

Third Revision of Unlinked Total Elbow Arthroplasty with Impaction Allografting and Postoperative Teriparatide Treatment: A Case Report

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Abstract

Total elbow arthroplasty (TEA) has been indicated for numerous degenerative inflammatory and traumatic diseases with favorable mid to long-term clinical outcomes. However, the complication rate is still high and the loss of bone stock makes the revision surgery challenging. We report a case of third revision TEA treated with impaction allografting and postoperative teriparatide treatment. After 2 years follow-up, loosening or displacement of components was not observed, and good bone remodeling presented at impaction bone grafting site and protruded anterior cortex.

Keywords: Total Elbow Arthroplasty; Aseptic Loosening; Revision Surgery; Teriparatide; Impaction allografting

Abbreviations: TEA (total elbow arthroplasty)

Introduction

Total elbow arthroplasty (TEA) has been indicated for numerous degenerative inflammatory and traumatic diseases. Mid to long-term favorable clinical outcomes have been reported either in linked semi-constrained TEA or non-linked resurfacing TEA [1-3]. Despite considerable developments in prosthetic design and surgical techniques, TEA has been associated with a high rate of complications such as loosening, infection, dislocation, implant failure and wear of polyethylene [4,5]. In the majority of revision cases, loss of bone stock through peri-prosthetic osteolysis makes the surgery challenging. We report a case of third revision TEA due to aseptic loosening with severe bone defect that is treated with impaction allografting and postoperative teriparatide treatment.

Case report

A 65-year old woman who underwent revision TEA twice presented with right elbow pain and aseptic loosening of the humeral component. At the age of 53, she visited our department due to pain and swelling of the right elbow. At the initial presentation, the flexion/extension range of motion of the right elbow was -40° to 90°. Plain radiographs revealed severe destruction of right elbow due to RA.

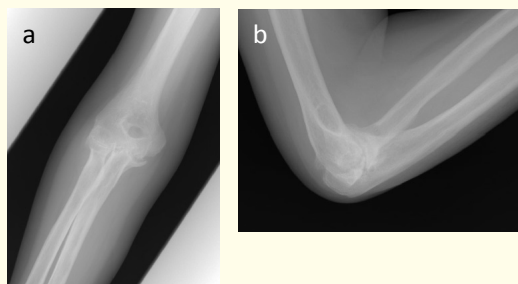


Figure 1: Preoperative plain radiographs.

a: AP view.

b: Lateral view.

This case had indication for surgery, and we performed unlinked TEA (OU - Elbow; Finsbury Orthopaedics, Surrey, UK), using short stem non-cemented humeral component and non-cemented ulnar component. Three years after surgery, she had pain and range of motion limitation of the right elbow. The flexion/extension range of motion was -50° to 115° , and radiographs showed loosening and displacement of the humeral component.

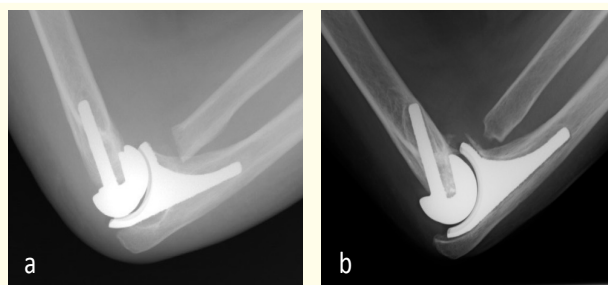


Figure 2a: Lateral view after initial TEA.

Figure 2b: Lateral view before first revision TEA.

Revision TEA was performed only for humeral component because ulnar component was not loose. We used humeral component with standard stem that was longer than humeral component implanted at initial surgery and fixed it using bone cement. After surgery the right elbow pain improved. However, 2 years after revision surgery, right elbow pain appeared again. The flexion/extension range of motion of the right elbow was -30° to 120° . Radiographs revealed atrophic change of distal humerus and loosening of ulnar component.

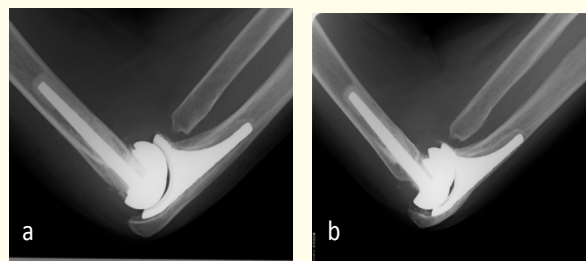


Figure 3a: Lateral view after first revision TEA

Figure 3b: Lateral view before second revision TEA.

