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CASE REPORT
Global Health

From a Chicken Model to a Patient: Microsurgical Repair of a Brachial Artery in Mozambique

Pedro Santos, MD*
Mauro Gonzalez, MD*
Greta L. Davis, MD†
Andrea L. Pusic, MD‡
Christine H. Rohde, MD§

Summary: In sub-Saharan Africa, options for reconstruction of traumatic injuries are limited due to lack of access to microsurgery-trained surgeons. Recently, the Plastic Surgery Foundation-sponsored Surgeons in Humanitarian Alliance for Reconstruction, Research and Education group hosted a virtual microsurgery skills course for junior plastic surgeons in this region. In this report, we describe a case of complete brachial artery transection requiring microsurgical techniques and use of vein graft for repair at our provincial hospital in Mozambique. By highlighting this case, we aimed to describe a direct clinical application of the Surgeons in Humanitarian Alliance for Reconstruction, Research and Education virtual microsurgery skills course and to demonstrate the profound impact such courses can have on patient outcomes in low-and middle-income countries with limited or no access to microsurgery-trained surgeons. Further, through newly gained familiarity with standard microsurgery instruments used in reconstructive procedures, we were able to improvise and develop modified instruments to overcome lack of resources at our institution. *(Plast Reconstr Surg Glob Open 2023; 11:e5216; doi: 10.1097/GOX.0000000000005216; Published online 24 August 2023.)*

In sub-Saharan Africa, options for reconstruction of traumatic injuries are limited due to lack of microsurgery-trained surgeons. Prior studies have cited lack of surgical expertise, instrumentation, and postoperative care settings as contributing factors.[1,2]

In 2021, the Plastic Surgery Foundation (PSF)-sponsored Surgeons in Humanitarian Alliance for Reconstruction, Research and Education (SHARE) organization developed a virtual course for plastic surgeons in sub-Saharan Africa to expand microsurgical capacity. The curriculum introduced basic microsurgery techniques through one-on-one skills sessions using a chicken thigh vessel model over two 1-day courses.[3,4] Participants practiced between sessions and received longitudinal feedback to enhance skill retention.

In this report, we describe an emergent brachial artery repair performed at the Matola Provincial Hospital in Mozambique. This is the largest of four health units in Maputo province serving a population of 2.2 million and staffed by one plastic surgeon, one otolaryngologist, two orthopedic surgeons, three maxillofacial surgeons, and five general surgeons. The procedure was performed by a local general surgeon and plastic surgeon with limited experience in small vessel repair, several months after participation in the SHARE microsurgery course.

By highlighting this case, we aimed to describe a direct clinical application of the SHARE virtual microsurgery course and to demonstrate the profound impact such courses can have on patient outcomes in low- and middle-income countries (LMICs) with limited access to microsurgery-trained surgeons.

CASE PRESENTATION

A 15-year-old boy with no comorbidities was admitted to the emergency department two hours after an altercation on school grounds. The patient was stabbed in the right upper arm with a broken glass bottle, and was noted to have a large, profusely bleeding laceration just proximal to the elbow crease.

Initial workup was notable for pulse rate of 120 bpm, respiratory rate of 28 cpm, blood pressure of 90/60 mm Hg, GCS 12, and pallor of skin and mucous membranes,

*From the *Department of Surgery, Matola Provincial Hospital, Matola, Mozambique; †Division of Plastic Surgery, University of California San Francisco Health, San Francisco, Calif.; ‡Division of Plastic and Reconstructive Surgery, Department of Surgery, Brigham Health, Boston, Mass.; and §Division of Plastic Surgery, Columbia University Irving Medical Center, New York, N.Y.*

Received for publication May 17, 2023; accepted July 12, 2023.

DOI: 10.1097/GOX.0000000000005216

Disclosure statements are at the end of this article, following the correspondence information.

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consistent with hemorrhagic shock. We were unable to assess motor and sensory function at the time of presentation due to altered mental status. A tourniquet was applied proximal to the laceration, and crystalloid volume resuscitation was initiated while arrangements for blood transfusion and surgery were made.

In the operating suite, wound exploration revealed a 3-cm laceration proximal and parallel to the elbow crease, which was extended for exploration. Complete transection of the brachial artery with retraction of the cut ends was identified. The internal diameter of the injured vessel was 5 mm. All major nerves were intact.

Due to excess tension on the vessel ends, we opted to repair the artery using a vein graft. A 3-cm vein segment of matching caliber was harvested from a branch of the vena comitans accompanying the vascular bundle. Smaller branches of the vein graft were ligated using 4-0 silk sutures (Figs. 1 and 2).

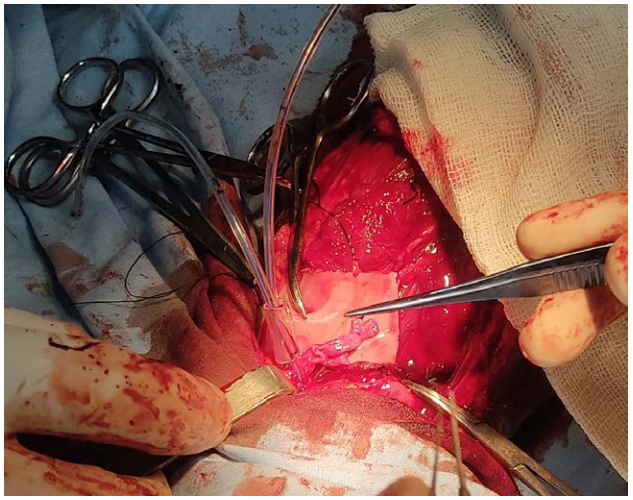

Fig. 1. Exposure of right upper arm brachial artery injury with modified microvascular clamp fashioned from low-cost IV and suction tubing.

