Radial Head Arthroplasty

79

Alessandro Marinelli, Alice Ritali, Enrico Guerra, and Roberto Rotini

79.1 Introduction

For indications for radial head replacement, refer to Chap. 1.

Over the recent decades, radial head implants have evolved significantly with advances in materials, shapes, "implant-capitellum" loading (Table 79.1), and stem fixation.

Table 79.1 Comparison of unipolar and bipolar prostheses

Prosthesis	Advantages	Disadvantages
Monopolar	– Stability – No debris – Good long-term results	– Lesser adaptable especially if humeral-radial malalignment
Bipolar	Better for chronic cases with persistent instability, when radio-humeral joint is not perfectly congruent	– Lesser stability is possible – Polyethylene debris – Prosthesis disassociation

Electronic Supplementary Material The online version of this chapter (https://doi.org/10.1007/978-3-662-58931-1_79) contains supplementary material, which is available to authorized users.

A. Marinelli (✉) · A. Ritali · E. Guerra · R. Rotini
Shoulder and Elbow Unit, Istituto Ortopedico Rizzoli, Bologna, Italy
e-mail: alessandro.marinelli@ior.it

79.2 Indications/ Contraindications

Indications and contraindications of radial head replacement, with possible alternative surgical treatments, are presented in Table 79.2.

Table 79.2 Radial head fractures

	Acute fracture	Chronic cases
Indications	– Unfixable fractures – Associated instability (coronoid, olecranon, MCL, LCL, IOM)	– Instability after radial head resection – Failure of radial head fixation
Contraindications	– Unable to contain prosthesis in radial head – Stability after radial head resection in low-demand patients – Infection metal allergy	– Elbow stability even without RH – Infection
Alternative treatments	– Back table reconstruction – Radial head allograft	External fixator, anconeus interposition arthroplasty

G. Bain et al. (eds.), *Surgical Techniques for Trauma and Sports Related Injuries of the Elbow*, https://doi.org/10.1007/978-3-662-58931-1_79

79.2.1 Surgical Technique

A lateral approach is performed. If the medial side also needs to be approached, then either a common posterior approach or a combined approach (lateral and medial) should be used. The lateral approach can be a Kaplan, Kocher, or Wrightington approach (Fig. 79.1).

We prefer the Kocher approach, developing the interval between anconeus and extensor carpi ulnaris. The joint capsule is incised, remaining anterior to the radial head to preserve the main lateral stabilizer: the lateral ulnar collateral ligament (LUCL). The annular ligament and joint capsule are divided and the radial head is exposed.

If the fracture cannot be fixed, all the bony fragments are removed and the radial neck is resected with a saw. The bony fragments of the radial head are recreated on the back table, to confirm that all the fragments have been excised and to determine the size of the implant [1].

The intramedullary canal is exposed, with a Hohmann retractor on the posterior aspect of the radial neck and applying a varus and supination stress (Fig. 79.2). Placing a Hohmann retractor anteriorly is discouraged, as it may risk the PIN. Rasp the canal of the proximal radius and insert trial components.

Choosing the correct head size is critical [2]. To select the right head size, we suggest five tips (Tables 79.3 and 79.4).

Fig. 79.2 Intraoperative view showing anterior langenbeck right angle retractor and the posterior typical retractors placement

Table 79.3 Five tips to choose the size of the radial head

Back table
1. Recreate the native radial head on the back table and compare it with the trial prosthesis and manufacturer's measurement devices (Fig. 79.5a–c).
2. When in doubt, choose the smaller diameter. Consider the height of thinner zone of the radial head, corresponding to the safe zone (Fig. 79.6a, b).
Surgical field
3. Use the lesser sigmoid notch as an intraoperative marker for the correct implant height [3] (Fig. 79.7; Video 79.2).
4. During intraoperative evaluation, ensure that the elbow is reduced. A varus stress, causing a widening of the radial-humerus space, may mislead to inserting overlengthened implant.
Intraoperative X-rays
5. Intraoperative fluoroscopy can confirm the correct diameter and stem alignment. Overlengthening can be missed on X-rays [2].

