CASE REPORT

Temporary arterial stenting in a full-house spaghetti wrist injury in a remote rural setting: benefit for hand perfusion or risk of increased morbidity?

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SUMMARY

We report a case of temporary arterial plastic tube stenting of the ulnar and radial artery in a complete spaghetti wrist injury in a remote rural setting. Exploration in a specialist centre 18 h postinjury revealed that the tubes were clotted off with adjacent thrombi but hand perfusion was maintained. Intimal damage required vein grafting of both arteries 24 h postinjury. Hand perfusion was not compromised at follow-up. This case highlights that arterial hand perfusion can be maintained without the ulnar and radial artery. Arterial manipulation and tube insertion outside a specialist centre bears the risk of increased morbidity and potential microembolism and must therefore not be attempted.

BACKGROUND

Complete also termed as ‘full-house’¹ spaghetti wrist injuries with division of both arteries and nerves are rare and account for about 6–14% of spaghetti wrist injuries, which are defined as severance of at least 10 volar wrist structures including one major nerve and artery.^{2–3} These injuries can be a treatment challenge, especially in the remote setting far away from a specialist surgeon. There are no reports about delayed treatment of these injuries in the literature and no studies assessing the contribution of the dorsal arterial supply to the perfusion of the hand. We report a case in an uncommonly remote setting leading to delay of definitive treatment. Primary treatment with intra-vascular tube stenting has never been described or recommended in the literature. The potential complications are discussed.

CASE PRESENTATION

A 27-year-old man had been brought to an outback hospital in Australia with complete transection of all neurovascular structures, tendons and pronator quadratus, after having punched a window under the influence of alcohol more than 2000 km far from the next available specialist surgeon. Prior to transfer, the patient had been taken to theatre in a rural hospital. The decision had been made to anastomose the ulnar and radial artery with plastic tubes made from a butterfly phlebotomy needle set. Two tubes had been cut to a length of 5 cm (figure 1), inserted into and tied against the vessel with external vicryl ties. Good perfusion of the hand with palpable distal pulses had been documented.

After transfer by jet the patient arrived in the tertiary hospital 16 h postinjury. Initial assessment in

the emergency room revealed a well-perfused hand with a capillary refill time of less than 2 s. The patient was taken to theatre, 18 h postinjury, and the wrist was re-explored. From deep to superficial pronator quadratus, 25% of brachioradialis, flexor digitorum profundus (II–V), flexor pollicis longus, flexor digitorum superficialis (II–V), flexor carpi ulnaris, radialis and palmaris longus were severed as well as the radial and ulnar artery, and the median and ulnar nerve. Ulnar and radial pulses could not be felt but Doppler signals could be made audible. The tubing (figure 1) was removed and neither flow nor backflow in the radial and ulnar artery could be observed. The tubing showed occlusion with clotted blood over its whole length (figure 2) and adjacent intravascular thrombi. After application of vascular clamps to both arteries hand perfusion was reassessed. The capillary refill was still less than 2 s suggesting sufficient arterial perfusion via the posterior interosseous artery (PIA) and its anastomoses with the dorsal carpal arch. A Doppler signal was still audible 2.5 cm distal to the transected and clamped radial artery suggesting turbulent flow in the artery or one of its branches. After repair of all tendons and the nerves the vessel ends were explored under the microscope. Despite repeated heparinised saline lavage of the proximal end of the radial and ulnar artery, flow could not be restored. The proximal ends showed intimal detachment and the vessels were cut back by 2 cm. The new cut-ends showed the same finding. Further lavage under vessel dilation was unsuccessful. A Fogarty catheter (figure 3) was used to remove further thrombi and satisfactory flow could be restored. The distal ends of the arteries required repeated flushing before good backflow could be established. The vessels were cut back further and anastomosed under the microscope with interpositional vein grafts (8.0 nylon; great saphenous vein, 3.5 cm length) 24 h postinjury. The patient was started on 100 mg aspirin orally per day.

