

A Five years audit of surgery for civilian vascular trauma in a teaching hospital

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This is a review of 69 consecutive cases of vascular injuries managed in a general surgical unit over a period of five years. The object of the review was to study the pattern of injuries, treatment offered and the outcome of these cases. Age of these patients ranged from 16 to 58 years with a male to female ratio of 13 : 1. Forty two patients had firearm injury, 17 stab injury and 10 had road side accidents. In 45 cases there was laceration and in 24 cases there was transection of the affected vessels. Thirty eight lacerations were repaired, in ten cases end to end anastomosis was done and in six cases reverse saphenous venous grafting was done. Vascular ligation was only employed when any of the above was not possible. In 14 cases fasciotomy was combined with above procedures or was the only procedure employed. In 76.81% the outcome was successful while in nine cases failure of revascularization resulted in amputation. The complication rate was 36.23% affecting 25 patients (sepsis in 13 renal failure in 3 secondary hemorrhage in 2 and gangrene in 7). There was a mortality rate of 17.39% in this series. Prevention of such injuries, through control of civilian violence and road traffic accidents, remains an ideal. A good ambulance system and properly staffed trauma centers providing a multidisciplinary approach for expeditious limb revascularization, rapid fixation of fractures and adequate soft tissue coverage can lead to an improved outcome.

Key words; Civilian; vascular injury; arterial injury; fasciotomy

Civilian vascular trauma is not uncommon over the last three decade. There has been a significant increase in such injuries¹. Vascular injuries characteristically involve the young and can result in limb loss, serious lifelong functional disability or even death. It is particularly tragic when such unfavourable outcome can be traced back to delayed or failed recognition or simply to incorrect or incomplete assessment. Most of the reported literature and developments are related to military experience². Extensive civilian series present epidemiological profiles that are distinctly different from military reports and serve as a guide for current trauma centre and health planners³. Unfortunately there is scanty local literature available on this subject.

We therefore conducted a 5 years audit of civilian vascular trauma to study pattern of injuries presenting in a major urban teaching hospital, treatment offered and outcome in such cases.

Material and methods

Medical records of all the patients who underwent surgery for vascular injury in one of the general surgical units of Mayo Hospital Lahore, from 1992 to 1996 were reviewed. None of the patients were under 12 years of age as these patients were managed in the paediatric surgery department. Patients with obvious gangrene at the time of presentation and distal peripheral vascular trauma were excluded from the study. The clinical features including details of all the injuries were noted. The operation notes were looked into regarding the vessels injured, type of injury whether a transection or laceration, injury to

surrounding tissues and other associated injuries were noted.

A note was taken of all the investigations carried out prior to operation and post operatively. These included CBC, blood grouping and cross matching. Duplex scan and contrast studies were not done because of lack of these facilities. Postoperatively Doppler studies were done when required. Post operative course of the patients was also studied.

Results

In this study there were 69 patients including 63 males and 6 females. Most of them were young with ages ranging from 16 to 58 years. Of these 42 were firearm victims, 17 had stab injuries, and 10 had road traffic accidents. The breakup of clinical features is shown in table 1. Pain was the commonest clinical feature present in 92.75%. Distal pulses were absent in 89.85% cases. However in rest of the patients the pulses were intact. The anatomical distribution of the injured vessels is shown in table 2.

Table 1-Clinical presentation of vascular cases

Clinical signs	n=	%age
Loss of pulses	62	89.85
Loss of sensations	29	42.02
Pain	64	92.75
Discoloration	38	55.07
Edema	17	24.63

Femoral arterial injury was the commonest(31.87%). Apart from the lower limb, neck was the next common site for vascular injury(10.13%). At exploration 46 vessels had partial injury in the form of lacerations of the wall,

while 24 vessels had suffered complete transection.

Table 2-Distribution of vascular involvement in trauma cases

Vessels involved	n=	%age
Superficial femoral	15	21.73
Common femoral	7	10.14
Popliteal artery	06	08.69
Femoral vein	06	08.69
Brachial artery	06	08.69
Iliac artery	05	07.24
Internal jugular vein	04	05.79
Profunda femoris	03	04.34
Axillary artery	03	04.34
Carotid artery	03	04.34
Inferior vena cava	03	04.34
Internal mammary artery	03	04.34
Abdominal aorta	02	02.89
Subclavian vessels	02	02.89
The heart	01	01.44

Heparin was used in all patients during operation both as a local and systemic administration. The details of operations are shown in table 3. In 15 cases repair / grafting was not possible or the vessel was of smaller calibre.