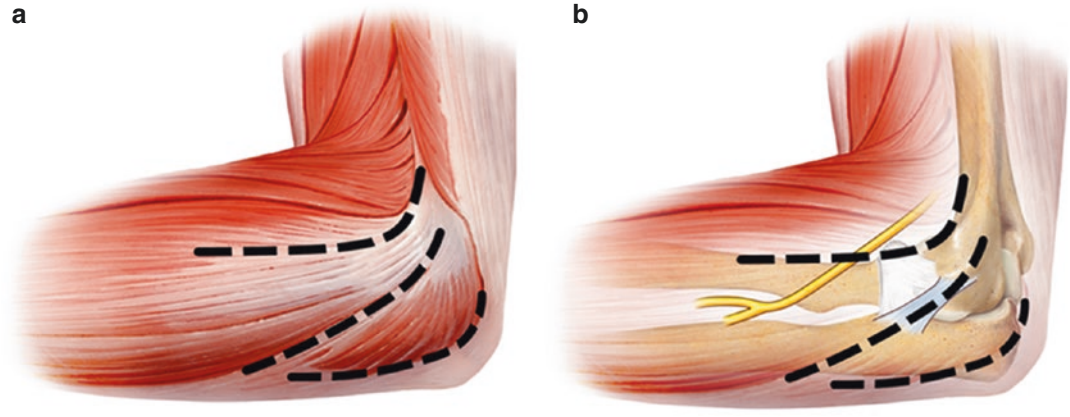

Fig. 79.1 (**a**) The surgical approaches for radial head prosthesis (from top: Kaplan, Kocher, and Wrightington approaches). (**b**) Relationship between surgical approaches, PIN, and LUCL

Table 79.4 Five tips to implant the stem

1. Use the resection guide if provided in the instrumentation set to maintain the correct prono-supination axis.
2. Using loose-fit stem implant: fit has not to be reached.
3. With a press-fit stem: aim for a firm fit. If this is not obtained, consider cementing the stem.
4. Curved stem: use the correct direction of the rasp, directing the tip towards the radial styloid (Fig. 79.3).
(a) If the fracture extends distally, into the radial neck, a longer stem has to be used, and use a prophylactic cerclage wire [1].
5. Once implanted, assess the range of motion and assess the joint stability. The annular ligament is repaired and the lateral ligament repaired with transosseous sutures or suture anchors (Video 79.1, Fig. 79.4).

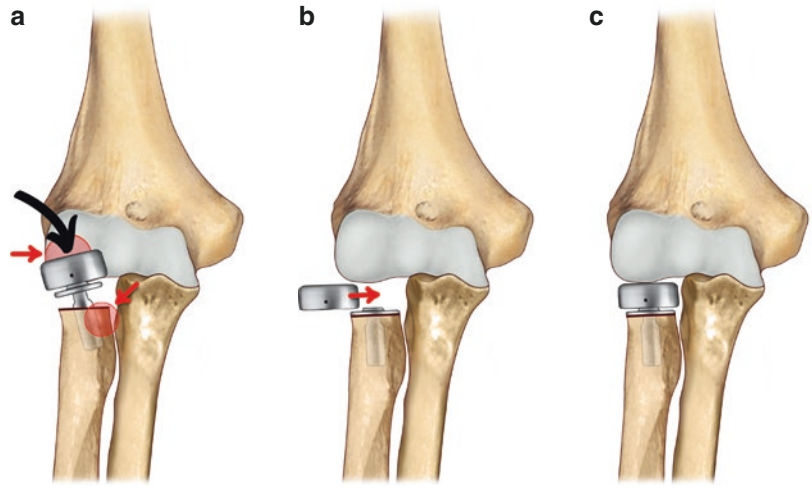

Fig. 79.3 Prosthesis design (**a**) impingement points with standard prosthesis, especially in case of intact LUCL. (**b**, **c**) Sliding system for side loading simplifies the implant insertion

