

## **Peripheral vascular trauma in karbala 6 years experience**

### **جروح الأوعية الدموية المحيطة في كربلاء**

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#### **Abstract**

**Introduction:** Traumatic Peripheral vascular injuries define as injuries to axillobrachial arteries and femoropopliteal arteries which represent 4-6% of major trauma. Although its uncommon, ischemia and hemorrhage can be limb threatening and life threatening. Early diagnosis and appropriate treatment is therefore crucial. Delay in management allows irreversible ischemic injury to take place and encourages propagation of intravascular thrombosis, which results in eventual loss of function or even limb itself. Management of vascular trauma often present a challenge due to lack necessarily setting in developing countries, adding to that additional burden from terrorist attack between time to time.

**Objective:** the aim of this study is to show the relationship between delay in surgical interference and outcome of surgery and to collect data about different aspect of epidemiology and management of peripheral vascular injuries.

**Period:** From 01 Jan 2008 to 31 Dec 2013.

#### **خلاصة البحث**

تمثل إصابات الشرايين المحيطة 4-6% من مجموع الإصابات الكبيرة وعلى الرغم من قلتها فان قصور الدورة الدموية والنزف الدموي الحاد يمكن أن يهدد الطرف المصاب وحتى حياة المريض.

إن التشخيص المبكر والعلاج الصحيح في غاية الاهمية. يمثل علاج إصابات الشرايين المحيطة تحدي وذلك لقلّة التجهيزات في الدول النامية يضاف إليها العمليات الارهابية بين وقت وآخر.

هدف البحث هو لتبيان العلاقة بين تأخر التداخل الجراحي للإصابة والنتائج المتأخرة من التداخل.

تشمل هذه الدراسة إصابات الشرايين في الأطراف العليا والسفلى فقط في كربلاء للفترة من كانون الثاني 2008 إلى كانون الأول 2013. كانت معظم الإصابات في الذكور وخصوصا في الشباب (21-40 سنة) وكان المسبب الرئيسي هو الطلاقات النارية يليها حوادث الطرق. كان وصول المصابين في معظم الحالات في الساعات الستة الأولى بعد الاصابة ومجموع الإصابات في المناطق الريفية أكثر من المناطق الحضرية. وقد استنتج من البحث وجوب التداخل الجراحي وبأسرع وقت ممكن وفي حالات التأخر قد تنتهي الإصابة ببتتر الطرف المصاب.

#### **Material & Methods:**

In this study only those patients who subjected to vascular trauma to upper and lower extremities involved whether by direct trauma (penetrating & blunt) or indirect (associated with fracture & dislocation ). Total of 98 cases of all age and sex groups was included in the study. Data was prospectively entered in to a database for retrospective analysis. History was taking either from patients themselves or from their relatives or witnesses, physical examination was performed and all available investigations whenever time permit was done and patients were treated accordingly.

#### **Results:**

traumatic peripheral vascular injuries were more common in males (80.63%) and more among young peoples 21-40 years old (67.34%). The commonest cause is firearm injuries (58.16%), other being RTA (26.53%) an blunt trauma in (9.18%). Time of reaching the hospital in most patient within 6 hours (59.18%) and rural area victims represent( 58%). Femoral artery injury represent 41.83% while brachial artery involved in 23.46%. Laceration of vessels wall were found in 55.10%

while part of artery losing in 18.36%. End-to-end anastomosis was most common type of repair (63.26%) ,others being interposition reverse vein graft (20.40%) and direct suturing of vessel wall (16.32%) . Amputation rate was highest in cases where revascularization occurred after 12 hour, 6 out of 8 patients (75%). Common complications after repair were wound infection (15.30%) and residual edema (6.12%). Overall mortality rate was 6.12 % and morbidity rate was 38.77%.

### **Conclusion:**

All cases of peripheral vascular injuries should be surgically explored. Revascularization should be achieved within 12 hours. Patients presenting late or with crush injuries may need amputation.

### **INTRODUCTION**

Peripheral vascular injuries constitute 2-3% in civilian trauma and 7% of combat related trauma<sup>(1)</sup>. Early diagnosis and appropriate treatment are essential in the management of peripheral vascular injuries, otherwise hemorrhage and ischemia can be limb threatening and life threatening. Irreversible damage including ischemic injury and intravascular thrombosis may take place if any delay happened which result in loss of function or even limb loss. In optimal situations, the patients must reach the hospital within 6 hours to obtain the promising results. Earliest reach, repair of associated injuries and availability of vascular or experienced surgeon all contribute successful outcome. Associated extensive soft tissue injury, bony injury or avulsed nerve may make the limb useless even in setting of a successful repair<sup>(2)</sup>.

