



Common Mechanisms of Peripheral Vascular Injuries

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Abstract

Background: The peripheral arteries and veins of the extremities are among the most commonly injured vessels in both civilian and warfare trauma. Traumatic vascular injury is caused by explosions and projectiles which may affect the arteries and veins of the limbs, and is common in wartime, triggering bleeding and ischemia. This study aimed to analyze the common mechanisms of peripheral vascular injuries. **Material & Methods:** This was a retrospective study and was carried out among 60 cases who attended the vascular surgery department at the National Institute of Cardiovascular Disease (NICVD), with vascular injury from January 2010 to January 2012. All data were analyzed by SPSS 10 version. **Results:** In this study, most of the patients (25, 41.6%) were in the 21-30 years age group, followed by 20 patients (33.33%) were in the 31-45 years age group and the rest 15 (25.0%) patients belonged to 15-20 years age group. Regarding sex distribution, male (48, 80.0%) was more preponderance than female (12, 20.0%). Concerning occupation, most of the subjects (50.0%) were students, followed by businessmen (33.0%) and service holders (17.0%). Regarding the mechanism of injury, most of the patients (25, 41.66%) had bullet injuries, followed by 20 (33.33%) had shrapnel injuries, and the rest 15 (25.0%) patients had blunt injuries. Concerning limb involvement, the upper limb was injured in most of the cases (37, 61.66%), followed by the lower limb (23, 38.33%). **Conclusion:** In this study, bullet injuries were the commonest mechanism of peripheral vessel injury followed by, shrapnel injuries and blunt injuries.

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INTRODUCTION

The peripheral arteries and veins of the extremities are among the most commonly injured vessels in both civilian and warfare vascular trauma. Blunt causes are more frequent than penetrating except during military conflicts and in certain geographic areas. Physical examination and simple bedside investigations of pulse pressures are key in the early identification of injuries. In stable patients computed tomography angiograms (CTA) and

magnetic resonance angiograms (MRA) have become the mainstay of screening and diagnosis. Early detection and treatment of compartment syndrome remain essential in the recovery of patients with significant peripheral vascular injuries.^[1] Nevertheless, diagnosing vascular injury is a challenge if a significant source of external bleeding cannot be found. The physical examination can confirm whether there is a blood vessel injury, and then determine whether surgery is needed. Doppler indices should be an integral part of the physical

examination and can screen patients with proximal injuries for further studies such as duplex sonography or arteriography.^[2] Immediate hemorrhage control and rapid restoration of blood flow are the primary goals of vascular trauma treatment. There are many operative treatment methods for vascular injuries, such as vascular sutures or ligation, vascular wall repair, and vascular reconstruction with blood vessel prostheses or vascular grafts. Embolization, balloon dilation, and covered stent implantation are the main endovascular procedures. Surgical operation is still the primary treatment for vascular injuries. Endovascular treatment is a promising alternative, proven to be effective, and the preferred selection for patients. It is very important to determine vascular injury in the lower extremities. The signs and symptoms of vascular injury in limbs can be described as "hard" or "soft" distinguished by whether the intervention was provided in time. Hard signs include arterial bleeding, loss of pulse, expanding hematoma, bruit or thrill, and signs of ischemia. Soft signs include a history of prehospital blood loss, diminished pulse, moderate hematoma, proximity to a large vessel or bony injury, and ipsilateral neurologic deficit.^[3] Hard signs indicate the need for surgical intervention.^[4,5] The objectives of the treatment are relief of symptoms, lower infection, and prevention of limb loss. In the lower extremity, the goal is to maintain a bipedal gait.^[6] The graft is the optimum treatment for vascular injuries. These vascular grafts include autogenous veins and artificial vessels. In addition to vascular grafts, a temporary intravascular shunt (TIVS) can also be used for temporary vascular reconstruction. TIVS techniques developed rapidly in the 20th

century.^[3] The safety of nonoperative management, use of temporary intraluminal shunts, and better recognition of posterior compartment syndromes have had a significant impact on the management of vascular injuries.^[7] peripheral arterial injuries, if inadequately treated, carry a high amputation rate. Explosive injuries are the most likely to lead to amputations, whereas stab injuries are the least likely to do so. The most significant independent risk factor for limb loss was failed revascularization.^[8] Vascular reconstruction plays a significant role in peripheral vascular injuries. 2-4 % of vascular injuries need operative reconstruction. In polytraumatized patients, the rate is even 10 %. Arterial vascular repair should precede venous reconstruction and orthopedic stabilization due to limb-threatening ischemia.^[9] Moreover, in case of multiple trauma, a multidisciplinary approach is suggested to provide the best medical care to the victims.^[10] This study aimed to analyze the common mechanisms of peripheral vascular injuries.