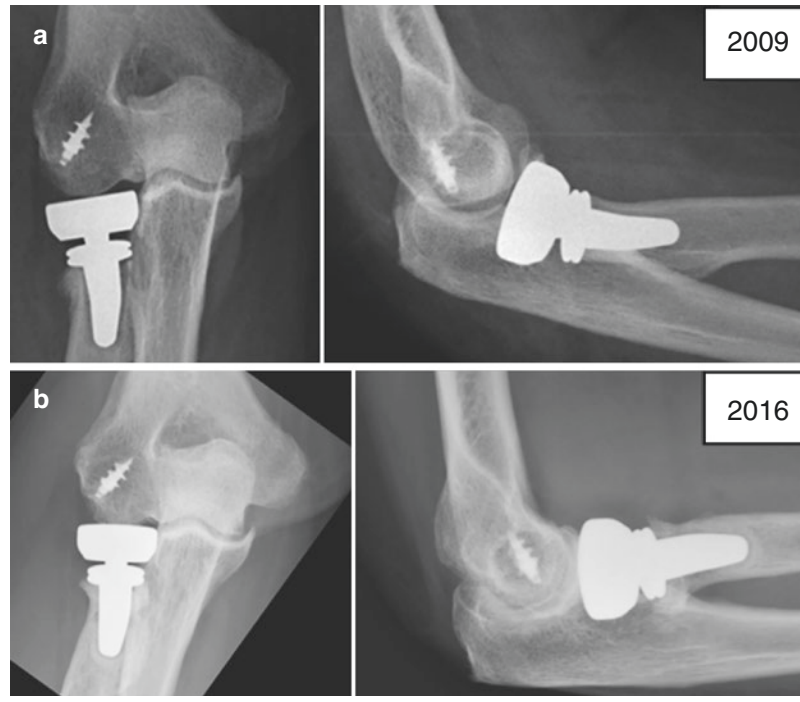

Fig. 79.4 Correct position of a radial head prosthesis at (**a**) 1-month (**b**) and 7-year follow-up. Suture anchor repair of the torn LUCL

