ORIGINAL ARTICLES

TRAUMATIC ARTERIOVENOUS FISTULA-A LATE COMPLICATION OF VASCULAR INJURIES

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ABSTRACT

Objective: To evaluate the causes, site, duration between the time of injury and presentation and management of traumatic arteriovenous fistula (AVF).

Study Design: A descriptive study.

Place and Duration of study: Department of vascular surgery at Combined Military Hospital Rawalpindi from March 2010 to Dec 2011 and Combined Military Hospital Kharian Cantt from Jan 2012 to March 2014.

Material and Methods: All the cases of traumatic AVF fistula which reported during this study period were included. Congenital arteriovenous (AV) malformations and fistula for hemodialysis access were excluded from this study. All the cases were evaluated with computerized tomography (CT) angiography or conventional angiography and managed with various open vascular surgical techniques and their results were assessed.

Results: Fourteen patients of traumatic AV fistula underwent various open vascular repairs. Age of patients ranged from 16 to 75 years with average age of 34.3 ± 14.5 years. Male to female ratio was 3.6:1. Penetrating injuries were the commonest cause i.e. 11 (78.6%). Time interval between injury and presentation in hospital ranged from 4 months to 25 years with average time interval 4.3 years. Lower limb vessels were affected in 10 (71.4%) the upper limb in 1 (7.1%) and neck vessels in 2 (14.3%) and 1 (7.1%) case of post appendectomy AVF between inferior epigastric artery and adjacent vein. Superficial femoral artery and vein was the most frequently involved vessels i.e. 7 (50%) cases.

Conclusion*:* Low velocity penetrating vascular trauma was the commonest cause of traumatic AV fistula. Lower extremities were the most frequently involved site. In most of the cases traumatic AV fistula presents late with its complications. Surgical intervention includes the excision of fistula and restores the continuity of the involved artery and vein with interposition reverse autogenous vein graft or prosthetic graft.

Keywords: Post traumatic arteriovenous fistula, Secondary varicose vein, Vascular injury, Vascular trauma.

INTRODUCTION

Arteriovenous fistula (AVF) is an abnormal communication between an artery and vein. Traumatic AVF is a complication of vascular injury. Penetrating injury is the commonest cause of traumatic AVF, followed by iatrogenic and blunt trauma[1]. Low velocity small fragment penetrating injuries in close proximity to main vessels cause a partial injury of an artery and adjacent vein, which lead to formation of traumatic AVF. The clinical manifestations of traumatic AVF are variable and depend upon the location, size and duration of fistula[2]. When one of the hard signs of vascular injury, palpable thrill or bruit is present on initial presentation then the diagnosis of traumatic AVF is obvious. In the absence of hard signs of vascular trauma these injuries are missed and later on present as AVF or pseudoaneurysm[3,4]. Physiological affects both local and systemic of a traumatic AVF like swelling, secondary varicose veins, venous ulcers and heart failure usually occur late and as a consequence its diagnosis may be delayed for many years[5,6]. Diagnosis of traumatic AVF is usually suggestive on history and clinical examination but conventional arteriogram or

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computerized tomography (CT) angiography required for confirmation and planning surgical management. Objective of this study was to evaluate the etiology, site, duration between the time of injury and presentation and management and outcome of traumatic AVF presented in our vascular unit during this study period.

MATERIAL AND METHODS

This case series was carried out in Department of Vascular Surgery at Combined Military Hospital Rawalpindi from March 2010 to Dec 2011 and Combined Military Hospital Kharian Cantt from Jan 2012 to March 2014. All the cases of post traumatic AVFs which reported in our hospitals during this study period were included. Patients with congenital AVF, AV malformation and AVF for hemodialysis were excluded. Informed written consent was obtained from the patients before their enrollment in the study. Fourteen cases of traumatic AVF reported during the study period. Patient's particulars, age, gender, time between the onset of injury and presentation, mechanism (penetrating, blunt or iatrogenic) and site of injuries were recorded. Diagnosis was made on the basis of history and clinical examination and confirmed with doppler study of the affected part. All the patients were evaluated with conventional arteriography or CT angiography before surgical intervention (fig-2). Blood complete picture, blood grouping and cross match, blood sugar, renal function tests, coagulation profile and screening for hepatitis B and C were advised before surgery. Five cases were operated upon under general anesthesia and 9 under regional block

Table-1: Causes, site and type of repair (n=14).

