EXTREMITY VASCULAR TRAUMA EXPERIENCE AT CIVIL SANDAMAN TEACHING HOSPITAL & BOLAN MEDICAL COLLEGE QUETTA

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SUMMARY

To evaluate vascular trauma management mainly on clinical assessment, at less equipped set up and to find out etiological factors, early and late presentation, deferent vascular technique, site of injury, their outcome in early and late arrival and outcome of surgery in vascular injuries. A Prospective study of vascular trauma patients presented to the emergency department of civil sandaman teaching Hospital Quetta, Jellani hospital, Akram hospital, Mansoor hospital Quetta, with acute vascular injuries from august 1995 to July 2003, were assessed. The Mangled Extremity Severity Score (MESS) was calculated for majority of individual to determine the magnitude of injury. A trauma database advised to analyzed each patients characteristics, time since the injury divided into early presentation < 6 hours were compared those presenting late more >6hours, etiology of trauma, surgical procedure, hospital mortality, complication associated injuries and outcome was assessed. One fifty-five patients of vascular injuries were managed. The male to female ratio was 142:13 with an age range of 8 to 65 years. The time since injury ranged 2-22 hours (mean9.3). 74.8% cases sustained vascular trauma by firearm followed by stab injuries 12.2%, blunt trauma 7.7% and 5.1% by crushed injury. 63.8% were arteries, 12.9% were venous, remaining were mixed, upper limb injuries were 25.8% lower limb 60%, the remaining were abdominal or neck injuries. Arterial bleeding from the wound was the most frequent presentation found in 40%, patients followed by absent distal pulses recorded in 32% subjects, complete vascular transaction was the most common operative finding noted in 47.09% cases followed by partial tear in 39.3%. Injuries treated with end to end anastomosis in 14.8%, Vein grafts 58.5%, prosthetic graft in 2.9%, lateral suture 17%, ligation in 6.6% and primary amputation 2.5%, in 84.9% subjects had a functional limb after vascular reconstruction, wound complication was recorded in 12% individuals. 15 (9.6%) patients died within 21 hours of injuries all due to torrential hemorrhage. Conclusion Extremity vascular trauma occur because of direct or indirect trauma and may result in loss of limb or function. Early recognition and prompt surgical intervention, use of saphenous vein graft and fasciotomy contributes to a successful outcome to save life and limbs in vascular trauma patients, the emergency physician is responsible for expedient recognition of injuries and rapid, appropriate consultation while stabilizing the patient.

INTRODUCTION

In most of the hospitals in our country, General or orthopedic surgeon manage vascular trauma. Since the arrival of cardiovascular surgeon and creation of cardiovascular surgery department in Quetta, our department is working as tertiary referred center for cardiovascular surgical diseases in the Baluchistan and adjacent Afghanistan and Iran, our department also deal emergency vascular trauma cases, which are more then the referral cases. In the West vascular trauma mainly occurs in urban areas but in Pakistan in general and in Baluchistan in particular due to easy availability of weapons, traditional family feuds and increasing violence, this unique entity of trauma comes from urban as well as from rural population. There has been a global rise in the incidence of vascular trauma due to terrorist violence and high speed motor vehicle crashes such injuries pose a challenge to the vascular surgeons particularly in the developing countries such as Pakistan.

METHODS

This study presents a prospective analysis of vascular traumas patients admitted through emergency.

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from April 1995 to July 2003. The parameters considered were age, gender, time since injury, vessels injured, mode of presentation, mechanism of injury, surgical outcome.

Preoperative Evaluation

The injured patients were evaluated according to the guidelines of advances trauma life support (ATLS) The Mangled Extremity Severity Score (MESS) was calculated for each patient to standardize the scoring of severity. The MESS >7 have been reported to be high predictive of the need for amputation.1. After initial resuscitation, Doppler study was performed on the injured limb. Where indicated, radiograph of the suspected bony lesions were obtained. Orthopedic or neurosurgeon consultation was sought as required.