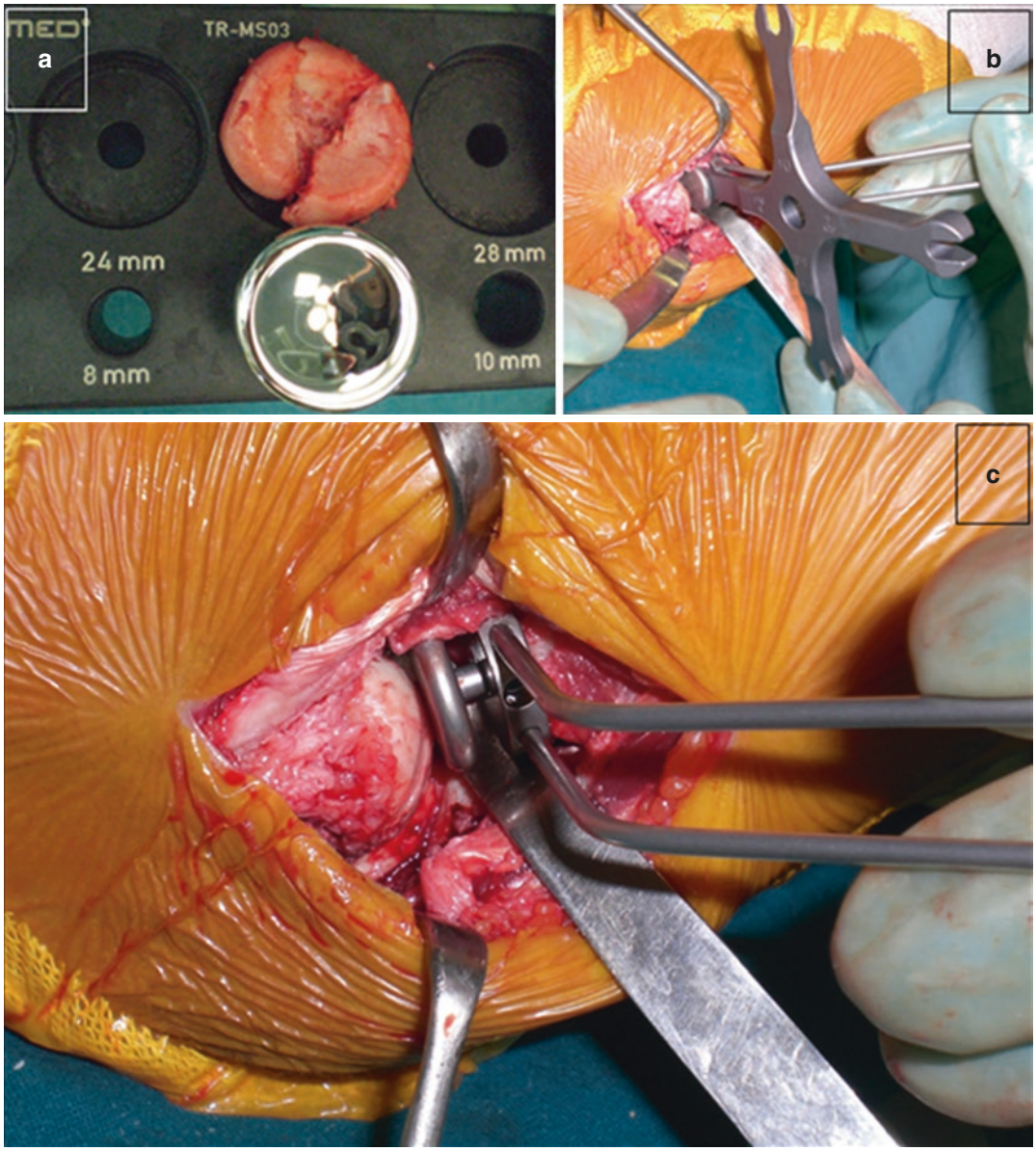

Fig. 79.5 Radial head sizing. (**a**) Radial head recreated on the back table. (**b**, **c**) Specific sizing device for radial head

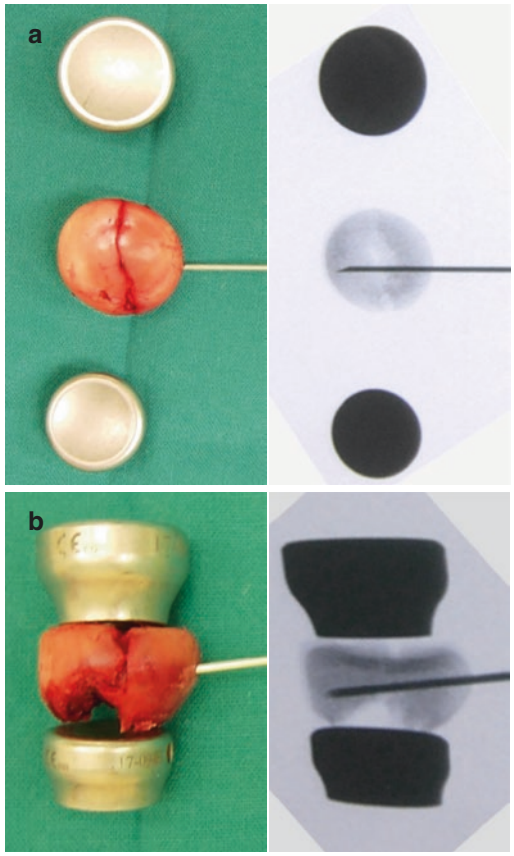

Fig. 79.6 Radial head trials. (**a**, **b**) Fluoroscopic and clinical comparison of two different sizes of radial head implants. Fluoroscopy shows that smaller diameter is similar to the native radial head

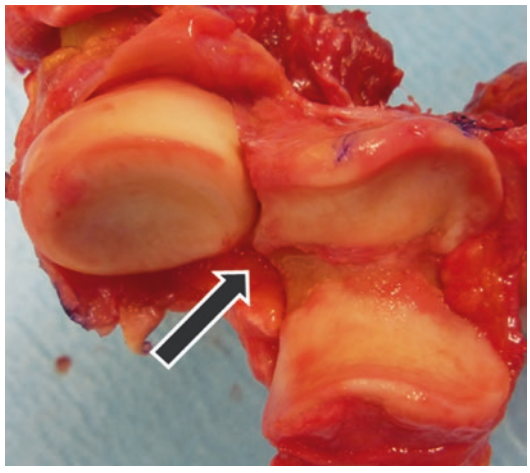

Fig. 79.7 Relationship between the normal radial head and lesser sigmoid notch

79.3 Tips/Tricks

79.4 Postoperative Management, Rehabilitation, Return to Sport

The postoperative management is tailored to the elbow joint stability and the associated injuries.

79.5 Stable Elbow

- Protective brace for 2–3 weeks.
- Early mobilization, with an articulated brace or removing a non-articulated brace.

79.6 Slightly Unstable with Posterolateral Rotatory Instability

- The elbow is protected in a 90° brace with the forearm in pronation.
- Active overhead mobilization allowed after 3–7 days.
- Avoid varus stress on the elbow.

In literature it is not possible to find any details regarding the return to sport after radial head arthroplasty. In our clinical practice, we discourage sport that causes high stresses on the radiohumeral joint (i.e., weight lifting and boxing).