Fig. 2. Completed repair of brachial artery transection using vein graft.

Due to lack of appropriate instruments, the surgery was performed using improvised materials. Atraumatic vascular clamps were improvised from IV tubing, which was looped around the vessel and fed into a segment of aspiration tubing, and ophthalmology instruments were used to suture the vein graft onto the brachial artery with two hand-sewn anastomoses using 8-0 nylon suture under 2.5× loupe magnification (Fig. 3). The quality of the anastomosis and graft patency were assessed by releasing the modified vessel clamps and observing pulsatile flow through the graft. (**See Video [online],** which displays successful patency test of completed brachial artery repair with vein graft.) Upon completion of the final anastomosis, 500 mL of packed red blood cells were transfused. Fasciotomies were not performed due to short ischemia time, and the patient was monitored postoperatively for evolution of compartment syndrome.

The duration of the procedure was 3 hours and 25 minutes. Total ischemia time, from application of tourniquet to release after repair, was 3 hours and 40 minutes. Patient recovery was uneventful, with no loss of motor or sensory function in the extremity immediately after the procedure and confirmed at follow-up. The patient was discharged on postoperative day 15 and proceeded to physiotherapy.

DISCUSSION

Absence of specialized microsurgical training in sub-Saharan Africa, compounded by lack of vascular and plastic surgeons at most hospitals, hinders the scope of reconstructive surgery performed in the region. When presented with complex devascularizing injuries of the extremity, amputation is often used as a life-saving measure.[5–7] However, many patients with traumatic injuries of the extremity would otherwise be candidates for limb-sparing techniques if seen at facilities with appropriate equipment and surgical expertise.

This case is a rare example where limb preservation was offered to a patient with major devascularizing injury of the extremity at our institution. There are few, if any, case reports describing microvascular reconstruction performed by in-country surgeons in our region. For example, Guzman et al reported on diagnoses managed by plastic surgeons at the neighboring Hospital Central Maputo and noted an absence of microsurgical cases due to lack of appropriate skillset, operative microscopes, and postoperative care setting and highlighted the need for improved training of local surgeons.[2] Specialized training in microsurgery has great potential to improve surgical outcomes for patients in our region.

Further, it is important to acknowledge the innovative approach required to implement advanced surgical techniques in a resource-constrained setting. Multiple prior reports describe surgical innovation necessitated by procedural urgency and available infrastructure, such as use of hypodermic needles for Kirshner wires or silicone infusion tubing for Hunter rods.[8,9] Our development of a modified, atraumatic vessel clamp from IV tubing was only possible through an understanding of existing microsurgical instruments and practices in high-income countries.

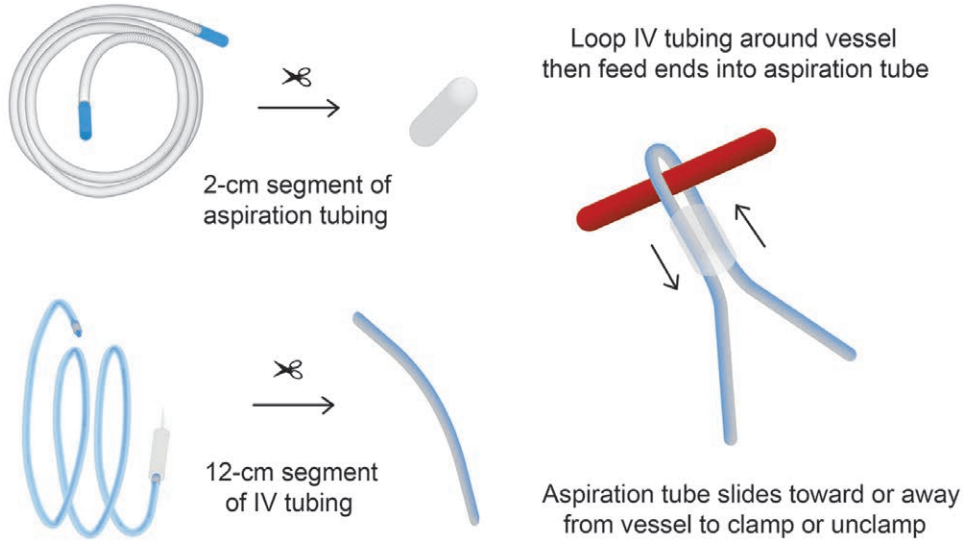

Fig. 3. Modified microvascular clamp using low-cost materials.

This is an unexpected and added value of receiving specialized training in microsurgery based on international standards, while allowing for modification when operating in a resource-constrained setting.

This case demonstrates the clinical utility of dedicated microsurgery skills training through the SHARE program for surgeons in LMICs and represents an important, early shift in how traumatic injuries of the extremity are managed at our hospital in Matola, Mozambique.

CONCLUSIONS

In this report, we describe a case where techniques learned through participation in a microsurgery training course were successfully applied for a patient who sustained a traumatic devascularization injury of the upper extremity. Virtual microsurgery training programs have great potential to expand surgical capacity and improve patient outcomes in sub-Saharan Africa.

Pedro Santos, MD
Matola Provincial Hospital
Plastic Surgery Division
Rua José Sidumo, 177, Bairro Central
Maputo, Mozambique

DISCLOSURE

The authors have no financial interest to declare in relation to the content of this article.

ACKNOWLEDGMENTS

We wish to acknowledge Dr. Mauro Gonzalez, coauthor and co-surgeon involved in this case, for his contribution of knowledge and experience through fashioning improvised surgical clamps, which made it possible to proceed with brachial artery repair. Without his innovation, our patient would have had very different and adverse outcomes after their injury.

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