Causes	Site	Type of repair
Penetrating trauma 11 (78.6%)	Lower limb 10 (71.4%) Upper limb1 (7.1%)	Excision and repair with reverse vein graft 9 (64.3%)
Iatrogenic (14.3%)	Neck 2 (14.3%)	Excision and repair with PTFE graft 3 (21.4%)
Post operative 1 (7.1%)	Ant abdominal wall 1 (7.1%)	Excision & ligation 2 (14.3%)

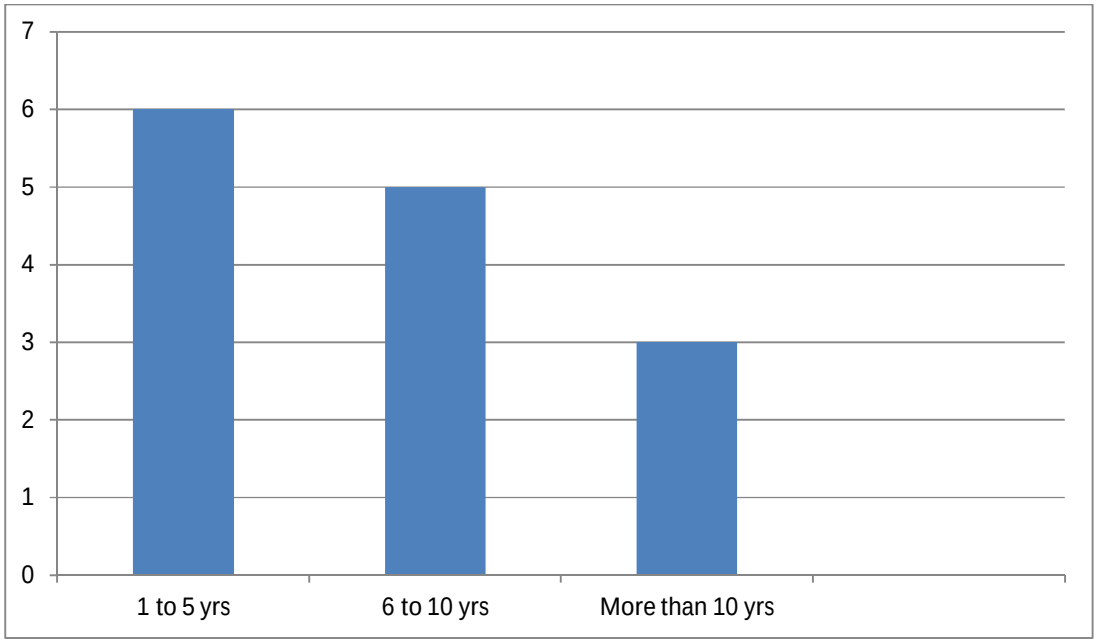

Figure-1: Duration between injury and surgical intervention.

