ORIGINAL ARTICLE

Determine the Etiology, Pattern and Treatment Outcomes of Vascular Trauma Patients

SANA SHARAFAT ALI[1], SYED TANSEER ASGHAR[2], MASOOD AHMED[3], *FAHAD HAFEEZ KHAN[4], ZARDAD KHAN[5], TALAL ALMAS[6]*

[1]Senior Registrar Department of Surgery, PIMS Islamabad
[2]Surgeon (General Surgery) Capital Hospital CDA Islamabad
[3]Department of Surgery, KhawjaSafdar Medical College, Sialkot
[4]Medical Officer DHQ Hospital TimergaraDir (L)
[5]Assistant Professor Surgery, Divisional Headquarters Hospital, Mirpur AK
[6]Royal College of Surgeons, Ireland
Correspondence to: Dr Sana Sharafat Ali, Email:sana_sharafat@yahoo.com

ABSTRACT

Aim: To examine the causes and pattern of vascular injuries also determine the treatment outcomes in patients with vascular trauma.
Study Design: Descriptive study.
Place and duration: PIMS Hospital Islamabad from 1st September 2018 to 30th September 2019.
Methods: Total 110 patients of both genders with ages 18 to 50 years presented with vascular injuries were enrolled in this study. Detailed demographic including age, sex, residence, causes and pattern of injuries were recorded after taking written consent from patients/attendants. Treatment methods for reconstruction were recorded. Outcomes such as complete recovery, complications rate and mortality were examined and recorded.
Results: There were 82 (74.55%) malesand 28 (25.45%) female patients with mean age 27.64±8.36 years. Majority of patients 70 (63.64%) patients had urban residency. 82 (74.55%) patients presents within 6 hours while remaining 28 (55.45%) above 6 hours and considered as delay. Most common etiology was penetrating injuries in 80 (72.73%)patients. Upper extremity vascular injury was found in 77 (70%) patients. Most common injured vesselswerefemoral artery in 35 (31.82%) patients followed by brachial artery, popliteal and subclavian artery.Interposition vein grafting was the most common method of reconstruction in 50 (45.45%) patients followed by artery ligation in 26 (23.64%). 15 (16.36%) patients received primary/delayed amputation. 90 (81.82%) patients had successful vascular repair, complications found in 9 (7.27%) and 11 (10%) patients were died in which 4 at initial management and 7 during treatment.
Conclusion: Incidence of vascular injuries in our setting is quite high. Penetrating injuries were most common etiology and vein grafting was the most common method for repair.
Keywords: Vascular Trauma, Penetrating, Blunt Injury, Limb Extremity, Vein Grafting, Primary Amputation

INTRODUCTION

Traumatic vascular injury may affect the arteries and veins of thelimbs, and is common in wartime, triggering bleeding, and ischemia. If it is not treated properly, the wounded are likely to be disabled and even death. Extremity vascular trauma poses several difficult dilemmas indiagnosisandtreatment. The increasing use of high-energy weapons in modern warfare is associated with severe vascular injuries. In the Iraq War (at the beginning of the 21st century), the proportion of trauma victims attained 50% to 70%[1,2,3]. Vascular firearm injuries are associated with hemorrhage and ischemic issues. In the Second World War, patients treated via vascular ligation suffered amputation rates as high as 48.9%[4].

The surgical management of extremity vascular injuries has evolved over time. In the civilian population, blunt trauma in road side accidents is more prevalent when compared with penetrating trauma, which is mostly related to warfare injuries.[5,6] However, recently, due to an increase in the urban violence, the patterns of vascular injuries are changing[7,8]. To date, there are no well-defined guidelines for the management of extremity vascular trauma and optimal strategies are variable depending upon the local setup and expertise available[9,10]. The present study was conducted aimed to examine the epidemiology and pattern of vascular injuries and management outcomes in patients presented with vascular trauma.

