

TECHNICAL NOTE

ONE-STAGE ELBOW INTERPOSITION ARTHROPLASTY WITH A FASCIOCUTANEOUS DISTALLY PLANNED LATERAL ARM FLAP

M. VANCABEKE¹, G. LAMRASKI¹, J. V. BERTHE², B. C. COESSENS²

We report a case of severe posttraumatic ankylosis of the elbow with chronic osteomyelitis of the lateral condyle of the humerus. The triple problem of restoring elbow mobility, providing for coverage, and controlling infection was treated in a one-stage procedure. A distally planned fasciocutaneous lateral arm flap was used for elbow interposition arthroplasty. Clinical examination at 27 months showed restoration of a useful range of elbow motion and good pain relief.

Keywords : interposition arthroplasty ; elbow ; flap.

Mots-clés : arthroplastie d'interposition ; coude ; lambeau.

INTRODUCTION

Severe posttraumatic elbow ankylosis is a challenging problem which may necessitate prosthetic joint replacement. Until now, no single total elbow prosthesis has ever been reported to provide satisfactory pain relief and restoration of elbow motion. Moreover, open fractures may represent obstacles for prosthetic elbow reconstruction because of scars, periarticular fibrosis, previous infection and loss of fascial tissue (2).

CASE REPORT

A 49-year-old man suffered a grade III comminuted fracture (Gustilo's classification (7)) of the right elbow with severe soft-tissue loss on the lateral part of the distal arm, elbow and proximal forearm. It was initially treated conservatively.

Eighteen months after the initial trauma, the patient presented to us with a 50° flexion deformity of the right elbow ; active flexion was limited to 90°, leaving an arc of active flexion of 40°, painful in all directions. Scar retraction was present over the lateral condyle (fig. 1).

Near complete attrition of the humeroulnar cartilage was visible on standard xrays and confirmed by CT-scan. Nevertheless, the head of the radius was intact. Chronic osteomyelitis was present in the distal humerus as demonstrated by bone scintigraphy. An elbow interposition arthroplasty was planned with use of a distally planned fasciocutaneous lateral arm free flap to provide for an adequate amount of well-vascularized tissue.

Osseous debridement of the humeroulnar joint was performed through a Froimson approach (4), leaving the radial head intact.

A 10 × 5-cm contralateral lateral arm flap, including an extended 10 × 7 × 1-cm fascial flap at its distal end (fig. 2) was raised. The fascial part of the flap was interposed in the elbow joint, and anchored all around the distal part of the humerus. The posterior collateral radial artery and vein were anastomosed end to end to the radial artery and one of its venae comitantes. The skin paddle of the flap

¹ Department of Orthopedic Surgery, Brugmann University Hospital, Brussels, Belgium.

² Department of Plastic and Reconstructive Surgery, Brugmann University Hospital, Brussels, Belgium.

Correspondence and reprints : M. Vancabeke, Department of Orthopedic Surgery, Brugmann University Hospital, Place Van Gehuchten 4, 1020 Brussels, Belgium.



Fig. 1. — Preoperative view of the right elbow showing the poor quality of skin coverage due to extensive scars from the initial trauma.



Fig. 2. — Operative view of the 10 x 5 cm left lateral arm flap with extended 10 x 7 x 1 cm distal fascial portion.

was designed to fill the soft tissue defect created by scar excision on the lateral condyle region. The donor site was closed primarily.

Healing was uneventful. After immobilization of the elbow in flexion at 90° for three weeks, physiotherapy was started. At three months postoperatively, there was an 80° arc of painless active flexion, from 35° to 115°. At 27 months postoperatively, the arc of active flexion was 100°, from 25° to 125° (fig. 3a,b), an increase of 60° compared with the preoperative arc. The range of elbow motion was still painless.

DISCUSSION

In the case reported here, the treatment of severe elbow ankylosis by prosthetic arthroplasty was hindered by the poor quality of the skin over the lateral condyle and the presence of chronic osteomyelitis. We chose to switch to another arthroplasty method.

