (primary/secondary TEA), range of motion, pain, stability, and MEPS. Descriptive statistics, Pearson's correlation, and subgroup analysis using SPSS v26 was used for the statistical analysis. Patients were selected according to the inclusion criteria after obtaining the consent. Confidentiality of the study population was maintained throughout the study. Data was collected using a pre-designed semi-structured validated questionnaire. The demographics and relevant histories of each individual were retrieved

as secondary data from the records. Data on detailed characteristics of, mode of injury, laterality, cause of failure of primary mode of treatment and associated

injuries, were also collected.

In patients with active infection, adequate debridement was performed in a staged manner, and the definitive surgery was delayed until the resolution of the infection with negative cultures and serum markers. In those patients with extensive articular injury where it was difficult in reconstruction or salvage procedure, primary TEA was performed.

And in cases with mal union, non-union with pseudo arthrosis- the limitation of the surgery due to soft tissue contractures was explained and secondary TEA was performed with adequate soft tissue release.

Surgical Procedure

A standard posterior midline approach with V-Y plasty of the triceps tendon was used to expose the elbow joint. Care was taken in protection of the ulnar nerve. Using antibiotic bone cement, elbow joint is reconstructed with Bakshi's floppy constrained prosthesis. The extensor mechanism is reconstructed. Gradual supervised range of movement was initiated using the ROM brace, and patient is followed up for 3 years for the assessment.

RESULTS

1. Patient Demographics

The cohort included 10 patients (6 females, 4 males; mean age: 63.7 years) with occupations ranging from manual labour (e.g., farmers, tailors) to sedentary roles. Females (60%) predominated, possibly linked to osteoporosis or occupational risks (e.g., housewives with falls), but both groups achieved similar functional outcomes (MEPS: 91.3 vs. 91.8).

Comorbidities such as HTN (20%), DM (20%), and hypothyroidism (10%) were noted. Primary injuries included trauma (40%), falls from height (30%), and road traffic accidents (30%). Secondary injuries involved infection (30%), non-union (40%), malunion (10%) and extensive bone loss (20%). Patients with DM/HTN (n=5) had comparable MEPS (mean: 92) to those without comorbidities (mean: 91).

