Traumatic arteriovenous fistulas and aneurysms at the Tikur Ambessa hospital, Addis Ababa

Orvar Johnson MD
Department of Surgery
Tikur Anbessa Hospital
Addis Ababa University

During the years 1992-1996 11 cases of arteriovenous fistula or aneurysm were reported in the Department of Surgery at Tikur Anbessa Hospital (TAH). Ten of these cases will be presented. Eight of the cases were operated upon in 1996. The mean age of the patients was 32 years (range 17-49). Nine were men. The aneurysms were located in the lower extremities in eight patients, and in the upper extremities in two. Eight of the injuries leading to aneurysms involved military personnel and there were two civilians. The mean time of operation after injury was 48.9 months (range 2-72 months). Of these, five were false aneurysms and five were arteriovenous fistulas. In all cases restoration of arterial and venous flow after excision was successful. All these cases have been followed for a minimum of four months after surgery (range 4-31 months). Results were considered excellent in one patient and good in nine.

Introduction

Traumatic A-V fistulas and false aneurysms have been known by surgeons for a very long time. A-V fistulas were described by William Hunter in the mid-eighteenth century and he emphasized the difference in the pathology of A-V fistulas and false aneurysms[1] . The Hunterian operation for A-V fistulas, including ligation of the afferent artery, was, however, often followed by ischemia and gangrene[1]. The standard treatment of quadruple ligation of A-V fistulas was introduced by surgeons like Halsted and Holman in the beginning of the twentieth century[1]. Subsequently, with experience in treating war injuries, particularly during the Korean conflict of 1950-53 and with the rapid development of vascular surgery, the feasibility of immediate repair of all acute arterial injuries was demonstrated[2]. Where A-V fistulas and false aneurysms did develop after trauma, restoration of arterial continuity, following excision, produced superior results to those of ligation when major vessels were involved[2]. The present study of traumatic A-V fistulas and aneurysms was made in the light of these advances in the surgical treatment of vascular trauma.

Patients and methods

A search of the theatre register of the Tikur Anbessa Hospital revealed that 11 patients with arteriovenous fistuala and aneurysms were operated upon between 1992-1996.

When operating on these cases the principle of restoration of the arterial and venous circulation of the limb was practised, when applicable. Restoration of flow was achieved either by repair of the artery and vein after excision of the aneurysm or by using a synthetic graft for that purpose. Bard PFTE (Poly tetrafluoroethylene) was used. Heparin was used locally during surgery and systemically after surgery.

Address for correspondence: Department of Surgery, Faculty of Medicine, Addis Ababa University, P O Box 9086, Addis Ababa,

In one case ligation of the artery and vein was undertaken after resection.

Results

All 11 patients were operated upon between 1994-1996, of whom eight had surgery in 1996. This is certainly a windfall effect coming some years after the end of the war, as the majority of these lesions involved the military. There were one female and ten male patients. The mean age of the patients was 32.8 years with a range of 17-49 years.

Table 1 shows the anatomical localization of these vascular lesions. There were eight in the lower extremities and two in the upper extremities. Eight patients were military personnel and two were civilians. The time of presentation after the injury was a mean of 48.9 months with a range of 2-72 months.

The causes of the lesions and their pathology are shown in Table 2. Six were due to gunshot wounds.

TABLE 1 Localisation of aneurysm, TAH Addis Ababa, 1992-1996.

Localization	Number of Cases
Right thigh	2
Left thigh	2
Right popliteal area	2
Left popliteal area	1
Right iliofemoral area	1
Left cubital area	1
Right axillary area	1
TOTAL	10

Two were the result of blast injuries, there was one stab injury and one iatrogenic injury after venepuncture in the cubital fossa. Five of the patients had A-V fistulas and five had false aneurysms. The presenting symptoms and signs in patients with A-V fistulas were invariably the presence of a thrill and a systolic/ diastolic bruit over the lesion. There were dilated and sometimes varicose veins distal to the lesions.

TABLE 2 Causes of aneurysms and A-V fistulas, and their pathology, TAH Addis Ababa, 1992-1996.