(epidural/ spinal). Broad spectrum antibiotics intravenously started before surgery and continued for 5 to 7 days after surgery. All the cases of traumatic AVF of upper and lower extremities and neck were explored through longitudinal incision extending proximal and distal to the site of fistula. Proximal and distal control of the affected vessels has been achieved before exploring the AVF (fig-3). In all cases 5000 units' unfractionated heparin was administered 3 minutes before applying the vascular clamps. After exploration and opening of the communication between artery and vein the extent of vessel injuries were assessed. Type of repair depended upon the extent and type of injury. In 9 cases of traumatic AVF after excision of fistula track, both artery and vein were repaired with reverse autogenous saphenous vein graft and in 3 patients repair done with polytetrafluoroethylene (PTFE) prosthetic graft. Postoperatively the patency of repair was assessed by palpation of distal pulses, capillary refill and with intraoperative probe of hand held doppler. In all patients repaired vessels were covered with muscles/ soft tissue and wounds were washed with normal saline. Suction drain was placed in all cases for 24 to 48 hours. Post operatively all the patients were closely monitored regarding the state of circulation (presence of distal pulses, capillary refill and the temperature) signs of secondary hemorrhage and wound infection. Hospital stay ranged from 4 to 15 days (mean 5.3 days). At the time of discharge they were advised to follow up in vascular outpatient department after two weeks. On follow up the vascularity of the limb was assessed both clinically and by doppler examination. Any neurological deficits and other wound related complications were recorded and advised to continue follow up initially after one month and then after every three months. Data was analyzed by using SPSS version 14. Frequency and percentages were used to describe the data.

RESULTS

Fourteen patients were reported with traumatic AVF and underwent various open vascular repair procedures. Age of the patients ranged from 16 to 75 years with average age of 34.3 ± 14.5 year. Male to female ratio was 3.6:1. Penetrating trauma (gunshot or splinter injuries) was the most common cause of injury present in 11 (78.6%) patients and in 2 (14.3%) patients cause was iatrogenic injury. In 1 (7.1%) patient AVF formed between inferior epigastric artery and adjacent vein after appendectomy. Time interval between injury and surgical intervention ranged from 4 months to 25 years with average time interval of 4.3 years (fig-1). One (7.1%) case of traumatic AVF had been reported after 25 years of initial injury with secondary varicose veins and venous ulcers. Lower limb vessels were affected in 10 (71.4%) the upper limb in 1 (7.1%) case and neck vessels in 2 (14.2%) cases and in 1 (7.1%) case the AV fistula formed between inferior epigastric artery and adjacent vein after appendectomy. Superficial femoral artery was the most frequently involved i.e. 7 (50%), common femoral artery in 2 (14.3%) cases, common carotid artery in 2 (14.3%) cases, popliteal artery in 1 (7.1%) brachial artery in 1 (7.1%) and inferior epigastric artery in 1 (7.1%) case. Interposition reverse autogenous saphenous vein graft was the most common type of repair performed in 9 (64.3%) and in 3 (21.4%) patients repair was done with polytetrafluoroethylene (PTFE) prosthetic graft. In 2 (14.3%) cases where nonessential or branched vessels were involved after division of fistula ligations of involved vessels were done (table-1). Superficial wound

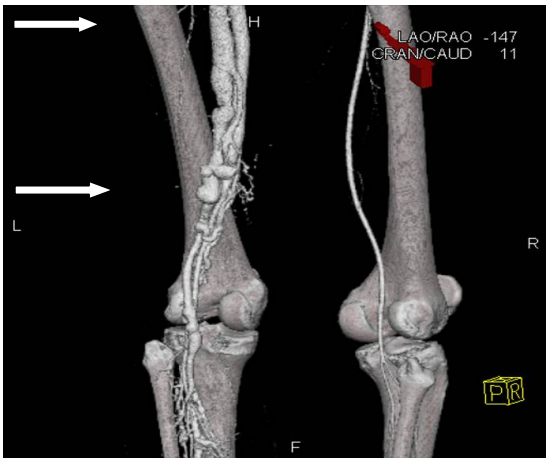

Figure-2: Site of AV fistula between superficial femoral artery and vein.

infection occurred in 2 (14.3%) cases which were managed with wound debridement, dressing and secondary suturing. Five (17.8%) patients had persistent swelling of distal limb. They were managed by elevation, compression stocking and anticoagulant therapy. All the patients who were present with secondary effects of AVF had marked symptomatic improvement after 3 months of follow up.