79.7 Radial Head Arthroplasty Complications

The most recurrent complications are the following:

Loosening: Radiolucent lines around the stem are frequently seen in loose-fit prosthesis and, less often, in press-fit stem. Radiolucent lines are often asymptomatic and do not concern (Fig. 79.8). Therefore, it is important to distinguish them from loosening of the implant (Fig. 79.9).

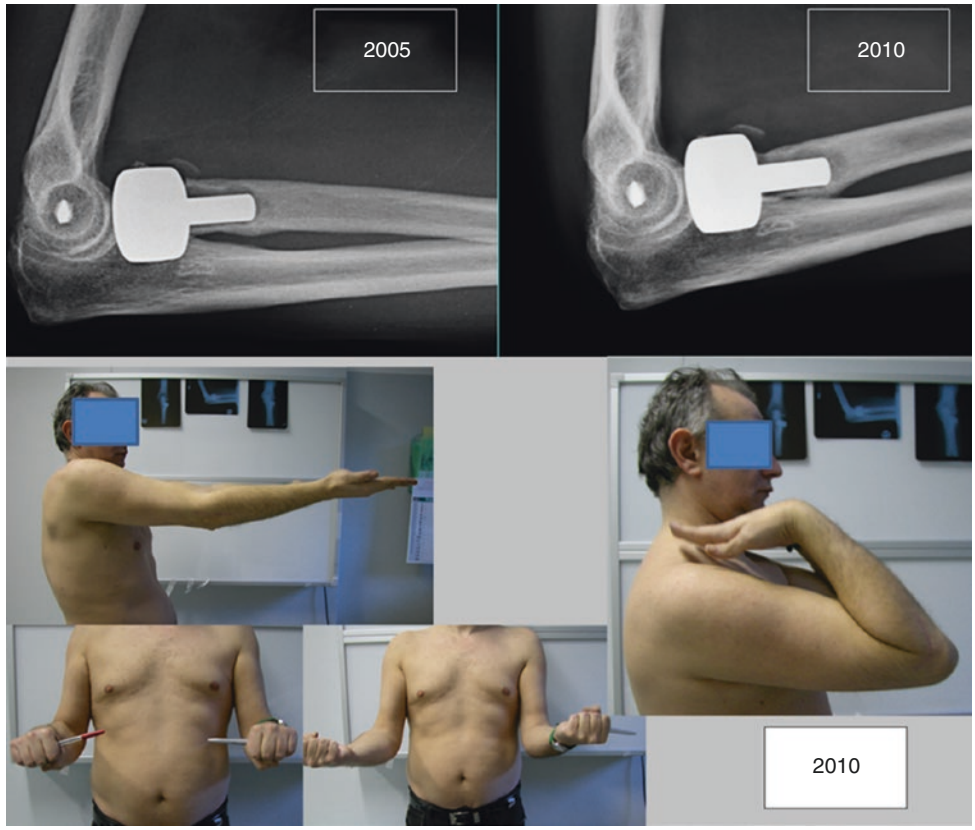

Fig. 79.8 Radiolucent lines around the stem have no progression at 5-year follow-up and are clinically asymptomatic

