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PROSPECTIVE DESCRIPTIVE RESEARCH ON PRESENTATION AND DIAGNOSTIC OF VASCULAR REPAIR METHODS AND ASSOCIATED OUTCOMES IN THE EVENT OF CURRENT SECURITY SCENARIO AND HIGH SPEED ACCIDENTS SPECIALLY IN YOUNG CIVILIAN POPULATION AND MILITARY PERSONNEL

Bakht Ullah, Attia Khan, Rohullah
Al Tibri Medical College, Isra University.

Abstract

Objective: *Assessment of the diagnostic evaluation and presentation of numerous vascular repair methods with associated outcomes.*

Methods: *Research was descriptive prospective in nature and it was carried out in CMH, Rawalpindi. Research was completed in the time span of two years starting from Oct, 2008 to Dec, 2010. Vascular injured patients (54 cases) were made a part of the research in the condition of extremity after experiencing vascular surgical interventions. Patients with an irreversible ischemia or with primary amputation including escaped vascular injuries were not included in the research. Injury mechanism was evaluated in the research including type of injury, site of injury, injury mechanism, related injuries, outcomes and repair type. Data was also evaluated for the values of frequency, percentage, mean and SD.*

Results: *In the total research sample mean age was observed as (26.8 ± 9.2 years), the age was calculated in the age group of 9 – 67 years. The ratio of male to female was as seventeen to one. Most repeated cause was penetrating trauma as 34 cases (62.9%) were noticed. Mostly affected area was the lower extremes 33 (61.1%) and most repeated vessel involvement was observed in 14 (25.9%) cases. Besides, 16 patients (29.6%) were having related fractures, while 12 cases were of concomitant venous injuries (22.2%). Common most type of repair was interposition autogenous saphenous vein graft was 42 (77.7%). Three cases were treated with Prosthetic graft (5.5%) patients. Common complication observed was the infection of wound observed in 6 cases (11.1%). Secondary amputation was observed in 3 cases (5.5%) and associated injuries deaths were observed in 2 cases (3.7%). Successful vascular reconstruction was carried out in 49 cases (90.7%).*

Conclusion: *An in-time re-vascularization and recognition by an expert vascular surgeon is key to treat ninety percent of the limbs facing vascular injuries.*

Keywords: *Extremity Vascular Injury, Amputation and Re-vascularization.*

Corresponding author:
Bakht Ullah,
Al Tibri Medical College,
Isra University.

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INTRODUCTION:

Limb loss can be the result of vascular injuries, which causes a life-long disability and may also end in death in the young males. An incomplete evaluation and delayed diagnosis is the reason behind these severe outcomes [1]. Recently, because of terrorist activities vascular injuries have been increased in our country [2]. Another reason is the accident with high speed motors [3]. Mostly in the light of our information military conflicts are the base of gaining the experience of vascular injuries. As in WW – II, the management of vascular injuries was carried out through injury of the vessels and fifty percent of the cases were resulted in the shape of imputation [4]. Peripheral vascular injuries formal repair process was evinced in Korean War and arterial repair refinement was observed in the war of Vietnam. Fifteen percent of the injuries were reduced because of amputation rate [5, 6] Improvement in the methods of vascular surgeries and material of suture, an early patient evacuation to tertiary healthcare facility and level of awareness in general healthcare practitioners may also be helpful in the reduced rate of vascular injuries [7]. A Higher suspicion index, detailed index such as injury mechanism and clinical evaluation through hand-held Doppler pulse oximetry with timely diagnosis can save ninety percent of the limb loss [8]. Our research objective was the outcome determination through various methods of vascular maintenance and repair with limb salvage rate and associated complications.

PATIENTS AND METHODS:

