Segmental Humeral Reconstruction with a Pedicled Radius Bone Flap in Congenital Amyoplasia

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The clinical case of a patient with a segmental humeral defect, in the context of an arthrogryposis congenita multiplex and morbid obesity, reconstructed with a pedicled segmental radial bone flap is reported. The use of the pedicled vascularized diaphyseal radial bone flap may be a useful technique for humerus reconstruction in patients with contraindication for microvascular bone transfers and an already injured or severely handicapped upper limb. (Plast Reconstr Surg Glob Open 2017;5:e1279; doi: 10.1097/GOX.0000000000001279; Published online 28 March 2017.)

CASE REPORT

A 51-year-old female patient with classic congenital amyoplasia and morbid obesity presented with a 14-cm bone defect in the distal right humeral diaphysis (Figs. 1, 2). The defect resulted from multiple attempts at internal fixation of a diaphyseal fracture complicated with infections. The patient was nonambulatory and used a motorized wheel chair. The residual function of the right limb was important for controlling the steering joystick. The patient referred some shoulder and elbow movement before the humeral fracture, with some limited finger movement. The upper limb was flail and useless due to the humeral defect (Fig. 3).

The absence of palpable distal pedal pulses and the morbid obesity contraindicated the use of a free fibular flap for reconstruction. Given the lack of wrist active movement and the relatively small demand expected on the right hand, the radius was selected as a donor for segmental vascularized bone. The humeral polymethyl methacrylate solid spacer was removed through a lateral approach after identification and preservation of the radial nerve. A 14-cm segment of the left radius was elevated as a pedicled flap based on the radial vessels and transposed to fit into the humeral defect (Fig. 3). Bone fixation was achieved with a lateral locking anatomic plate (Acumed, Hampshire, UK). No fixation was performed between the distal radius and the ulna. The postoperative course was uneventful, with primary bone healing and maintenance of the preexisting hand and wrist function (Fig. 4).

DISCUSSION

The functional negative impact of a humeral segmental bone defect in the overall upper limb function is significant. The inability to position the hand in the space severely impairs its use. The reconstruction of sizable bone defects of the humerus can be approached in different ways, including vascularized free tissue transfer, bone transport, and membrane-induced osteogenesis. The latter 2 techniques are relatively popular with orthopedic surgeons, although the complication rates are nonnegligible.1–7 In the case presented here, the distal epiphysal fragment was small and fragile, and it was not considered suitable as docking site for bone transport. The experience of the author in membrane-induced osteogenesis

Disclosure: The authors have no financial interest to declare in relation to the content of this article. The Article Processing Charge was paid for by the authors.
has been mixed, and it was discarded as the treatment of choice in this case.

Vascularized bone is the procedure of choice for sizable bone defects for most plastic surgeons, fibula being the donor site of choice. The literature supports its use in long bones, although with a higher rate of late complications in the humerus. In the case presented herein, the absence of palpable pedal pulses along with the morbid obesity of the patient contraindicated the use of a free fibular flap. Other options for vascularized bone were the
scapula or iliac crest, but the body habitus of the patient discouraged their use. The radial diaphysis was selected in this case due to the expected low demand of the upper limb and the already severely limited hand and wrist functions in this patient. It is technically straightforward (even in obese patients), safe, and allows internal fixation with locking 3.5-mm plate and screws. It would allow inclusion of a skin island for monitoring or soft-tissue augmentation (not needed in the case presented).

The donor-site morbidity may be unacceptable in a healthy upper limb, and this technique would not be reasonable. Axial forearm and wrist instability with severe impairment of pronation–supination would ensue. In the present case, plans had been made to secondarily perform a distal radioulnar synostosis if axial wrist–forearm instability became a problem. This would have corrected the instability but at the price of suppressing forearm rotation. The patient did not have active pronation previously (supination provided by biceps brachii), but the passive forearm rotations proved helpful in her daily activities (as is usually the case in arthrogryposis patients). Donor morbidity was extensively discussed with the patient before the surgery.

In conclusion, the use of the pedicled vascularized diaphyseal radial bone flap may be a useful technique for humerus reconstruction in patients with contraindication for microvascular bone transfers and an already injured or severely handicapped upper limb.

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