Surgical Techniques

Under general anesthesia, with single lumen endotracheal incubation, patients were placed in the required position. Routine monitoring included transcutaneous oxygen saturation, continuous end tidal carbon dioxide, blood pressure, and electrocardiogram. All patients were given 3rd generation cephalosporin antibiotic at the time anesthesia and exploration were done. Proximal and distal vascular controls were taken by using the standard operative approaches. The injured vessels were isolated and the exact extent of vascular damage established. The orthopedic fixation was undertaken before proceeding for vascular reconstruction. Repair of the damaged vessel took precedence in the presence of exsanguinating hemorrhage or profound limb ischemia. Repair of the injured vessel was undertaken after thorough debridement of the soft tissues. In all cases where loss or damage to the vessel was < 2 cm, mobilization of the vascular ends and subsequent anastomosis with 5 / 0 or 6 / 0 interrupted prolene stitch was performed. A larger gap was bridged with a reverse saphenous vein graft harvested, from the contraleteral uninjured limb. In the absence of adequate blood flow, a fog arty catheter was used to retrieve the thrombus. A heparinized saline flush 10 iu/ml of the distal vessels was carried out in all cases. Fasciotomy was considered where time since injury exceeded 6 hours, in the presence of extensive soft tissue and bony injuries, concomitant arterial and venous trauma and the clinical suspicious of compartment syndrome. Venous repair was performed by lateral venography and ligation undertaken when venous reconstruction was not possible or required. The areas of focal neural transaction, if found, were tagged and left for either immediate repair after vascular reconstruction or delayed repair by the attending surgeon. Adequate soft tissue coverage was ensured with primary closure, delayed primary closure, skin grafting or local rotation flap closure. All patients were subjected to Doppler examination along with a daily bedside clinical evaluation in the ward.

Follow-up

All patients were followed up on OPD basis and underwent complete Doppler evaluation at 3 Month, 6 Month, and 1 Year of the procedure; we carefully looked for any ischemic sign on each visit. Length of follow-up ranged from 2 days to 623 days. No patient has shown a singe of ischemia in follow-up , all incisions healed well without significant scarring or complications.

RESULTS

There were 155 patients of vascular injuries .The male to female ratio was 142:13 with an age range of 8 to 65 years. The time since injury ranged 2-22 hours (mean9.3). 116cases (74.8%) cases sustained vascular trauma by firearm followed by stab injuries 19 cases (12.2%), blunt trauma 12 cases (7.7%) and 8 cases (5.1%) by crushed injury. This study also demonstrated that 135cases (87%) had arterial injuries, 20 cases (12.9%) had venous, remaining cases were mixed , upper limb injuries were 48 cases (30.9%) lower limb 107 cases (69%), the remaining were abdominal or neck injuries.

Arterial bleeding from the wound was the most frequent presentation found in 62 cases (40%), patients followed by absent distal pulses recorded in 51 cases (32%) subjects, complete vascular transaction was the most common operative finding noted in 73 cases (47.09%) cases followed by partial tear in 61 cases (39.3%).

Injuries treated with end to end anastomosis in20 cases (14.8%), Vein grafts 79 cases (58.5%), prosthetic graft in 4 cases (2.9%), lateral suture 23

cases (17%), ligation in 9 cases (6.6%) and primary amputation 4 cases (2.5%), venous repair was performed by lateral venography 15 (75%) patients and venous ligation in 5 (25%) patients. Fasciotomy was performed in 27 (17.4%) cases. A concomitant orthopedic fixation was carried out in 15 (9.6%) case; external fixation in 6, splinting in one and skin traction in one patient. Out of the 8 nerve injuries, 3 were primary repaired. Others were either observed or tagged for delayed repair due to significant segmental loss. The patients with extensive soft tissue trauma and open wounds were taken to operating room every 48 hours for dressing change, irrigation and further debridement.This was continued until the wound was ready for grafting or delayed primary closure. Following vascular repair, 35 wounds were primary closed, 26 had delayed primary closure, 15 cases were treated with delayed primary closure with skin graft whereas 5 limb were amputated (All with MESS >7) .Two primary amputation were carried out as life saving procedures. Both these patients had a concomitant popliteal artery and venous injuries along with profoundly devitalized soft tissues. Six patients developed wound infections, all treated successfully with the aseptic dressing protocol. There were 15 (9.6%) deaths due to torrential hemorrhage following irreversible shock; all died within 21 hours of injuries In 84.9% subjects had a functional and useful limb after vascular reconstruction,

