

Major Defect to the Brachial Artery Following Blunt Trauma – A Five Year Follow-up

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ABSTRACT

A 29-year-old soldier was injured when a collapsible side of an army truck fell on his left upper arm creating lesion to the brachial artery with a defect in the artery of about 10 cm in length. Injury to one brachial vein, of the same length, was also sustained without bone or neural injury. Intraoperative Doppler ultrasonography was performed. A reverse autologous saphenous vein interposition graft with a circumference similar to that of the injured brachial artery was used to perform end-to-end anastomosis between artery and reversed vein graft. The patient returned to his military formation 16 days post operatively, with a return to full military calisthenics routine 2 months after injury. Surgical and Doppler ultrasonography control was kept regularly. Excellent late result revascularization of the injured brachial artery with reversed interposition vein graft can be seen in CT angiography five years after injury.

Key words: brachial artery defect, reversed interposition vein graft, anastomosis

Introduction

Blunt injuries form around 10% of all injuries to the brachial artery. Large deficits attributed to blunt trauma are infrequent, if not rare¹. Penetrating injuries to the brachial artery make up 90% of all injuries to this vessel: gunshot 50–60%^{2,3} stabbing 35–40%³ pellet 4% and dog bite⁴. Except for in military engagements, penetrating trauma to the brachial artery is more likely to occur in large, urban populations; however in rural districts injury to the brachial artery tend to be as the result of blunt trauma⁵. This case report discusses a blunt trauma injury sustained during routine military duty.

Case Report

A 29-year-old special formation soldier on routine duty injured his left upper arm when a collapsible side of an army truck fell. A 12 cm laceration wound was sustained to the m. biceps brachii with blunt lesion of the brachial artery creating a defect of the artery about 10 cm in length. Injury to one brachial vein, of the same length, was also sustained without bone or perceptual neural injury. At the site of injury, the soldier was given first aid then transported to our hospital. Approximately 50 minutes passed before the patient was received in the

emergency room. Immediately he was given analgesic therapy (tramadol 100mg) and antibiotic therapy (Cry-stacillin (benzylpenicillium) 4x4 mil., gentamicin 2x120 mg, metronidazol 4x500 mg) and tetanus antitoxin. Radiological diagnostic upon admission was not necessary because pulse on the left arm was clinical absent, and he was immediately prepared for surgical intervention. Induction into endotracheal anesthesia was made with 450 mg tiopental and 125 mg Leptosuccin (suxamethonium), followed by 1.7 vol% isofluran, 2 mL per hour fentanyl, and 4 l per min. N₂O, 2 l per min. O₂. During surgical treatment, debridement and revision of the wound, injury to the brachial artery and vein with 10 cm defects became apparent. Ligation of the injured brachial vein was immediately performed because the other brachial vein was still intact and functioning well. Intraoperative Doppler ultrasonography was made of the left brachial artery and vein, with a comparison done on the uninjured right arm vessels. Then, after placing vascular non-traumatic occlusion clamps on proximal and distal parts of the destroyed brachial artery edges were excised. The edges of the injured artery extended to the uninjured arterial intima. Then the occlusion clamps were removed, first distally then proximally, and a Fogarty bal-



Fig. 1. CT Angiography of the left brachial artery five year after injury, A-L projection. Arrows are showing the places of anastomosis between proximal and distal parts of the left brachial artery with reversed interposition saphenous vein graft.

loon catheter was passed to remove any thrombotic or embolic material in the remaining artery. After back bleeding from artery, distal and proximal edges were flushed with 0.1% heparin solution to prevent fresh thrombosis formation. Systemic heparin anticoagulation was administered intravenously before the vessels were occluded proximally and distally with non-traumatic vascular clamps. We took a reverse autologous saphenous vein interposition graft approximately 12 cm long with a

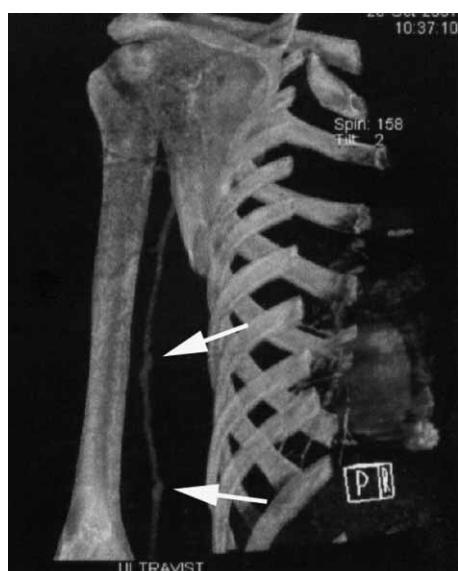


Fig. 2. CT Angiography of the left brachial artery five years after injury, P-R projection. Arrows are showing the places of anastomosis between proximal and distal parts of the left brachial artery with reversed interposition saphenous vein graft.