Causes of Aneurysm	Month
Bullet	6
Blast	2
Stab	1
Iatrogenic	1
Total	10
Pathology	
Arterial false aneurysm	5
Arteriovenous aneurysm	5

Swelling and skin changes were not seen in these cases. Distal pulses were not palpable in all cases. There were no systemic signs or symptoms.

In patients with false aneurysms, there was invariably a pulsatile mass, which was of considerable size in a few cases. There was severe swelling of the limb below the lesion with eczematous skin changes and sometimes ulceration. A systolic bruit was heard over the aneurysms in all cases except one. Distal pulses were invariably not palpable.

All patients were in a generally good condition. However patients with false aneurysms in the legs were disabled and unable to walk. There were few other lesions associated with the vascular injury. One patient with an A-V fistula of the axillary area had an injury to the brachial plexus, with weakness of the hand, which improved during follow up.

All patients had surgery. Table 3 shows the different operative procedures that were used. In nine cases, the vascular flow, mainly the arterial, and in some cases the venous as well, was restored. In five cases a synthetic graft was used for the repair. Excision of a false aneurysm and ligation of the artery was done for an aneurysm of the superficial femoral artery. In this case, the arterial sac was completely obliterated and the outgoing arteries could not be located. The immediate post-operative course was followed by wound infection in a few cases. One patient with sepsis required further surgery.

TABLE 3 Surgery on traumatic A-V fistulas and aneurysms, TAH Addis Ababa, 1992-1996.

Type of Surgery	Number of Cases
Excision and ligation	1
Arterial repair by suture	4
Excision and restoration of Arterial passage by graft	5
TOTAL	10

Nine patients have been followed for over three months, with a range of 4-31 months. One case has not returned for follow up. Results have been assessed as good in eight cases and excellent in one.

The following criteria were used in the assessment results:

Excellent — Complete restoration of arterial and venous flow with palpable distal pulses.

Good — Restoration of function of the limb without symptoms of arterial or venous insufficiency; however, distal pulses not palpable.

Fair — Incomplete restoration of function of the limb with swelling and absence of distal pulses but without ischaemic symptoms.

Poor — Incomplete restoration of function of the limb with swelling and ischaemic symptoms and signs.

Discussion

Traumatic A-V fistulas and false aneurysms are late results of trauma. Most published series are from conditions of war. There is a very large series from the second world war[3] and several from the Korean War[4]. In times of peace, and as a result of civilian injuries, these injuries are rare, which is also seen in this series from TAH, where most of the patients were male military personnel.

The causes of these injuries in most military cases were gunshot wounds and blast injuries, and sometimes stab wounds. The underlying pathology after trauma was partial rupture of the artery and vein in A-V fistulas, and of mainly the artery in false aneurysms. The bleeding after injury is contained by the surrounding tissues. If an A-V fistula develops the blood returns via the concommitant vein to the heart and eventually an aneurysm is formed between the affected artery and vein or a simple fistula will remain. In false aneurysms, a wall is formed by the contiguous structures, and fibrin deposition, and later on invasion by fibrous tissue, will form the false aneurysm. The false aneurysm is always filled with an organized blood clot. One ingoing and outgoing artery is found in most cases and there is a constant flow of blood through the aneurysm. The arterial and venous circulation distal to the lesion is seriously affected with ischaemia and venous stasis. The venous stasis is more pronounced in a false aneurysm and causes considerable swelling of the limb with ischaemic skin changes. In A-V fistulas and aneurysms, due to the raised venous pressure, there is dilatation and varicosities of the superficial veins but no apparent swelling. If the returned volume of blood is large, there are systemic features with a raised cardiac output with tachycardia, high pulse-amplitude and, subsequently, cardiac hypertrophy. In the affected limb compensatory changes in the form of collateral circulation, arterial as well as venous, are established. Traumatic false aneurysms grow invariably due to the instability of the aneurysmal wall and cause progressive insufficiency both arterial and venous, resulting in gangrene and loss of the limb.

In the present series there were an equal number of A-V fistulas and false aneurysms. Findings in a larger series have shown a ratio of two A-V fistula to one false aneurysm[4]. The small size of our series is the explanation for the unusual ratio.