Table 1
Presentation of Vascular injuries

Presentation	n 155	=	%
Arterial bleeding	62	=	40%
Pulse deficit	51	=	32%
Shock	18	=	11.5%
Hematoma	25	=	16.1%
Neurological deficit	9	=	5.8%
Pulsatile mass	8	=	5.1%

Table 2
Site of Arterial Injuries

Artery	n 135	=	87%
Common femoral	24	=	17.7%
Superficial femoral	46	=	34%
Popleteal	11	=	8.1%
External Iliac	6	=	4.4%
Brachial	35	=	25.9%

Table 3
Site of Venous Injuries

Vein	n 20	=	12.9 %
Common femoral	3	=	15%
Superficial femoral vein	7	=	35%
Popliteal	8	=	40%
Axillary	2	=	10%
Concomitant venous and arterial injury	23	=	14.8%

Table 3
Site of Venous Injuries

Vessel	Types of Repair	n 155	=	%
Artery (135)	Interposition vein graft	79	=	58.5%
	Primary repair	20	=	14.8%
	Lateral repair	23	=	17%
	Ligation	9	=	6.6%
	Prosthetic graft	4	=	2.9%
Vein (20)	Lateral venography	15	=	75%
	Ligation	5	=	25%
Fasciotomy		27	=	17.4%

DISCUSSION

Vascular traumas have become increasingly important nowadays. Fast-speed means of transportation, use of firearms and the ever-growing violence in large urban centers have turned traumatic vascular lesions into commonplace events. Approximately 90% of peripheral arterial lesions are located at extremities, accounting for remarkable morbidity and mortality among traumatized patients.1,2 Vascular trauma is one of the more challenging aspects in the care of the injured patients presenting a unique array of problems in diagnosis, decision making, and surgical technique, is almost associated with injuries to the other organs, many patients are critically ill, and while the control of hemorrhage is life saving and usually rapid and first priority, extremity vascular trauma is often a threat to the viability of the limb, bleeding and ischemia are deferent priorities, this management decision in vascular trauma require experience and judgment because all that is technically feasible is not always in the patients best interest. The actual frequency of extremity vascular injuries worldwide is difficult to quantify 2. In Pakistan the escalating incidence of

extremity vascular injuries in civilian practice demands a high index of suspicious while managing patients with multisystem traumas Data on blunt and penetrating injury are somewhat easier to derive. In wartime circumstances, the number of injuries may be extreme 3. Sherif et al 4 reported 224 extremity vascular injuries in 18 months during the Afghanistan War, roughly 150 per year. Fason et al 5 reported 94 patients in 3 months (ie, approximately 376/y) on the Thailand-Cambodia border. In both studies, antipersonnel mines caused the majority of civilian extremity vascular injuries. Humphrey et al 6 reported 12.4 extremities vascular injuries per year at a rural trauma center in Missouri; Feliciano et al 8 reported approximately 55 lower extremity vascular injuries per year at Ben Taub General Hospital (a high-volume urban trauma center) in Houston, Tex. In both extremes, the predominant cause of injury, especially in isolated vascular injury, was due to penetrating causes