circumference similar to that of the injured brachial artery. The vein graft was trimmed to fit exactly into the defect created in the artery. End-to-end anastomosis between artery and reversed vein graft was performed first distally and then proximally with 6–0 polypropylene sutures. After distal pulse was achieved, musculorrhaphy was completed and the wound closed. Doppler ultrasonography showed normal values for repaired and contra lateral brachial arteries. Post operatively anticoagulant heparin therapy was continued for 10 days, and antibiotic therapy was continued for 7 days. The wound was checked and freshly bandaged daily. Clinical examination continued to show correct pulsation and no neurological deficit. The patient was released from the hospital after 10 days. At this time, Doppler ultrasonography control was regular, stitches were removed and he was given postoperative immobilization in the form of a sling to wear for 20 days. He returned to his military formation 16 days post operatively. As recommended, he gradually increased weight bearing to his injured arm 25 days post operatively, resulting in a return to full military calisthenics routine (push ups, pull ups, helicopter jumps, etc) 2 months after injury.

The patient reported for regular surgical and Doppler ultrasonography control, once per month for the first 6 months, followed by yearly exams for surgical and Doppler ultrasonography control. Five years after injury CT angiography was required before the patient's special formation was deployed out of country (Figures 1 and 2).

Discussion

Our patient came from a military terrain in an emergency vehicle as quickly as possible. Revascularization of the injured brachial artery was made within the critical ischemic time, which is 4 hours for this vessel⁶. Doppler ultrasonography was indicated in this type of brachial artery injury⁷. Emergency angiography is indicated when the arterial injuries would be difficult to expose and arterial injury is problematic to predict⁷. Doppler ultrasonography of the upper extremities has been shown to be as specific and sensitive as arteriography in detecting brachial artery injuries^{7–9}. After physical examination of the brachial artery injuries it is important to make Doppler ultrasonography of the contra lateral brachial artery, which has a normal index of approx. 0.95; it is rarely less than 0.85⁷. Our patient had pulse insufficiency on manual examination and this was confirmed with Doppler examination. A 10 cm defect of the brachial artery is extremely large and possibilities for revascularization are decreased, some authors have put forth the lower limit of 2.16 cm for repaired venous graft in the brachial artery, and an upper limit of 3.43 cm when repaired with anastomosis¹⁰. Experience from the Vietnam War⁵ has shown that veins should be repaired with a similar diameter graft, and from our experience it is important for the reversed vein graft be of similar dimensions as the damaged artery to avoid later complications such as stenosis and dilation of the vein graft and edges of the repaired

artery. Some authors^{3,11} additionally use the cephalic vein graft to care for brachial artery defects. This is justified because of the anatomic positioning of the vessels. Considering the major defect of our patient, in our opinion, the saphenous vein graft was an absolutely better choice than the cephalic vein, or any synthetic vein grafts in this case. The reason for our opinion about the saphenous vein interposition vein graft is because it has

better patency rates, and better resistance to infection compared with synthetic grafts^{7,12}. Our patient is exposed daily to above normal physical exertion and has not experienced discomfort with his injured arm. Excellent late result revascularization of the injured brachial artery with reversed interposition vein graft can be seen in CT angiography (Figures 1 and 2) five years after injury.

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VELIKI DEFEKT BRAHIJALNE ARTERIJE NAKON TUPE TRAUME – PRIKAZ BOLESNIKA U PETOGODIŠNJEM PRAĆENJU

SAŽETAK

29-godišnji vojnik specijalnih formacija ozlijeđen je prilikom pada pomične stranice vojnog kamiona, pri čemu je ista izazvala ozljedu lijeve nadlaktice s lezijom brahijalne arterije i defektom iste u dužini od oko 10 cm. Također, ozlijeđena je i jedna brahijalna vena u istoj dužini, no evidentne ozljede kosti i živaca lijeve nadlaktice nije bilo. Čim je evidentiran nedostatak pulsa na lijevoj ruci, pristupilo se operacijskom zahvatu. Intraoperativno je učinjen ultrazvučni Doppler. Za zbrinjavanje velikog defekta brahijalne arterije iskorišten je reverzni autologni transplantat vene safene magne koji je bio podjednake cirkumferencije kao i ozlijeđena arterija. Učinjena je end-to-end anastomoza između brahijalne arterije i ovog venskog grafta, proksimalno i distalno. Ozlijeđeni vojnik vratio se u svoju vojnu jedinicu 16 dana nakon ozljede, ispunjavajući u roku od 2 mjeseca sve obaveze koje nalaže njegova specijalna vojna formacija. Redovito je dolazio na kontrole kirurga i ultrazvučni Doppler. Izvršni kasni rezultati revaskularizacije ozlijeđene ruke, nakon velike ozljede brahijalne arterije, upotrebom reverznog venskog interpozituma vidljivi su također na CT angiografiji pet godina nakon ozljeđivanja.