Research was descriptive prospective in nature and it was carried out in CMH, Rawalpindi. Research was completed in the time span of two years starting from Oct, 2008 to Dec, 2010. Ethical approval was secured before the research activity. We included all the cases of vascular trauma with lower or upper extremity and they were directly observed by the peripheral hospitals or they were evacuated from an operational field. All the cases facing vascular stained injuries of neck, abdomen and thorax were made a part of the research; whereas missed vascular injuries cases such as pseudoaneurysm and were not included in the research. In our research sixty-four extremity vascular trauma cases were observed in the research period. Among these cases 10 cases (15.6%) were already irreversible ischemic development considered comparable to Rutherford Grade – III (RG – III). Acute limb ischemia was classified by Rutherford in 3 grades. Grade – I, II and III respectively not immediately threatening (viable limb); needs immediate intervention (viable at the same time threating) and non-viable limb cases because of the irreversible ischemia [9]. Prescription of primary amputation was given to the patients facing these issues and they were also excluded from our research, duty surgeon assessed these cases through on call trauma surgeon in trauma center. In the guidelines of Advanced Trauma Life Support protocols, the resuscitation of the patients was carried out. We also secured the patient's consent and gathered information about gender, age, injury time, injury mechanism (iatrogenic, blunt or penetrating), hospital arrival time, related injuries and injury site. On the basis of clinical evaluation and history the diagnostic process was carried out on soft and hard symptoms of vascular injuries, ankle-brachial index (ABI) measurement and affected limb's pulse oximetry. Five cases (9.2%) were subjected to Doppler research having equivocal clinical outcomes. To avoid any delay pre-operative arteriogram was not carried out in the diagnosis process. Blood CP, cross-match, grouping, sugar level, creatine, serum urea and X-ray was completed of the damaged area. In operation theatre 41 cases (75.9%) operated through general anesthesia; whereas, management of 13 cases (24.0%) was carried out under the spinal / epidural regional block. Broad spectrum antibiotics (injection amikacin 500mg & injection cefuroxime 1.5g) was given before surgery and the same was continued for four to five days after surgical act. Both of the lower-limbs for injury of lower extremity and complete upper injured limb including one lower-limb was draped and prepared. Other linked fractures were also treated through orthopedic surgeon before the repair of vascular. Temporary passing of shunt was made in 3 cases (5.5%) which were treated through popliteal artery before fracture fixation. The exploration of all injuries was made through longitudinal incision through proximal and distal incision to the site of injury. Correlated injuries such as nerves, muscles, tendons, veins, type and extent in the case of arterial injury was evaluated. Debridement of nearby affected vessels and soft tissue was carried out and tagging of affected nerves was carried out by 2-o proline. Before arterial injury repair both distal and proximal vessels were cleaned for residual thrombus through Fogarty catheter and flushing through heparinized saline was carried out at the rate of 10 units/ml. Repair of every damaged arterial injury was carried out through 6 / 0 proline. Repair type was depended on the type and extent of the injury. Common most repair was reverse autogenous saphenous vein graft, in post-operative cases repair patency assessment was made through palpation of capillary refill, distal pulses and hand-held Doppler. Repaired vessels were protected with soft tissue / muscles and washing of wounds was carried out through normal saline. Replacement of suction drain was carried out for 24 – 48 hours. Twenty-three cases were treated with prophylactic

fasciotomies, in these cases the time of ischemia exceeded above eight hours, had both venous and arterial and extensive musculoskeletal injury. Close monitoring of all the patients after operation was carried out for distal limb circulation state such as presence of capillary refill, temperature, distal pulses, secondary hemorrhage signs, compartment syndrome and reperfusion injury. After fasciotomy wounds closure and satisfactory healing, the patients were discharged. Follow-up was advised at discharge in the period of two-weeks. Limb vascularity assessment was made through Doppler and clinical examination. Any presence of wound complication and neurological deficits were documented and follow-up was advised after one month and after first follow-up after every three months.

RESULTS:

In the total research sample mean age was observed as (26.8 ± 9.2 years), the age was calculated in the age group of 9 – 67 years. The ratio of male to female was as seventeen to one. The range of the stay at hospital was 5 – 29 days. Common most injury was penetrating trauma and then blunt trauma respectively observed in 34 cases (62.9%) and 18 cases (33.3%) remaining cases were of iatrogenic injury. Hospital evacuation and injury gap was in the range of 2 – 21 days, in most of the cases the time of hospital reporting was observed as six and twelve hours. Common involvement was observed in the lower limb cases as we observed 33 cases (61.1%) and most frequent involvement was of superficial femoral in 14 cases (25.9%) as shown in Table-I. Besides, 16 cases (29.6%) were observed with related fractures and nerve injuries were observed in 9 cases (16.6%).