Ligation was resorted to in 15 cases including 4 cases of femoral vein injury, all cases of internal mammary artery injury and in a case of the inferior vena cava injury. Twenty five patients had one or more complications as shown in table 4. Of these 12 patients eventually expired. Causes of deaths are shown in table 5. Nine patients who required amputation resulting from ischemia had anastomosis / graft failure in seven and ligation in the remaining two cases.

Table 3-Management and results of vascular injuries

Vessels	Laceration	Transection	Repair	Anastomosis	Graft	Ligation	Success	Failure	Fasciotomy
S-femoral/	07	08	06	03	05	01	13	02	04
c-femoral	06	01	06	01	00	00	05	02	03
Femoral vein	02	04	02	00	00	04	06	00	00
Popliteal	04	02	04	01	00	01	04	02	04
Axillary artery	04	02	02	02	01	01	06	00	00
Iliac vessels	03	02	02	02	00	01	03	02	02
Int. Jug. Vein	03	01	02	00	00	02	0400	00	00
profunda femoris	02	01	02	01	00	00	03	00	01
Carotid artery	03	00	03	00	00	00	03	00	00
Int. Jug. Vein	03	00	02	00	00	01	03	00	00
Axillary vein	02	01	02	00	01	03	00	00	00
Internal mammary	01	02	00	00	00	03	03	00	00
Subclavian	02	00	02	00	00	00	02	00	00
Abdominal aorta	02	00	02	00	00	00	02	00	00
heart	01	00	01	00	00	00	00	01	00
Total	45	24	38	10	06	15	60	09	14

R=repair. RA=resection anastomosis. G=graft. L=lignature. P=polypropylene. V=vicryl L=Laceration. T=Transection.

Table 4 Breakup of complications

Complications	n=	%age
Infection/septicemia	13	18.84
Gangrene	08	11.59
Renal failure	04	05.79
Secondary hemorrhage	02	02.89

Table 5 Causes of death

Cause	n=	%age
Septicemia	04	05.79
Associated injuries	04	05.79
Renal failure	03	04.34
Secondary hemorrhage	01	01.44

Discussion

The incidence of vascular trauma is different in various parts of the world. In marked contrast to North America and Northern Ireland it is relatively uncommon in UK⁴. Mattox et al have shown an increase from 27 cases to 213 cases per year from early 1960's to 1987 in their series of 4459 patients of civilian vascular injuries managed in a single trauma centre³.

The mechanism of injury again is different in different regions and is also changing with time. Penetrating trauma accounted for 90% of all civilian vascular injuries in a study from North America³, which is quite similar to our experience. However it is in marked contrast to the

experience from UK where accidents accounted for 77% of injuries and stabbing for other remaining 23%, interestingly there were no firearm injuries⁴.

Another interesting feature is in the vascular distribution of these injuries. Whereas truncal injuries accounted for 66%, abdominal vascular injuries 33.7% and lower limb injuries including the groin only 19% in a large series from North America. In a 10 year audit of surgery for vascular trauma in a British teaching hospital the distribution of the vascular trauma is as follows; brachial 30% and superficial femoral in 15%. In our series surgery for vascular injuries was done mainly for extremities i.e. 70.8%, there were only 17.7% truncal vascular injuries and 11.4%, cervical vascular injuries.

Though mode of injury in present study is quite similar to that of North American series, a significantly lower incidence of major truncal injuries can be explained on the lethal nature of these injuries, as in our setup these victims are less likely to reach at a proper facility for definitive treatment. With improvement in mode of transport and commissioning of motorways we are likely to encounter more severe vascular trauma in our operation theatre.

Due to the limitations imposed by time and associated complicating injuries there is a very limited role of

angiography except in protracted blunt injuries (with absent distal pulses) where early use of angiography helps to avoid amputations secondary to missed or delayed diagnosis⁵. Duplex ultrasonography is a reliable method of diagnosis in patients with potential vascular injury⁶.

Fasciotomy plays an important part in limb salvage. It is recommended in patients with compartment syndrome, popliteal vascular injuries and where both arterial and venous injuries are present. A liberal use of fasciotomy in the above instances is recommended instead of observation and selective use in spite of the fact that fasciotomy considerably prolongs hospital stay⁷. The obstruction to venous drainage is a major factor in the development of compartment syndrome in dual vascular injuries of lower extremity⁸. The repair of venous injuries was done in 8 cases. The role of venous repair in civilian trauma remains controversial. A substantial percentage of venous repairs will thrombose in the postoperative period, especially if an interposition vein graft is used. However, this does not adversely influence limb salvage⁹.