DISCUSSION

Low velocity penetrating injuries in close proximity to an artery and vein are the most common causes of traumatic AVFs. Iatrogenic AVF following catheterization of femoral or brachial arteries for diagnostic and therapeutic endovascular procedures are frequently reported now-a-days[7]. Extremities are more frequently affected sites of traumatic AVF, followed by head and neck in most published series. Abdominal and thoracic vessels are rarely involved[8]. Most of the occult arterial injuries healed spontaneously or stabilized without compromising the distal circulation and perfusion but low-velocity small fragment injuries can result in serious delayed complications months or even years after the injury[11]. Physiological effects of an AVF occur due to shunting of arterial blood into venous system. It causes swelling, superficial varicosities and in long standing cases signs of venous stasis including pigmentation, indurations, ulceration and haematuria may be present[12'13]. Shunting of arterial blood through direct communication increases the cardiac work load and in chronic cases lead to heart failure[14]. Long standing peripheral AVFs are usually accompanied by ectasia of proximal arteries. Iliac and even infrarenal aortic aneurysms associated with traumatic AVF have been reported. Like one of our patients few cases of external iliac vein aneurysm with traumatic AVF of thigh have been reported in literature[15]. The diagnosis of traumatic AVF is frequently evident clinically. History of penetrating injuries, presence of a pulsatile mass with thrill and machinery murmur and positive Branham signs (reduction in resting pulse rate on compression of fistula and proximal artery) are suggestive of AVF. Doppler study, CT angiography, magnetic resonance imaging (MRA) and conventional arteriography are the investigations required to confirm the diagnosis and for planning surgical intervention of AVF. A doppler study shows an increased velocity in the proximal artery and pulsatile flow pattern in the proximal veins. CT angiography provides anatomical information regarding the size and location of AV fistula and involvement of adjacent structures[16]. The preferred treatment of a traumatic AVF is surgical correction. It includes the excision of fistula and to restore the continuity of the involved artery and vein with interposition reverse autogenous vein graft or prosthetic graft. When a fistula arises from a nonessential artery, proximal and distal ligation of involved artery is sufficient. Recent developments in endovascular techniques have provided significant and effective alternatives to open surgical treatment. Endovascular coil embolization has been used for occlusion of AVFs in smaller vessels and can help temporize bleeding if open repair is necessary. Covered stent grafts have been reported to be used in the exclusion of AVFs[17,18].

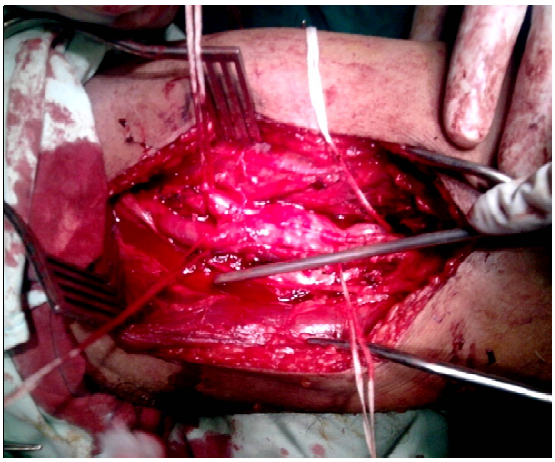

Figure-3: Site of AV fistula between superficial femoral artery and vein exposed and proximal and distal arteries and veins slinged.

CONCLUSION

Traumatic AV fistula is one of the complications of vascular trauma. Low velocity penetrating injuries involving the extremities and neck was the commonest cause and lower

limbs were the most frequently involved site. Majority of the cases present late with secondary effects. In order to avoid the consequences of complications of vascular injuries one should have high index of suspicion.

CONFLICT OF INTEREST

The authors of this study reported no conflict of interest.

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