Table – I: Vascular Injury Site

Anatomical site of injured vessel	No	Percentage
Superficial femoral artery	14	25.9
Popliteal artery	11	20.3
Common femoral artery	3	5.5
Anterior tibial artery	3	5.5
Posterior tibial artery	2	3.7
Brachial artery	10	18.5
Axillary artery	5	9.3
Subclavian artery	3	5.5
Radial artery	2	3.7
Ulnar artery	1	1.8

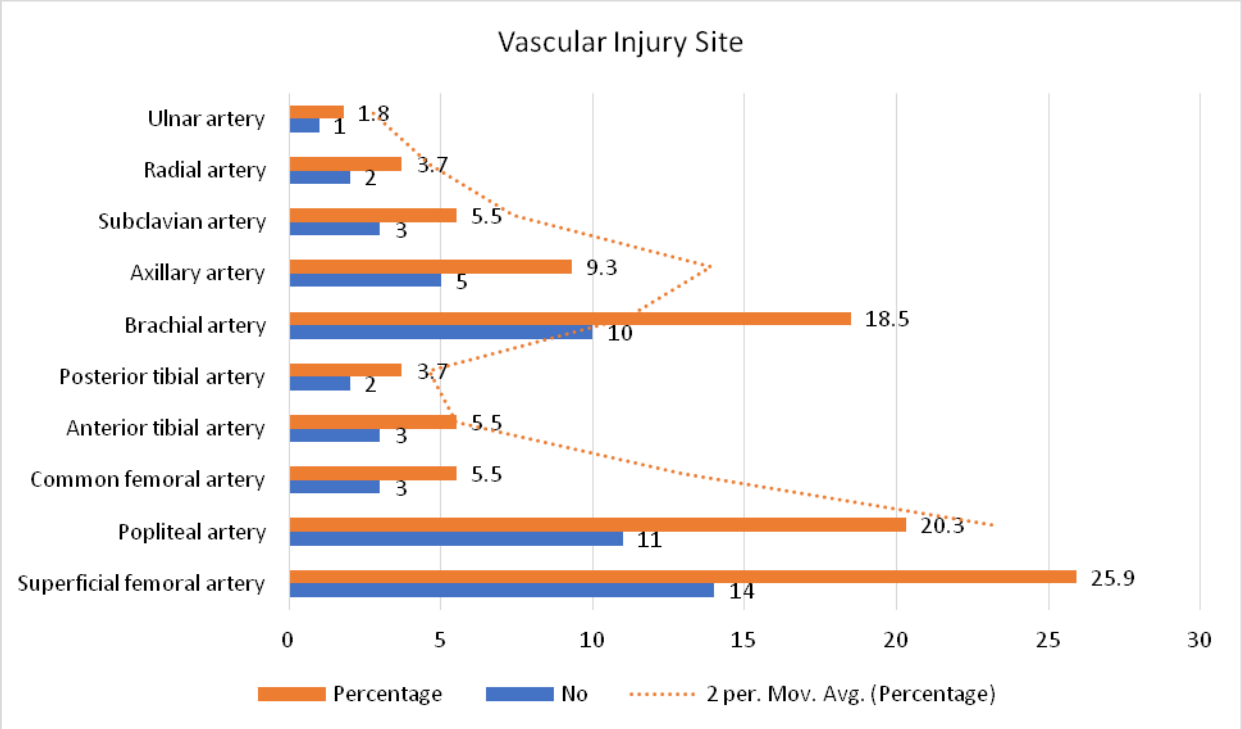


Table – II: Vascular Injuries Type

Type of injury	No	Percentage
Complete transection	19	35.1
Transection and thrombosis	14	25.9
Contusion and thrombosis	11	20.3
Laceration	8	14.8
Dissection	2	3.7

