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Case Report

Coronoid Impingement Causing Early Failure of Total Elbow Arthroplasty

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A R T I C L E I N F O

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Total elbow arthroplasty (TEA) is a well-established treatment for end-stage rheumatoid arthritis of the elbow. With improved surgical techniques and implant designs, TEA is also effective in treating elbow osteoarthritis, posttraumatic arthritis, distal humerus nonunion, and comminuted distal humerus fractures in the elderly population. There have been multiple reports of greater than 90% survival rate, free of reoperation at 10 years. We present a case of early failure of TEA caused by coronoid impingement, to provide a surgical pearl for others to avoid this complication.

Total elbow arthroplasty (TEA) is a well-established treatment for end-stage rheumatoid arthritis of the elbow. With improved surgical techniques and implant designs, TEA is also effective in treating elbow osteoarthritis, posttraumatic arthritis, distal humerus nonunion, and comminuted distal humerus fractures in the elderly population. There have been multiple reports of greater than 90% survival rate, free of reoperation at 10 years.[1] We present a case of early failure of TEA caused by coronoid impingement and provide a technical pearls for others to avoid this complication.

Case Report

An 85-year-old, very active man presented to our institution 1 year after sustaining a comminuted intra-articular distal humerus fracture, for which he underwent a porous coated Nexel (Zimmer, Warsaw, IN) TEA by the senior author (P.J.E.) (Fig. 1). The initial procedure was uncomplicated, with restoration of the elbow's mechanical axis and intraoperative range of motion (ROM) of 0° to 140°. The postoperative course was uneventful, with return to activities of daily living without pain. Thirteen months after the index procedure, the patient began to have forearm pain with elbow flexion, which continued to progress over the next 4 weeks.

Upon physical examination, he had a well-healed surgical incision with no erythema and no elbow effusion. Elbow ROM was 15° to 130° with pain in deep flexion. Pronation and supination were 80° and 85°, respectively. No pain, crepitans, or squeaking could be reproduced with short-arc ROM; however, forearm-based pain could be elicited with elbow flexion greater than 120°. Standard anteroposterior and lateral radiographs of the elbow revealed new lucency around the ulnar stem. Because of radiographic findings and increased elbow pain, we obtained routine inflammatory blood work for possible infection and discussed revision of the ulnar component. No effusion was present and preoperative inflammatory markers were within normal limits.

The patient was taken to the operating room and a fluoroscopic examination under anesthesia was performed that demonstrated coronoid impingement on the anterior flange of the humeral prosthesis with resultant pistoning of the ulnar component (Fig. 2). The prior posterior surgical incision was used followed by exposure of the TEA by the triceps fascial tongue technique.[2] No purulence was found and intraoperative frozen sections were negative for acute inflammation or infection. Deep cultures were obtained and sent to the microbiology laboratory for aerobic, anaerobic, acid-fast bacilli, and fungal organisms.

Intraoperative examination of the elbow showed pistoning of the ulnar component with deep flexion (Fig. 3). The prosthesis was disarticulated, the humeral component was well-fixed, and the ulnar component was easily extracted. The wound was copiously irrigated, ostectomy was performed on the coronoid to prevent future impingement, and a new ulna component was placed with antibiotic cement after appropriate reaming and broaching. Full

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Figure 1. Immediate postoperative imaging: **A** posteroanterior and **B** lateral radiograph of TEA.

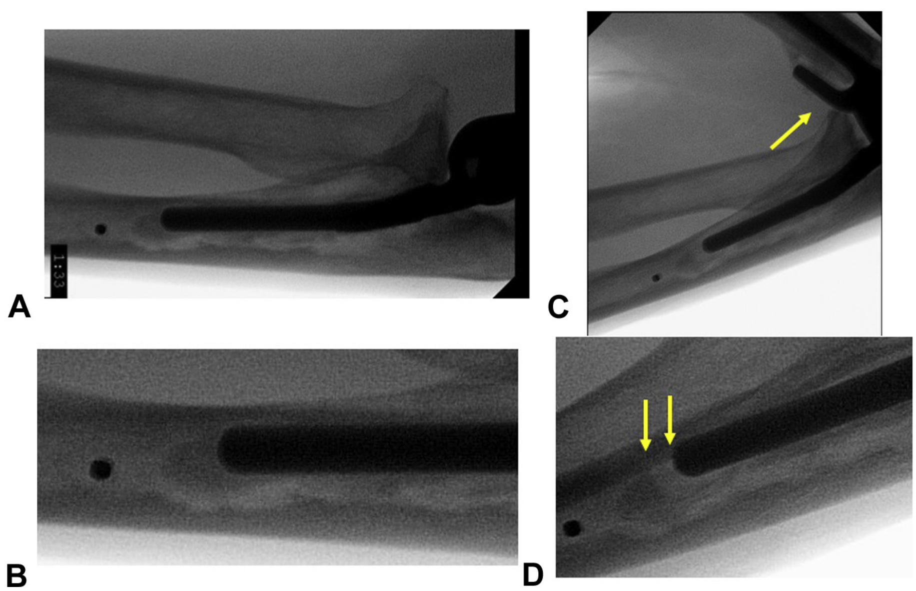

Figure 2. A,B Lateral radiograph of elbow at 30° and 130° flexion. **C,D** Note the lucency around the ulnar stem. Single arrow shows the coronoid impinging on the humeral flange. Twin arrows show pistoning of the ulnar component with deep flexion.

