

# Changing Etiological Spectrum of Acute Peripheral Vascular Injuries – A Clinico-Epidemiological Study

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The overall incidence of acute peripheral vascular injuries is on a rise in civilian practice which is largely attributable to frequent use of firearms, terrorist violence and high speed road traffic accidents. This study reveals the clinical and operative details of 19 patients with peripheral vascular trauma which necessitated surgical intervention from August 1998 to February 2000. Present study also aims to highlight an emerging change in the etiological spectrum of vascular injuries with an alarming contribution by the drug addicts (15.7%), which demands a multi-disciplinary approach. An understanding of modes of presentation of vascular trauma with early diagnosis and appropriate treatment are essential for all surgeons to maximize the chances of limb salvage. Time is the prime factor in determining the final outcome of vascular repair.

**Key Words:** Acute vascular injury, drug abuse

Peripheral vascular trauma is scaling new heights in Pakistan and severe vascular injuries make upto 4–6% of major trauma<sup>1</sup>. Arterial ligation was the mainstay of treatment throughout the Second World War with an overall amputation rate of 40%<sup>2</sup>. Remarkable reduction in limb loss was achieved in the Korean and Vietnam wars by adhering to a policy of vascular reconstruction. Most of the principles learnt during these major conflicts have been translated into civilian practice and recent studies have revealed an amputation rate of less than 5%<sup>3,4,5</sup>.

The young, previously fit adults are mostly at risk of sustaining vascular trauma. Hemorrhage and ischemia may prove to be limb-threatening and life-threatening. Such patients may survive the injury but have the most to lose in terms of quality of life as a result of delayed presentation, missed injury or unsuccessful surgical treatment. Presentation of acute vascular injury sometimes confounds the clinical acumen of even the most experienced surgeon so the integration of clinical, doppler and if available arteriographic findings are mandatory.

In addition to an ever-increasing risk of exposure to major trauma, this is again the younger generation indulged in and hence prone to various complications of intravascular drug abuse. Difficulties encountered in the management of drug addicts are considered and an attempt is made to outline certain principles specific to vascular repair in drug abusers.

## Patients and Methods

This is a prospective study carried out at Surgical Unit I, Jinnah Hospital, Lahore over a period of 18 months from August 1998 to February 2000. All the patients were admitted through A&E Department. The parameters considered were age, sex, pattern of injury, time since injury, vessels involved, associated injuries, mode of presentation and outcome of surgical intervention. Initial resuscitation with IV fluids, analgesia, tetanus prophylaxis and chemoprophylaxis with 2nd generation cephalosporins was carried out. Primary survey was undertaken to establish the extent of vascular injury by clinical examination and doppler study. Visceral, soft tissue and bony injuries were also recorded. Where appropriate chest x-ray, ECG, arterial blood gases and radiographs of suspected bony lesions were taken. Partial or complete

vascular lacerations were directly sutured after trimming damaged edges. In the absence of adequate blood flow, balloon catheter was used to retrieve any thrombus alongwith gentle flushing of vessels with heparinised saline solution to prevent thrombosis. Where the loss or damage to the arterial wall was less than 2 cm, mobilisation of the two ends with subsequent resection and end-to-end anastomosis with 5/0 interrupted prolene suture was undertaken. A larger gap was bridged with autologous reverse saphenous vein graft. Suction drains were used in all wounds.

Fasciotomy was considered where time since injury exceeded 6 hours, clinical suspicion of compartment syndrome and where post-revascularisation edema was anticipated. Secondary closure of fasciotomy wounds was done 7–10 days later. Systemic heparinisation for five days and physiotherapy were employed to all patients. In addition, psychiatric rehabilitation and regular counselling with the families was done for drug addicts. All the patients were subjected to doppler studies alongwith daily bedside clinical assessment in the ward. Complications, if any were recorded.

All patients were followed up in outpatients monthly for three months by clinical examination and doppler studies.

## Results

A total of 19 patients formed this study group.

**Age & Sex:** All patients were male. The age incidence varied from 6–52 years with a mean age of 28 years.

**Response Time:** Which is defined as time between injury and arrival to hospital varied 5–13 hours (mean 7.8 hours).

**Clinical Presentation (Table 1):**

Table I Clinical Presentation (n = 19)

Presentation	No.	%age
Pulse deficit	13	68.4
Arterial bleeding from wound.	10	52.6
Shock		44.4
Distal ischemia	8	26.3
Expanding hematoma	5	21.0
Major neurological deficit	4	10.5
Pulsatile mass	2	5.2
	1	

Pulse deficit was the commonest sign observed in 13 cases (68.4%) followed by arterial bleeding from the wound in 10 patients (52.6%).

**Vessels Involved (Table 2):** Eleven (57.8%) had lower limb vascular injuries and eight (42.1%) had upper limb vessels injured. Popliteal artery was the commonest vessel injured in 7 cases (36.8%) followed by brachial artery in 4 patients (21.0%). Combined popliteal artery and vein were injured in 2 patients (10.5%).