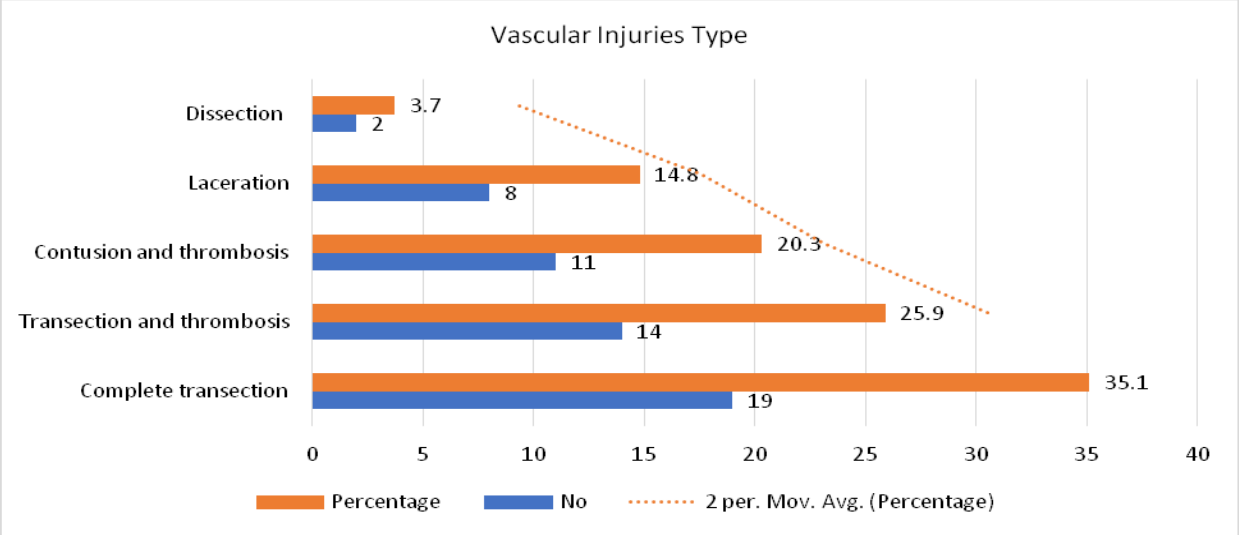
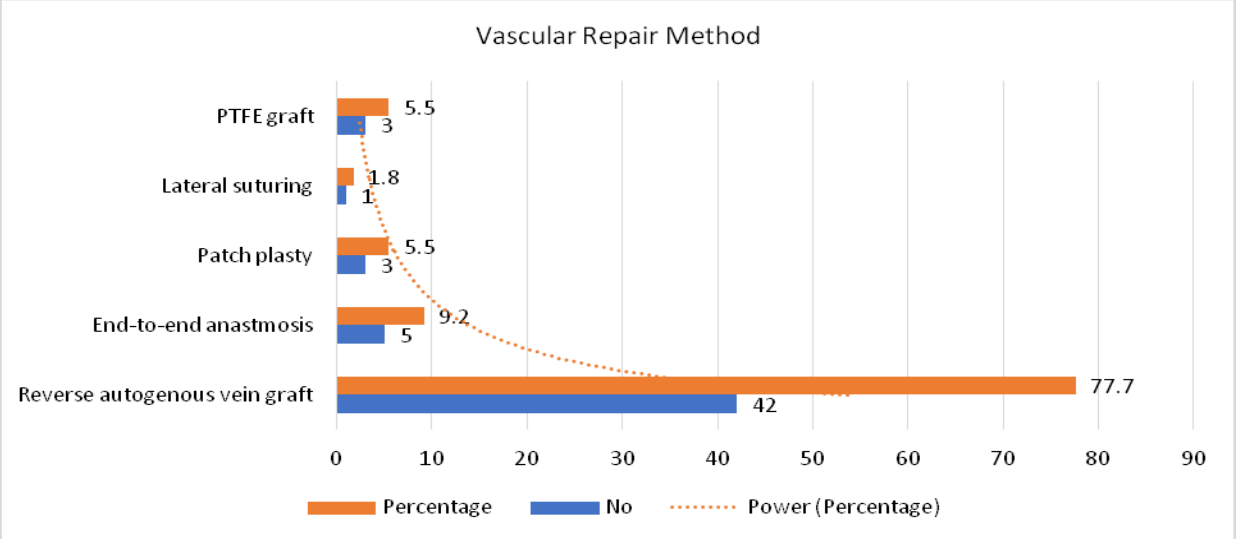


Table – III: Vascular Repair Methods

Type of repair	No	Percentage
Reverse autogenous vein graft	42	77.7
End-to-end anastomosis	5	9.2
Patch plasty	3	5.5
Lateral suturing	1	1.8
PTFE graft	3	5.5



Twelve cases were of concomitant venous injury (22.2%). Common type of vascular injury was complete transection in 19 cases (35.1%) as shown in Table-II. Common most repair was inter-position reverse autogenous saphenous vein graft applied in 42 cases (77.7%) as shown in Table-III. Twenty-three cases were performed with fasciotomies (42.5%). Most common complication was the infection of the

wound observed in six cases as (11.1%), their management was carried out through debridement, secondary suturing and dressing. Development of distal swelling was observed in 5 cases (9.2%) with related venous injuries. Management of these patients was carried out in comparison and elevation of anticoagulant therapy and stocking. Secondary hemorrhage was developed in 3 cases (5.5%) because of the anastomotic blow-out. Extra anatomical autogenous vein graft management was extended to 1 cases (1.8%); whereas, one more case presented 2 vessels ligated as a measure of safety of life and both the cases ended with amputations of below-knee. Three cases were observed with graft thrombosis (5.5%) and they experienced re-exploration. Re-vascularization and Embolectomy was carried out in 2 cases (3.7%); whereas, 1 case (1.8%) presented ligation with popliteal artery injury and finally experienced an amputation. Because of related head and abdominal injuries 2 cases (3.7%) died.

