

EXPERIENCE WITH MAJOR VASCULAR TRAUMA 126 CASES

JALAL KHAN, RIAZ ANWAR KHAN, PARVEZ MANNAN,
SOHAIL ASLAM AND TASKEEN AHMAD

*Department of Cardiovascular Surgery,
Postgraduate Medical Institute,
Lady Reading Hospital, Peshawar.*

SUMMARY

Vascular injuries are relatively common in North West Frontier Province of Pakistan and can occur as part of Firearm injury, road traffic accident, stab wound or Iatrogenic. Aim of this study was to evaluate the incidence of vessels involved in major trauma and its outcome. This study shows the experience of 126 vascular injuries over a period of twenty two months from 1st June, 1995 to 31st October, 1996. Out of these 113 cases were firearm, 06 cases were stab wounds, 01 blunt trauma and 06 iatrogenic (aortic 2, IVC 3, femoral 1). Vessels in the lower limb were involved most commonly 74/126, upper limb vessels 39/126, (subclavian 6, axillary 5, brachial 19, below elbow 9) and neck vessels 8, (common carotid 4, external carotid 2, jugular vein 2). All cases were diagnosed clinically. Angiography was done only for neck injuries. Vessels injured were repaired either by end to end anastomosis or interposition of grafts. Venous repair was carried out at the time of operation. Carotids were dealt successfully at a later stage as an elective procedures except two case which were explored because of expanding haematoma. Late revascularization in the absence of ischaemic changes showed good result, but in the presence of ischaemic changes revascularization was not satisfactory. The cases which were received within six hours of injury yielded excellent results. If there is any suspicion of vascular injury, patient should be referred quickly to the appropriate centre to achieve good.

INTRODUCTION

Major vascular injuries may be encountered in any civilian setting, but the greatest incidence is in urban areas where violence is likely.¹⁻³ Penetrating wounds as a result of firearm are most common than stab wounds by knives in our practice. They are usually caused by low velocity missile, which produces damage mainly in the area of missile track without destroying surrounding tissue. Such a missile can cause disruption of blood vessels, internal injury with thrombosis or transection. Small skin wounds are often accompanied by a large defect in the deep tissues, at time contaminated with pieces of clothes and dirt, which

increases the incidence of serious infection. Mortality and limb salvage depends on adequate first aid and quick transportation to a hospital where proper vascular surgery can be performed.⁴

Every effort should be made to perform revascularization within 6 hours of injury. According to the data from Vietnam, Korean and Middle East wars⁵⁻⁷ prolonged ischemia (beyond 8 hours) increases the proportion of amputation to as high as 98%. There are some reports, that arterial repair may be successful upto 12-15 hours after injury if the collateral circulation is sufficient, depending upon the site of injury. Excision of devitalized tissue should be complete before

TABLE - I
MECHANISM OF INJURY

FAI	113
STAB	06
BLUNT	01
IATROGENIC	06
TOTAL	126

vascular reconstruction.⁸ Autologous saphenous graft is the material of choice for revascularization in all contaminated wounds. Prosthetic grafts are used only when saphenous vein is not available or patient is unstable. Arteriography and venoraphy can be performed after small clear cut vessel laceration. Communitted and contaminated fractures are often associated with vessel injuries. External fixation is the best method for immobilization of bones.

Nerve injuries often follow vascular trauma. Post operative paresis is often the result of prolonged ischaemia or post operative oedema. Fasciotomy is required in patients with compartmental hypertension when there had been delayed arterial repair or concomitant vascular injuries.⁹⁻¹⁰

MATERIAL AND METHODS

This data was collected from cardiovascular surgical department at Lady Reading Hospital Peshawar from 1.1.95 to 31.10.96.

TABLE - II
NUMBER OF ARTERIAL, VENOUS,
NERVE, AND ASSOCIATED INJURIES

Arteries	97
Veins	06
Arteries and Veins	27
Intact Vessels	03
Associated Fracture	11
Associated Nerve Injuries	30
Associated Chest Injuries	10
Associated Abdominal Injuries	08
Associated Head Injuries	02

This indicates higher incidence of vascular injuries in the lower limbs 62% and about 32% in the upper limb, the remaining were abdominal and neck injuries. The commonest mechanism of injury in our series was firearm which accounted for 91% of cases, followed by stab injuries 4.83%, iatrogenic 3.2% and blunt trauma 0.08% (Table-I). Seventy five percent cases were of arterial involvement, 4.8% veins only, 17.74% artery and vein together, 2.4% cases had intact vessels (Table-II). Associated nerve injuries were the commonest and account for 24% (Table-II). Most of the nerve injuries were repaired at the time of operation of vascular repair. Fracture accounted for 8.87% of the cases. In such cases arterial repair was done and the limb was immobilized with external fixators or plaster of paris cast.

