Elbow Hemiarthroplasty for Late Reconstruction of a Traumatic Elbow Bone Defect in a Young Patient

A Case Report

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Hemiarthroplasty of the human elbow was first described in 1947 by Mellen and Phalen. Encouraging follow-up results with good range of motion and substantial pain relief after elbow hemiarthroplasty were published in 1974. Nevertheless, in cases with severe bone loss and comminution, the semiconstrained total elbow arthroplasty has been a very reliable solution during the last decades, especially in elderly patients. However, in active patients with an injured dominant arm, the major mid and long-term complication of these semi or totally linked polyethylene components is the risk of loosening. In younger patients, the new anatomic elbow hemiarthroplasty offers the possibility of greater mobility, stability, and promising long-term results.

We present the case of a young patient with a comminuted type-IIIB open fracture of the elbow with bone loss of the humeral condyles. After elbow hemiarthroplasty, the final follow-up (4.5 years postoperatively) showed that the treatment had been successful.

The patient was informed that data concerning the case would be submitted for publication, and he provided consent.

Case Report

A thirty-one-year-old obese man (body mass index [BMI] of 35) without any other medical comorbidities presented to the emergency department following a motorcycle accident. Clinical and radiographic evaluation demonstrated an open intercondylar fracture (type IIIB according to the Gustilo-Anderson classification) of the right dominant elbow, with bone loss of the humeral condyles and fracture of the olecranon tip. Complete radial nerve palsy was also noted.

Immediate wound irrigation and surgical debridement were performed in the operating room. During surgical exploration, the radial nerve was found to be intact, and no major vascular injury was apparent. Because of extensive soft-tissue damage, internal fixation was not an option. An elbow-bridging external fixator (Orthofix, Lewisville, Texas) was applied, and a

Fig. 1
Radiograph of the right elbow showing complete destruction of the humeral articular surfaces.
local skin flap was used to cover the posterolateral aspect of the joint. Intravenous antibiotics were administered for four days, and the patient was discharged from the hospital six days postoperatively. Daily wound inspection was performed for twenty days on an outpatient basis.

Three months postoperatively, the soft-tissue and skin defects had healed, the erythrocyte sedimentation rate and C-reactive protein levels were within normal limits, and the radial nerve had fully recovered. The external fixator was removed, and a functional elbow brace was applied for a period of one month. High-resolution computed tomography (CT) with a slice thickness of 1.5 mm and three-dimensional (3D) reconstruction were also performed in order to evaluate joint damage and bone loss. Complete destruction of the humeral articular surfaces and a small avulsion fracture of the triceps tendon from the olecranon tip were confirmed (Figs. 1 and 2).

The patient’s general health was excellent, and his job as an office manager did not require heavy manual labor. He was informed in detail about the possible treatment options, the lifetime restrictions regarding weight lifting, and the possible complications following an arthroplasty. Despite the young age, the high BMI, and the hand dominance, the patient agreed to undergo an elbow hemiarthroplasty as the final treatment in order to achieve the best functional result.

With use of a standard posterior approach, the remaining articular surfaces were removed, and the lateral and medial epicondyles were reconstructed with a 3.5-mm Mayo Clinic Con-
(Tornier, Montbonnot-Saint-Martin, France) was implanted. Since the overall function and stability of the anatomic Latitude prosthesis rely on collateral ligament integrity, the varus-valgus stability and the collateral isometry during full range of motion were carefully examined before wound closure. The collateral ligaments were both intact, but, because of contraction, isometry and stability were ensured with the application of an articulated elbow external fixator for three weeks (Figs. 3-A and 3-B).

Forty-eight hours postoperatively, the patient started nearly full range of passive flexion-extension exercises. The results of intraoperative cultures were negative, and the postoperative period was uneventful. Follow-up at 4.5 years demonstrated 10° to 100° of active range of elbow flexion; pronation and supination were 80° and 55°, respectively (Figs. 4 and 5). The epicondyles had healed, and no sign of implant loosening was observed (Fig. 6). The patient had remained compliant with our lifetime instructions and restrictions. Seven months postoperatively, he had returned to his previous occupation, and he has been able to perform daily activities without any difficulty. He has been very satisfied with the functional result and the final Mayo Elbow Performance Score of 85 of a possible 100.

