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Treatment of Elbow Osteomyelitis With an Interposition Arthroplasty Using a Rectus Abdominis Free Flap

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Introduction: Osteomyelitis of the elbow may be a complex clinical problem. Treatment goals include the eradication of infection and preservation of maximal joint function. Bony debridement may be necessary in addition to elbow joint arthroplasty. The use of synthetic material or allograft as the arthroplasty material may be contraindicated in the setting of infection. The use of free muscle transfer as an arthroplasty medium has not been well described.

Methods: A 22-year-old paraplegic man developed recurrent osteomyelitis of the right elbow, necessitating extensive bony debridement by the orthopedic surgery team. Reconstruction arthroplasty was performed using a free rectus abdominis muscle flap as the arthroplasty material to serve as a source of biologically active, well-vascularized arthroplasty medium in the presence of ongoing infection.

Results: A successful free muscle flap arthroplasty was performed. External fixation and physical therapy were implemented postoperatively. The patient had resolution of osteomyelitis and excellent functional use of the elbow for activities of daily living and wheelchair motion.

Conclusions: Elbow arthroplasty in the setting of active infection may be accomplished by means of free tissue muscle transfer. Elimination of infection and acceptable joint function may be possible with this form of reconstruction.

Key Words: interposition arthroplasty, elbow joint, free flap, muscle flap

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Chronic osteomyelitis of the elbow may be difficult to resolve. Goals of treatment include elimination of infection while still preserving maximal joint function. In addition to antibiotics, proper treatment may require extensive debridement of involved joint surfaces and bone. Reconstructive options after any extensive debridement of the elbow include replacement with prosthesis; joint fusion in a functional position; or interposition arthroplasty accomplished via Achilles tendon allograft, fascia lata, anconeus muscle, or autograft cutis.[1–3] However, none of these options are ideal in the setting of infection.

Although not commonly described previously, a muscle-based flap may serve a useful interposition function in the setting of active osteomyelitis by providing a biologically active surface with a robust blood supply. We describe the case of a paraplegic patient with chronic osteomyelitis who was treated with a free flap from the rectus abdominis muscle to restore a functional elbow joint while assisting in elimination of infection.

METHODS

A 22-year-old right-hand–dominant man with history of T1 paraplegia from a gunshot wound to the spine and a 7-year history of chronic bursitis of the right elbow presented with an acute abscess of the bursa. He had previously undergone multiple prior debridements and a rotational flap at another institution.

The patient initially underwent incision and drainage of the bursa and subsequent bursectomy, complicated by a wound dehiscence after a fall sustained by the patient 2 weeks postoperatively. This dehiscence resulted in a chronic draining sinus tract and elbow instability that was explored in the operating room. Noted intraoperatively was a complete lack of synovial capsule as well as medial and lateral ligaments. A vacuum-assisted closure therapy device (V.A.C. KCI, San Antonio, Tex) was placed. Two weeks into his hospital course, he was noted to have ongoing purulent drainage. Repeated exploration revealed osteomyelitis of the proximal ulnar and radial heads, which was subsequently debrided. Cultures grew group A *Streptococcus* and *Pasturella*; the patient was discharged on an intravenous infusion of penicillin.

He was readmitted 1 month after the debridement with bacteremia and extensive osteomyelitis of the right elbow. A decision was made at that time for further debridement of the elbow and reconstruction using a free muscle flap to serve as an interposition material between the debrided ends within the joint. Given the patient's need to maintain latissimus dorsi muscle function for transfers and propelling his wheelchair, a left rectus abdominis free flap was used as the muscle of choice.

After debridement of the elbow joint, the proximal ulna, and the radial head by the orthopedic surgery team, the plastic surgery team harvested the rectus abdominis muscle in the standard fashion. The deep inferior epigastric artery was anastomosed to a recurrent branch of the right radial artery at the recipient site using 8-0 nylon in an interrupted fashion. The deep inferior epigastric vein was joined to the right cephalic vein using a 2.5-mm coupler. Total flap ischemic time was 52 minutes. The flap was wrapped laterally around the elbow, completely filling the elbow joint space (Fig. 1). An implantable Doppler device was placed

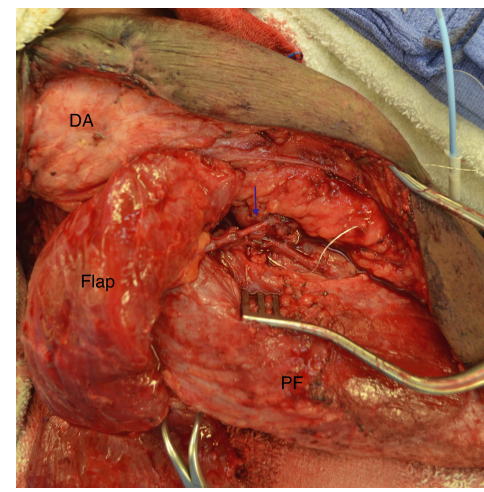

FIGURE 1. The rectus abdominis muscle free flap was anastomosed and then wrapped around the remaining elbow joint, filling the dead space. The flap is labeled, and the venous anastomosis is illustrated with an arrow. The distal arm (DA) and the proximal forearm (PF) are marked for orientation.

