Radial head fractures: Treatment by prosthetic replacement

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Accepted: 1st July 2009

Introduction

Radial head’s role in elbow valgus stability has been demonstrated in numerous clinical and mechanical studies. In complex fractures of the radial head, conservative treatment is sometimes impossible and dictates resection. Elbow stability is therefore compromised due to the dual loss of the lateral bone capital and the frequently associated lesions of the medial collateral ligament. Over the long term, loss of the radial head causes the radial collateral ligament to get overstrained, a source of secondary instability and osteoarthritis. Like King [1], we consider that preservation or reconstruction of the external side with a radial cup prosthetic implant is indispensable.

Approaches

The lateral approach is the most frequently used and has a number of variants: we prefer the posterolateral approach described by Cadenat (Fig. 1), which is best adapted to prosthesis implantation [2]. Nevertheless, the posterior approach is possible for certain complex injuries associating fracture of the distal end of the humerus and fracture of the radial fovea. Two precautions should be taken if this latter approach is used: [1] Place the anular ligament on stay sutures after its lateral section. When closing, it will require repair to preserve stability of the radial cup [2]. Make sure to limit the approach from extending too far distally to avoid injuring the deep branch of the radial nerve. This surgery should also be done with the forearm in pronation.

Cutting the radius

Thorough joint cleaning helps evacuate the hemarthrosis and residual loose fragments (Fig. 2). The operator should always, as much as possible, attempt internal fixation. If conservative fixation is impossible, the fovea of the radial head is carefully preserved. It will be used to select the prosthesis (diameter and height). Then the proximal extremity of the radius is cut with the oscillating saw. The resection should be minimal, even if it means a secondary cut. At the same time, if necessary, eventual fixation of the coronoid process can be performed given the easy access to the humeroulnar joint once the radial head has been removed [3]. At the end of this first step, the valgus stability of the elbow is assessed to check the medial collateral ligament soundness. The decision to implant a prosthetic replacement is made if the elbow is unstable under valgus stress.
Figure 1  The Cadenat’s posterolateral approach is trans-tendinous. The incision directly exposes the fractured head and the capitulum. Sectioning the anular ligament is completed by placing traction suture, which facilitates opening the area and repair.

However, some surgeons [4] systematically repair the medial ligaments if they are torn. The capitulum cartilage should also be checked. Severe osteochondral lesions should rule out a metallic cup radial head prosthetic device. Alternatively in this situation, a silicon prosthesis (a rare indication here), or an anconeus muscle flap [5] can be proposed.

Preparation of the radius
The medullary canal of the radius is identified using a square rod. A rasp adapted to the radius size is used to prepare the canal. A single rasp size is available and is shifted so as to avoid damaging the lateral condyle (Fig. 3).

Radial stem trials
After rasping, trials are carried out with a collared design single-diameter stem (Fig. 4). Placing the stem should take into account the curve of the proximal radius metaphysis. Most implants have a straight radial stem.

Radial cup trials
The diameter of the radial cup is evaluated by observing the resected radial fovea (Fig. 5). The resected radial head should be saved until the end of surgery so that the height of the resection can also be evaluated. The cup height can be modified by selecting either the height of the collar (two sizes) or one of two heights for the radial cup. Mobile cups are the best adapted to joint movement [6,7].

Evaluating the height of the radial head implant
The proper positioning of the implant is first judged with the elbow in maximal flexion (Fig. 6). The metallic cup should
Figure 5  The resected radial head was preserved to estimate the dimensions necessary for the prosthesis: A. The level of the radial head can be adjusted because of the implant’s modular aspect: B. Two collar thicknesses and two cup heights are available: C and D. The combination of two maximal thicknesses can compensate insufficient radius length.

be flush with the capitium cartilage when the elbow is flexed at 130°. In extension, the space between the capitulum and the implant normally increases by 2–3 mm. If the implant height is insufficient, it is possible to raise the prosthesis during the cementing phase.

Implant cementing

A low-viscosity cement is recommended to improve cementation (Fig. 7). A gripper is used to implant the final stem. Once the cement has set, the radial cup can be tested again. Then the cup is adapted and the final trial carried out in complete flexion-extension. If the radius height is insufficient, we recommend placing a stem with a raised collar associated with a radial cup of maximum height. In this situation, the prosthesis is cemented in flexion (130°), making sure that the cup is flush with the capitulum cartilage [8].

End of the intervention

Once the implant has been cemented, valgus stability again must be tested. The elbow may remain unstable with rotational instability. With the coronoid process repaired, the medial collateral ligaments can be sutured if there is persistent instability after implanting the prosthesis. The suture of the annular ligament is indispensable for the stability of the prosthetic radial head (Fig. 7). Drainage is required, but immobilization remains debatable. For a stable elbow at the end of the intervention, immediate mobilization is recommended. For residual rotational instability cases after medial collateral ligament repair, the
elbow must be immobilized in −30° extension. The patient will undergo daily mobilization without a splint for 6 weeks.

**Conclusion**

Reestablishing the lateral unit of the elbow is indispensable, in order to preserve valgus stability. The repair and final status of the medial collateral ligament cannot be dissociated from preservation of the radial head. Moreover, restoring pronosupination depends on the proximal radioulnar joint and the integrity of the distal radioulnar joint. Isolated resection of the radial head can have severe consequences on the distal radioulnar index. The radial head (or its prosthetic substitute) is indispensable to achieve good forearm function.

**References**