**Discussion**

Fractures of the distal part of the humerus occur in a bimodal distribution: in young patients, they result from high-energy trauma, and in elderly patients, they occur as a result of low-energy injury combined with osteoporosis. Treatment options include immobilization in a cast, splint, or brace; open reduction and internal fixation (ORIF); total elbow arthroplasty (TEA); and elbow hemiarthroplasty. Nonsurgical treatment is reserved for minimally displaced fractures or for patients who are medically unfit for surgery. ORIF has been the gold standard for many years, with the goal of anatomical reconstruction of the articular surface. This is usually achieved with plates and screws in order to build a stable construct that will allow early range of motion. The plates either can be parallel to each other or orthogonal (90°-90° plating). However, ORIF can prove technically demanding, if not impossible, in elderly patients with severe osteoporosis and fracture comminution and is associated with multiple complications. TEA can be a viable solution, offering these patients a functional and pain-free elbow joint but with the disadvantage of strict activity restrictions for the rest of their lifetime.

Elbow hemiarthroplasty for a fracture of the distal part of the humerus is not new; to our knowledge, there are fifty-seven
cases reported in the English-language literature. Parsons et al. described the technique used in eleven patients with fractures of the distal part of the humerus or nonunions who were treated with the Sorbie-Questor prosthesis. They presented the short-term results of eight of these patients (the youngest was forty-six years old). The overall results were encouraging: the average American Shoulder and Elbow Surgeons elbow outcome score was 80.6. Adolfsson and Hammer treated four patients (average age, eighty years) who had acute complex fractures of the distal part of the humerus with the Kudo humeral component. At the ten-month follow-up, they reported three excellent results and one good result according to the Mayo Elbow Performance Score. Adolfsson and Nestorson reported the midterm results of eight patients treated in the same manner for the same condition; again, the results were good to excellent. Despite the suboptimal design of the prosthesis, which requires resection of the radial head and can lead to attrition of the coronoid process, the final result was not affected. Burkhart et al. treated a group of ten elderly women with the Latitude hemiarthroplasty for acute fractures of the distal part of the humerus or early failed osteosynthesis. According to the Disabilities of the Arm, Shoulder and Hand score, the short-term results were good to excellent, and only one patient reported a fair clinical outcome.

There is much controversy concerning the ideal treatment for high-energy comminuted fractures of the distal part of the humerus in younger patients. Parsons et al. suggested that in the case of severe articular comminution, which precludes anatomic reduction and stable fixation, ORIF could lead to unsatisfactory results. On the other hand, TEA has the risk of aseptic loosening and polyethylene wear. As a result, elbow hemiarthroplasty can fill the gap between these two options. Other authors do not agree with this approach. Galano et al. reported a 50% complication rate with this procedure; according to them, elbow hemiarthroplasty should be considered as a last resort in a young patient. Adolfsson and Nestorson do not recommend hemiarthroplasty for younger patients. However, Adolfsson and Nestorson did not support this same argument in an article that was published later with a larger series and longer follow-up.

Our patient had an open highly comminuted fracture of the distal part of the humerus with bone loss of the articular surface. We did not proceed with ORIF, which would have had a predetermined catastrophic result. We believed that the best choice was arthroplasty (TEA or hemiarthroplasty). As mentioned above, the possible procedures were discussed with the patient, and he agreed with our course of action. Because of his young age and greater activity demands, we decided to perform a delayed hemiarthroplasty, which can be converted later to a TEA without the need to remove a well-fixed humeral component. We believe that this approach helps avoid early aseptic loosening caused by polyethylene wear. Furthermore, the Latitude prosthesis we used is more anatomical compared with earlier designs. Elbow hemiarthroplasty has the same complications as TEA, with the addition of instability. In order to avoid instability, the collateral ligaments should be either intact or reconstructed. In our patient, we reconstructed the two columns, and we supported the elbow in the postoperative period with an external fixation system that allowed early flexion and extension but protected it from valgus and varus stresses.

Aside from small case series, there is limited evidence to support elbow hemiarthroplasty as a widespread option in the treatment of fractures of the distal part of the humerus, but it remains a potential treatment option for difficult clinical scenarios. This procedure provided our patient with a pain-free and functional elbow during a critical and productive time of his life.

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