

Bangle avulsion injuries of the forearm

Dear Sir,

Bangle avulsion injuries are a specific subset of forearm avulsion injury. This injury is analogous to the ring finger avulsion injury and occurs in female machine operators wearing gold bangles, a common custom on the Indian subcontinent.

Based on the patterns of injury observed, we have found it useful to classify these injuries using an adaptation of the classification system for ring avulsion injuries described by Urbaniak (1981) and modified by Kay et al. (1986):

1. Circulation adequate: A. No skeletal injury; B. With skeletal injury.
2. Circulation inadequate: A. No skeletal injury; B. With skeletal injury.
3. Complete amputation.

This classification allows for rapid information transfer to convey the severity of the injury and the surgical needs for salvage of the limb.

Replantation surgery is performed in accordance with the technical considerations previously described by Sabapathy et al. (2007). The tendons of the avulsed part must be radically debrided of devitalized muscle as this will necrose and is likely to precipitate infection. Bone shortening is always performed to allow direct repair of vessels and nerves, avoiding the need for grafts. Primary nerve grafting is not considered because we aim to keep operating time to a minimum.

We have experience of seven such injuries, treated over a 4-year period, with an average follow-up of 23 months (Table 1). One patient sustained a degloving skin injury of the mid-forearm with fracture of both forearm bones, but without significant neurovascular injury. Another patient suffered a sub-total amputation requiring fixation of fractures of both forearm

bones and revascularization. Five patients suffered complete amputation that required replantation (Figure 1).

Five of the six replantations/revascularizations survived. The average ischaemia time for all patients was 5 hours. None of the patients developed systemic complications and there were no occurrences of serious infection in the affected limbs.

Functional outcome was assessed using Chen's classification (Chen et al., 1981). The patient who sustained a class 1B injury had normal sensation and achieved Chen grade 1 function at 6 months (return to original occupation, $\geq 60\%$ joint mobility, high grade recovery of sensibility). Patient 2, who underwent successful revascularization of a class 2B subtotal amputation at the mid-forearm level, achieved Chen grade 4 (no useful function) after 6 months. An unfavourable fracture pattern and significant soft tissue injury contributed to this poor functional outcome. Of the four patients who underwent successful salvage of class 3 injuries, two achieved Chen grade 4, one Chen grade 3, and one Chen grade 2, at a mean follow-up of 30 (range 18–38) months.

All patients were happy to have had the procedure performed and would do so again. The psychological benefit of being able to maintain a "normal" body image appears to outweigh the functional limitations encountered by this group of patients.

Bangle avulsion injuries of the forearm can range in severity from a relatively minor soft tissue injury to complete amputation. With modern microsurgical techniques and a methodical approach, these limbs can be successfully salvaged. We have found that patients' use of a salvaged limb improves with time, with recovery of adductor pollicis function being of particular importance. This allows the patient to hold objects between the thumb and fingers, even if finger and wrist flexion is limited. Provided the patient's life is not put at risk, we would recommend that limb salvage should always be attempted with injuries of this kind.