Objective

General Objective

- To analyze the common mechanisms of peripheral vascular injuries.

Specific Objectives

- To see the epidemiology of peripheral vascular injuries.

MATERIAL AND METHODS

This was a retrospective study and was carried out at the National Institute of Cardiovascular

Disease (NICVD), with peripheral vascular injury. The study duration was from January 2010 to January 2012. A total of 60 cases were selected for this study who attended the casualty block of the hospital. Data sheets were prepared considering variables such as age, sex, and the different mechanisms of injuries. The data were collected and recorded on a broadsheet. Detailed history and examination were done on all patients to exclude any associated injury. The main variables included sensitivity of clinical impression, ultrasound, and radiological investigations. All these data were analyzed by SPSS 10 version. All information was kept with strict confidentiality.

Inclusion Criteria

- Patients with a vascular injury who came within 24 hours of trauma.
- Patients who had given consent to participate in the study.

Exclusion Criteria

- Patients who had any associated injury along with peripheral vessel
- Patients who did not give consent to participate in the study.

RESULTS

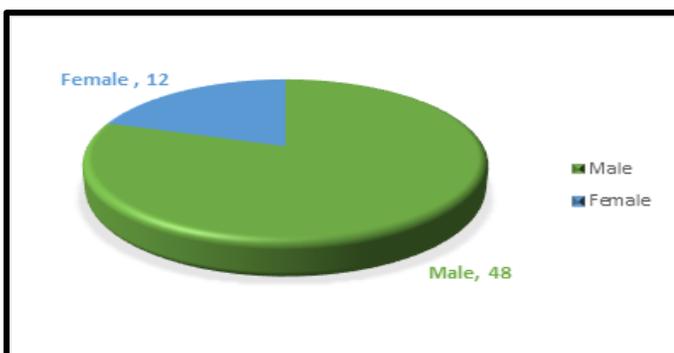


Figure 1: Distribution of respondents according to sex (N=60)

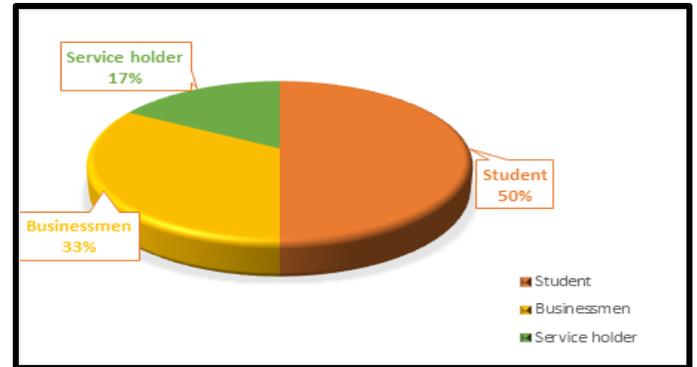


Figure 2: Distribution of subjects according to occupations (N=60)

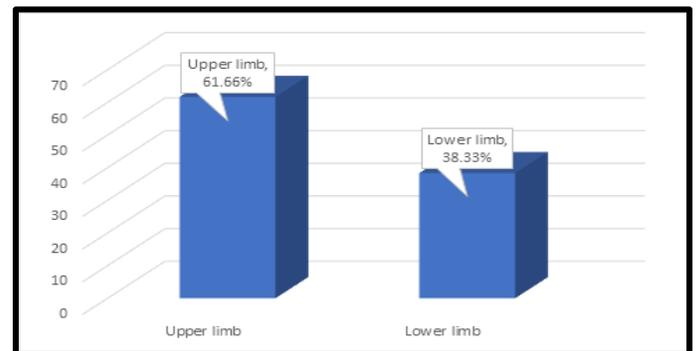


Figure 3: Distribution of subjects according to limbs involvement (N=60)

In this study, most of the patients (25, 41.6%) were in the 21-30 years age group, followed by 20 patients (33.33%) were in the 31-45 years age group and the rest 15 (25.0%) patients belonged to 15-20 years age group. [Table 1]

Regarding sex distribution, male (48, 80.0%) was preponderance than female (12, 20.0%) [Figure 1]

Concerning occupation, most of the subjects (50.0%) were students, followed by businessmen (33.0%) and service holders (17.0%) [Figure 2]

Concerning limb involvement, the upper limb was injured in most of the cases (37, 61.66%),



followed by the lower limb (23, 38.33%).

