Out Come of Early Management of Lower Extremity Arterial Trauma

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This prospective study was carried out in East Surgical Unit of Mayo Hospital, Lahore from January 2000 to December 2001. This study included 26 patients who presented to A&E department of Mayo Hospital with lower extremity peripheral arterial trauma, where repair of the artery was done within 06 Hrs of the initial trauma to restore arterial circulation. All the patients were resuscitated according to ATLS manual and were admitted for further management. All were males with mean age of 35 years. 18 of these had FAI (69.2%) while 08 had blunt trauma (30.7%). 03 patients had associated open type III fracture of the proximal tibia, of which 02 had associated venous injury. 18 patients had hard signs and 08 had soft sings of arterial trauma. Popliteal artery injury was found to be the commonest (76.9%), followed by common femoral (15%) and superficial femoral (7.69%). Reverse sephnaous graft was applied in 16 cases and repair with end to end was made in 06 cases and lateral suture in 04 cases. Fortunately there was no mortality. Morbidity included infection in 06 cases, gangrene in 02 that ultimately ended in above knee amputation.

Key words: Arterial trauma, Hard signs, Soft signs, popliteal artery, Reverse Sephnaous graft.

Peripheral vascular injuries may result from penetrating or blunt trauma to the extremities[1]. If not recognized and treated rapidly, Injuries to major arteries may have disastrous consequences[1,2].

In the lower extremity, the area of greatest concern extends from the top of the thigh, across the knee and inferiorly to the level of mid calf[1]. The locations of highest risk of arterial trauma are inguinal region, medial thigh and popliteal fossa[5]. Below the knee the popliteal artery trifurcates into anterior and posterior tibial and peroneal arteries, arterial wounds affecting single artery distal to trifurcation may be treated by simple ligation if there is adequate distal collateralization[1,16].

The highest risk of serious vascular injury is associated with high-energy gunshot wounds[7]. Blunt and penetrating injuries associated with fractures also have a high incidence of associated vascular injury, even in the absence of clinical signs[6]. The likelihood of serious vascular injury is less in patients who have received low-energy wounds, such as those produced by handguns and stab wounds[7].

In the US peripheral injuries account for 80% of all cases of vascular trauma. In two-thirds of patients with vascular injuries, the lower extremities are involved[1].

The current study describes our experience in the management of peripheral arterial injuries of the lower extremity at Mayo Hospital Lahore.

Material and methods

This was a prospective study carried out in East surgical Unit of Mayo Hospital Lahore, from January 2000 to December 2001. All the patients where surgical intervention was done within six hours of initial injury were included in this study. The mechanism of the injury was noted and the time interval between the initial injury and the evaluation was recorded. All those patients with hard signs (5,8) were operated immediately after resuscitation and those with soft signs (5,8) were observed by serial examination.

All the patients were resuscitated. Antibiotics (Third generation cephalosporins 1 gm, iv) and tetanus prophylaxis was given. The site of the arterial injury was located by missile tract exploration and pulse deficit. Proximal and distal control was obtained at least 2 cm from the site of injury to ensure the assessment of arterial injury. Proximal clot was removed by flushing and distal by milking and passing forgarty balloon catheter. Local heparinization was done with diluted heparin saline (100 U/ml). Repair was done with 5/0 monofilament non-absorbable sutures. Pulses in the distal extremity were confirmed and the repair was covered by healthy soft tissue. Drains were selectively employed for a period of 24 to 48 hours. Distal fasciotomy was done in all cases.

Postoperative care was ensured by maintaining normal intravascular volume. Vital signs were monitored 2 hourly and examinations of the distal pulses of the repaired side were noted 4 hrly. Third generation cephalosporin, was given in a dose of 1 gm Bid. Systemic heparinization was instituted in some patients.

Results

During January 2000 to December 2001, a total of 26 patients presented with lower extremity arterial trauma were repair was undertaken within 06 hours of the initial injury. All these patients were male with the mean age of 35 (range 23-48).

Table I. Age and Sex Incidence

Total no of patients	13
Sex	All males
Age	35 (23-48)

Of these 26 patients 18 had history of penetrating trauma while rest of 08 had blunt trauma.

Eighteen of these patients exhibited hard signs while rest of 08 had soft signs (table III). Of the 18 patients with the hard signs, active pulsatile bleeding was the commonest

clinical findings (12), followed by signs of ischemia (04) and expending Hematoma (02) respectively (Table IV). Absent distal pulses (clinically) were also noted in 14 cases with doubtful absent pulses in 04 cases. In the patients with soft signs the injury was in proximity of the vascular structure with persistent doubtful distal pulsations in all cases (Table V).

Table II. Etiology of Injury.

Mode of injury	n=.	%age
Penetrating injury.	18	69.23
FAI.	14	53.84
Stab.	04	15.38
Blunt injury	08	30.76
Total	26	100

Table III. Signs of Injury.

Signs of injury.	n=	%age
Hard signs.	18	69.23
Soft signs.	08	30.76

Of these 26 patients 03 had associated fracture of the Tibal shaft (open type III), which required fixation prior to the repair, 02 patients had associated intraabdominal injuries which needed laparatomy and 03 of these patients had severe contamination of wound with gross skin loss. (Table IV)

Table IV. Associated injuries.

