

# Shoulder Fusion in Two Patients with a Long-standing Proximal Humerus Resection

## Artrodéza ramenního kloubu po dlouhodobé resekci proximálního humeru: kazuistika dvou případů

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### SUMMARY

With a “headless” humerus active abduction and elevation of the arm are hardly possible. Especially if the humeral head was removed because of an infection, shoulder fusion is often the only safe solution for this disabling condition.

Large corticocancellous, autologous bone grafts are interposed between the thin humeral stump on one side and its broad glenoid-acromion counterpart on the other. A 4.5 narrow AO-plate stabilizes the fusion. The technique is described and the functional result of two patients is shown.

Ten years after the operation, both patients were free of pain and very satisfied about the utility of the arm. The fusion had convincingly healed in the planned position.

Shoulder fusion proved to be a safe and good solution for both our patients with a longstanding headless humerus. Ten years after the operation they were free of pain and had regained a useful arm.

### INTRODUCTION

Different from the status after head-neck resection of the proximal femur (Girdlestone), a headless humerus represents a complete useless resection arthroplasty. In absence of a hypomochlion, abduction and elevation of the arm are hardly possible. This condition is comparable with a high plexus lesion. The forearm and hand cannot be brought where the patient needs them. Often there is pain. If this situation continues for a long period, muscles of the rotator cuff become atrophic, and without a substantial remnant of the tuberosities, re-attachment to a prosthesis is impossible. Furthermore, if there is a history of infection, this is another (relative) contraindication for a prosthesis. The only operative option for these patients is a shoulder fusion. The upper arm will become mobile within the limits of the scapulothoracic mobility and pain will subside. Aim of this article is to describe an operative technique of shoulder fusion and show the functional results based on the history of two patients with a long standing headless humerus who underwent this treatment.

### OPERATIVE TECHNIQUE

If the anatomy of the proximal humerus is normal, previous to a shoulder fusion, the humeral head unites with the glenoid as well as the acromion (1). The technical problem in case of a headless humerus is created by the incongruence between the thin humeral stump on one side and its broad glenoid-acromion counterpart

on the other. Two large corticocancellous, autologous bone grafts, taken from the iliac crest, should therefore be interposed (Fig. 1) to solve this problem. Both grafts represent 3–4 cm of iliac crest. After thorough surgical debridement of the joint and decortication of the acromion and glenoid (2), the proximal end of the humerus is pointed so that it fits into a little hole in the glenoid in order to improve stability. The bone grafts are interposed between the acromion and the humeral stump.

The right positioning of the arm is chosen. We established fusion in 20° of forward flexion, 30° of internal rotation and 30° of abduction. A 12–14-hole 4.5 mm-plate is prebended to an angle of about 100° and fixed to the scapular spine. The AO-compression device is then applied to the humeral shaft and compression is established. At least one of the screws through the plate should fix the bone graft. Because of the obesity of both patients, described below, we were able to take such large full-thickness bone grafts from the iliac crest without cosmetic and functional drawbacks. Immediately after surgery a preoperatively fitted abductor brace was applied to protect the fusion during the recovery period and the first two post-operative months.

### PATIENTS AND RESULTS

#### Patient A

An obese, 36-year old lady fell from the stairs on her right shoulder and had a severely comminuted proximal humeral fracture. A laborious and prolonged internal

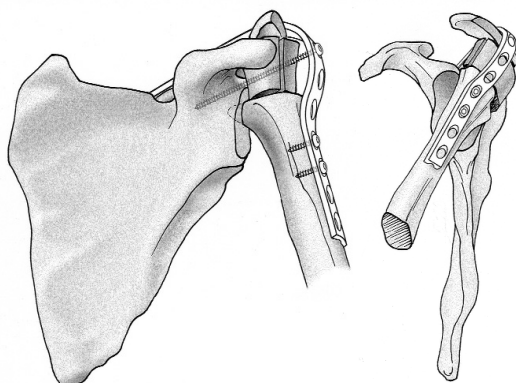


Fig. 1. Shoulder fusion in with a long-standing proximal humerus resection.

fixation ended up with a deep infection and the only way to cure the infection was to remove all the dead bone fragments, in fact, the whole head-neck fragment of the humerus, including both tuberosities. In this disabling condition, she was referred to our institution, 11 months after the accident (Fig. 2a). There were no signs of infection but because of her medical history the possibility of a reversed prosthesis was rejected. She was operated by the above-described technique and there were no post-operative complications. After refraining from the abductor brace during the day the arm was increasingly useful. One year after the operation, the patient was free of pain and very satisfied about the utility of the arm. The fusion had convincingly healed in the original position (Fig. 2b). Ten years after the operation we found an elevation of 80° and abduction of 60°. The patient was able to reach her face for washing and feeding. She could also reach the midline for dressing. With the help of her

left arm she was able to take care of her personal hygiene. The x-ray showed a complete healing of the fusion (Fig. 2c). Eleven years after the operation the infection recurred, produced a fistula and healed promptly after plate removal. One year after this last operation the patient was free of complaints.