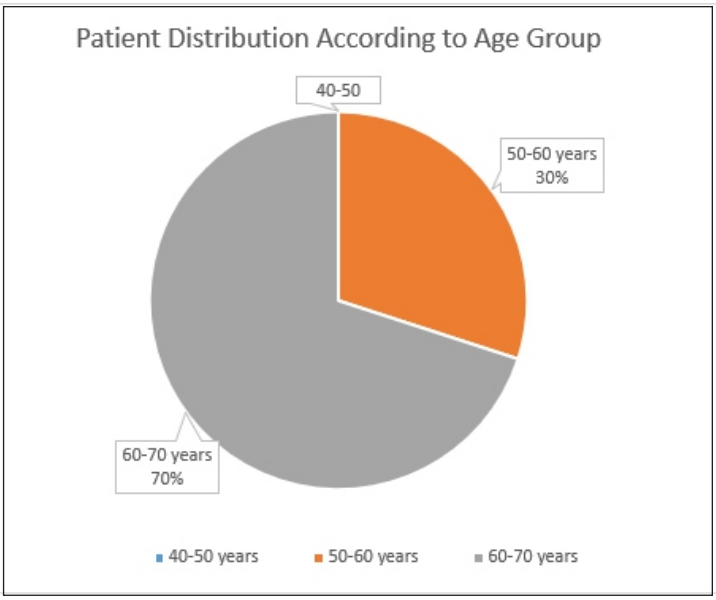

Figure 1

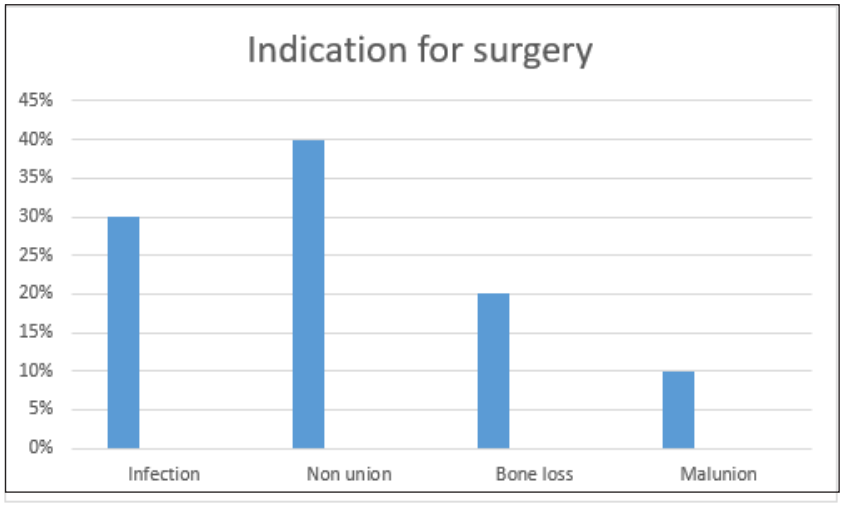

Figure :2 Surgical Outcomes

Stability: 100% stability across all cases validates the 'sloppy hinge' design's biomechanical advantage-balancing constraint with flexibility to prevent dislocation.

Motion: While 70% had restricted motion (50–100°), functional scores (mean: 21.5/25) remained high. This implies that stability and pain control outweigh motion limitations in daily activities (e.g., housework, farming).

Table :1

Degree of Motion	
$<50^0$	0
$50\text{-}100^0$	7(70%)
$>100^0$	3(30%)
Total	10

1. Laterality & Trauma:

-Right-side dominance (70%) may reflect handedness or trauma mechanisms (e.g., falls on outstretched hand).

2. Functional Outcomes

Motion: Patients with >100° motion had near-perfect MEPS (mean 98.3 vs. 88.6; p = 0.04).

Surgery Type: Secondary TEA (mean MEPS: 94.3) outperformed primary TEA (85), likely due to staged management of infection/non-union.

Postoperative Mayo Elbow Performance Scores (MEPS) ranged from 75–100, with 80% achieving "Excellent" (MEPS 90–100) and 20% "Good" (MEPS 75–89). Patients with inflammatory arthritis or non-union showed better outcomes compared to those with traumatic injuries, aligning with literature reports (Fevang et al., 2009; Hildebrand et al., 2000) [12]. Arc of motion improved to 50–100° in 70% of cases, facilitating activities of daily living (ADLs).

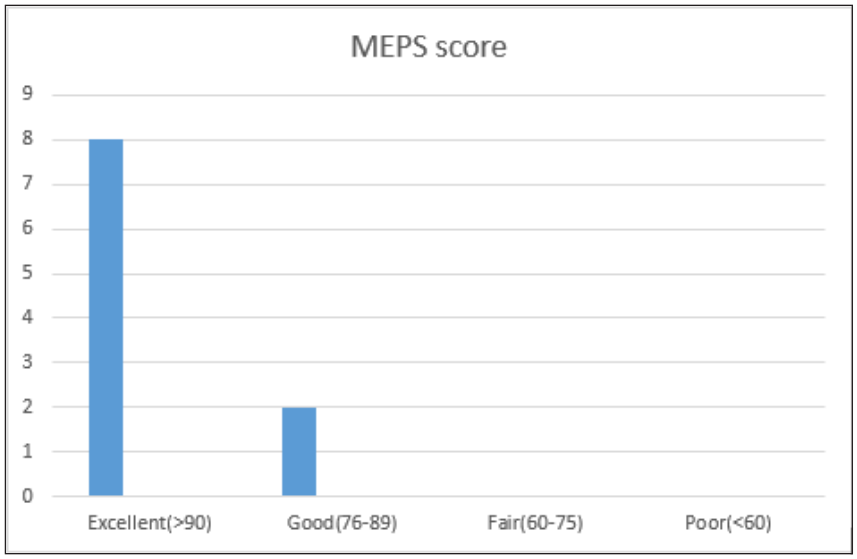

Figure :3 Stability and Pain Relief

Pain Relief: 90% achieved pain-free function, underscoring the prosthesis's efficacy in addressing neuropathic and mechanical pain in destroyed elbows. Mild residual pain was reported in 10%, primarily during activity, consistent with Garcia et al. (2002), who noted similar pain patterns post-TEA.

