

Elbow prosthesis revision with custom-made ulnar stem

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SUMMARY

Introduction. Total elbow arthroplasty (TEA) is a relatively infrequent orthopedic procedure compared to other types of arthroplasty operations, such as knee and hip replacements. To date, the indications have expanded to include non-synthesizable distal humerus joint fractures, osteoarthritis, and post-traumatic arthritis.

Case presentation. A 75-year-old woman presented to the emergency room following an accidental fall at home. Radiographic control revealed a distal diaphyseal fracture of the humerus on the left with complete paralysis of the radial nerve and mobilization of the ulnar stem of the TEA on the right. It was decided for an initial reduction and synthesis of the left distal humerus fracture with a plate and screws and subsequent partial revision surgery of the TEA. In the following two weeks of follow-up, significant skin distress generated by the apex of the ulnar stem was observed. We proceeded with synthesis and partial reconstruction of the ulna with cadaver bone and plate and screws before the definitive operation. After approximately 3 months, we proceeded with the definitive operation to remove the fixation devices and revision of the ulnar component of the TEA. At 12 months of follow-up, the patient had excellent results with a slight deficit in extension and flexion, without painful symptoms.

Conclusions. TEA revision is an increasingly frequent intervention. This is due to the gradual increase in primary implants, but also due to the expansion of surgical indications. The main causes of revision are component loosening and post-trauma periprosthetic fractures. In the present case, the revision surgery of the ulnar component of a TEA with a custom-made stem was associated with satisfactory clinical and radiographic results throughout follow-up. There are few articles in the literature dealing with this topic. To date, revision of TEA is still a challenge due to the complexity of the operation and related complications.

Key words: mobilization, stem, prosthesis, elbow, revision, custom-made, complications

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Introduction

Total elbow arthroplasty (TEA) is a relatively infrequent orthopedic procedure compared to other types of arthroplasty procedures, such as knee and hip replacements ¹. It was initially indicated as a treatment to manage end-stage rheumatoid arthritis ². To date, the indications have expanded to include non-synthesizable distal humerus joint fractures, osteoarthritis, and post-traumatic arthritis ³⁻¹¹. The design of TEA systems has evolved in recent decades. The first TEA was described in 1972 by Dee who reported the results of this intervention in patients with rheumatoid arthritis ². We present a case of mobilization of the ulnar component of a post-traumatic TEA with in-depth analysis of the surgical management and the results at the follow-up.

Case presentation

A 75-year-old woman presented to the emergency room of Oliveto Citra Hospital (SA, Italy) following an accidental fall in a domestic environment. The patient, suffering from rheumatoid arthritis, has a reverse shoulder prosthesis and TEA on the right for 5 years. Clinically there is widespread edema and ecchymosis

in the distal third of the left humerus with pain on palpation and total functional impotence. On the right, there is pain referred to palpation of the ulnar region of the middle third of the forearm. Following diagnostic investigations, a distal diaphyseal fracture of the humerus on the left was found with complete paralysis of the radial nerve (Fig. 1) and mobilization of the ulnar stem of the TEA on the right (Fig. 2).



Figure 1. Left distal humerus shaft fracture with complete radial nerve paralysis.

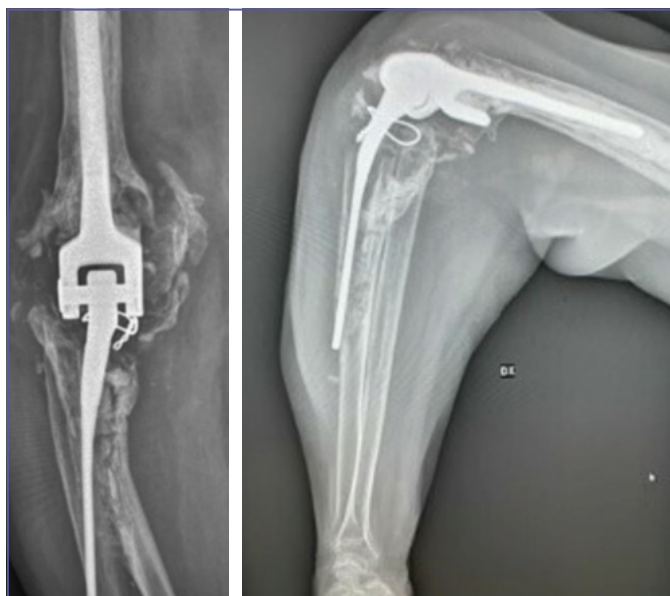


Figure 2. Mobilization of the ulnar stem.