She underwent revision TEA again. We replaced only ulnar component, to the cemented polyethylene implant.

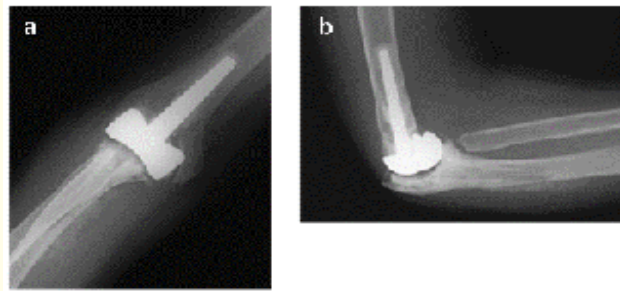


Figure 4a & 4b: Plain radiographs after second revision TEA.

The symptoms got better, and postoperative course was uneventful. Five years after the second revision surgery, she noticed range of motion limitation of the right elbow. The symptoms gradually deteriorated, and she visited our department at 7 years after the surgery. Flexion of the right elbow was decreased to 80° and extension was -30°. Severe loosening and displacement of the humeral component with bone defect were shown on radiographs.

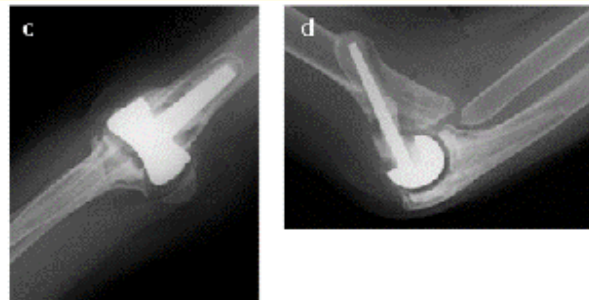


Figure 4c & 4d: Plain radiographs before third revision TEA.

Loosening of the ulnar component was not observed, therefore revision surgery of the humeral component was performed. Bone defect of the right humerus was observed at the anterior and posterior cortex. To achieve better stability of the implant, the humeral component with longer stem was required, but no such implant was available commercially. Thus we ordered a custom-made humeral component with 55 mm longer than standard stem. During surgery, the stem and anterior flange partially catch the anterior cortex. Therefore, we considered that the humeral component achieve adequate fixation. Furthermore, we used impaction allografting technique to fill the gap between the distal end of the stem and anterior flange, and also deficient posterior wall with the implant in place. Then we once pulled out the implant gently and inserted again with cement.



Figure 5a & 5b: Plain radiographs immediately after third revision TEA.

After 10 days immobilization, she started passive range of motion exercise. Six weeks after surgery, she started to receive treatment with teriparatide for remodeling of impaction bone grafting site. The weekly teriparatide treatment has been continued by 72 weeks. Posterior dislocation appeared at the extension position, therefore brace was used for joint stability.

Two years after surgery, she had no right elbow pain, and brace was not required because of enough stability. The range of motion of right elbow improved, flexion was 125 degrees and extension was -20 degrees. No loosening or displacement of components was observed, and good bone remodeling presented at impaction bone grafting site and protruded anterior cortex.



Figure 5c : plain radiographs 2 years after third revision TEA.

Figure 5d: Arrow indicates the bone remodeling of the protruded anterior cortex.

Discussion

The most important finding of this report is that the bone stock of the distal humerus was successfully restored by impaction allografting together with postoperative teriparatide treatment. Aseptic loosening is the most common complication after TEA. In this case unlinked short stem component was used initial surgery. Puskas., *et al.* reported that meantime to revision was shorter in short stem humeral implant in Coonrad-Morrey prosthesis [6]. They also described that longer humeral stem has the potential benefit of a longer interface for implant fixation and force distribution. Thus we replaced the humeral component with a longer stem in initial revision surgery. However adequate fixation was not archived due to the defect of the distal anterior cortex and we compensated the gap between the stem and anterior flange. That might result in early failure of the humeral component. The anterior and posterior cortex was not survived at the third revision. To get metaphysical fixation at the distal humerus, we inserted the humeral component a little bit deeper to get the fixation by the stem and anterior flange. Furthermore, we inserted small strut allograft between the anterior cortex and flange, and filled the gap by impacting the allograft cancellous bone to get further initial fixation and long-term biological fixation.