### Patient B

A 63-year-old lady with an intra-articular comminuted proximal humeral fracture on the right side was initially treated conservatively. A year later a resection of the head and neck of the humerus was performed because of a painful malunion. An axillary nerve paralysis was caused by this operation. The result was a painful and almost unusable arm.

Five years after the fracture this patient watched a television show, dealing with the case history of patient A, and concluded that she had the same problem. This lady was then referred to our hospital and was operated in the same way as patient A. In her case a referred prosthesis was not considered as an alternative treatment option because of the paralysed deltoid muscle. There were no post-operative complications. One year after the operation the patient was free of pain and a good radiological and functional result was observed (Fig. 3). At final follow-up, 8 years after the operation, the patient was still very satisfied with the result. She was able to feed, dress and take care of personal hygiene. We found an elevation of 70° and an abduction of 40° (Fig. 4). The x-ray of the right shoulder showed solid healing of the fusion. The plate caused occasionally discomfort, especially during the night but our offer for removal was rejected.

A telephonic interview, 10 years after the fusion confirmed that the patient's condition was still satisfactory.

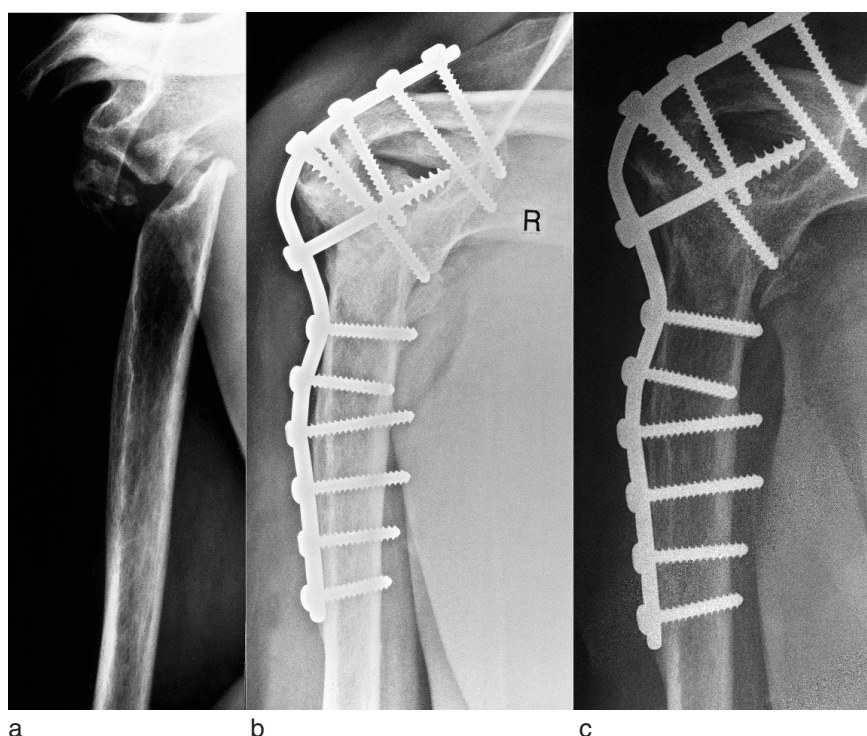


Fig. 2a–c. Shoulder fusion in with a long-standing proximal humerus resection.



Fig. 3. Functional results 1 year after surgery.