[Figure 3]

Table 1: Distribution of respondents according to age (N=60).

Age (years)	N	%
15-20	15	25.0
21-30	25	41.66
31-45	20	33.33

Table 2: Distribution of subjects according to the mechanism of injury (N=60).

Mechanism of injury	N	%
Bullet injuries	25	41.66
Shrapnel injuries	20	33.33
Blunt injuries	15	25.0

Regarding the mechanism of injury, most of the patients (25, 41.66%) had bullet injuries, followed by 20 (33.33%) had shrapnel injuries, and the rest 15 (25.0%) patients had blunt injuries. [Table 2]

DISCUSSION

Among the study subjects, most of the patients (25, 41.6%) were in the 21-30 years age group, followed by 20 patients (33.33%) were in the 31-45 years age group and the rest 15 (25.0%) patients belonged to 15-20 years age group. Regarding sex distribution, male (48, 80.0%) was more preponderance than female (12, 20.0%). In a study, authors identified 1395 popliteal arterial injuries among the 1,130,000 patients. Among them, 82% were male, with a mean age of 33 years.^[11] In another study, 162 patients sustained a total of 200 peripheral nerve injuries. The mean patient age was 34.6 years (SEM +/- 1.1 years), and 83% of patients were male, which was quite relatable to this study.^[12] Regarding the mechanism of injury, most of the patients (25, 41.66%) had bullet injuries, followed by 20 (33.33%) had shrapnel injuries, and the rest 15 (25.0%) patients had blunt injuries. Traumatic peripheral vascular injury is a significant cause of disability and death either in civilian environments or on the

battlefield. Penetrating trauma and blunt trauma were the most common forms of vascular injuries according to a study.^[13] In the United States, 56-90% of these injuries were a result of penetrating wounds, mainly because of high rates of massive destruction of soft tissue and bone, mainly depending primarily on the range from which the shotgun was fired.^[14] Another study stated, vascular injuries were present in 256 patients (4.4%) of the 5823 total trauma admissions. Penetrating trauma caused 135 (53%) vascular injuries whilst the remainder resulted from blunt trauma.^[15] While another study showed, among 52 patients with aged between 13- 50 years, penetrating trauma (82.7%) and blunt trauma (11.5%) were the commonest modes of injury.^[16] Concerning limb involvement, the upper limb was injured in most of the cases (37, 61.66%), followed by the lower limb (23, 38.33%). Approximately 90% of all peripheral arterial injuries were located in the extremities according to a study.^[17] In another study, trauma accounted for 11 (73.3%)

cases. Upper limb involvement occurred in 7 (63.6%) of the traumatic cases which were similar to this present study.^[18]

Limitations of the Study

The study was conducted in a single hospital with a small sample size. So, the results may not represent the whole community.

CONCLUSIONS

In this study, bullet injuries were the commonest mechanism of peripheral vessel injury followed by, shrapnel injuries and blunt

injuries. The surgical approaches according to the anatomical injured region should be selected. The priority is to reestablish limb perfusion via primary repair or damage control techniques.

Recommendation

An early diagnosis and intervention are fundamental to preserve the function and perfusion of the extremity. Moreover, further studies should be conducted involving a large sample size and multiple centers in this regard.