MATERIALS AND METHODS

This descriptive/observational study was conducted at PIMS Hospital Islamabad from 1st September 2018 to 30th September 2019. Total 110 patients of both genders with ages 18 to 50 years presented with vascular injuries were enrolled in this study. Detailed demographic including age, sex, causes of injury, injure vessels, and time since injury were recorded. Patients excluded who were died during time since injury to presentation.Patients were initially resuscitated in emergency reception and patients having hard signs on clinical examination like pain, pallor, pulselessness, paresthesia, pulsatile bleeding and large or expanding hematoma were transferred directly to emergency theater and explored while patients having soft signs like relatively diminished but palpable pulse, non expanding hematoma were subjected to vascular Doppler before exploration. All patients received third generation cephalosporin at induction of anesthesia. All fractures were fixed before vascular repair by orthopedics department. The injured vessel was exposed after proximal and distal control of bleeding. Extent of injury was accessed. Patients with >2.5cm segmental loss were revascularized by

reverse saphenous vein graft. Thorough debridement of wound was done. Different surgical procedures like direct end to end anastomosis, saphenous vein graft interposition and lateral repair were performed for revascularization. Postoperatively patients were analyzed thoroughly for prevention of any severe morbidity. Treatment outcomes such as complete recovery/ discharge, amputation, complications and mortality were examined.All the data was analyzed by SPSS 24. Chi-square test was applied to examine the mortality rate between early and delayed presented patients. P<0.05 was taken as mortality.

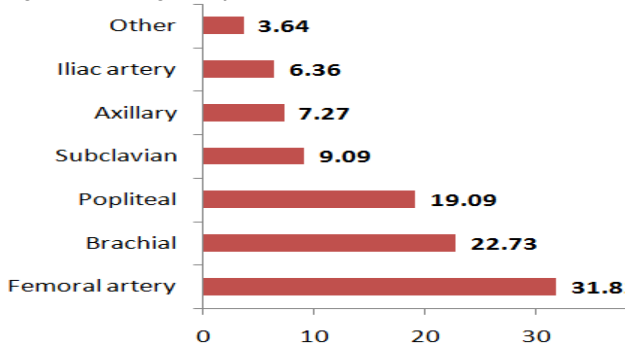
RESULTS

There were 82 (74.55%) males while 28 (25.45%) females with mean age 27.64±8.36 years. Majority of patients 70 (63.64%) patients had urban residency while 40 (36.36%) patients had rural residence. Median delay was 6.5 hours after injury. Most common etiology was penetrating injuries in 80 (72.73%) patients followed by blunt in 30 (27.27%). Upper extremity vascular injury was found in 77 (70%) patients while 33 (30%) patients had lower extremity vascular trauma (Table 1)

Table 1: Demographics of all the patients

Variable	No.	%
Age (years)	27.64±8.36	
Gender		
Male	82	74.55
Female	28	25.45
Residence		
Urban	70	63.64
Rural	40	36.36
Etiology		
Blunt	30	27.27
Penetrating	80	72.73
Vascular extremity		
Upper Limb	77	70
Lower Limb	33	30
Median delay	6.5 Hrs	

Fig. 1: Percentage of injured vessels



According to the distribution of injured vessels, most common injured vessels were femoral artery in 35 (31.82%) patients followed by brachial artery, popliteal, subclavian, axillary, iliac artery and others in 25 (22.73%), 21 (19.09%), 10 (9.09%), 8 (7.27%), 7 (6.36%) and 4 (3.64%) patients respectively (Fig. 1). According to the treatment procedures, 50 (45.45%) patients received interposition vein grafting, artery ligation in 26 (23.64%), 15 (16.36%) were amputated, 9 (8.18%0 patients received conservative management, 6 (5.45%) received end to end anastomosis and 4 (3.64%) received PTFE graft (Table 2). According to the treatment outcoms, 90(81.82%) patients had successful vascular repair, complications found in 9(7.27%) and 11(10%) patients were died in which 4 at initial management and 7 during treatment (Fig. 2). From 11 died patients 8(72.72%) had delayed presentation and 3(27.28%) with early presentation. Thus, mortality was significantly associated with delayed presentation with p-value <0.0001 (Table 3).

Table 2: Vessels reconstruction procedures

Variables	No.	%
Interposition vein graft	50	45.45
Artery Ligation	26	23.64
Amputated	15	16.36
Conservative	9	8.18
End to End Anastomosis	6	5.45
PTFE Graft	4	3.64

Fig. 2: Treatment outcomes of vascular trauma

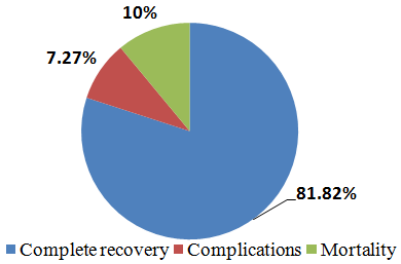


Table 3: Association of mortality with delayed and early presentation

Mortality	Delayed(>6 hours)	Early(<6 hours)	P-value
Yes	8 (72.72)	3 (27.28)	<0.0001

