

Surgery of traumatic peripheral arterial injury with delayed transfer during the Ethio-Eritrean War -1997-2000

Mohammed Kedir M.D.

Abebe Bekele M.D.

Gondar College of medical sciences, Gondar, Ethiopia

Correspondence to: Dr. Mohammed Kedir, GCMS, Fax No.0251-08-11-14 79

E- Mail: Muheet2000@yahoo.com

Background: The traditional approach to severe vascular injuries in Ethiopia has been ligation. This paper presents the results of an alternative approach in which Ethiopian surgeons with some basics of vascular reconstruction techniques used vein patch-repair, whenever possible, during the Ethio-Eritrean war between 1997-2000.

Patients and methods: The population study consisted of 13 military and 7 civilian patients with vascular injuries. The superficial femoral and the brachial arteries were involved each in eight patients respectively. Four victims each sustained injury to the deep femoral, radial, ulnar and anterior tibial arteries respectively. Intra operative findings revealed arteriovenous fistulae and false aneurysms each in nine patients.

Results: Vein Patch reconstruction was undertaken in 12 patients. In eighteen Patients, a perfect or near perfect functional result was achieved. Surgery failed in two cases. The two failures may have been due to extraordinarily concomitant injury or late presentation.

Conclusion: Our result suggests that; repair rather than ligation represents the “gold-standard” and that it can be achieved in the absence of “high tech” vascular facilities. This is because viability of the limb has been maintained by the development of an A-V fistula, false aneurysm, or through an alternative arterial source on those whose limb survives during the several days required to transport them to an appropriate facility.

Introduction

In Ethiopia and many other African countries, specialized vascular surgery is unavailable. It is however known that, in this continent, many general surgeons encounter patients with vascular problems, especially following trauma. In the absence of specialist vascular surgeons and with limited facilities, the most likely treatment is ligation of affected arteries, in order to save the patient's life. As far back as the Korean conflict (1950), arterial reconstruction had become an indispensable method of treatment in the United States army¹. Such management proved to be extremely valuable when compared with ligation, not only in saving life but also in attaining full functional recovery of the affected limb.

In the Gondar College of Medical Sciences Hospital, Ethiopia, arterial reconstruction was initially performed at the end of the 1970's by surgeons who came from then East Germany (GDR). The aim of this retrospective survey was to evaluate the outcome of our “repair if possible” approach, in patients injured during the 1997 – 2000 Ethio-Eritrean war, particularly during the major intensive conflict locally known as the battle of sun-set that took place in February 1999.

Patients and methods

In this study, all patients who underwent surgery for peripheral arterial injuries in the Gondar College Medical Sciences Hospital from 1997 to 2000 were included. Information concerning the date and cause of the injury, the pre-operative measures, the intra-operative diagnosis, method of operative treatment and post-operative condition was obtained from patients' files and theatre registers. A complete database was compiled-from which data was analysed.

The nature and extent of vascular injury were made solely on clinical grounds. A palpable thrill around the site of injury and an audible bruit suggested the presence of an arterio-venous fistula. Patients with a false aneurysm presented with a pulsatile mass. Brisk uncontrolled bleeding also suggested a probable arterial injury.

Operative Technique

A pneumatic tourniquet inflated by compressed air was, whenever possible, applied before removal of pressure bandages. The tourniquet remained inflated until the injured artery was exposed and vascular clamps were applied proximally and distally. The type

of reconstruction was decided after evaluation of the extent of injury, presence of free-back flow of blood and viability of the limb musculature. For vein patch reconstruction the long saphenous vein at the ankle joint of the contra lateral leg was preferred if possible. Fine prolene was the suture material of choice.

Results

All patients in this study were males aged between 20 to 60 years with a median of 30 years. Thirteen of the victims were soldiers and 7 were civilians. Twelve injuries were due to bullets. Table 1 shows the etiology of the injuries. Three patients presented in congestive heart failure. The haematocrit ranged from 11- 44% (mean -27%). The average time lapse between injury and surgery was 3 days. Only one patient received surgery within 1 hour following trauma. One civilian aged 60 sought medical attention 40 days after the injury. (A wood fragment to his brachial artery.)

Thirteen patients needed blood transfusion. Of these, eight received one unit. Two units were given to three patients and four units to one patient. Antibiotics were

administered to the majority of the patients. Intra - operative diagnosis of an A-V fistula was made in nine cases, because of injury to both artery and vein with resultant communication (Table2). Of these five patients had a superficial femoral artery injury, one a deep femoral, two a popliteal and one a brachial artery injury. Nine patients were diagnosed to have false aneurysms. Of these, the brachial artery was involved in eight cases. One patient had a false aneurysm of the anterior tibial artery. Two patients arrived to the hospital with uncontrolled bleeding from injuries of the radial and ulnar artery respectively.