There were 8% chest injuries which were dealt with by the thoracic surgeons at the same time. Abdominal visceral injuries were 6.4% which were dealt with by the general surgeons. Associated head injuries were recorded in 1.61% cases, which were treated conservatively in collaboration with neurosurgeon.

The low incidence of aortic and caval injuries might be due to poor prospect of surviving, late recognition by the medical personnel and late referrals.

RESULTS

Twenty five cases which were received with in 6 hours were explored immediately. All of them had excellent recovery. Out of the other 10 late arrivals, 13 cases of lower limbs injuries presented with signs of ischaemia, 03 had mottling. These cases were also operated upon in emergency. Out of these 13 cases 2 amputations were done at a later date Table-IV.

Vascular repair included 59 cases of end to end anastomosis Table-III. Interposition of grafts were done in 33 cases, 29

TABLE – III
NUMBER AND TYPE OF VASCULAR
REPAIR

END TO END ANASTOMOSIS	59
VEIN GRAFT	29
SYNTHETIC GRAFT	04
ARTERIOGRAPHY	15
LIGATION OF VESSEL	14
VENORRAPHY	03

had saphenous vein grafts and 04 prosthetic grafts. Arteriography was done in 15 cases, venoraphy was done in 3 cases. Poor back flow was improved by putting a Fogarty's catheter to remove the distal clot and irrigation of distal vessel with heparinized solution.

Primary suturing of the wounds were done in all the cases received within 06 hours of injury. However in late arrivals we did primary closing but with thorough wound toilet with hydrogen peroxide, broad spectrum antibiotics. Infected wounds were left open with muscle cover over the repaired vessels. They were closed later.

In 14 (11%) cases ligation of vessels were carried out. Four in the calf, 7 in the forearm, 2 in popliteal and 01 in femoral area. These ligations were done in the presence of frank sepsis or where the general condition of the patient did not permit prolong anaesthesia.

Iatrogenic injuries were 6 (2 aortic, 3 IVC, 1 femoral). One aortic injury was repaired by prosthetic dacron graft the other was repaired with direct sutures and in both cases patients survived. The inferior vena caval (IVC) injuries which were mainly in the abdominal region were repaired. Two by lateral sutures and 1 by end to end anastomosis. In this, one patient with end to end anastomosis died of hypovolemia and shock. Femoral artery was repaired by

saphenous vein graft and patient did very well.

Eleven bony fractures were associated with vascular injuries (7 femur, 2 humerus, 1 tibia and fibula, and 1 clavicle). These fractures were stabilized at the time of vascular repair, out of 7 femur fractures 4 were stabilized with external fixator, 1 with internal medullary nail, and 2 with plaster cast and traction. Two humerus fractures were stabilized with external fixator. One tibia and fibula fracture was fixed with external fixator but lead to amputation at a later stage. One clavicle fracture was stabilized with figure of eight crepe bandage after repairing the vessel.

There were three (12%) deaths in the early group with patient received within 6-12 hrs of injury. Two were explored by the casualty staff initially for intra abdominal visceral injuries where a major vascular laceration had been found and vascular team had been called upon who in turn joined them. These two patients died while still being managed in casualty department. One patient died in the ward, 2 days later because of septicaemia. Where as deaths in late arrival were 04(3.96%), (1 acute MI, 1 fat embolism, 2 with severe wound sepsis and disruption of anastomosis leading to haemorrhage and shock). Wound infection was 12.08% in early arrival group and 28% in

TABLE – IV
OUT COME OF 126 CASES

	Early Arrival (within 6-12 Hrs of injury)	Late Arrival (12-72 Hrs of injury)
No. of cases	25(19.84%)	101(80.15%)
Deaths	03(12%)	04(3.96%)
Amputation	02(8%)	06(5.94%)
Wound infection	03(12.8%)	28(28%)
Renal failure	NIL	12(12.8%)
Re Exploration	NIL	02(1.5%)

late arrival group. Incidence of acute renal failure was 12% in late arrival group where as zero in the early group. These patients recovered after dialyses in the nephrology department. Reexploration was done in cases of late arrival with blocked grafts. These were replaced with synthetic graft.