Vascular trauma mechanism can be direct or indirect. Direct trauma includes penetrating or blunt injuries, while in indirect trauma fractures and dislocations are the commonest causes of vascular injuries. Penetrating and blunt injuries to arteries and veins are major cause of morbidity and mortality in trauma patients. Blunt trauma carry worse prognosis when compared with penetrating injuries<sup>(3)</sup>.

Vascular repair includes lateral repair, end to end anastomosis and interposition venous graft or prosthetic graft whenever its possible, and it depend on type of injury which are lateral wall injury, complete transection and segmental loss of vessels. Signs of ischemia should be known like parasthesia, pallor, poikilothermia, pain, paralysis and pulselessness to prevent limb loss<sup>(3)</sup>.

The liberal use of fasciotomy in the injured extremity is imperative in reducing post operative edema and compartment syndrome. Successful management of traumatic vascular injuries depend upon a high index of suspicion, aggressive resuscitation and prompt surgery<sup>(4)</sup>. In emergency practice no special investigations are necessary and a selective policy for use of angiography can be followed<sup>(5)</sup>. There are difficulties in obtaining emergency arteriogram in vascular trauma even in the best centers in the world<sup>(6)</sup>. A diminished or absent distal pulse, a history of persistent arterial bleeding, a large or expanding hematoma, major hemorrhage with hypotension, an injury to anatomically related nerves or a bruit, alone or in combination are useful in the diagnostic evaluation<sup>(7)</sup>. Urgent amputation of the limb is indicated when perfusion of limb cannot be resorted for sepsis and for a limb which is so severely injured that can be no prospect for return of any function<sup>(8)</sup>. Venous trauma has been neglected for long the reason being absence of significant short and long term problems and inaccurate analysis of the venous trauma<sup>(9)</sup>.

Some authors have achieved best results with simple ligation, other consider the issue controversial. The type, severity and location of the injury all are important. The role of interposition vein graft or synthetic graft in venous injury is not well established. The rate of post operative edema following ligation of vein is variable. Hardin did not observe long term squeal in these cases<sup>(10)</sup>, while Sullivan had many patients with long term venous insufficiency<sup>(11)</sup>. The role of heparin or dextran in increasing the patency of venous repair is still not well defined<sup>(12)</sup>.

## **MATERIAL AND METHODS**

Patient with trauma to the extremity whether direct or indirect admitted in Al Hussein medical city in Karbala, were studied for vascular injuries. All the patients of vascular injuries of any age and sex group were included in the present study. A total of 98 patients were studied. Relevant history was obtained from the patient themselves and also from their relatives or witnesses. In case of penetrating trauma victims were enquired about the size of stabbing weapon or caliber of the gun and distance from which the firearm was discharged. In case of road traffic accident and blunt trauma, history was taken regarding the time, mode of injury and position of the patient. Presenting complaints of the patients especially of severe hemorrhage, pain, parasthesia, and paralysis were recorded. Physical examination was done by recording of vital sign like pulse, blood pressure, temperature and respiratory rate was strictly maintained. Careful examination of the injured extremity was done and special attention was given to establish the diagnosis. Diminished or absent pulse. Major hemorrhage with hypo-tension. Large or expanding haematoma. Bruit at or distal to injury. Anatomically related neurological defect. Proximity of injury to major vessel. We diagnosed vascular injuries on clinical ground and to some extent with Doppler Ultrasonography in doubtful cases. Associated fractures were diagnosed clinically and confirmed radiologically. haemoglobin estimation was done in every case. In all patients with suspected vascular injury, exploration was done. Method adopted for repair were according the type of vascular injury and includes end-to-end anastomosis, direct suturing of vessel wall and interposition reverse vein graft where segment loss was more than 6-8 cm. Graft was taken from the great saphenous vein of contra lateral side. Fasciotomies were performed in those cases which were operated after 12 hours or had gross edema of limb. The main nerves were repaired primarily in clean cases and repair was deferred for 6-8 weeks in contaminated cases.

## **RESULTS**

Patients with trauma to the extremity whether blunt, stab or gunshot admitted in Al Hussein medical city from January 2008 to December 2013, were evaluated for the peripheral vascular injuries. The results were recorded in the form of tables. A total of 98 cases of peripheral vascular injuries were included. Although no age was found to be safe yet the peak incidence was noted between 21-40 years of age (67.34%) (table1).

Age (year)	No. of Pts	%
0-10	05	5.10%
11-20	11	11.22%
21-30	41	41.83%
31-40	25	25.51%
41-50	09	9.18%
>50	07	7.41%
Total	98	100%

Table 1 Age Distribution

Out of 98 patient of peripheral vascular injuries, 80 (81.63%) were males and 18 (18.36%) were females with sex ratio of 4.5:1 (table2).