Gufta et al 9 reported 95% of patients being males in their study of 153 cases. Whereas this study showed a male predominance of 9805%. Vascular injuries in infants and children are rare and usually iatrogenic. They often require a substantially different approach than similar injuries in older children and adults. Many injuries, particularly injuries in infants, must be approached with the understanding that operative intervention may be less successful because of the technical difficulties related to small vessel size and vessel spasm. Also, peripheral vascular injuries that may result in limb loss in adults rarely do so in infants and children. Children have a particular propensity to rapidly develop collateral vessels, which often allows for limb preservation without surgical intervention. However, the development of an adequate collateral circulation for limb preservation is not necessarily sufficient to ensure normal limb growth patterns. The diagnosis of vascular trauma is often either overlooked or delayed. Vascular trauma should be always be suspected in patient who had a road traffic accident and is shocked, or after any kind of penetrating injury such as knife or gunshot wound, the most common missed injuries are associated with fracture of long bones and dislocation.29,30. The early diagnosis of arterial trauma is very important due to the morbidity associated with late treatment of hidden injuries. Clinical history is essential in order to evaluate severity and determine the probable mechanism having caused the wound. However, physical examination is not always to be trusted, and in up to 40% of patients with axillary artery trauma, there are palpable distal pulses.10, 11 The measurement of pressure by linear Doppler ultrasound is the first non-invasive examination to be carried out. Duplex mapping is used increasingly more often due to its high sensitivity, specificity and precision 10,11 Arteriography is also useful, but it must be indicated with care since it is an invasive method. When used indiscriminately, arteriography results in normal diagnoses in most of the cases. It should only be used on patients who are hemodynamically stable, and must not delay any treatment 13,14. Rich et al 16 said, most arterial injuries can be identified because of external bleeding or large hematoma, ischemia distal to the injury is uncommon with isolated vascular injuries except for wounds of the popletial and common femoral artery. Distal pulses may be intact in 20% of patients with arterial wounds, although weak or absent distal pulses are important finding. Extremity vascular injury may result from penetrating injury (eg, gunshot wounds, knife injuries), but not all penetrating injuries are violent in nature. Many penetrating extremity injuries reported in the literature are from industrial accidents (eg, nail guns) or are iatrogenic complications of vascular access procedures for other medical problems. Blunt injuries causing vascular injury typically result from motor vehicle accidents but may include falls, assaults, and crush injuries. Fractured long bones or dislocated joints frequently increase the overall risk of vascular injury, but certain injuries (eg, posterior knee dislocation) are more likely to cause vascular injury than other injuries (eg, a Colles fracture of the wrist, which rarely results in radial or ulnar artery injury). It is predicted that by the year 2003 firearm-related injuries will be the leading cause of death in persons between 1-44 years of age. This disturbing projection is based upon documentation of a trend beginning in 1968 and continuing through 1991, during which firearm-related deaths increased by 60% and accounted for an alarming 38,317 deaths by 1991. Firearms were found to be most common cause of acute vascular trauma reported by many authors, 12,17 Which is in accordance with the results of this study? Arterial bleeding from the wound was the most common presentation observed in 40% cases in the present study, which contrast with the results published by stumm et al 26. where pulse deficit was