Table II Site of Vascular Injuries (n = 19)

Site	No.	%age
Upper Limb	8	42.1
Brachial art.	4	21.0
Axillary art.	3	15.7
Radial art.	1	5.2
Lower Limb	11	57.8
Popliteal art.	5	26.3
Common Fem. Art.	3	15.7
Ext. Iliac art.	1	5.2
Popliteal art. & vein	2	10.5

**Cause of Injury:** Penetrating firearm or stab injuries were the commonest etiology observed in 16 patients (84.2%). Blunt trauma leading to crush laceration of popliteal artery associated with open fracture of femur was seen in 2 cases (10.5%) whereas one patient (5.2%) presented with ruptured mycotic pseudoaneurysm of femoral artery. Three patients (15.7%) had vascular injuries due to intravascular drug abuse. Out of these three, one presented with ruptured aneurysm of femoral artery, one stabbed his popliteal fossa and one shot himself in right lower abdomen. The later two patients injured themselves for the want of drugs like heroin and Pentazocine.

**Type of Injury:** Vascular laceration was found in 13 cases (68.4%) and complete transaction was observed in 5 cases (26.3%) while one (5.2%) had ruptured mycotic pseudoaneurysm of femoral artery. Three patients (15.7%) had fracture / dislocation, six (31.5%) had associated extensive soft tissue injuries, one (5.2%) had visceral injury involving jejunum with multiple perforations. Major neurological deficit with paralysis were seen in one case whereas paresis due to neuropraxia was observed in two patients.

**Repair:** Reverse interposition saphenous vein graft was used in 13 patients (68.4%) while 5 cases (26.3%) had end-to-end anastomosis and primary repair with lateral anastomosis was employed in one patient (5.2%).

**Complications:** Four patients (21.0%) had wound infections treated with dressing and appropriate antibiotics and two patients (10.5%) who presented with associated venous injuries developed postoperative distal edema which settled in due course of time.

A number of practical problems are encountered while managing the drug addicts as summarised in Table III.

#### Discussion

The threatening rise in the incidence of vascular trauma demands increased awareness and high index of suspicion by the treating surgeon. In USA most penetrating vascular

injuries are inflicted by firearms whereas in U.K., these injuries are usually the result of stabbing<sup>3,4</sup> while in this study 84.2% of acute vascular trauma is caused by gunshots. In the present study, the commonest sign of acute vascular injury is pulse deficit (68.4%) which is comparable with other reports<sup>6</sup>. Distal pulse may be present in upto one quarter of peripheral vascular injuries so the site rather than size of skin laceration should alert the surgeon in patients with penetrating injuries overlying vascular structures<sup>7,8</sup>. 17% of vascular injuries may present late with either AV fistula or aneurysm<sup>9</sup> though no such complications were encountered in this study apart from one ruptured infected Pseudoaneurysm noted in a drug addict.

Table III. Problems Encountered In Drug Addicts

Delayed clinical presentation.
Difficult resuscitation because of lack of venous access.
High risk HIV & Hepatitis carriers.
Septic foci, endocarditis, lung abscess, bacteremia.
Lack of availability of suitable autologous graft.
Prosthetic grafts with extra-anatomic bypass.
Early "self discharge".
Difficult wound management, choice of perioperative analgesia.
Need for psychiatric rehabilitation.

Trauma to upper limb vessels accounts for 33-45 % and lower limb vessels 45-50 % of major vascular injuries<sup>10,11</sup>. Similar findings are observed in this study (upper limb 42.1 % and lower limb 57.8 %). In the present study, long saphenous vein was used in 11 patients although internal jugular vein can also be harvested and used for interpositional vein graft<sup>12</sup>. Fasciotomy was performed in 15 patients (78.9%) at the time of vascular reconstruction. Fasciotomy is advised to be done before definite reconstruction to allow collateral flow to improve during limb revascularisation<sup>13,14</sup>. Low threshold for fasciotomy is justified on account of response time of 7.8 hours in the present study. Routine pre-operative arteriography can significantly prolong the ischemia time<sup>15</sup> while per-operative arteriography can be quick, cost effective and is a valuable tool to diagnose vascular damage at a number of sites<sup>16</sup>.

Serious complications of intravascular drug abuse are now being acknowledged with increasing frequency as well. About 40 cases per year are reported by Burgner and Benitez at Detroit Receiving Hospital with a several fold increase observed since the last decade. This study reveals three patients (15.7%) with acute vascular injuries related to drug abuse where almost every vessel including the heart is a potential site of self injury<sup>17</sup>. Various drugs reported are pentazocine, heroin, barbiturates, "mixed jive", cocaine and propoxyphene<sup>18</sup>. Clinical presentation is often delayed because of social factors and a full history is difficult to obtain. These patients are usually immunocompromised, high risk for HIV and hepatitis, early "self-discharge" is common and are prone to be retracted back to the company of drug abusers. Approximately half of the patients who had blood cultures drawn on admission were reported to have positive cultures in one study<sup>19</sup>. The predominant organism found was MRSA (54%). A variety of mechanisms may singly or in combination result in

infection and destruction of vessel wall. These include puncture with contaminated needles, development of intimal flap, perivasculitis and secondary infection of perivascular hematoma<sup>20,21</sup>.