Associated injuries	n=
Fractures.	03
Venous injuries.	03
Nerve injury	02
Intraabdominal injuries.	02

The most commonly injured vessel of the lower extremity that required early repair for the limb salvage was popliteal artery (20) followed by common femoral (04) and superficial femoral (02). (Table V)

Table V. Injured Arteries.

Injured Artery	n=	%age
Popliteal.	20	76.92
Common femoral.	04	15.38
Superficial femoral.	02	7.6

As a primary procedure reverse sephnaous graft was performed on 16 (61.5%) patients and primary repair of the injured artery was under taken in 10. (38.6%) patients with end-to-end repair in 06 patients and lateral suture in 04 patients. Of the reverse sephnaous procedure all were performed for popliteal artery injuries (table No VI).

Table VI. Operative procedures.

Type of procedure.	n=	%age
Reverse sephnaous graft.	16	61.5
Repair.	10	38.6
End-to-end.	06	23
Lateral suture.	04	15.8

Immediate complications of anastomotic leakage was noted in 02 patient of the end-to-end anastomosis in which case reverse sephnaous graft was applied, Another patient with end to end anastomosis had absent distal pulses that required reverse sephnaous graft. Compartmental hypertension was noted in 04 patients in spite of distal all compartment close fasciotomy. Myo-fascial infection was noted in 04 patients and 02 of these patients with arterial injury associated with open tibial fractures end up in below knee amputation. There was no mortality seen in our series. (Table VII).

Table VII. Complications

Complications.	n=
Infection.	06
Gangrene.	02
Mortality.	00

Discussion

Peripheral vascular injuries occur because of direct or indirect trauma and may result in loss of limb or function[1,5]. Prompt diagnosis and intervention is crucial. The emergency physician is responsible for expedient recognition of injuries and speedy availability of vascular surgeon, while stabilizing the patient in emergency room.

Blunt trauma causes vascular injury by two mechanisms, tensile strain and shear strain[5,13,17]. Vessel or intimal rupture is caused by excess longitudinal force from tensile strain, which exposes flowing blood to a large surface area rich in thrombogenic substances, resulting in local thrombosis[1]. Shear strain is secondary to lateral forces acting on the vessel wall. It frequently is encountered with deceleration injuries and can result in partial or complete transaction[2].

Penetrating and blunt trauma can cause direct or indirect injury. Examples of direct vascular injury include partial or complete transaction, contusion, laceration, and arteriovenous (AV) fistula formation[4]. Indirect injuries can be more subtle in presentation and include vessel spasm, external compression, mural contusion, thrombosis, and aneurysm formation[2,4].

In peripheral vascular injuries the tissue can tolerate if collateral vascular flow is adequately present[13,16]. This may not always be the situation, as this depends on the mechanism, location, and extent of injury and the anatomy of arterial circulation of that extremity. In general, distal tissues of extremity tolerate 4-6 hours of ischemia before irreversible injury occurs[1,5]. Ischemia is less likely to occur in the presence of adequate collateral flow[5,16].

Peripheral vascular injuries comprise approximately 3% of major injuries[14]. Most are caused by acts of violence or vehicular collisions[14]. Isolated peripheral vascular trauma usually has a low mortality rate[13]. Morbidity increases with prolonged ischemia and gangrene[15]. This can result in amputation of the affected limb[15]. False aneurysms and AV fistula formation may complicate this injury[5]. Morbidity associated with arterial reconstruction includes post repair

edema, infection, arterial compression, and anastomotic thrombosis[7].

A detailed history usually is not required to determine the nature of penetrating vascular injury[8]. Knowing the type of weapon used and the velocity or potential path of the missile may help in assessment[10].
In blunt vascular injury, a detailed mechanism of injury often helps in appreciating subtle injuries[17].

Penetrating vascular injuries usually are easy to diagnose. Profuse bright red colored blood suggests arterial injury, and a continuous flow of dark blood suggests venous injury[1,5]. It is possible to observe an innocuous entrance wound with significant underlying pathology. Blunt vascular injuries usually are more obscure, more severe, and surrounded by greater local injury[17]. Skin that appears intact may obscure diagnosis. Displaced or angulated fractures should be reduced immediately if there is any evidence or suspicion of vascular compromise[16]. For patients with hard signs of vascular injury, refractory hypotension, and obvious limb ischemia surgical repair is performed as early as possible. Otherwise, a preoperative angiogram is preferred where the signs are equivocal[9,11]. In recent years, the Duplex ultrasonography has emerged as a reliable method of diagnosis in patients with potential vascular injury[6,12]. Low-risk injuries may be observed in the hospital or on an outpatient basis, with a strict schedule of repeat evaluations[1]. Low-risk injuries without hard signs may be managed as an outpatient with careful follow-up[5]. All other cases should be admitted either for definitive repair or for observation[1,5].

Patients must be given explicit instructions to perform extremity neurovascular checks on a scheduled basis and they should be instructed to return to the ED if there is increased pain, edema, active bleeding from the wound, or if any weakness, numbness, or tingling develops in the injured extremity[5].

We conclude that an early repair with in six hours of the initial injury had reduced mortality and morbidity by increasing the chances of survival of the peripheral tissues. As compared to the other studies there is no mortality in our series, the rate of infection is less; 15% in our series and 28% in other series[6]. Similarly no thrombosis, A.V fistula or pseudoaneurysm was seen in our study the credit of which goes all to early repair of the affected artery with in 06 hrs of initial injury. So we recommend that an early attempt should be made to repair the artery of the affected limb for its salvage.

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