Impaction bone grafting in combination with a cemented stem is a well-established technique for revision hip arthroplasty in patients with severe bone defect of the proximal femur [7,8]. Impaction bone grafting for revision total arthroplasty is designed for two specific purposes. One is to restore bone stock around the osteolysis site and the other is to enhance the bone-cement interface. This strategy has been modified and used in revision total elbow arthroplasty [9,10].

On the other hand, teriparatide treatment has been proven to increase skeletal bone mass in osteoporotic patients [11]. Interestingly, Reynolds., *et al.* reported that teriparatide therapy enhances devitalized femoral allograft Osseointegration and biomechanics in a murine model [12]. Teriparatide treatment has been demonstrated to improve the femoral allograft healing by enhancing intramembranous bone formation [13].

To enhance the osteoblastic bone formation and remodeling, we added the postoperative teriparatide treatment for 72 weeks.

Because of the severe osteolysis around the distal humerus, linked type TEA might be an option for such cases. However, the ulnar component was not loosening at the latest surgery, we decided to revise only humeral component using a long stem custom-made prosthesis.

The patient was relatively young at the latest surgery. Thus we planned to restore bone stock around the distal humerus using impaction bone grafting. If next revision surgery will be needed in future, we believe the treatment can broaden the surgical option.

Two years follow-up is too short to evaluate the loosening of the prosthesis. This is the limitation of this case report and it should be evaluated in the future. However, bone loss at the distal humerus was successfully restored by the impaction allografting and postoperative teriparatide treatment at the latest follow-up. We recommend the impaction allografting and postoperative teriparatide treatment for revision TEA cases with severe bone loss to restore the bone stock and to achieve the metaphyseal fixation.

Conclusion

In case of revision TEA with severe bone defect, impaction allografting together with teriparatide treatment is a useful method.

Declaration of interest: The authors declare no conflicts of interest concerning this article.

Bibliography

1. Gill DR and Morrey BF. "The Coonrad-Morrey total elbow arthroplasty in patients who have rheumatoid arthritis. A ten to fifteen-year follow-up study." *Journal of Bone and Joint Surgery American volume* 80.9 (1998): 1327-1335.
2. Mori T, et al. "Kudo type-5 total elbow arthroplasty in mutilating rheumatoid arthritis: a 5- to 11-year follow-up." *Journal of Bone and Joint Surgery British volume* 88.7 (2006): 920-924.
3. Plaschke HC, et al. "Implant survival after total elbow arthroplasty: a retrospective study of 324 procedures performed from 1980 to 2008." *Journal of Shoulder and Elbow Surgery* 23.6 (2014): 829-836.
4. Krenek L, et al. "Complication and revision rates following total elbow arthroplasty." *Journal of Hand Surgery American volume* 36.1 (2011): 68-73.
5. Voloshin I, et al. "Complications of total elbow replacement: a systematic review." *Journal of Shoulder and Elbow Surgery* 20.1 (2011): 158-168.
6. Puskas GJ, et al. "Aseptic loosening rate of the humeral stem in the Coonrad-Morrey total elbow arthroplasty. Does size matter?" *Journal of Shoulder and Elbow Surgery* 23.1 (2014): 76-81.
7. Duncan CP, et al. "Impaction allografting with cement for the management of femoral bone loss." *Orthopaedics Clinics of North America* 29.2 (1998): 297-305.
8. Leopold SS, et al. "Impaction allografting with cement for revision of the femoral component. A minimum four-year follow-up study with use of a pre coated femoral stem." *Journal of Bone and Joint Surgery American volume* 81.8 (1999): 1080-92.
9. Lee DH. "Impaction allograft bone-grafting for revision total elbow arthroplasty. A case report." *Journal of Bone and Joint Surgery American volume* 81.7 (1999): 1008-12.
10. Loebenberg MI, et al. "Impaction grafting in revision total elbow arthroplasty." *Journal of Bone and Joint Surgery American volume* 87.1 (2005): 99-106.
11. Neer RM, et al. "Effect of parathyroid hormone (1-34) on fractures and bone mineral density in postmenopausal women with osteoporosis." *The New England Journal of Medicine* 344.19 (2001): 1434-1441.
12. Reynolds DG, et al. "Teriparatide therapy enhances devitalized femoral allograft osseointegration and biomechanics in a murine model." *Bone* 48.3 (2011): 562-570.

13. Takahata M., *et al.* "Delayed short-course treatment with teriparatide (PTH(1-34)) improves femoral allograft healing by enhancing intramembranous bone formation at the graft-host junction." *Journal of Bone and Mineral Research* 27.1 (2012): 26-37.

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