DISCUSSION

Vascular injuries are commonly found injuries across the world, especially in regions with war and civilian violence. Vascular trauma is directly associated with high morbidity and mortality.[11,12] Many of etiological factors involved for increasing the incidence of vascular trauma in which road traffic accidents, firearms andblunt injuries were most commonly found etiology.[13]We conducted this study aimed to examine the etiology, pattern and treatment outcomes of vascular trauma. In this regard 110 patients were analyzed.Majority of patients 74.55% were males and mostly patients were ages 25 to 35 years. These results showed similarity to the study by Shabbiret al[14] in which male patients were high in numbers 87.5% as compared to female 12.5% with mean age of 25 years. In Pakistan, rate of road traffic accidents increasing day by day because of not following the safety rules and this dilemma caused serious increase of vascular injuries. Also intrapersonal violence contributed a lot in increasing incidence of vascular trauma and all these factors are directly associated with younger age group.[15]

In present study we found that 82 (74.55%) patients presents within 6 hours while remaining 28 (55.45%) above 6 hours and considered as delay. Most common etiology was penetrating injuries in 80 (72.73%)patients. Upper

extremity vascular injury was found in 77(70%) patients. A study conducted by Usmanet al[16] reported that blunt injuries were most common in 65.4% and majority of patients were males and partial laceration was the commonest type of arterial injury. Another study conducted by Berlaset al[17] reported that penetrating injuries were the most common etiology among vascular trauma patients accounted 71% and median delay was 6 hours.

In our study most common injured vessels were femoral artery in 35(31.82%) patients followed by brachial artery, popliteal, subclavian, axillary, iliac artery and others in 25(22.73%), 21(19.09%), 10(9.09%), 8(7.27%), 7(6.36%) and 4 (3.64%) patients respectively. Berlas et al[17] reported brachial artery was the most common injured vessel 26% followed by radial artery in 18.2% patients among vascular trauma patients. Another study regarding vascular injuries demonstrated that 60% patients had arterial injuries[18]. Another study showed similarity in which femoral, brachial, subclavian and axillary were the most common injured vessels[19].

In present study 50(45.45%) patients received interposition vein grafting, 26(23.64%) patients received artery ligation, 15(16.36%) were amputated due to delayed presentation, 9(8.18%) patients received conservative management, 6(5.45%) received end to end anastomosis and 4 (3.64%) received PTFE graft. Sidique et al[20] reported interposition autogenous vein graft was the most common procedure for vessel repair 77.7% and prosthetic graft was done at 5.5% patients. Berlas Fahad reported interposition venous grafting was the most common procedure of vessels repair performing at 44%[17]. Some other studies reported interposition veinous grafting was the commonest method of vessels reconstruction[21,22].

We found that 90 (81.82%) patients had successful vascular repair, complications found in 9 (7.27%) and 11 (10%) patients were died in which 4 at initial management and 7 during treatment. From 11 died patients 8 (72.72%) had delayed presentation and 3 (27.28%) with early presentation. Thus, mortality was significantly associated with delayed presentation with p-value <0.0001. These results were similar to many of other studies in which patients presented late had significantly high mortality rate and complete recovery accounted 80% to 95% with fewer rate of complications.[23-25]

CONCLUSION

Incidence of vascular injuries in our setting is quite high. Penetrating injuries were most common etiology and vein grafting was the most common method for repair. Majority of patients had successful vessel repair. Mortality was high in patients with delayed presentation.