DISCUSSION:

Vascular injuries are the outcomes of ongoing war against terrorism in the country. Increased use of self-protective devices such as body armor, helmets and bullet-proof jackets has been helpful in the reduction of these injuries as they decrease the exposure of limbs but still most of the body are exposed. Mostly patients were affected through blast penetration as reported worldwide [7 – 12]. An incidence of these injuries is reported vastly in the war affected areas and in conflict zones such as a result of an air strike and shelling. Vascular injuries reporting is as that in Iraq operation on an Air Base the major reported cases of vascular injuries were 192 [11]. In the course of Soviet-Afghan war the reported cases of vascular extremity injury were 224 [13]. Hard signs of vascular injuries include increasing hematoma or pulsatile bleeding, thrill presence or distal and bruit ischemia) indicate immediate exploration without any diagnosis. We observed that 49 cases (90.7%) observed on the clinical assessment grounds. Physical examination accuracy is focused in the available literature [14]. According the review presented by Spencer about the 269 arterial injuries, absent pulses combination, pulsatile bleeding and distal ischemia signs accurately indicate an arterial injury in the patients [15]. Pulse oximetry is considered as a cost-effective, safe and non-invasive diagnostic solution for the vascular injury assessment. All patients were dealt with pulse oximeter for the limb oxygen saturation measurement. We observed above 92% saturation of oxygen in affected extremity after excluded major vascular injury resuscitation [16]. According to Meissner, physical examination combination, measurement of Doppler arterial pressure and Duplex USG was optimum method of screening of the potent vascular injuries in the patients [17]. For stable cases having equivocal clinical outcomes, calculated tomography angiography is one of the alternative which is effective and also alternate of the conventional arteriography for the vascular trauma assessment [18]. Interval between injury onset and repair is significantly affects the outcomes in the patients in terms of complication avoidance and salvage of limb [19]. Inadequate assessment and late referral in peripheral hospital causes an irreversible ischemic amputation and changes. Vascular injury repair method depends upon injury mechanism, extent and type of the vascular injury. In complex injured cases a temporary intraluminal arterial shunt is prescribed, which requires fixation of the fracture and an extensive debridement of wound. Time of ischemia may also be reduced, hospitalization and amputation [20, 21]. For the repair of extremity vessel common most conduit is reverse autogenous vein graft applied commonly in other series [7, 22]. In the non-availability of an autogenous vein graft we can use Polytetrafluoroethylene (PTFE) graft but at the same time it is to be kept in mind that its patency is poor [23]. Lateral structure repair and patch angioplasty is possible in the case of vessel clean laceration. At first an end-to-end anastomosis is required in case if the distal and proximal gap is below two centimeters after vessel wall debridement. Venous injury management is controversial. Expert vascular surgeon is required for the management of these injuries for all the cases; it improves arterial repair outcomes and minimizes complication of long-term [24]. Veins ligation is advised for the non-stable cases and in the case of an extensive venous injury requiring long interposition vein graft. Venous repairs in large amount will thrombose in the course of post-operative condition, especially in the use of an interposition vein graft [25]. A useful repair adjunct id an adequate fasciotomy for extremity vascular injuries repair and management, especially in the cases of prolonged time of ischemia and prevention of the associated injuries [26]. Most repeated infection and complication was the infection of wounds. Wound infection incidence was reduced through soft tissue aggressive debridement and reduction of vessel wall, amputation rate and secondary hemorrhage. We observed an amputation rate of 5.5% because we excluded the patients of through debridement, already developed ischemic changes and careful repair of the arteries

CONCLUSION:

Vascular trauma incidence, especially extremity vascular injuries are at increase because of the

security situation, high speed accidents and activities of the non-state actors. Gunshots and blasts are the reasons of penetrating trauma in majority of the cases. Civilians and military personnel both are at risk of these injuries. An early re-vascularization and recognition by vascular surgeon can be helpful to save up to ninety percent limb loss and provide better functional results.

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