OPEN

CASE REPORT

Hand/Peripheral Nerve

Forequarter Replantation and the Lessons Learnt

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Summary: The literature on major upper limb replantation, especially those proximal to the elbow, is inadequate. An 18-year-old man presented to us with a left forequarter amputation. A replantation was attempted with a view to salvaging function and avoiding prosthesis. The procedure was technically challenging with a number of issues not highlighted in previous reports, particularly bony stabilization. The procedure was initially successful, with good perfusion. However, with time, the limb showed sepsis and had to be abandoned. We report this case to add to the literature on replantation at the shoulder level in the hope that this procedure may be reported successfully in the future. *(Plast Reconstr Surg Glob Open 2015;3:e509; doi: 10.1097/GOX.0000000000000485; Published online 9 September 2015.)*

Since the dawn of extremity replantation in 1962 by Malt and McKhann,[1] the technique has evolved with centers now reporting success rates of around 80%. However, most reported cases are limited to those distal to the wrist, and literature on replantation proximal to the elbow is inadequate. We report a case of traction avulsion amputation of the forequarter, where replantation was attempted. Although initially successful, the limb ultimately had to be amputated. This is the first such recorded case to the best of our knowledge, with the highest attempted replantations thus far being at the shoulder joint level. We report our findings to add to the limited literature on this subject in the hope that this procedure may be reported successfully in the near future.

CASE REPORT

An 18-year-old man presented with a workplace-related injury, wherein his left shirt sleeve was caught in a cloth rolling machine and consequently his left upper limb was avulsed and amputated at his shoulder. He presented to our center 3 hours after the incident, with the amputated part brought without cooling. Initial examination showed pallor but no major systemic injuries. The stump site showed exposed upper lateral chest wall without the scapula, with visible axillary vessels and brachial plexus remnants deep in the stump. The limb was preserved on ice and examined without flushing any fluids. The glenohumeral joint was intact, and attached scapular musculature was avulsed and torn. Distal to the shoulder, there were no bony injuries, as confirmed by radiographs, and no major soft-tissue injuries (Fig. 1). After proper counseling, it was decided to attempt a replantation.

After initial resuscitation, the patient was urgently shifted to the operating room. Thorough debridement of avulsed musculature was done. The axillary artery and vein and the cephalic vein were identified for viable anastomoses. A long-segment vein graft was harvested from the left lower limb. We performed an expedient plating of the acromioclavicular joint, with a view to fixing the scapula to the posterior chest wall at a later date (Fig. 2). The anastomoses were then completed, at which time segmental axillary artery loss was noted, which was bridged with the vein grafts (Fig. 3). The brachial plexus elements

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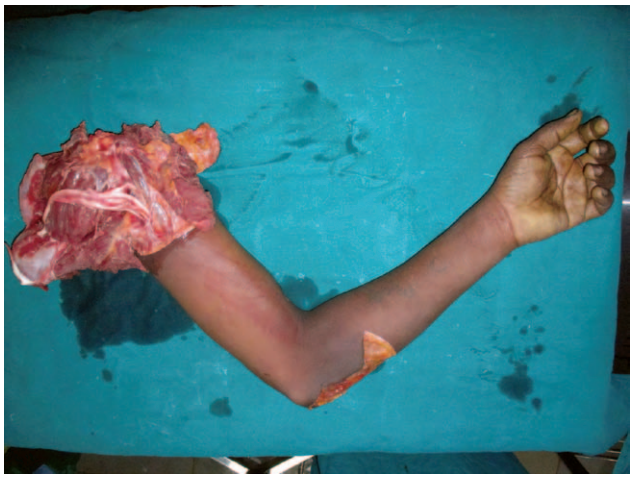

Fig. 1. Amputated forequarter.

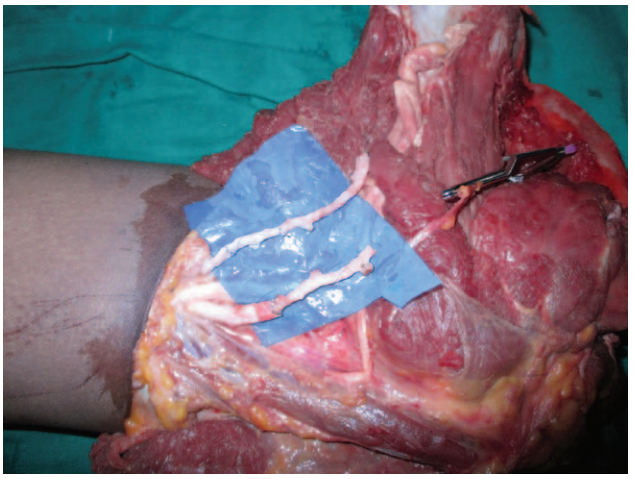

Fig. 3. Arterial and venous anastomoses with vein grafts.

were found to be avulsed very proximally deep in the stump; hence, primary nerve repair was deemed unadvisable. Revascularization was accomplished at 8 hours post injury (warm ischemia time of 3 hours, cold ischemia time of 5 hours), with good perfusion. Fasciotomies were done in the arm and the forearm. A strong musculotendinous repair was done around the axilla, and the limb strapped to the chest wall.