Vein patch vascular reconstruction was under taken in 12 patients (Table3). Of these, six patients had femoral, four brachial and two popliteal artery injuries. Three direct repairs and one end-to-end anastomosis after resection were undertaken injuries to brachial arteries. Quadruple ligation was performed on one patient with an A V-fistula of the femoral artery and vein. The remaining three small arteries-the ulnar radial and anterior tibial were all ligated.

Table 1: Causes of injuries among patients operated for vascular injuries in GCMS – (1997-2000)

Gunshot	12
Metal fragment	3
Wood fragment	2
Blast	2
Stab	1

Table 2: Site and nature of peripheral vascular injuries among patients operated for vascular injuries in GCMS- (1997-2000)

	AV Fistula	False Aneurysm	Hemorrhage
Femoral artery	6	-	-
Popliteal artery	2	-	-
Brachial artery	1	8	-
Anterior tibial artery	-	1	-
Ulnar artery	-	-	1
Radial artery	-	-	1
Total	9	9	2

Table 3: Surgical procedure done among patients operated for vascular injuries in GCMS –(1997-2000)

	Vein patch reconstruction	Direct suture	End to end anastomosis	Ligation
Femoral artery	6	-	-	*1
Brachial artery	4	3	1	-
Popliteal artery	2	-	-	-
Ulnar artery	-	-	-	1
Radial artery	-	-	-	1
Anterior tibial artery	-	-	-	-

*** Quadruple ligation.**

Three patients underwent re-operation for either bleeding or deterioration of the peripheral circulation. Of these, repeat vein patch reconstruction was undertaken successfully in two patients with injuries to the femoral or popliteal arteries respectively. The third patient was the civilian with brachial artery injury who arrived after 40 days. The initial surgical technique was direct suturing. Postoperatively, he developed a profuse bleeding from the suture site. Re-operation revealed grossly ischaemic forearm, muscles, which led to the decision to ligate the brachial artery. Subsequently, he developed gangrene of the arm and was discharged against medical advice. The mean hospital stay was 18.4 days for all the patients. Eighteen of them left the hospital with full recovery. One patient developed shortening of the forearm, which was most likely due to ischemia and/or associated bone fracture.

Discussion

During the Second World War, ligation of injured arteries resulted in unacceptably high rates of limb amputation. De Bakey and Someone², when reviewing 2471 battle injuries to major arteries treated by ligation reported a 49% amputation rate. They noted a 30% amputation rate for brachial artery ligation, and a 75% amputation rate for femoral-popliteal injuries. Successful repair of arterial injuries started to be accomplished frequently by the time of the Korean war¹. It soon became evident that repair was valuable, not only in saving life but also in attaining full functional recovery of the affected limb.

In this study, despite the absence of a specialized vascular unit in the hospital, vascular reconstruction

was the main goal of treatment. This became possible because of availability of different materials needed for vascular surgery, which were prepared and used by previous surgeons. We always applied a pneumatic tourniquet inflated by air compressor. Many surgeons disapprove of the use of tourniquets in patients with a compromised circulation. However, the application is brief only during exposure of the vessels and has been advocated by some experts³. It was our experience that the use of compression tourniquets allowed a good exposure of the affected vessels and avoided sudden brisk hemorrhage, which might otherwise have resulted in the tendency towards “blind” application of clamps with further unnecessary damage to the vessels in question.

This background and experience leads us to encourage many general surgeons in Africa to attempt vascular reconstruction. We do not advocate the use of heparin in patients following trauma with extensive soft tissue damage³. We did not need to use a Fogarty catheter because the arterial back flow was always excellent. The explanation for this may be partly because the majority of our patients were young and the fact that their arteries were otherwise in excellent condition.

The time lapse between injury and surgery was generally considerable; three days on average. Given this marked delay before surgery, a perfect functional result in 18 patients was beyond our expectation. There was only one gangrene and one of shortening. We believe that these encouraging results stem, in part, from the presence of a post-traumatic A-V fistula or false aneurysm, which kept the blood supply distal to injury above a critical level. We do not know how many patients with peripheral artery injury died, or received primary amputation or ligation within, or close to, the war zone. During the Korean, and more especially the Vietnam conflict, rapid transfer to

properly equipped surgical centres, usually by helicopters, was generally achieved within minutes or at most within a few hours.

Wars in Africa, even in the present day, are generally associated with much delay before transfer to hospital. The result of our study suggests that when days elapse before victims of significant traumatic vascular diseases present to a centre, the limb may well be viable owing to the presence of an A-V fistula or false aneurysm. In the absence of a post-traumatic A-V fistula or false aneurysm, viability of the limb may have been obtained owing to another arterial source or an unusually good collateral circulation.

We have found that repair, rather than ligation, is generally achievable, results usually in an excellent functional status, is not associated with increased mortality, and does not require specialized equipment or facility, which are unlikely to be available in most of the hospitals in Africa. Further large prospective studies are clearly desirable; preferably with radiological characterization of exact nature of the injury. However, we feel that our results merit transmission to those surgeons who will undoubtedly receive significant numbers of such patients throughout Africa, and elsewhere, for the foreseeable

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