Operative planning consisted of two phases:

- first phase: reduction and synthesis of the fracture of the left distal humerus with a plate and screws (Fig. 3) with exploration of the radial nerve, which was incarcerated in the fracture site but intact throughout its course (Fig. 4);
- second phase: partial revision surgery of the elbow with replacement of the ulnar component with a custom-made stem (waiting time 3 months).

In the following two weeks of follow-up, it was observed that the apex of the ulnar stem generated increasingly greater skin distress, with identification of the same on palpation of the middle third of the forearm (Fig. 5). For this reason, we proceeded with synthesis and partial reconstruction of the ulna with cadaver bone and plate and screws before the definitive surgery (Fig. 6). Numerous intra-operative swabs were taken to exclude the risk of infection of the implant.

After approximately 3 months, following further radiographic planning and an excellent post-operative recovery, we proceeded with the definitive operation of removal of the

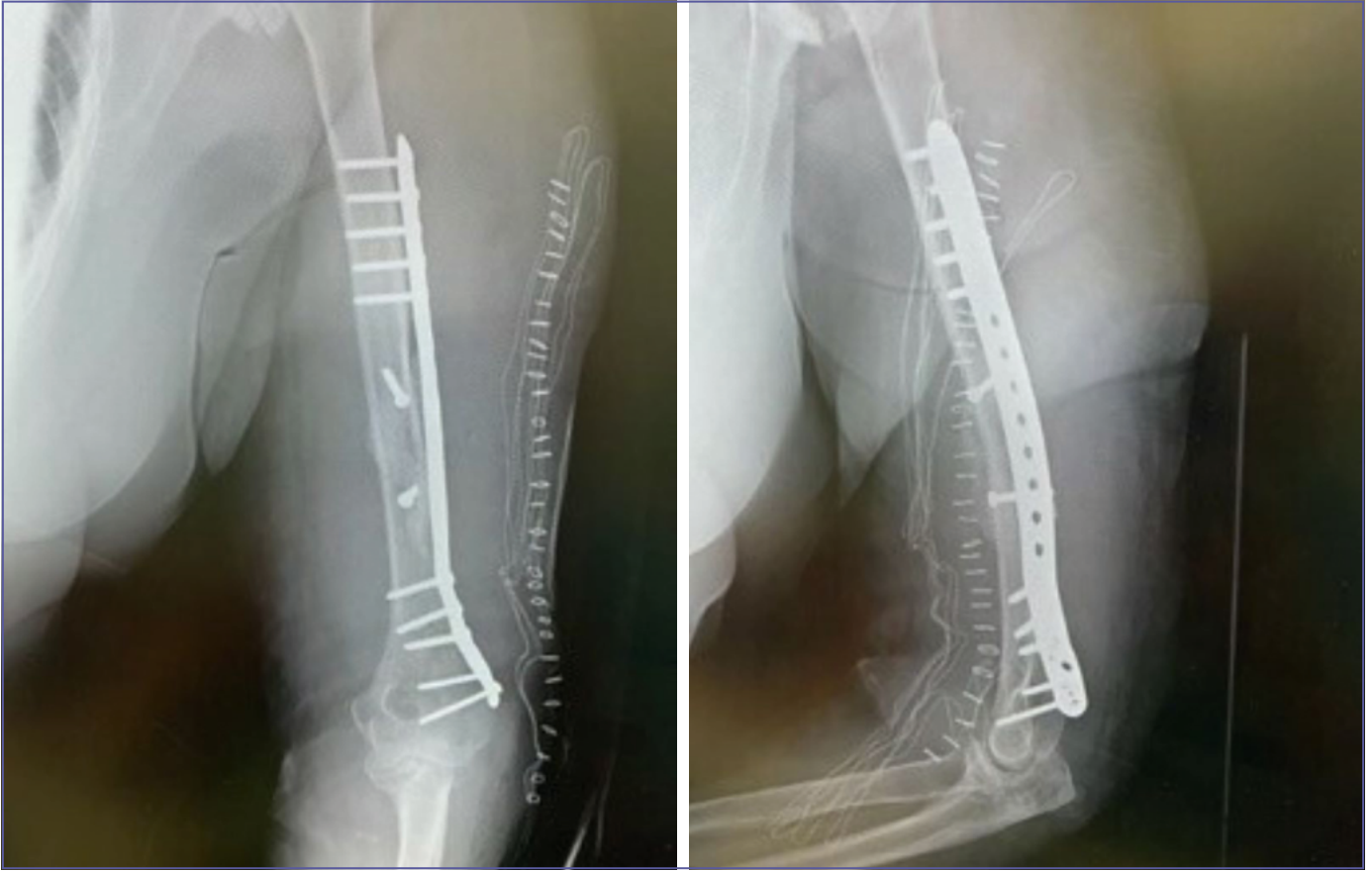


Figure 3. Reduction and fixation of the left distal humerus fracture with plate and screw.

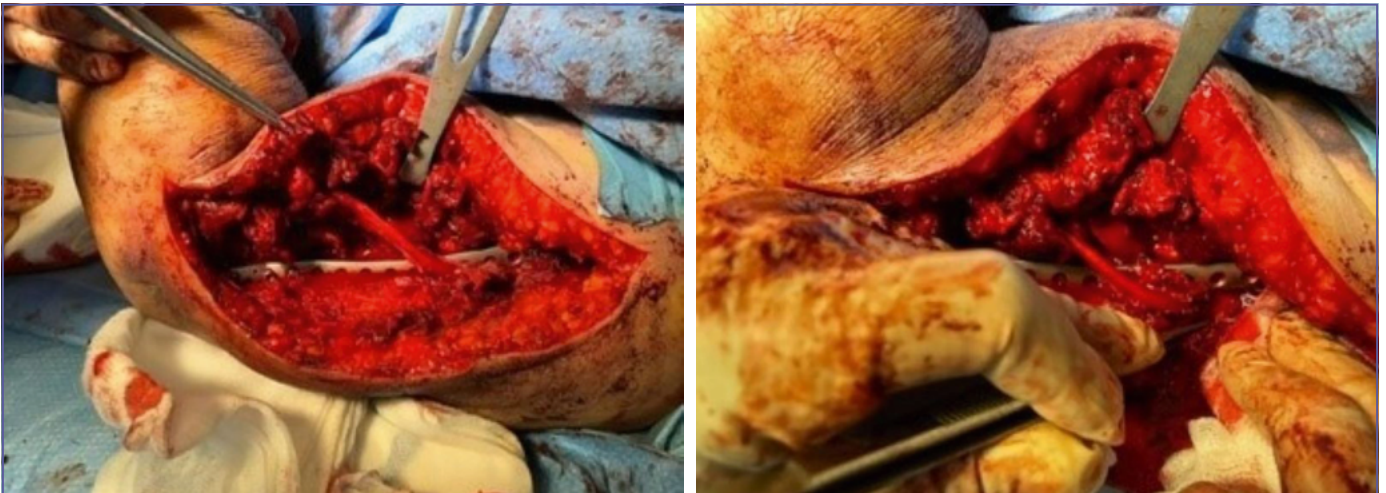


Figure 4. Exploration of the radial nerve, intact throughout its course.

prosthetic implant and fixation devices, and custom-made prosthetic revision with a 160 mm cemented ulnar stem (Fig. 7). The request for a custom-made ulnar stem was giv-

en by the need to have a longer than standard ulnar stem. The revision stem has, upon our request, anchoring holes for the triceps brachii with high-strength wires (Fig. 8A-B).