Postoperatively, the limb was well vascularized as determined by pulse oximetry, clinical examination, and capillary refill. Reperfusion injury, though anticipated, was not seen (normal creatinine, creatine kinase, and blood gas levels). The shoulder musculature showed necrosis after a few days. The patient was taken for serial debridement of unhealthy muscle for a total of 3 sittings (on perioperative antibiotics for 10 days) (Fig. 4). Ten days postoperatively, the limb appeared to be infected, though still perfusing. Higher antibiotics were initiated, and another thorough debridement was done. On day 14, the patient was found to be in sepsis, and his limb was found to be grossly swollen and edematous. Patient was taken for an urgent disarticulation at which time venous thrombosis was noted on table. The stump was closed primarily, and the patient eventually recovered fully and was discharged.

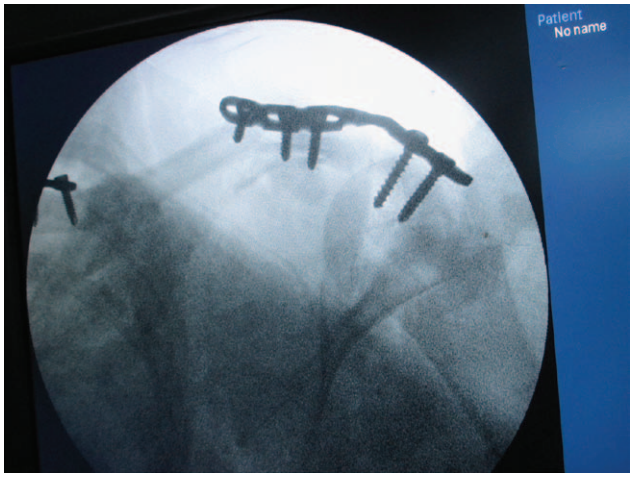

Fig. 2. Bony stabilization with acromioclavicular plating.

DISCUSSION

There have been a few published reports of major upper limb replants, the largest series to date being by Sabapathy et al.[2] However, the term major replantation refers to any procedure done proximal to the wrist. Thus, even within this category, most of the cases reported are distal to the elbow level.[3] The highest level of attempted replantation in the reports to date is at the upper humerus or through the shoulder joint.[4] Chuang et al[5] had proposed their

Fig. 4. Postoperative muscle necrosis.

classification and guidelines for traction avulsion injuries of the upper limb. However, their highest level IV ends at those through the shoulder joint, whereas a forequarter amputation occurs higher than this level. Ours is the first reported case of an attempted forequarter replantation.

One of the critical aspects of such a major replantation is the decision to attempt the surgery itself. Although the replanted limb may survive, the functional outcome is often unsatisfactory.[6] We justify our attempt due to the poor prosthetic options available at affordable costs for such a high level of amputation. Moreover, some studies have shown major replants to be functionally superior to prosthetics.[7] Also, the psychological aspect of having one's own limb, even with less functionality, cannot be underestimated.

We would like to highlight some of the challenges we faced in the forequarter amputation. First and foremost, bony stabilization was difficult as the scapula was also part of the amputated segment. We temporarily stabilized the acromioclavicular joint with a plate and planned to secondarily fix the scapula to the posterior chest wall with screws/wires.[8] We believe this to be the only practical option, although scapula-wall fixation might be attempted primarily if time permits. The second biggest challenge we faced was performing the anastomosis at depth in the axilla. Moreover, nerve repair at this level and depth is not something that would be feasible in the primary setting, due to the number of nerve trunks injured, as well as the proximal ends being buried deep in the stump. We had planned to perform a nerve repair or a functional muscle transfer secondarily.[9]

Postoperatively, we did not encounter reperfusion injury. We performed aggressive debridements as advocated by other authors.[10] One possible reason for the early necrosis of the shoulder musculature might be the segmental loss of the axillary artery with loss of shoulder-supplying vessels. In hindsight, we also feel that we should have explored the paraspinal area during the replant and cleared any frayed muscle ends. We also believe that the decision to amputate the limb should not be postponed and should be taken at the first suspicion of systemic sepsis or nonsalvageable limb.

CONCLUSIONS

We believe it is better to have tried and failed than not to have tried at all. We present our experience in the hope that others might succeed where we have failed.

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