INVESTIGATIONS

A CT angiogram of the hand, 1 day after vein grafting, revealed good flow and run off in the ulnar artery but a filling defect in the radial artery suggesting its occlusion after grafting.

OUTCOME AND FOLLOW-UP

Hand perfusion was unremarkable on clinical assessment 2 weeks and 6 months after surgery.

To cite: Bauer S, Savundra J. *BMJ Case Rep* Published online: [please include Day Month Year] doi:10.1136/bcr-2013-008575

Figure 1 Intra-arterial plastic tubes in radial and ulnar artery at exploration.

DISCUSSION

The arterial anatomy of the forearm and hand has been studied in several cadaveric studies.^{4–6} No experimental anatomical studies and no reports exist assessing the exact contribution of the PIA to the dorsal blood supply of the hand at the level of the wrist nor its ability to provide hand perfusion in the absence of the radial and ulnar artery. The usefulness of reverse PIA flaps to cover defects on the dorsum of the hand and in the first web space has well been documented in the literature.^{7–9} The pedicle of these flaps is mainly based not only on the distal anastomosis with the anterior interosseous artery (AIA) but also on the anastomoses of the PIA with the dorsal arterial arch of the carpus.¹⁰

This case report shows that hand perfusion at rest can be sufficiently maintained after complete severance of the ulnar and radial

Figure 3 Plastic tube and Fogarty catheter with thrombi removed from the proximal arterial ends.

artery at the wrist via the dorsal carpal arch fed by the PIA. Their anastomoses are arteries of small calibre on the floor of the fourth extensor compartment and in the septum between extensor carpi ulnaris (ECU) and extensor digiti minimi (EDM). The PIA and its anastomosis to the AIA and the dorsal carpal arch were found to be present in 98.6% of specimens in a benchmark anatomical cadaveric study.¹¹ In our case we could show that the arterial supply of the hand was maintained via dorsal anastomoses. This could be seen clinically (capillary refill), intraoperatively (retrograde arterial flow from the hand) as well as intraoperatively through Doppler study. An important consideration for hand tissue haemostasis in these injuries is that venous drainage, which is of paramount importance, is largely preserved due to the rich dorsal venous network. In previously published case series on spaghetti wrist injuries there are no reports of ischaemia, necrosis or amputations after volar wrist lacerations^{1–3 12–16} despite the fact that 14–23% of injuries severed both, the ulnar and radial artery.^{2 3} These outcomes underpin temporary preservation of hand tissue haemostasis after these injuries prior to surgical repair.

In case of complete severance of the volar blood supply, intra-vascular manipulation and tube anastomosis can lead to further morbidity with intravascular damage, intimal delamination and occlusion requiring excision and venous grafting as shown in our case. Clotting in the vessels and plastic tubes could be demonstrated. This exposed the patient to a significant risk of microembolism, hand ischaemia and necrosis as previously reported after arterial cannulation.¹⁷ As a treatment advice for the remote rural setting, arterial cannulation aiming to achieve temporary vascular anastomosis should not be undertaken. If required for haemostasis, ligation of the arteries close to the severed ends is considered appropriate especially in profusely bleeding incomplete lacerations which do not constrict since application of a pressure dressing may compromise the remaining hand perfusion and venous drainage.

Learning points

- ▶ Temporary arterial tube stenting should not be undertaken.
- ▶ There are risks of vascular complications such as intimal damage and microembolism.
- ▶ Despite volar arterial severance at the wrist, hand perfusion can be maintained at rest (posterior interosseus artery and dorsal carpal arch).
- ▶ Ligation of the arteries close to the severed ends is considered appropriate since pressure dressings may compromise remaining hand perfusion and venous drainage.

Figure 2 Occluded plastic tube in the radial artery (above) and ulnar artery (below).

Contributors: SB supervised surgeon and manuscript. JS is the consultant supervising surgeon and was involved in supervision at surgery and review of manuscript. Both the authors approved the final draft of the article.

Competing interests None.

Patient consent Obtained.

Provenance and peer review Not commissioned; externally peer reviewed.

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