



Total elbow arthroplasty: outcomes after triceps-detaching and triceps-sparing approaches

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Background: Total elbow arthroplasty (TEA) is associated with high complication rates compared with other large-joint arthroplasties. The frequency and type of complication may differ, depending on the surgical approach. A comparison of outcomes with triceps-off and triceps-on approaches was investigated.

Methods: Seventy-three patients underwent 83 primary TEAs between 2003 and 2012. Forty-six elbows had a triceps-off approach, and 37 had a triceps-on approach. Results were reviewed at a mean of 4.2 years. Cementing technique was graded according to Morrey's criteria, and clinical outcomes were assessed by means of the Mayo Elbow Performance Score.

Results: There was no statistically significant difference between the triceps-off and triceps-on groups with regard to the patient's age, gender, preoperative Mayo Elbow Performance Score or range of motion, or previous surgery on the affected elbow. Among patients who underwent a TEA for an inflammatory arthropathy, there was a significant difference in outcome between groups with regard to final flexion, extension, arc of motion, and pronation. Cementing technique in the triceps-off group was adequate in 70%. In the triceps-on group, cementing technique was adequate in 92%. The complication rate in the triceps-off group was 32.6% and included 7 triceps ruptures. Three patients who had attempted repairs of the triceps rupture developed deep infections requiring multiple further surgeries. The complication rate in the triceps-on group was 8.1%.

Conclusion: A triceps-on approach in TEA results in consistently good clinical outcomes with no risk of triceps rupture, and the approach does not compromise the cement mantle. We believe that this approach will reduce complication rates in TEA.

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Total elbow arthroplasty (TEA) has proved to be a successful procedure, with reliable pain relief and improvements in range of motion for patients with a broad range of elbow arthropathies.^{7,9} Whereas inflammatory arthritis in its advanced stage remains a common indication, TEA is becoming increasingly used in post-traumatic arthropathy or instability and in acute fractures in osteoporotic bone.^{3,8,13,17,19-21} The current growth rates in both shoulder and elbow arthroplasty are comparable to or higher than growth rates for total hip and knee arthroplasty.⁵ However, 10-year failure rates in TEA range from 13% to 35%,^{6,14,24-26} and complication rates range between 20% and 45%.^{10,14,27} Both these rates are significantly higher than those seen in other large-joint arthroplasties, and this continues to stimulate research into modifiable factors such as implant design and surgical technique.

In an early review of the literature that looked at 957 TEAs performed between 1986 and 1992, Gschwend et al¹⁰ reported an overall complication rate of 43%. No mention of triceps function was made in this review, with their most commonly identified complications being aseptic loosening, infection, instability, and ulnar nerve lesions. In a subsequent systematic review of 3618 TEAs performed before 2004, Little et al¹⁴ reported an overall complication rate of 33%. The incidence of triceps rupture was 0.56% (1 of 177) in triceps turndowns, 2.8% (12 of 428) in triceps-reflecting approaches, and 11% (14 of 129) in approaches where the tendon insertion was released from the ulna. Postoperative triceps function was assessed in only 41% of papers, however. In the most recent systematic review looking at complications of 2938 TEAs performed between 1993 and 2009, Voloshin et al²⁷ found an overall complication rate of 24.3%, with triceps-related complications accounting for 2.4%. There was no statistically significant difference in the rate of triceps-related complications between triceps-reflecting, triceps-splitting, or triceps-tongue approaches. Significantly, approaches other than the 3 mentioned were excluded from the analysis, and thus no comparison could be made with a triceps-sparing approach. The authors concluded that they were well aware of the poor documentation of postoperative triceps function and believed that the full impact of the problem was not being accurately reported. Triceps dysfunction can be overlooked if it is not actively assessed at follow-up as gravity-assisted extension may conceal a weakened or absent extensor mechanism.

Several studies published in the early 2000s reported rates of triceps disruption ranging from 7% to 11% with

triceps-reflecting approaches and failure of subsequent attempted repair in 66% to 100% of cases.^{11,12,22} These outcomes were similar to the experience at our unit, and the senior authors (B.C.V.,S.J.R.), frustrated with the morbidity associated with these triceps ruptures and the lack of a reliable method of surgical salvage, gradually moved to a modification of the triceps-on approach first described by Alonso-Llames.¹ The presumed benefits of this approach were 2-fold: that it would, first, eliminate triceps-related complications and, second, allow immediate active and resisted extension of the elbow postoperatively, with the advantage of an earlier return of function and possibly an improved final range of motion. Concerns with the triceps-on approach included the technical nature of the approach, which may compromise cementing of the prosthesis and result in longer surgical times. We are not aware of any literature comparing long-term outcomes between triceps-off and triceps-on approaches in TEA. We therefore undertook a retrospective review of all primary TEAs performed at our unit during a 10-year period from 2003 (when we began using the triceps-on approach) to 2012, comparing clinical and radiologic outcomes between triceps-off and triceps-on approaches, with specific focus on Mayo Elbow Performance Score (MEPS), range of motion, cementing technique, and complication rates.

Materials and methods

A list of all patients who underwent a TEA between 2003 and 2012 by the University of Cape Town Shoulder and Elbow Unit was obtained from a surgical database. These patients formed the study cohort, and their medical records and radiographs were reviewed. Exclusion criteria were revision TEAs and postoperative follow-up of <12 months. Data captured included patient demographics, range of motion preoperatively and at various stages postoperatively, surgical time, radiographic analysis of cementing technique, presence of any complications, and MEPS preoperatively and at most recent follow-up. Preoperative range of motion and MEPS were not recorded in the patients with fractures. The preoperative function component of the MEPS was estimated from the history if it was not specifically noted in the folder. Complications were included if they resulted in additional surgical treatment or permanent morbidity to the patient, as described by Voloshin et al.²⁷

One hundred consecutive patients who underwent 110 TEAs were identified. Ten patients underwent bilateral TEAs during the study period. Nineteen revision TEAs and 8 patients with inadequate follow-up were excluded from the study, leaving 83 TEAs for analysis (47 right, 36 left). Eleven patients were deceased at

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