Figure 5. Apex of the ulnar shaft outside the medullary canal of the ulna.



Figure 7. Custom-made ulnar stem: proximally, anchor holes for the triceps brachii.



Figure 6. Partial reconstruction of the ulna with cadaver bone, plate and screws.

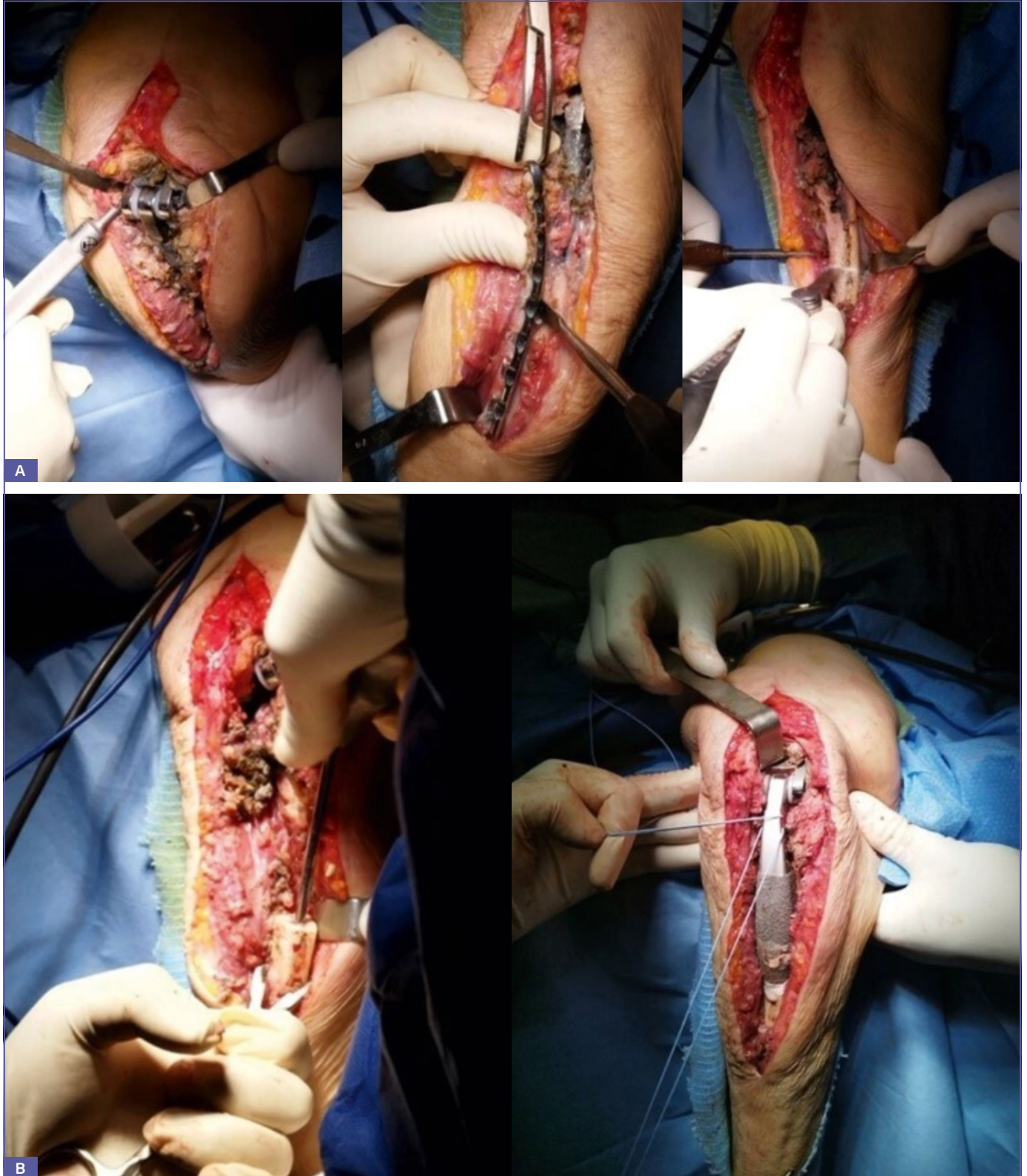


Figure 8. A) removal of the old ulnar stem and screw plate: on the right, note the good osteo-integration of the cadaveric bone splint and the regularization osteotomy of the ulnar region; **B)** preparation of the ulnar canal and implantation of the custom-made stem: on the right, note the holes for anchoring the triceps brachii.

During the definitive operation, good osteo-integration of the previously implanted cadaver ulnar bone splint was observed.

Post-operative radiographic checks showed good positioning of the prosthetic components. Clinical and radiographic controls

at 1, 3 and 6 months showed satisfactory results. At 12 months of follow-up, the radiographic checks were optimal (Fig. 9A) and the patient presented clinically an extension deficit of 15° and 10° degrees of flexion, without painful symptoms and no limitations in daily living activities.