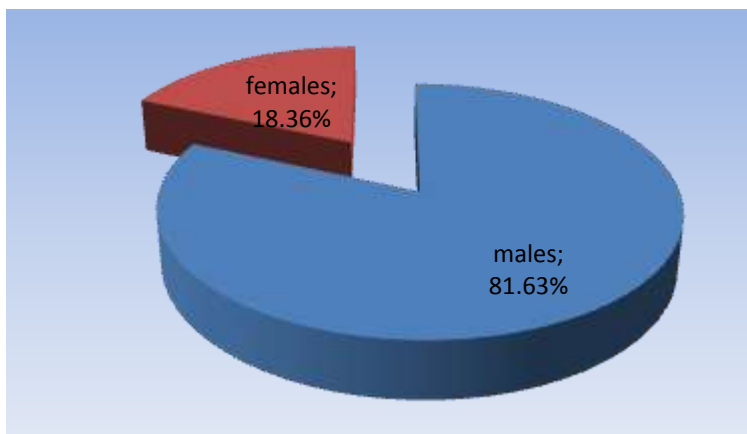


Table 2 Sex distribution

Etiological factors were firearm injuries in 57 (58.17%), road traffic accident seen in 26 (26.53%), blunt trauma seen in 9 (9.18%) and injury due to sharp instruments seen in 6(6.12%) as shown in table 3.

Mechanism of injury	No of pts	%
Firearm injuries	57	58.17%
Road Traffic accident	26	26.53%
Blunt trauma	09	9.18%
Injury due to sharp objects	06	6.12%
Total	98	100%

Table 3 Etiology

The time interval between injury and hospital arrival were as follow , 90 (91.84%) patients reached hospital within 12 hours and 8 (8.16%) patients reached after 12 hours. fifty four patients (55.10%) were evacuated from rural area and 44 (44.89%) were from urban area.

Frequency of vessels involved in the upper limb was brachial artery in 23(23.46%) and axillary artery in 15 (15.30%) patients. In the lower limb femoral artery was involved in 41 (41.83%) and popliteal artery in 19 (19.38%) patients as shown in table 4.

Vessel Involved	No of pts	%
Upper Limb	38	38.78%
Axillary artery	15	15.31%
Brachial artery	23	23.47%
Lower Limb	60	61.22%
Femoral artery	41	41.84%
Popliteal artery	19	19.38%
Total	98	100%

Table 4 Frequency of involvement of vessels

Most common pattern of vascular injury which we encountered was laceration of the vessel wall with or without thrombus formation in 54 patients (55.10%). Loss of vessel wall segment was found in 18 patients (18.36%), complete transection of vessel wall in 13 (13.26%) patients and compression of vessel in situ in 9 (9.18%) patients. Partial cut of the vessel wall was found in 4 (4.08%) patients (table 5).

Pattern of injury	No of pts	%
Laceration of vessel wall with or without thrombus	54	55.10%
Loss of vessel wall segment	18	18.36%
Complete transection of vessel wall	13	13.26%
Compression of vessel in situ	09	9.18%
Partial cut of vessel wall	04	4.08%
Total	98	100%

Table 5 pattern of vascular injury

Method used for vascular repair were end-to-end anastomosis in 62 (63.26%) patients, interposition reverse vein graft in 20 (20.40%) patients and direct suturing of vessel wall in 16(16.32%) patients (table 6).

Method of repair	No of pts	%
End to end anastomosis	62	63.26%
Interposition reverse vein graft	20	20.40%
Direct suturing of vessel wall	16	16.32%
Total	98	100%

Table 6 methods of repair

fractures of long bones were found in 16 (16.32%) patients, these fractures were fixed prior to vascular repair. Radial nerve injury was found in 4 (4.08%) patients and median nerve injury in 4 (4.08%) patients. All of these injuries were repaired after 8 weeks. Associated venous trauma included popliteal vein injury in 14 (14.28%) patients and femoral vein injury in 9 (9.18%) patient. These veins were ligated.

Wound infection was most common postoperative complications which was found in 15 patients (15.30%) and they are treated by appropriate antibiotic, the second most common postoperative complication was residual edema encountered in 12 patients (12.24%) and also treated conservatively by elevation of limb and compression bandage, it was due to combined effect of trauma and surgery, more ever in most of our cases we ligated the nearby injured vein. Primary hemorrhage occurred in 4 (4.08%) patients, while acute renal failure developed in 4 (4.08%) patients, both these complications were managed accordingly. three patients (3.06%) had thrombosis which ultimately resulted in amputation (table 7).

Complications	No of pts	%
Wound infection	15	15.30%
Residual edema	12	12.24%
Hemorrhage	04	4.08%
Acute renal failure	04	4.08%
Thrombosis	03	3.06%
Total	38	38.77%

Table 7 Post operative complication

Time interval between injury and revascularization was variable ,In most of the patients 90(91.84%) revascularization was restored within 6-12 hours and out of them 24 (24.48%) patients required amputation. 8 patients (8.16%) arrived after 12 hours and 6 (75%) of them required amputation as shown in table 8.