As previously described by several authors (2, 4, 16), various materials such as cellophane sheets, fascia lata and skin have been used for elbow interposition arthroplasty. Satisfying results were reported in more than 60 % by Kimura *et al.* (13) with the Hass skin elbow arthroplasty. However, some major drawbacks limit the indications of such “inert” interposition arthroplasties.

The original technique includes resection of the damaged radial head, which could result in considerable postoperative elbow instability. Because it was almost intact, we chose to preserve the radial head when performing the joint debridement, in order to limit instability by decreasing the lateral deviation forces on the ulna.

Recurrence of elbow ankylosis is also frequently noted with classic methods of elbow interposition arthroplasty. This may be related to the fibrosis induced by the presence of nonvascularized tissues in the joint. More than two years postoperatively, we noted good elbow stability and a significant increase in the arc of active flexion with the use of a vascularized free tissue transfer.

The use of free flaps is recognized as the best method for the treatment of chronic osteomyelitis because they are thought to provide a permanent



Fig. 3a, b. — At 27 months, the postoperative arc of active flexion of the right elbow was 100°, from 25° to 125°.

blood supply to the tissues (15). However, although for many authors the use of muscular tissue seems to be a better treatment for osteomyelitis, free fasciocutaneous flaps can also be successfully used to cover such lesions (3). The concept that muscular

flaps offer a better revascularization to the infected bony tissues relies, until now, only on experimental animal data (17).

Among fasciocutaneous flaps, the distally-planned lateral arm free flap is an excellent reconstructive alternative. The lateral arm flap is recognized as a versatile donor source. Clinical series have established its use in free tissue transfer of skin, fascia, nerve and bone (11, 12). Fascial and fasciocutaneous flaps can be reliably raised over the lateral aspect of the arm, based on fascial and cutaneous perforators of the posterior collateral radial artery (5). By extending the design of the skin paddle of the lateral arm flap over and beyond the lateral condyle, the surface of the flap can be increased and thin cutaneous tissue can be obtained (1, 10, 14).

In a one-stage procedure, we took advantage of both the cutaneous and the fascial part of a distally planned lateral arm flap. The thin proximal cutaneous half of the flap was used to resurface the lateral condyle. On the distal half of the flap, beyond the lateral condyle, only fascia was raised. This part of the flap was interposed between the humerus and the ulna.

To our knowledge, no elbow interposition arthroplasty using free tissue transfer has ever been reported in the literature. The good recovery of range of elbow motion and absence of pain at 27 months' follow-up show the distally planned lateral arm flap to be a valuable tool for elbow interposition arthroplasty.

Moreover, the distal design of the flap minimizes the classically described donor-site morbidity (6, 9). Patients have a more limited and less conspicuous scar and a limitation of the anesthetic area over the proximal lateral part of the forearm.

In conclusion, we have shown that when performing an elbow interposition arthroplasty, the extended fascial portion of the distally planned lateral arm flap can be used with preservation of the radial head to enhance elbow stability. In the presence of chronic osteomyelitis around the joint, a considerable amount of well-vascularized tissue is provided. When skin of poor quality is present, the proximal portion of the flap can be used for soft-tissue coverage.