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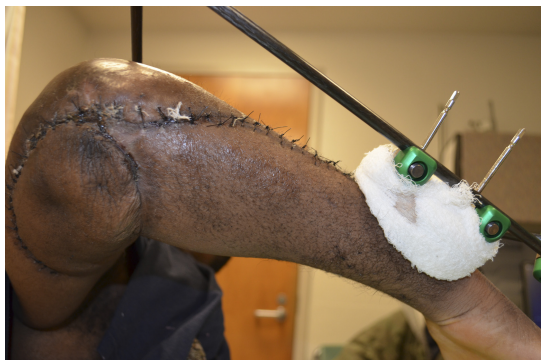

FIGURE 2. Postoperatively, the flap had taken, and there was complete wound healing without evidence of recurrent infection. An external fixator remained in place with the elbow in 90 degrees of flexion.

in addition to a drain. The local skin flaps were undermined and closed over the flap without tension in a layered fashion. The abdominal closure was reinforced with acellular dermal matrix. A Hoffman external fixator was placed on the right elbow in a delta configuration with the elbow in 90 degrees of flexion by the orthopedic surgery team.

RESULTS

The flap was monitored for 7 days postoperatively and remained viable. The patient healed without complication and was discharged on postoperative day 19 on intravenous ertapenem. Postoperative follow-up showed a well-healing flap (Fig. 2). At 8 weeks, the external fixation was removed and the patient was kept in a Bledsoe brace with 90 degrees of flexion for an additional 6 weeks. No specific physiotherapy protocol was needed—the patient was instructed to work on range of motion exercises via active flexion and extension of the elbow. The patient was able to complete all activities of daily living including transfers and wheelchair propulsion. He had 50 degrees of extension and 160 degrees of flexion of the right elbow (Fig. 3, Video 1, http://links.lww.com/SAP/A134). At 1.5 years postoperatively, the patient was noted to still have excellent functional status of the elbow. A magnetic resonance imaging study showed no evidence of flap atrophy.

DISCUSSION

After extensive debridement of bone and elbow joint in the setting of osteomyelitis, placement of a foreign body—as in a total elbow arthroplasty—is contraindicated. In addition, placement of a graft for interposition purposes may assist in achieving the goal of preserving joint function and range of motion but will not be beneficial in the elimination of infection. For a paraplegic patient who is wheelchair bound, arthrodesis is not a practical option for elbow reconstruction because the ability to manually propel a wheelchair would be lost.

Muscle and myocutaneous flaps have been used frequently in the setting of open wounds with osteomyelitis, exposed grafts, or exposed hardware and shown to decrease the bacterial burden compared with other flaps.[4] Muscle offers the benefits of providing well-vascularized tissue to promote wound healing and antibiotic delivery to the infected area in addition to elimination of dead space. The cost, however, is the sacrifice of a potentially functional muscle.

Akpuaka et al[5] previously described using a regional radial recurrent artery fasciocutaneous flap as the interposition material for the treatment of elbow ankylosis. The first description of free tissue transfer for serving as interposition material for elbow arthroplasty was provided by Vancabeke et al,[6] who used a contralateral fasciocutaneous lateral arm flap. The use of muscle-based flaps, however, as interposition material has not been frequently described. After resection of the elbow joint in addition to the radial and ulnar heads, the free rectus muscle was able to provide a biologically active surface in the dead space between the resected joints. The advantages of using this strategy include adequate coverage of the radiohumeral and ulnohumeral joints, preservation of elbow function, avoidance of foreign material, and providing well-vascularized tissue to assist with easing the bacterial burden. The disadvantages include the need for free flap procedure and the donor-site morbidity of muscle loss, although this patient's paraplegic status rendered his rectus abdominis muscle effectively nonfunctional.

Henry previously described using a latissimus dorsi free flap to treat chronic osteomyelitis of the elbow joint by both providing well-vascularized tissue for filling dead space and serving as a membrane surface for interposition arthroplasty, with good long-term follow-up results in the patient.[7] However, sacrificing the latissimus dorsi muscle may result in shoulder joint morbidity including loss of joint stability and strength.[8,9] In a patient who requires use of the latissimus dorsi muscle for activities of daily living including lifting, turning, transfers, and wheelchair propulsion, functional loss of this muscle could negatively impact quality of life.

A potential limitation of free muscle transfer is the long-term atrophy of muscle after denervation. In this case, a magnetic resonance imaging study obtained 1.5 years after the operation did not demonstrate any evidence of muscle atrophy. Should one wish to optimize bulk after free muscle transfer, anastomosing the nerve to maintain innervation to the muscle may be a solution. However, in the case of elbow reconstruction with free muscle transfer as an interposition arthroplasty, long-term muscle bulk is likely not necessary and may in

FIGURE 3. The patient demonstrates good range of motion in elbow flexion and extension at follow-up after flap and wound healing.

fact potentially inhibit range of motion or have a suboptimal esthetic appearance requiring a debulking procedure.

CONCLUSIONS

Reconstruction of an elbow joint after extensive debridement of osteomyelitis may require a muscle-based flap as an interposition arthroplasty. The use of a free rectus abdominis muscle flap for interposition arthroplasty has not been previously described. The advantages of this flap in a paraplegic patient include providing well-vascularized tissue for wound healing and delivery of antibiotics while avoiding donor-site morbidity of loss of a functional muscle. Other free flaps have also been described for interposition arthroplasty, and continued illustrations of the success of this reconstructive strategy may give surgeons confidence in their utility.

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