The basic principle for the treatment of mycotic aneurysm has clearly been established. The involved vessel must be ligated and excised while obtaining proximal control before entering the aneurysm is the preferred approach<sup>22</sup>. Thorough exploration, debridement and extra-anatomic bypass, often with a prosthetic material may be considered as a measure for simultaneous revascularisation<sup>17,23</sup>. Psychiatric rehabilitation, moral support and vigilant follow-up are the mainstay of management plan.

To conclude, an early diagnosis of vascular injury is essential for the success of subsequent repair. The paucity of unequivocal signs makes a high index of suspicion of vascular damage essential when assessing a polytrauma patient. The clear message stems from the fact that reducing the delay between vascular trauma and reconstruction is the key prognostic factor. The new change in the etiological spectrum of vascular trauma observed in drug addicts is dreadful and needs a clear understanding of principles specific to the management of such cases.

#### References

1. John SP Lumley, Norman M Rich; Vascular Injury: Surgery Int. 1997; 15; 49 - 2.
2. DeBakey ME, Simeone FA. Battle injuries of arteries in World War II; an analysis of 2471 cases. *Ann Surg* 1946; 123:534. 79.
3. Rich NM, Spencer FC, Vascular Trauma, Philadelphia: WB Saunders Company, 1978.
4. Adinolfi MF, Hardin WD, O'Connell RC, Kerstein MD. Amputations after vascular trauma in civilians. *South Med. J* 1983;76: 1241-3.
5. Colledge J, Scriven MW, Fligelstone LJ, Lane IF : Vascular trauma in Civilian Practice. *Ann R Coll Surg Engl* 1995; 77 417-20.
6. Stumm H, Boddy RC, Rothenberger DA, Petty JE; Arterial injuries of the extremities following blunt trauma. *J Trauma* 1980; 20 : 982-6.
7. Bergentz SE, Bergqvist D, Ericsson BF; Vascular Trauma. *Acta Chir Scand* 1983; 149 : 1-10.
8. Degiannis E, Velmahos GC, Florizoone MGC, Sachia R: penetrating injuries of popliteal artery: the Baragwanath experience, *Ann R Coll Surg Engl* 1994; 76; 307-10.
9. Blacklay PF, Duggan E, Wood RFM: Vascular Trauma. *Br. J Surg.* 1987; 74: 1077-83.
10. Robbs JV, Baker LW. Major arterial trauma: Review of experience with 267 injuries. *Br. J Surg* 1978; 65: 532-8.
11. Hughes CW, Bawers WF. Traumatic lesions of peripheral vessels. Springfield, Illinois: Charles C Thomas, 1961.
12. Feliciano DV, Bitondo CG, Mattox KL et al. Civilian trauma in the 1980's. *Ann Surg* 1984; 199: 717-23.
13. Lim LT, Saletta JD, Flanigan DP. Subclavian and innominate artery trauma - Surgery 1997; 86: 890-6.
14. Meck AC, Robbs JV. Vascular injuries associated with bone & joint trauma; *Br. J Surg* 1984; 71 : 341-4.
15. Ransom KJ, Shantey CH, Soderstrom CA, Cowley RA. Management of arterial injuries in blunt trauma of extremity. *Surg Gynecol Obstet* 1981; 153 : 241-6.
16. Macfarlane C, Boffard KD, Saadia R, Wilkinson AE. Emergency room arteriography; a useful technique in the assessment of peripheral vascular injuries. *JR Coll Surg Edinb* 1989; 34; 310-3.
17. David B Hocken: Acute Vascular Injury; *J Surgery* 1995; 13; 44-8.
18. Ramon Berguer, Pamela Benitez. Surgical Emergencies from intra-vascular injection of drugs; 1987: 309-16.
19. Wallace JR, Lucas CE, Ledgerwood AM: Social, economic and surgical anatomy of a drug related abscess. *Ann Surg.* 52 : 398, 1936.
20. Berguer R. Feldman AJ; Infected groin aneurysm from heroin addiction, in Bergan JJ, Yao JST: Aneurysms; Their Diagnosis and Treatment. New York, Grune and Stratton, 1982.
21. Johnson J, Ledgerwood AM, Lucas CE; Mycotic aneurysms - New concept in therapy - *Arch Surg.* 118: 577, 1983.
22. Anderson CB, Butcher HR, Ballinger WF: Mycotic aneurysms. *Arch Surg* 109; 712, 1974.
23. Fromm SH, Lucas CE: Obturator bypass from mycotic aneurysms in drug addict: *Arch Surg* 100: 82, 1970.