the most common clinical finding reported in 61.2% of the patients, the distal pulse may be present in up to one quarter of peripheral vascular injuries, therefore, the site rather than size of the skin laceration overlying a vascular structure should alert the treating surgeon.16. In their series of 153 patients, Gupta et al 9 have documented the femoral artery being the most common vessel of the lower limb injured and this observation is further substantiated by this study , femoral artery traumatized in 70 (51%) cases. Trauma to the upper limb vessels accounts for 33-45% and lower limb vessels 45-50% of major vascular trauma 17.While this series revealed 30.9% for upper limb and 69% for lower limb. The rarity of isolated venous injuries has been reported in civilian practice 15%, 18 During the Croatian war 12% as well as in this study 12.9%. This observation, however, must be tempered by the understanding that venous injuries might be under diagnosed or under reported as they are scarcely limb threatening, all the patients in this series were subjected to Doppler study as the facilities for arteriography were not available at Bolan Medical College, although some authors have suggested to abandon routine arteriography as it can significantly prolong the ischemia time and some authors Still maintain that preoperative arteriography would reduce the incidence of missed injuries. However, direct arterial imaging with color flow Doppler is a valuable diagnostic tool and has further limited the use of angiography.13, 14, 18. The key principles of the treatment of traumatic arterial lesions include immediate control of bleeding and reestablishment of distal blood flow. The first option should be the primary repair of the lesion at an anatomical site, however, interposition grafts are also recommended when primary repair is not possible. Various types of grafts have been tried such as veins, arteries, intestinal sub mucosa, Dacron and polytetraflouroethylene 25. In present study, 2.9% synthetic graft was used as (58.5%) patients had an autogenous saphenous vein graft with promising results (97.4%) limbs were saved. Williams et al 27 have concluded in their retrospective study of 88 cases that the rates of limb salvage and neurological sequel were similar in early (within 12 hours) and late (after 12 hours). In some situations, due to adverse local conditions such as infection and extensive tissue damage, extra-anatomical bypass is the best alternative to limb salvage. 20. Deferent published reports have even suggested the use of fasciotomy particularly in the presence of profound soft tissue damage and concomitant arterial and venous trauma 2 ,22 27. In this study 38 fasciotomies were performed at the time of vascular reconstruction. A low threshold for fasciotomy is justified on account of a response time of 9 hours. Delayed presentation may have also contributed to a slightly higher incidence of amputation rate 10.5% as compared to 2-8% rate reported in the developed countries.28 this observation reaffirms that the time is the key factor in determining the final outcome of vascular surgery 22, 23, 27. In most cases, an upper and/or infraclavicular incision is sufficient to reach the axillary artery. However, depending on the extension of the wound, proximal control of the subclavian artery is also necessary. In this case surgical access involves a median sternotomy - for wounds on the right side - and an antero-lateral thoracotomy between the 3rd and 4th intercostals spaces - for wounds to the left side, due to the difference in anatomical origin. Another factor which makes the treatment still more complex is the frequent association with venous and lymphatic lesions, bone fractures, trauma to the soft tissues, and principally neurological injuries. Neurological injuries are present in half the trauma cases involving the upper limbs - this is not observed with the same frequency in trauma involving the lower limbs. In spite of the success of vascular injury treatment, the neurological injuries result in an important functional deficit in up to 40% of cases.28, 31. Brachial plexus injuries depend upon the mechanism causing the injury, and can be caused by: 1) distension in closed injuries; 2) compression resulting from hematoma or false aneurysm; 3) laceration or 4) contusion of nerve fibers. The more severe the neurological injury, the higher the chances of a concomitant arterial injury. In specific cases related to FA wounds, surgical repair of the nerves is not indicated due to the high degree of associated contusion.31. There are vascular injuries that do not require surgical treatment. These are called minimal injuries. Several investigators have recommended observation as the best procedure in cases of isolated arterial injuries in asymptomatic patients. However this concept is new and conservative treatment is still controversial. Patients who are not submitted to surgery must be closely followed. On the other hand, simple ligature of the subclavian or axillary artery should only be carried out in cases where hemodynamic instability or

concomitant injuries threaten the patient's life, thus preventing revascularization 22, 23. It is generally accepted that most complex injuries require reconstruction with grafts. Grafts should be preferentially autologous, the most frequent choice being the internal saphenous vein. Therefore, prosthesis should not be used as a first option. In some cases, also as an exception, resection of the injured segment and primary anastomosis of the artery can be carried out 19. Many traumatic injuries can be corrected by endovascular techniques. However, endovascular treatment of trauma to these arteries has poor results. This is supposedly due to: 1) the strangling of the endoprosthesis by the costal-clavicular space and 2) the mobility of the shoulder girdle can function as an occlusion factor.11 Fortunately late occlusion permits the development of new collateral circulation, thus minimizing the consequences of a superjacent ischemic state. Especially in tumor syndromes, in false aneurysms, and in cases of arteriovenous fistulas, endovascular treatment is of great value. Currently, it is possible to correct acute or chronic injuries by using minimally invasive techniques, thus avoiding surgery (difficult in most cases) in sites with distortion of anatomic structures and intense bleeding 23, 26, 29.

Conclusion

The management of extremity vascular trauma is a team efforts, and involving, vascular, orthopedic, and plastic aspects, to achieve the best possible limb salvage rates. Early recognition and prompt surgical intervention, use of saphenous vein graft, fasciotomy contributes to a successful outcome to save life and limbs in vascular trauma patients.

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