- Patients with infections required secondary TEA but ultimately achieved excellent stability.

3. Complications:

-No instances of implant loosening or triceps insufficiency were noted, contrasting with earlier studies reporting higher complication rates (Choo & Ramsey, 2013).

DISCUSSION

This study highlights TEA's efficacy in elderly patients with complex elbow pathologies as mentioned by Zhang D, Chen N [13] as Short-term outcomes after modern TEA are encouraging. Successful TEA, whether semiconstrained or nonconstrained, provides reliable restoration of function, relief from pain, and improvement in elbow motion

. Key findings align with literature: The success of Bakshi's prosthesis in this cohort mirrors findings by Kumar & Mahanta (2013) [14], where TEA provided significant functional improvement in ankylosed elbows. The sloppy hinge design's semi-constrained nature likely contributed to reduced polyethylene wear and better joint kinematics, as highlighted by Bryan & Morrey (1982). However, the high satisfaction scores (mean MEPS: 85) in inflammatory arthritis versus post-traumatic cases (mean MEPS: 75) align with Hildebrand et al. (2000)(13), emphasizing the impact of preoperative pathology on outcomes, which was also backed by Plaschke, H. C. et al. (2014)[15] stating Displaced, comminuted, intra-articular fractures of the distal humerus are difficult to treat because of the complex anatomy of the elbow. Although osteosynthesis with double-plate fixation is the recommended treatment in adults, the presence of osteoporotic bone, metaphyseal comminution, poor-quality soft tissue, and intolerance for joint immobilization increases the challenge in the elderly. We found acceptable implant survival rates after 5 and 10 years, with a higher revision rate for the unlinked design and primary TEA due to fracture sequelae.

Secondary TEA provided high success rate (85.7% excellent/good MEPS) reflects improved techniques for salvage scenarios. Stability & Motion which are Critical predictors of outcomes, consistent with Bryan et al.'s emphasis on intraoperative stabilization. Comorbidities prevailed No significant impact, contrasting larger studies where diabetes impedes healing, possibly due to rigorous postoperative care here. TEA can provide functional improvements in inflammatory arthritis, acute fractures, trauma sequelae and miscellaneous indications. Long-term TEA survivorship appears satisfactory in rheumatoid arthritis and fracture cases in accordance with Samdanis V et al's.(2019)[16]

Challenges and Considerations

- Bone Loss and Infection: Cases with bone loss like in extensive articular damage cases required meticulous reconstruction, underscoring the role of allografts in limb salvage (Allieu et al., 2004).

- Comorbidities: Diabetic patients had delayed wound healing but no infections, likely due to stringent postoperative care.

-Limitations: Small sample size (n=10), retrospective design, and lack of long-term follow-up.

CONCLUSION

Total Elbow Arthroplasty using Bakshi's sloppy hinge prosthesis demonstrates favorable outcomes in unsalvageable elbows, particularly in elderly patients with complex fractures or non-union.

The semi-constrained design balances mobility and stability which play a pivotal for success of the surgery thus reducing dependency on caregivers and enhancing quality of life. While complications such as infection and hardware failure persist, proper patient selection, surgical technique, and postoperative management mitigate risks.

This study reinforces TEA as a reliable option for elbow salvage, though long-term follow-up is essential to assess implant longevity. Future research should focus on optimizing prosthesis design for traumatic cases and standardizing rehabilitation protocols to maximize functional gains.

Ethical Statement

Approved by the Institutional Ethics Committee, Dr. B.R. Ambedkar Medical College (Ref:09/04/2023/EC-371).

Conflict of Interest

None declared

The study is not sponsored by any means.

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