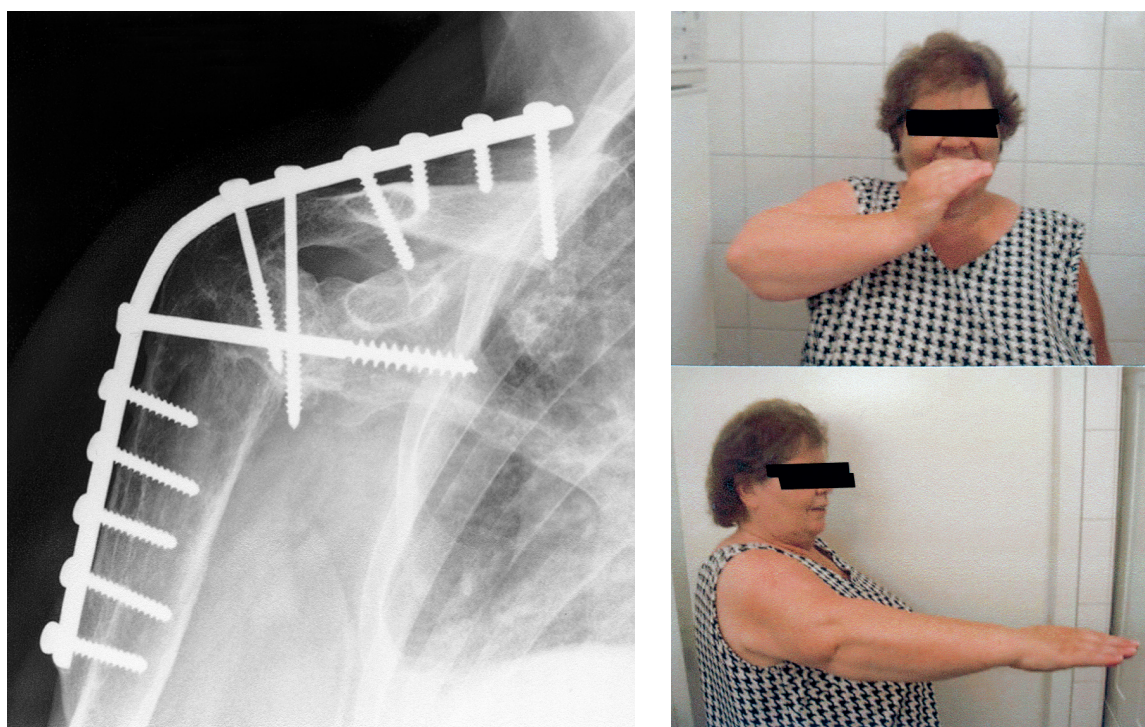


Fig. 4a–c. Shoulder fusion in with a long-standing proximal humerus resection (a); 8 years after the fusion confirmed that the patient's condition was still satisfactory (b, c).

## DISCUSSION

### Indication

Resection of the humeral head without reconstruction of the rotator cuff leaves an almost useless shoulder. It is therefore only a treatment option in older patients with a poor mental and physical condition, who suffer intolerable pain (4). In younger and more vital patients a resection arthroplasty is, unlike for other joints, such as the hip, not a possible alternative way of treatment (5, 14). A treatment should be chosen, that provides a better functional result. A scapulohumeral fusion (14) is a safe treatment for this condition, even if infection recurs. The functional results of the arthroplasty are disappointing in these cases, related to the destructive effects of the initial infection on capsula and cuff structures (9). Furthermore, there is always the risk of recurrence of the infection, as is demonstrated by patient A. If both the rotator cuff muscles and the deltoid muscle do not contribute any more to the active mobility of the shoulder, as was assessed in patient B, a reasonable functional outcome can not be expected of even an reversed prosthesis. A shoulder fusion, as described above, can provide a solid, painless shoulder with a fair range of motion: within the limits of the scapulothoracic mobility, assuming that the trapezius, the levator scapulae (abduction) and serratus anterior muscles function normally (11).

### Bone graft

A direct fusion between the humerus stump and the glenoid would shorten the arm considerably: 5–8 cm.

Furthermore, in that case, the humerus would only be in contact with the glenoid. Consequently, the acromion cannot contribute to the healing of the fusion. This weakens the reconstruction and increases the risk of nonunion and refracture (12). Interposition of autologous cortico-cancellous full-thickness grafts, taken from the iliac crest, between acromion and glenoid at one side and the humerus stump at the other side has 5 - two advantages: the loss of length of the humerus will be limited to 2–5 cm. and the incongruence between humerus and acromion/glenoid is avoided, which facilitates solid union of the fusion. This technique, that was successfully applied in our two patients, has only been mentioned by Safran and Iannotti (15), but they show only a postoperative x-ray of their patient without a long-term follow-up. Both our patients were obese. Removal of a substantial part of the iliac crest was therefore well tolerated. In slender patients an alternative technique can be used. Just below the level of the iliac crest, which remains intact, cortico-cancellous bone grafts with a total breadth of 9 centimeters can be taken out (16). One of our patients underwent a proximal humerus resection because of an infection. We did not add local antibiotics to the graft, although good in vitro results of this technique are described (8).

### Fixation

In order to reach bony union of a shoulder fusion in cases where the humeral head is missing (after resection for benign or malignant diseases or after a failed arthroplasty), plate fixation is the only type of fixation, that has been successfully applied. (7, 12) Undisturbed

healing after external fixation (10), and screw fixation (3, 6) has only been described in cases with a preserved anatomy.

### Complications

Complications of shoulder arthrodesis are especially frequent after resection of the proximal humerus (13). Unfortunately, Rühmann does not specify these complications. We cannot compare our results with other case histories in the literature. Apart from the recurrence of infection in patient A we did not encounter any complication. We can advocate plate fixation with interposition of autologous, full-thickness cortico-cancellous bone grafts for shoulder fusion in case of a "headless" humerus.

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