The mean time of presentation to hospital for treatment after trauma, in the present series, was 48.9 months, which is considerably longer than in other series. This is probably due to limited access to surgical services here. Therefore most patients with traumatic aneurysms had large pulsating masses and severe swellings with skin changes, eczema and ulceration. In patients with A-V fistulas no systemic effects were recorded. That is, to some extent, because of the absence of central and large fistulas

in this series. In this series most cases involved the lower extremity, which is also consistent with other series of war injuries. No patients with injuries of vessels of the head are included.

Diagnosis and evaluation of cases in the series is entirely based on history and physical findings and that seems to be satisfactory in most cases. Angiography can give further information on the collateral circulation and a more exact localization of A-V fistulas, which, in some cases, can be difficult to ascertain. Studies of flow using Doppler or oscillometry are useful in assessing pre and post-operative effects. Assay of PaO2 and cardiac output is made in cases of large flow fistulas. In the surgical treatment of A-V fistulas and false aneurysms, there are two principal ways of handling the problem. The older and well tested method is excision of the lesion and ligature of artery and vein[3]. Such an approach is made possible by the presence of a well established collateral circulation. There is a general consensus based on a large experience that the time after trauma required for the establishment of a safe collateral circulation should not be less than three months. During the last 50 years or so, vascular surgery has been enormously developed mainly by the introduction of angiography for diagnosis and by the introduction of synthetic grafts for the restoration of flow after removal of any type of pathology. Accordingly, the modern view to the management of vascular injuries is immediate revision and restoration of flow by vascular suture of graft, autologous or synthetic. In case of A-V fistulas and false aneurysms which are diagnosed some time after injury, operation should be undertaken as soon as inflammatory reactions have subsided and a delay of more than three months should not be necessary. This mode of treatment is successful from the functional view point, reducing length of hospitalization and time of disability and sick leave. This has been proven in well established series of military[4] as well as civilian cases[1].

In the present series, patients with A-V fistulas and false aneurysms have been managed following this principle. All five A-V fistulas were resected and arterial and venous continuity were restored by vascular suture and, when needed, synthetic grafts. Resections of the aneurysms was made in all five cases of false aneurysm and vascular continuity was established with synthetic grafts in four cases. In one case of aneurysm of the superficial femoral artery the artery was simply ligated as the aneurysm had stopped pulsating and the outgoing artery could not be found. The importance of restoration of continuity of the venous flow as well as the arterial inflow in these cases has been emphasized by Carl W Hughes, et al[4]. Disturbing venous insufficiency with swelling of the limb and endophlebitis is often seen if the venous circulation is not restored. At follow-up, the function of the affected limb was assessed and found to be good in eight cases and excellent in one One patient with a vascular injury associated with injury to the brachial plexus still has some weakness in his hand. The degree of swelling and temperature of the limb was noted. The presence of a distal pulse is an important criterion for restoration of the arterial flow. Distal pulses were not observed in several of our cases. However, other clinical features of ischaemia were not found in these cases.

The conclusion is that patients having A-V fistulas or false aneurysms of the limbs can be successfully treated by excision and restoration of vascular flow, a fact which is already well agreed upon in current literature. That does not mean, however, that the traditional method of excision and ligation should not be used at all. It is applicable in all aneurysms of smaller vessels below the elbow and knee. In the Ethiopian setting the experience of the surgeon and the availability of vascular sutures and grafts will be the decisive factors in the choice of treatment.

References

1 Beall AC. Harrington OB, Crafoord ES, De Bakey ME. Surgical management of traumatic arteriovenous aneurysms. *Am J Surg* 1963;106:610-8.

2 Hughes CW, Jahnke EJ. Surgery of traumatic arteriovenous fistulas and aneurysms. A five year follow up study of 215 lesions. *Ann Surg 1958;* 14:790-7.

3 Surgery in World War II. Vascular Surgery. Office of the Surgeon General, Department of the Army, US Govt printing office, Washington DC, 1955.

4 Seeley SF, Hughes CW, Cook FN, Elkins DC. Traumatic arteriovenous fistulas and aneurysms in war wounded. *Am J Surg* 1952; 83:471-9.