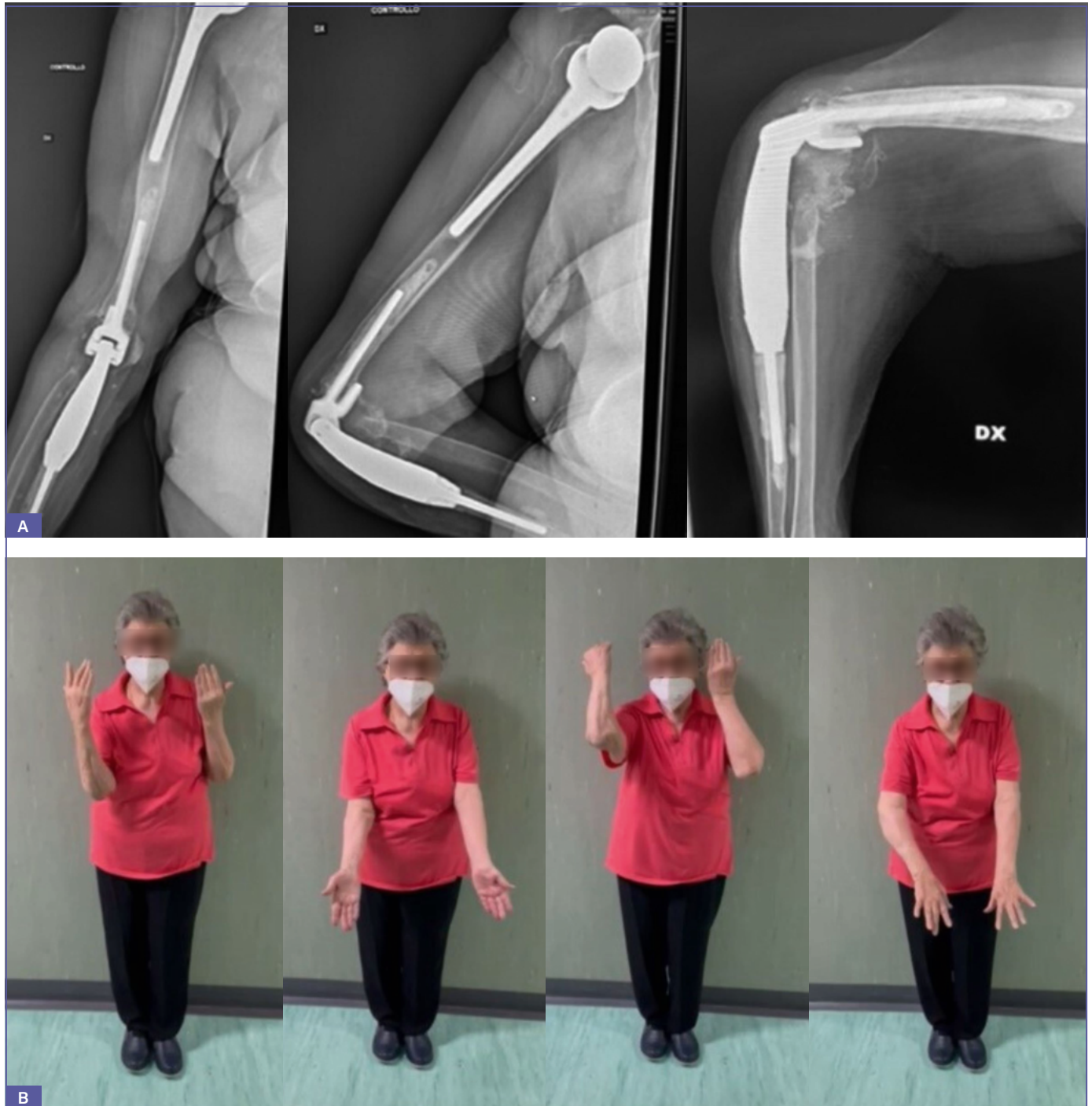


Figure 9. A) radiographic check-up at 12 months; B) clinical check-up at 12 months, slight deficit in flexion and extension of the right elbow without painful symptoms.

Discussion

TEA is a relatively infrequent procedure compared to other types of arthroplasty procedures, and has higher rates of complication compared to other arthroplasty interventions¹². To date, with the increase in TEA implants, the risk of short and long-term complications has also increased¹³⁻¹⁵. The most important complications are infections, aseptic mobilization, instability and periprosthetic fractures^{13,16-20}. Complications are observed more frequently in obese, smoking, and young patients, as well as those with numerous comorbidities²¹⁻²⁷. There are few studies in the literature discussing this topic on many patients. Peretta et al.²⁶ studied the main causes of revision TEA in a cohort of 102 primary implants in 82 patients, observed over approximately 25 years. The revision rate of the prosthetic implant was 41% (42 of 102). The main cause of revision was the loosening of the prosthetic components, present in about half of the cases. The next most common cause is trauma. According to their study, the average duration of the implant is approximately 5 years. Gill and Morrey²⁸ in their study of 69 patients reported different values, with a survival percentage of TEA of 94.4% at 5 years and 92.4% at 10 years. It is stated in the literature that primary implant failure rates are higher in traumatic cases than in arthritic cases^{26,29,30}. Our case mirrors what is also described in the literature. The patient had undergone TEA surgery 5 years prior. She had rheumatoid arthritis, a major indication for surgical treatment. She presented a mobilization of the post-traumatic ulnar component. At our follow-up, although short (12 months), the patient showed excellent results such as lack of pain and near complete recovery of elbow mobility.

Conclusions

TEA revision is an increasingly frequent intervention. This is due to the gradual increase in primary implants, also due to the expansion of surgical indications. The main causes of revision are component loosening and post-trauma periprosthetic fractures. In our case, revision surgery of the ulnar component of a TEA with a custom-made stem showed satisfactory clinical and radiographic results throughout follow-up. There are few articles in the literature dealing with this topic. To date, revision of TEA is still a challenge due to the complexity of the operation and related complications.

Conflict of interest statement

The authors declare no conflict of interest.

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Author contributions

GA, GT: writing – original draft, writing – review & editing, study selection, data collection and extraction, risk of study bias assessment; FM: writing – original draft, study selection, data collection; AA: writing – original draft, writing – review & editing; GV: writing – original draft, writing – review & editing; GC: writing – original draft, writing – review & editing, final approval. All authors: final approval.

Ethical consideration

This study was approved by the Institutional Ethics Committee (ASL SALERNO, P.O. Oliveto Citra). The research was conducted ethically, with all study procedures being performed in accordance with the requirements of the World Medical Association's Declaration of Helsinki. Written informed consent was obtained from each participant/patient for study participation and data publication.

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