A meticulous attention to perioperative care for the patients including systemic and local heparinization is recommended. Following quick and appropriate surgery post operative anticoagulation is not mandatory. The use of IV Dextran, 500ml/day for first 2 days is however beneficial¹⁰. The new arterial prosthetic materials have still to stand the test of time with possible late problem of false aneurysm. The designers and manufacturers have possibly been over-obsessed with the ability of the prosthesis to incorporate itself naturally into the tissues, and modern prosthesis do this quite well but still have a disappointing long term patency rate.

In better trauma centers limb salvage is virtually guaranteed when arterial injury is associated with a gunshot or stab wound. In this setting, arterial injury is limited and is uniformly suspected, deliberately sought and expeditiously repaired⁵. A 16.07% amputation rate i.e. 9 out of 56 extremity injuries is a far cry from the aforementioned optimism, it can be explained on a number of adverse factors to which our patients are exposed, including delay in reaching the few centers where vascular injuries can be properly managed. Absence of trauma centers, lack of training and genuine interest in vascular trauma both by the general and cardiac surgeons. The management of such trauma is practically delegated to the residents with variable experience in a few teaching hospitals. In addition to the lack of training there is a uniform lack of investigative, operative as well as monitoring facilities for these patients.

We suggest more studies of this nature in order to create awareness of the magnitude of civilian vascular trauma morbidity, especially limb loss, and associated mortality. We strongly recommend establishment of

trauma centers manned by surgeons competent in dealing with the vascular injuries. Prevention of these injuries is however more desirable through a strict gun control legislation, preemption of civilian violence and prevention of road traffic accidents.

We conclude that improved outcome requires a coordinated multidisciplinary approach, expeditious limb revascularization, fasciotomy as indicated, rapid fixation of osseous injuries and adequate soft tissue coverage of the underlying repair.¹¹

References

1. Bergqvist D, Helfer M, Jensen N, Tagil M: Trends in civilian vascular trauma during 30 years. A Swedish perspective. *Acta Chir Scand*. 1987 Jul-Aug 153(7-8):417-22. Mattox KL, Feliciano DV, Burch J, Beall AC Jr, Jordan GL, De Bakey ME.
2. Feliciano DV, Bitondo CG, Mattox KL: Civilian trauma in the 1980s: an experience with 456 vascular and cardiac injuries. *Ann Surg* 199; 717, 1984.
3. Mattox KL, Feliciano DV, Beall AC: Five thousand seven hundred sixty cardiovascular injuries in 4459 patients. Epidemiological evolution 1957-1958. *Ann Surg*: 1989 June; 209(6): 698-708. Discussion 706-707.
4. Magee TR, Collin J, Hands LJ, Gray DW, A ten year audit of surgery for vascular trauma in a British teaching Hospital. *Eur J Endovas Surg* 1996 Nov; 12(4): 424-27.
5. Shah PM, Ivatury RR, Babu SC, Nallathambi MN, Claus RH, Stahl WM. Is limb loss avoidable in circulation vascular injuries? *Am J Surg* 1987 Aug; 154(2):202-5.
6. Bynoe RP, Miles WS, Bell RM, Greenwold DR, Haynes JH, Rush DS Sessions G: Non-invasive diagnosis of vascular trauma by duplex ultrasonography. *J Vasc Surg* 1991 Sept; 14(3):346-52.
7. Damron T, McBeath A. Diagnosis and management of vascular injuries associated with skeletal trauma. *Ortho Rev* 1990 Dec; 19(12):1063-70.
8. Shah PM, Wapnir I, Babu S, Stahl WM, Claus RH: Compartment syndrome in combined arterial and venous injuries of the lower extremity. *Am J Surg* 1989; August; 158(2):136-40; Discussion 140-1.
9. Meyer J, Walsh J, Schuler J, Barret J, Durham J, Eldrup Jorgensen J, Schmarcz T, Flamigen DP. The early fate of venous repair after civilian vascular trauma. A clinical, haemodynamic and venographic assessment. *Ann Surg* 1987 Oct; 206(4):458-64. Five thousand seven hundred sixty cardiovascular injuries in 4459 patients. Epidemiologic evolution 1958-1957. *Ann Surg* 1989 June; 209(6):698-708. Discussion 706-7.
10. Burnett HF, Parnell CL, Williams GD: Peripheral arterial injuries: a reassessment. *Ann Surg* 183: 701, 1986.
11. Bergqvist D, Helfer M, Jensen N, Tagil M: Trends in civilian vascular trauma during 30 years. A Swedish perspective. *Acta Chir Scand*. 1987 Jul-Aug 153(7-8):417-22. Mattox KL, Feliciano DV, Burch J, Beall AC Jr, Jordan GL;