DISCUSSION

In civilian practice the prevalence of arterial injuries appear to be increasing. In most published series penetrating wounds caused either by low velocity missiles or by sharp penetrating instruments predominates the blunt injuries.¹¹ In our series firearm was the commonest 89%, stab 4.76%, blunt 0.79%, iatrogenic 0.76%. Early diagnosis is the result of alertness on the part of clinicians.¹² Overt ischaemia was less common in upper limb vascular injuries because of rich collaterals. Lower limb arterial disruption is more easily diagnosed without ancillary aids because of pulse deficit.

End to end anastomosis without tension was possible in 47% of our cases. It is important that the artery be cut back to healthy vessel wall and anastomosis be constructed without tension. If there is tension, then graft may be interposed between two ends of artery. Saphenous vein graft is superior to cephalic vein or other small veins,¹³ and even better than synthetic grafts. In this series 29 vein grafts were used where as only 4 synthetic grafts were used Table-III. Ten vessels were ligated either because of poor risk patient or sever sepsis. Injured veins should be repaired at the same operation.¹⁴ Sepsis is a major contributing factor towards late vascular repair failure due to secondary hemorrhage or thrombosis. In our series 12.8% was wound infection in the early arrival group and 28% in the late arrival group Table-IV. Reexploration was done in two cases with blocked grafts because of sepsis. Primary skin closure is contraindicated in contaminated wounds. Thorough wound toilet

should be carried out in dirty wounds. Arteries repaired should be covered by muscle flaps and wound secondarily closed with strong broad spectrum antibiotic cover. Displaced, bony fractures should be fixed by external fixators in case of contaminated wounds, and internal fixation if wounds are clean, at the time of vascular repair.¹⁵

Revascularization in an irreversible ischaemia may be dangerous. This state is difficult to describe but generally is accompanied by fixed ischaemic changes i.e. colour changes, paralysis, increased muscle turgor. Revascularization on fixed ischaemic changes should not be attempted. One can attempt to repair but great care is to be taken in monitoring renal failure. If it occurs, it should be treated aggressively.

Arterial repair should always to performed in the presence of nerve damage because accurate objective assessment is difficult in the presence of ischaemia and in the inebriated patients or in emergency situation. Compression neuropraxia may continue to improve over the period of 6 months or more.¹⁵

Fasciotomy is well established adjunct to limb revascularization.¹⁶ We selectively performed fasciotomy when increased tissue turgor was noted at the start of operation or at the conclusion of the operation where the patients had arrived late for surgery.

Good first aid of the primary receiving hospital by establishing good peripheral vein access, splintage of fracture etc and prompt referral and transportation to the vascular surgical centre is essential in achieving good results in vascular injuries.

REFERENCES

1. Shires GT (ed). Preface. In principle of trauma care, 3rd ed, New York, Mc Graw Hill, 1985; 11;
2. Perry MO. The management of acute vascular injuries. Baltimore. William and Wilkins, 1981; 74-78.

3. Feliciano DV, Bitondo CG, Mattox KL, et al. Civilian trauma in 1980's. *Ann Surg* 1984; 199: 717.
4. Rich NM, Baugh JH, Hughes CW. Acute arterial injuries in 1000 cases. *J Trauma* 1970; 10: 359.
5. Hughes CW. Arterial repair during Korean war. *Ann Surg* 1958; 147: 61.
6. Gorman JF. Combat wound of popliteal artery. *Ann surgery* 1968; 168: 978.
7. Majeski JA, Gants A. Management of peripheral arterial injuries with Javid Shunt. *Ann J Surg* 1979; 138: 324.
8. Luetic V, et al. Military vascular injuries in Croatia cardiovascular surgery. 1997; 1: 3.
9. Robert RM, String ST. Arterial injuries in extremity with shotgun wound: requisite factors for successful management. *Surgery* 1984; 96: 902.
10. Peck JJ, et al. Popliteal vascular trauma. *Arch Surg* 1990; 125: 1339.
11. Hardy TD, Raju S, et al. Aortic and other injuries. *Ann Surg* 1957; 181: 640.
12. Golman BS, Firor W. The recognition and management of peripheral arterial injuries. *Can Med Assoc J* 1965; 92: 1154.
13. Hewitt RL, RL, Smith AD, et al. Penetrating vascular injuries of thoracic outlet. *Surg* 1986; 76: 715.
14. Lan JM, Mattox KL. Use of substitute conduits in traumatic vascular injuries. *J Trauma* 1994; 17: 541.
15. Green NE, Allen BL. Vascular injuries associated with dislocation of knee. *J Bone Joint Surgery* 1985; 59: 236.
16. Burnett HF, Parnell CL. Peripheral arterial injuries assessment. *Ann Surg* 1993; 183: 701.