REFERENCES

1. Brandt K. E., Khouri R. K. The lateral arm proximal forearm flap. *Plast. Reconstr. Surg.*, 1993, 92, 1137-1143.
2. Brown J. E., MacCaw W. H., Shaw D. T. Use of Cutis as an interposing membrane in arthroplasty of the knee. *J. Bone Joint Surg.*, 1958, 40-A, 1003-1018.
3. Fix J. R., Vasconez L. O. Fasciocutaneous flaps in reconstruction of the lower extremity. *Clin. Plast. Surg.*, 1991, 18, 571-581.
4. Froimson A. I., Silva J. E., Richey W. G. Cutis arthroplasty of the elbow joint. *J. Bone Joint Surg.*, 1976, 58-A, 863-865.
5. Gosain A. K., Matloub H. S., Yousif N. J., Sanger J.R. The composite lateral arm free flap : Vascular relationship to triceps tendon and muscle. *Ann. Plast. Surg.*, 1992, 29, 496-507.
6. Graham B., Adkins P., Scheker L. R. Complications and morbidity of the donor and recipient sites in 123 lateral arm flaps. *J. Hand Surg.*, 1992, 17-B, 189-192.
7. Gustilo R. B., Merkow R. L., Templeman D. The management of open fractures. *J. Bone Joint Surg.*, 1990, 72-A, 299-304.
8. Hamalainen M. J., Kataoka Y. Late radiographic result after resection skin interposition arthroplasty of the elbow in rheumatoid arthritis. *Rheumatology*, 1991, 15, 42-46.
9. Hamdi M., Coessens B. C. Evaluation of the donor site morbidity after lateral arm flap with skin paddle extending over the elbow joint. *Brit. J. Plast. Surg.*, 2000, 53, 215-219.
10. Hamdi M., Coessens B. C. Distally planned lateral arm flap. *Microsurgery*, 1996, 17, 375-379.
11. Katsaros J., Schusterman M., Beppu M., Banis J. C., Acland R. D. The lateral upper arm flap. Anatomy and clinical applications. *Ann. Plast. Surg.*, 1984, 12, 489-500.
12. Katsaros J., Tan E., Zoltie N., Barton M. Further experience with the lateral arm free flap. *Plast. Reconstr. Surg.*, 1991, 87, 902-910.
13. Kimura C., Vainio K. Arthroplasty of the elbow in rheumatoid arthritis. *Arch. Orthop. Unfall Chir.*, 1976, 84, 339-348.
14. Lanzetta M., Bernier M., Chollet A., Saint-Laurent J. Y. The lateral forearm flap : An anatomic study. *Plast. Reconstr. Surg.*, 1997, 99, 460-464.
15. Mathes S. J., Alpert B. S., Chang N. Use of muscle flaps in chronic osteomyelitis. Experimental and clinical correlation. *Plast. Reconstr. Surg.*, 1982, 69, 815-819.
16. Mills K., Rush J. Skin arthroplasty of the elbow. *Austr. N. Z. J. Surg.*, 1971, 41, 179-181.
17. Saltz R., Hochberg J., Given K. S. Muscle and musculocutaneous flaps of the foot. *Clin. Plast. Surg.*, 1991, 18, 627-637.

SAMENVATTING

M. VANCABEKE, G. LAMRASKI, J. V. BERTHE, B. C. COESSENS. Interpositie arthroplastie van de elleboog in één tijd, met een laterale, distaal gesteelde fasciocutane bovenarmflap.

Beschrijving van een geval van ernstige posttraumatische elleboogankylosis met osteomyelitis van de laterale humeruscodyl.

Het therapeutisch probleem was drievoudig en werd aangevat in één tijd : herstel van de elleboogmotiliteit, degelijke weekdeelbekleding en infectie controle.

Een distaal gesteelde laterale bovenarmflap werd gebruikt als interpositie materiaal voor de arthroplastie van de elleboog.

Bij klinisch nazicht na 27 maanden was er een nuttige motiliteit herwonnen en een goede pijn verlichting bereikt.

RÉSUMÉ

M. VANCABEKE, G. LAMRASKI, J. V. BERTHE, B. C. COESSENS. Arthroplastie d'interposition du coude par lambeau libre fascio-cutané.

Les auteurs rapportent un cas d'ankylose sévère du coude faisant suite à un traumatisme ouvert qui avait laissé une ostéomyélite chronique du condyle externe de l'humérus.

Le traitement devait à la fois restaurer une mobilité au coude et apporter une couverture cutanée suffisante tout en traitant l'infection, si possible en un seul geste opératoire. Un lambeau libre fascio-cutané prélevé sur la face externe du bras opposé a donc été utilisé en tant qu'arthroplastie d'interposition du coude. L'évaluation clinique à 27 mois de l'opération a montré une récupération d'amplitude articulaire acceptable, associée à une indolence.