Repair time	no.of pts	amputation	%
0-6 hours	58(59.18%)	6/58	(6.12%)
6-12 hours	32(32.65%)	18/32	(18.36%)
>12hours	8(8.16%)	6/8	(6.12%)
Total	98	30/98	(30.61%)

Table 8 repair time

## **DISCUSSION**

Vascular injuries are major cause of morbidity and mortality in trauma patients and have the highest resuscitation priority after the airway and breathing have been protected. The most important and critical prognostic factor is time of presentation since injury. Our main aim of this study was to see epidemiology and management of peripheral vascular injuries, secondly to study the relationship between latent period for revascularization and outcome of surgery. The age group most prone to get peripheral vascular injury observed in our study was between 21-40 (67.34%). Similar finding have been reported by Hood and associates in their study age group was 25-40 years (65%)<sup>(13)</sup>. Knudson and associates found in 42 cases that most commonly affected group was between 20-40 years age (60%)<sup>(14)</sup>. Large number of cases in this age group can be explained by the fact that persons in this age group are at their peak of their activity and are subjected to the hazards of accidents and injuries. In our study we observed that males are more subjected to peripheral vascular injury. Out of 98 cases 80 (81.63%) were male and 18 (18.36%) patients were female because males more vulnerable to trauma than females. The firearm injury is the most frequent aetiology of peripheral vascular injury in our study represent (58.16%) . Fryberg ER. et al studied 65 victims of vascular injury caused by firearm in a one year period representing 58% of vascular trauma<sup>(15)</sup>. In our study most of patients reached hospital between 1-12 hours 90 (91.83%) patients. In recent study carried out at Nishter Hospital Multan in which 52 patients of peripheral vascular trauma similar results were observed. 18 (34%) patients were operated within 8 hours of injury and in 34 (65%) patients revascularization occurred after 8 hours<sup>(16)</sup>. Brachial artery was most commonly affected in upper limb (23.46%) and femoral artery in lower extremity (41.83%). These observations are similar to the study of Nassoura et al, who described a study of 101 patients in whom femoral artery injury 40% was most common<sup>(17)</sup>.

Common pattern of vascular injury that were found in our study were laceration of vessel wall with or without thrombus formation in 54(55.10%) patients, loss of vessel wall segment in 18 (18.36% ) patients, Savage and Walker observed in their study of vascular trauma, a rise of 40 (60%) patients had laceration of vessel wall and 10 (15%) patients were having loss of vessel wall segment<sup>(18)</sup>. Method of vascular repair adopted were end to- end anastomosis in 62 (63.26%) patients, interposition reverse vein graft in 20 (20.40%) cases and direct suturing of vessel in 16 (16.32%) cases. Hughes reported in his study on the primary repair of wound of major arteries that end-to-end anastomosis was most common method<sup>(19)</sup>. Vanway described that interposition reverse vein graft is usually needed in cases where vascular injury is associated with blunt trauma<sup>(20)</sup>. In our study most common associated injury was fracture long bones in 16(16.32%) cases. Rich in Vietnam reported thousand cases out of 310, (31%) had associated fracture of long bones<sup>(21)</sup>. Other associated injury was popliteal vein injury in 14 (14.28%) cases. Drost et al concluded in his study that popliteal vein injury was common in lower extremity vascular trauma<sup>(22)</sup>. Wound infection was most commonly encountered post operative complication in 15 patients (15.30%) which was treated conservatively by appropriate antibiotics. Residual edema were the next common complications

occurring in 12 patients. It was due to combined effect of trauma and surgery, moreover in most of our cases we ligated veins.. Thrombosis was found in only in 3 (3.06%) patient. Smith and associates reported that thrombosis is more common after vascular repair <sup>(23)</sup>, but in our study only 3 patients developed thrombosis. Rate of amputation was 75% when revascularization established after 12 hours but it dropped to 6.12%, when arterial repair was accomplished within 6 hours and elevate to 20.40% if repair done between 6-12 hours. Fryberg and associates noted that gangrene was rare if repair done within 6 hours but occurred in 50% cases if repair was delayed for 12 hours<sup>(15)</sup>. Where as in study of Nishter Hospital in 52 patients were studied showed that 61.56%cases reached the hospital after 8 hour and in these amputation rate was 38.46%. The rate of amputation was 5% when repair was accomplished within 8 hours <sup>(16)</sup>.

## **CONCLUSION**

The time interval between incidence of injury and revascularization was directly proportional to the rate of amputation. All cases of peripheral vascular injuries should be surgically explored. Every effort should be made to achieve revascularization within 12 hours.

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