REFERENCES

1. Woodward EB, Clouse WD, Eliason JL, Peck MA, Bowser AN, Cox MW, et al. Penetrating femoropopliteal injury during modern warfare: experience of the Balad Vascular Registry. J VascSurg 2008;47:1259–64.
2. Eliason JL, Cox MW, Bowser AN. In-theater management ofvascular injury: 2 years of the Balad Vascular Registry. J Am CollSurg 2007;204:625–32.
3. Gifford SM, Aidinian G, Clouse WD, et al. Effect of temporary shunting on extremityvascular injury: an outcome analysis from the Global War on Terrorvascular injuryinitiative. J VascSurg 2009;50:555–6.
4. Slama R, Villaume F. Penetratingvascular injury:diagnosisand management updates. Emerg Med Clin North Am 2017;35:789–801.
5. Medina O, Arom GA, Yeranosian MG, Petrigliano FA, McAllister DR. Vascular and nerve injury after knee dislocation: a systematic review. ClinOrthopaedicsRelat Res 2014;472:2621–9.
6. Quan RW, Adams ED, Cox MW, Eagleton MJ, Weber MA, Fox CJ, et al. The management of trauma venous injury: civilian and wartime experiences. PerspectVascSurgEndovascTher 2006;18:149–56.
7. Wu B, Mottola G, Schaller M. Resolution ofvascular injuryspecialized lipid mediators and their evolving therapeutic implications. Mol Aspects Med 2017;58:72–82.
8. Ahanger AG, Wani ML, Lone RA, Singh S, Hussain Z, Mir IA, et al. Missile vascular injuries: 19-year experience.UlusTravmaAcilCerrahiDerg2010;16(2):135–8.
9. Fox N, Rajani RR, Bokhari F, Chiu WC, Kerwin A, Seamon MJ, et al.Evaluation and management of penetrating lower extremity arterial trauma: an Eastern Association for the Surgery of Trauma practice management guideline.J Trauma Acute Care Surg2012;73(5 Suppl 4): S315-20.
10. Inaba K, Aksoy H, Seamon MJ.Multicenter evaluation of temporary intravascular shunt use in vascular trauma.J Trauma Acute Care Surg2016;80: 359-65.
11. Perkins ZB, Yet B, Glasgow S.Meta-analysis of prognostic factors for amputation following surgical repair of lower extremity vascular trauma.Br J Surg2015;102: 436-50.
12. National Trauma Data Bank, NTDB Annual report 2015.
13. Rich NM, Baugh JH, Hughes CW. Acute arterial injuries in Vietnam: 1,000 cases. J Trauma 1970; 10:359-69.
14. Shabbir S, Jamal S, Ahmad I, Khan ZM, Khaliq T. Outcome of Vascular Trauma at Pakistan Institute of Medical Sciences, Islamabad. Ann. Pak. Inst. Med. Sci. 2011; 7(1): 29-32.
15. GurayaSY. Extremity vascular trauma in Pakistan. Saudi Med J 2004;25(4). 498-501.
16. Usman R, Jamil M, Anwer MF. Evaluation, surgical management and outcome of traumatic extremity vascular injuries: a 5-year level-1 trauma centres experience.Ann Vasc Dis 2018;11(3):312–7.
17. Berlas FT,Salahuddin F, Mumtaz A, Ali R, Rajpar N, An audit of "vascular trauma" cases in a tertiary level hospital in Pakistan. JVS 2018; 68(5 Supplement): 52.
18. Dhillan R, Bhalla A, Jha SK, Singh H, Arora A.Vascular injuries due to penetrating missile trauma in anti-terrorism ops. JTrauma Injury 2019;32:93-100.
19. Feliciano DV, Rasmussen TE. Evaluation and treatment of vascular injuries. In: Browner BD, Jupiter JB, Kretteck C, eds. Skeletal Trauma. Basic Science, Management and Reconstruction. Philadelphia: Elsevier Saunders, 2015: 423-35.
20. Siddique MK, Bhatti AM. A two-year experience of treating vascular trauma in the extremities in a military hospital. JPMA2013; 63(3): 327-30.
21. Kruger A, Florido C, Braunish A, Walther E, Han Yilmaz T, Doll D. Penetrating arterial trauma to the limbs; outcome of a modified protocol. World J EmergSurg 2013;8:51.
22. Ahmad S. Efficacy of percutaneous sclerotherapy in low flow venous malformations: asingle center series. Neurointervention 2019;14(1):53-60.
23. Dua A,Patel B,Desai SS, Holcomb JB,Wade CE,Coogan S,et al.Comparison of military and civilian popliteal artery trauma outcomes.JVascSurg 2014; 59: 1628-32.
24. Mazhar A, Moosa S, Abbas A, Mallick Y, Samad L. A multi-disciplinary, multimodal approach for the management of vascular anomalies. Pak J Med Sci Special Supplement 2020; 36(1):S14-9.
25. Alam HB, DiMusto PD. Management of lower extremity vascular trauma. Curr Trauma Rep. 2015;1:61–8.