CASE REPORT

Adipofascial radial artery perforator flap interposition to treat post-traumatic radioulnar synostosis in a patient with head injury

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SUMMARY

We report this 47-year-old man who presented with polytrauma following a fall from a roof in March 2011. He sustained a head injury and a complex, comminuted forearm fracture. He underwent an open reduction and internal fixation of the fracture at the time of injury, but later developed a rigid type 2 diaphyseal radioulnar synostosis, with loss of forearm rotation. Synostosis excision and a radial artery perforator-based adipofascial interposition flap to prevent recurrence has resulted in a good functional outcome and no recurrence at 2.5 years follow-up.

recovery and rehabilitation was also influenced by his head injury which caused altered perception, memory lapses and fits of anger. He also experienced chronic fatigue. After consolidation of his synostosis, he had no supination and pronation possible.

BACKGROUND

Post-traumatic radioulnar synostosis is a rare, disabling complication of complex comminuted forearm fractures. In the setting of a head injury, the probability of a synostosis forming significantly increases. The management of this condition aims not only at excising the synostosis but at preventing recurrence. The concept of using an interposition graft to prevent recurrence is not new, but the use of a vascularised fascial flap is a recent development with potentially less scar, infection and recurrence. The radial artery perforator flap has the added advantage that it may be elevated without sacrificing the main axial vessel. This flap is versatile and may be used for a number of indications in the forearm and wrist. We present a case with a complex forearm fracture and closed head injury, with a strong predisposition for synostosis to both develop and recur. We treated this patient with synostosis excision and a vascularised radial artery perforator-based forearm interposition flap. He regained forearm rotation and has maintained this without synostosis recurrence at 2.5 years follow-up.

CASE PRESENTATION

This 47-year-old man, a roofer by profession, suffered a fall from a height, in March 2011, sustaining a closed head injury and a comminuted fracture of both bones of his forearm at the junction of the proximal 2/3 and distal 1/3 of the forearm (figures 1 and 2). He underwent open reduction and internal fixation with a long volar locking plate to the radius, a 3.5 mm dynamic compression plate to the ulna and a separate dorsoradial styloid plate. The wounds healed well. Over time, he developed a rigid type 2 radioulnar synostosis which completely restricted his pronosupinatory movements. His

Figure 1 X-ray showing complete radioulnar synostosis following fixation.

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Figure 2 Follow-up X-ray after implant exit, synostosis excision and flap inset.

INVESTIGATIONS

Plain X-rays 1 year following the surgery revealed that the bones had united, and the presence of a Vince and Miller type 2 metaphyseal extra-articular radioulnar synostosis ([figure 1](#)).

TREATMENT

One year after the open reduction and internal fixation of his fractures, he underwent the reconstructive surgery. Through his

Figure 3 Adipofascial flap raised on radial artery perforator.

old surgical scars all the implants were removed, the fibrotic remnant of pronator quadratus was excised, the volar distal radioulnar joint capsule was released and the synostosis was completely excised ([figure 2](#)). An adipofascial flap was raised based on volar forearm perforators from the radial artery ([figure 3](#)). The radial artery perforator to be used, for optimum flap positioning, was identified using a Doppler ultrasound probe prior to tourniquet inflation. Axillary regional anaesthetic block was employed. Following a curvilinear skin incision, the deep fascia was incised at the radial margin over the flexor carpi radialis muscle and the ulnar border was mobilised down to the brachioradialis tendon. The plane was developed up to the previously identified perforator. The tissue paddle supplied by this vessel was dissected and lifted off. To avoid distortion during rotation and inset, the fascia around the perforator was incised. The size of the flap is determined to a large extent by the perforator site to ensure that the proximal edge pivots to the distal inset site. The flap was about 10 cm in length and 5 cm maximum width, narrowing to about 2 cm at the site of the perforator. This tissue around the perforator is of paramount importance in preventing damage to the vessel during dissection and transposition. The flap was then set into the synostosis site to act as a vascularised mechanical barrier to synostosis recurrence. Bleeding after release of the tourniquet confirmed vascular integrity of the flap. Full passive forearm rotation was initiated from the second postoperative day.

OUTCOME AND FOLLOW-UP

The surgical wound healed well with no flap complications. At 2.5 years following surgery, the patient has regained 75° of supination and 35° of pronation, giving him an arc of 110°. His radial and ulnar deviation of the wrist are 20° and 10°, respectively. His palmar flexion and dorsiflexion of the wrist are 40° and 25°, respectively. His Jamar level 2 grip strength on the operated hand was 58 kg which was the same as his unaffected hand. He has returned to his preinjury occupation as a roofer, although he mainly works on domestic rather than industrial projects since the accident.

DISCUSSION

Radioulnar synostosis, although a reasonably rare complication of forearm fractures, can be devastatingly disabling. The initial understanding and treatment of this condition was driven by isolated reports and a few small case series. Vince and Miller, in the late 1980s, published their series and also classified post-traumatic radioulnar synostosis into types 1, 2 and 3 depending on the location of the synostosis.¹ Synostosis occurs due to heterotopic ossification between the radius and the ulna. Several risk factors have been identified by Vince, Failla and Pape for the development of heterotopic ossification, such as comminuted fractures, burns, major surgery and bone fragments on the interosseus membrane among others.¹⁻³ The presence of a head injury has been shown to have an accelerative effect on heterotopic bone formation and thus synostosis.^{4 5} The treatment of

Patient's perspective

I have made a very satisfactory recovery and have regained good movement of my forearm. I have returned to my occupation as a roofer. The effects of head injury that I suffered from have also improved greatly with counselling and therapy during the course of my treatment.

Learning points

- ▶ Synostosis is more likely to complicate a fracture when associated with a head injury.
- ▶ Complex comminuted fractures of the forearm requiring extensive surgery and fixation with implants are more prone to heterotopic ossification and synostosis formation than simple fractures.
- ▶ Recurrence of synostosis following radical excision is a fairly common event in the setting of an associated head injury and the prevention of recurrence should be an important consideration when planning the initial intervention modality.
- ▶ Use of a vascularised interposition graft is a good method of preventing recurrence of synostosis in a patient with a head injury.
- ▶ We can achieve a good mean range of motion following synostosis take down and interposition grafting with a vascularised radial artery perforator-based forearm interposition flap without adjuvant radiation.

post-traumatic synostosis has been controversial at best with several theories proposed for the optimal management and prevention of recurrence. To prevent recurrence, interposition grafts are gaining in popularity. Several vascularised and non-vascularised materials have been used for interposition ranging from silicone, fascia lata, anconeus and brachioradialis muscle flaps, posterior interosseus artery-based flaps and free lateral forearm flaps.^{3 6–8} We report the use of a radial artery perforator-based adipofascial flap for the interposition which has resulted in excellent restoration of a functional range of

motion, and has shown no recurrence of the synostosis at follow-up and no need for adjunctive radiation therapy. Being a perforator-based flap, the main radial artery is not compromised thus leaving intact the distal blood supply and reducing donor site morbidity. There is no microvascular anastomosis which reduces the operative time and avoids the need for long post-operative inpatient flap monitoring. We put forward the radial perforator flap as a relatively easy, versatile, rugged and complication free option for the treatment of radioulnar synostosis in patients with a high risk of recurrence.

Contributors DP and ST performed the surgery. DS reviewed the patient in clinic, evaluated outcome, collated the data and wrote the case report.

Competing interests None.

Patient consent Obtained.

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