ROM of the elbow was achieved without impingement (Fig. 4). All cultures were held for 21 days for *Propionibacterium acnes* and were negative. One year after the revision surgery, the wound was well-healed, elbow ROM was 10° to 140° without pain, and the patient resumed activities of daily living.

Discussion

Numerous recent reports have focused on the successful long-term outcomes of TEA with survival rates of greater than 90% at 5 years and 80% at 10 years, but few have focused on early failures.[3–5] Despite advances in surgical techniques and implant design, TEA complications have been reported to be as high as 45%; loosening of one of the components is the most common cause.[5–7]

The Nexel TEA is Zimmer's third-generation linked prosthesis. It has an improved polyethylene bushing designed to increased contact area and decrease peak stresses in the hope of decreasing the rates of polyethylene wear and subsequent osteolysis.[3,8] The anterior humeral flange was added to the last 2 designs, which has provided resistance against torsional forces that may lead to humeral loosening. It is porous coated to decrease cement–implant interface loosening.

Schneeberger and colleagues[9] reviewed 23 Coonrad-Morrey TEAs with a mean follow-up of 4 years. A total of 78% of patients

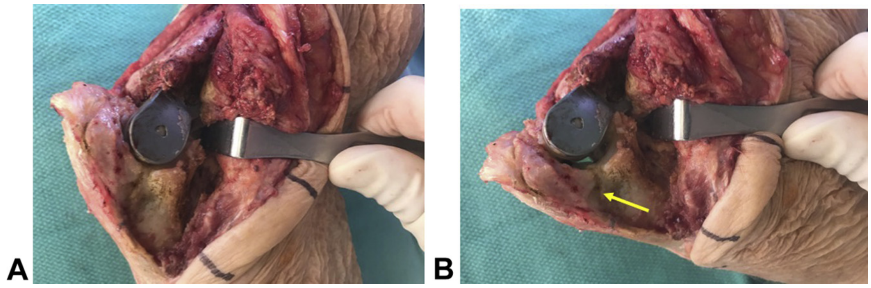

Figure 3. Intraoperative photograph of elbow **A** at 45° and **B** 130° flexion. Note the distraction force to the ulna when the humeral flange impinges with the coronoid.

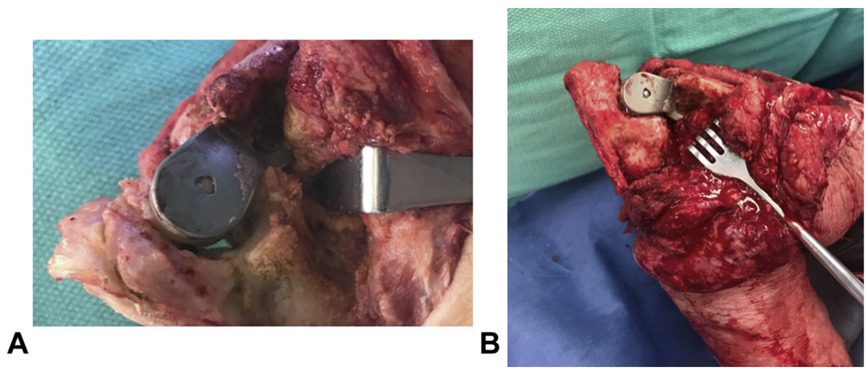

Figure 4. Intraoperative photograph **A** before and **B** after resection of coronoid with the elbow in 135° flexion.

Figure 5. A,B Saw bone model demonstrating humeral flange and coronoid impingement with successive increase in flexion. **C** Removal of prominent coronoid and elimination of impingement.

had a satisfactory outcome although 30% required revision surgery. Three patients experienced early loosening, which the authors attributed to seating the ulnar component too deep and not removing coronoid osteophytes; both factors were attributed to coronoid impingement with elbow flexion and placing a distraction force between the ulnar component and ulna. Cheung and O'Driscoll et al[1] retrospectively reviewed 10 early failures of the Coonrad-Morrey (second-generation) prosthesis with polymethylmethacrylate (PMMA) precoated ulnar components. They described loosening of the ulnar component with impingement of any anterior structure (coronoid, heterotopic ossification, or soft tissue or scar). They also advised that this complication could be avoided by removing anterior structures and implanting porous versus PMMA-coated stems, because no prior reports existed with porous coated implants. The advantage of a porous coated implant over a PMMA coated stem is that it eliminates the development of a fibrous membrane between the bone–cement or cement–implant interface, which may lead to loosening. In our case, the humeral flange impingement on the coronoid led to loosening of the ulnar component while the humeral component remained well-seated (Fig. 5).

Patients who present with pain after a TEA should be thoroughly evaluated for early causes of failure including loosening, infection, and periprosthetic fracture. A history of an audible prosthesis (squeaking or clunking) and increased pain with deep flexion should raise suspicion for ulnar component pistoning. Radiographs of the elbow should be scrutinized for signs and causes of early failure. Bai et al[10] retrospectively reviewed 104 TEAs with a mean follow-up of 826 days. They found radiographic complications (heterotopic bone, peri-implant lucency, fracture, or polyethylene wear) in 67% of patients; 55% developed elbow pain and 30% underwent at least one additional procedure. Lateral radiographs with progressive elbow flexion or increased osteolysis around the ulnar component may also aid in the diagnosis. Pistoning ulnar components should be treated with revision and removal of anterior impinging structures (Fig. 4). We believe this is the first report on loosening of a porous coated ulnar component resulting from impingement or pistoning. This complication can be minimized during the index TEA by placing the elbow in deep flexion and removing any impinging anterior structures.

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