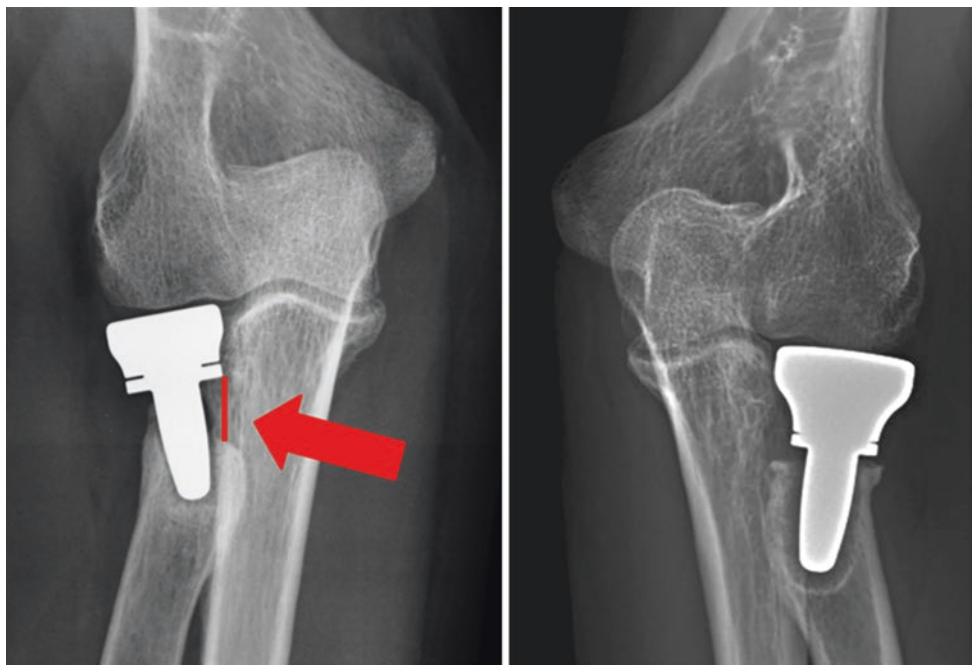

Fig. 79.9 Stem mobilization. (**a**) Inadequate radial neck. (**b**) Loose stem

Overstuffing: It is one of the most frequent complications after radial head arthroplasty. On the anteroposterior X-ray it can be found as asymmetric humero-ulnar joint space, widening on the radial side (delta river sign) (Fig. 79.10a, b). With the CT scan it is possible to compare the prosthesis length to the lesser sigmoid notch [3]. In the sagittal view a loss of symmetry between the humeral center of rotation and the olecranon and coronoid confirms the overlengthening of the radial head (Fig. 79.10c, d).

Capitellar erosion: It is usually due to prosthesis overstuffing (Fig. 79.10e) or longitudinal instability (Essex-Lopresti).

Nerve lesions: The most frequently damaged nerve is the PIN. To prevent these iatrogenic lesions, we suggest:

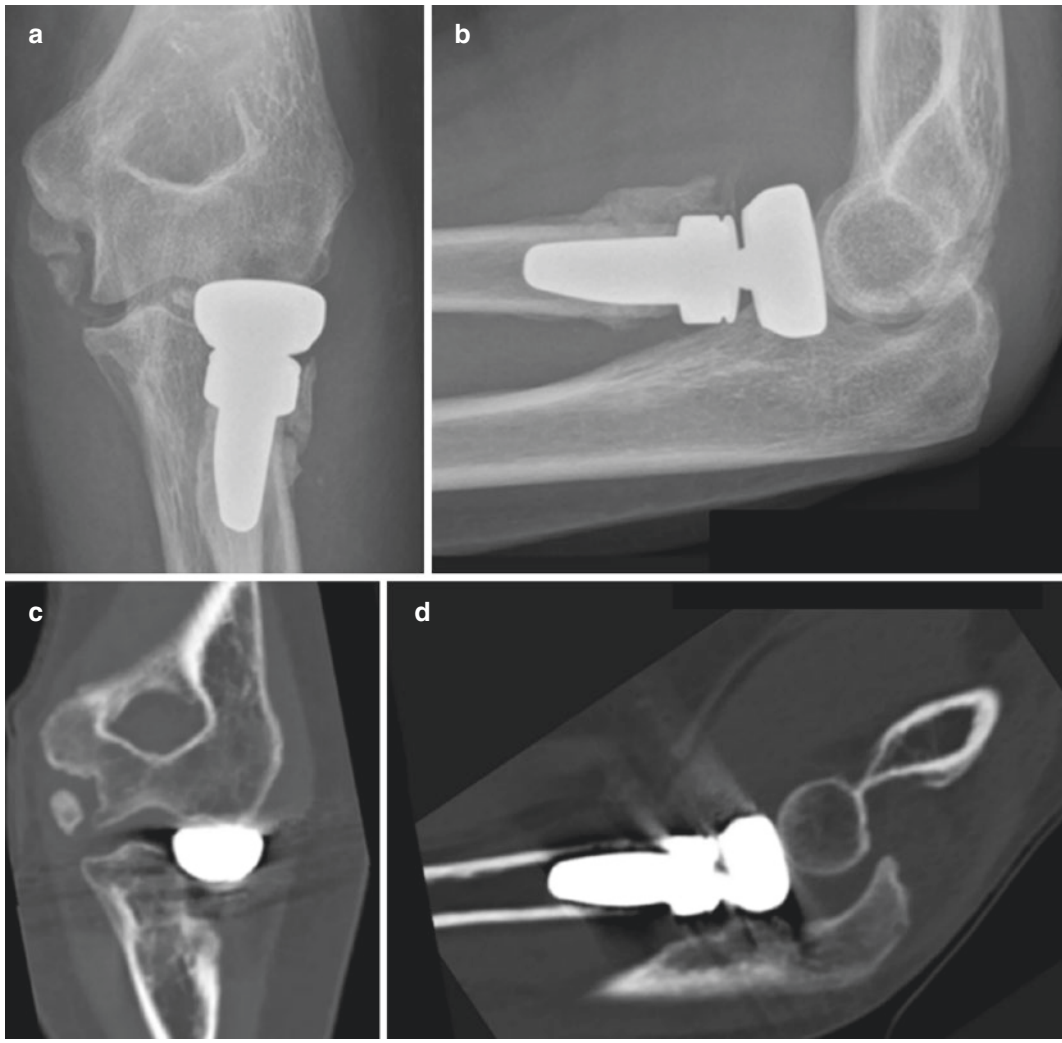

Fig. 79.10 Overstuffed prosthesis with capitellar erosion: (**a**, **b**) radiographs; (**c**, **d**) CT image; (**e**) intraoperative photo with capitellar erosion

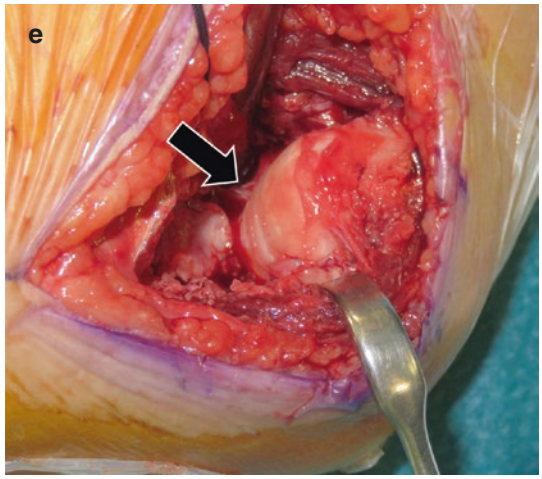

Fig. 79.10 (continued)

- Do not use a Hohmann retractor on the anterior radial neck.
- Pronate the forearm while exposing the radial neck, to keep the PIN anterior.
- Avoid tissue dissection beyond the biceps tuberosity of the radius.

Osteoarthritis: Arthritis of the capitellum is usually the consequence of post-traumatic cartilage lesions. This can deteriorate if there is instability or increased pressure from the prosthesis.

Stiffness and heterotopic ossification: Postoperative stiffness can be caused by capsular contracture, osteoarthritis, HO, or ulnar neuropathy.

79.8 Results

A recent systematic review of >700 metallic modular prosthesis highlights good results in a short and medium follow-up, without any implant being superior to another [4]. In our experience, we have not found any significant difference between monopolar and bipolar prosthesis [5].

There are few studies with a long follow-up and they suggest that good results achieved in the short term are maintained over time [1].

The percentage of implant failure is between 0 and 29% [4]. In our experience [5] the revision rate was 6% at 2-year follow-up. These results are maintained at 5-year follow-up (unpublished data).

References

1. Bain GI, Ashwood N, Baird R, Unni R. Management of Mason type-III radial head fractures with a titanium prosthesis, ligament repair, and early mobilization. Surgical technique. J Bone Joint Surg Am. 2005;87(Suppl 1 (Pt 1)):136–47.
2. Frank SG, Grewal R, Johson J, Faber KJ, King GJ, Athwal GS. Determination of correct implant size in radial head arthroplasty to avoid overlengthening. J Bone Joint Surg Am. 2009;91(7):1738–46.
3. van Riet RP, van Glabbeek F, de Weerdt W, Oemar J, Bortier H. Validation of the lesser sigmoid notch of the ulna as a reference point for accurate placement of a prosthesis for the head of the radius: a cadaver study. J Bone Joint Surg Br. 2007;89(3):413–6.
4. Rotini R, Marinelli A, Guerra E, Bettelli G, Cavaciocchi M. Radial head replacement with unipolar and bipolar SBi system: a clinical and radiographic analysis after a 2-year mean follow-up. Musculoskelet Surg. 2012;96(1):69–79.
5. Heijink A, Kodde IF, Mulder PG, Veltman ES, Kaas L, van den Bekeron MP, Eygendaal D. Radial head arthroplasty: a systematic review. J Bone Joint Surg Rev. 2016;4(10) https://doi.org/10.2106/JBJS.RVW.15.00095.