REFERENCES

1. Kobayashi L, Coimbra R, Goes AMO Jr, Reva V, Santorelli J, Moore EE, et al American Association for the Surgery of Trauma-World Society of Emergency Surgery guidelines on diagnosis and management of peripheral vascular injuries. *J Trauma Acute Care Surg.* 2020;89(6):1183-1196. doi: 10.1097/TA.0000000000002967.
2. Nassoura ZE, Ivatury RR, Simon RJ, Jabbour N, Vinzons A, Stahl W. A reassessment of Doppler pressure indices in the detection of arterial lesions in proximity penetrating injuries of extremities: a prospective study. *Am J Emerg Med.* 1996;14(2):151-6. doi: 10.1016/S0735-6757(96)90122-9.
3. Liu JL, Li JY, Jiang P, Jia W, Tian X, Cheng ZY, et al. Literature review of peripheral vascular trauma: Is the era of intervention coming? *Chin J Traumatol.* 2020;23(1):5-9. doi: 10.1016/j.cjtee.2019.11.003.
4. Frykberg ER, Dennis JW, Bishop K, Laneve L, Alexander RH. The reliability of physical examination in the evaluation of penetrating extremity trauma for vascular injury: results at one year. *J Trauma.* 1991;31(4):502-11. doi: 10.1097/00005373-199104000-00009.
5. Espinosa GA, Chiu JC, Samett EJ. Clinical assessment and arteriography for patients with penetrating extremity injuries: a review of 500 cases with the Veterans Affairs West Side Medical Center. *Mil Med.* 1997;162(1):19-23.
6. Ratnayake A, Samarasinghe B, Halpage K, Bala M. Penetrating peripheral vascular injury management in a Sri Lankan military hospital. *Eur J Trauma Emerg Surg.* 2013;39(2):123-9. doi: 10.1007/s00068-012-0228-4.
7. Feliciano DV. Management of peripheral arterial injury. *Curr Opin Crit Care.* 2010;16(6):602-8. doi: 10.1097/MCC.0b013e32833f3ee3.
8. Davidovic LB, Cinara IS, Ille T, Kostic DM, Dragas MV, Markovic DM. Civil and war peripheral arterial trauma: review of risk factors associated with limb loss. *Vascular.* 2005;13(3):141-7. doi: 10.1258/rsmvasc.13.3.141.
9. Markgraf E, Böhm B, Bartel M, Dorow C, Rimpler H, Friedel R. Traumatic peripheral vascular injuries. *Unfallchirurg.* 1998 Jul;101(7):508-19.
10. D'Alessio I, Domanin M, Bissacco D, Romagnoli S, Rimoldi P, Sammartano F, et al. Operative Treatment and Clinical Outcomes in Peripheral Vascular Trauma: The Combined Experience of Two Centers in the Endovascular Era. *Ann Vasc Surg.* 2020;62:342-348. doi: 10.1016/j.avsg.2019.06.037.
11. Mullenix PS, Steele SR, Andersen CA, Starnes BW, Salim A, Martin MJ. Limb salvage and outcomes among patients with traumatic popliteal vascular injury: an analysis of the National Trauma Data Bank. *J Vasc Surg.* 2006;44(1):94-100. doi: 10.1016/j.jvs.2006.02.052.
12. Noble J, Munro CA, Prasad VS, Midha R. Analysis of upper and lower extremity peripheral nerve injuries



- in a population of patients with multiple injuries. *J Trauma*. 1998;45(1):116-22. doi: 10.1097/00005373-199807000-00025.
13. Liu JL, Li JY, Jiang P, Jia W, Tian X, Cheng ZY, et al. Literature review of peripheral vascular trauma: Is the era of intervention coming? *Chin J Traumatol*. 2020;23(1):5-9. doi: 10.1016/j.cjtee.2019.11.003.
14. Zhong S, Zhang X, Chen Z, Dong P, Sun Y, Zhu W, et al. Endovascular Repair of Blunt Popliteal Arterial Injuries. *Korean J Radiol*. 2016;17(5):789-96. doi: 10.3348/kjr.2016.17.5.789.
15. Perkins ZB, De'Ath HD, Aylwin C, Brohi K, Walsh M, Tai NR. Epidemiology and outcome of vascular trauma at a British Major Trauma Centre. *Eur J Vasc Endovasc Surg*. 2012;44(2):203-9. doi: 10.1016/j.ejvs.2012.05.013.
16. Aduful H, Hodasi W. Peripheral vascular injuries and their management in accra. *Ghana Med J*. 2007;41(4):186-9. doi: 10.4314/gmj.v41i4.55289.
17. Weaver FA, Papanicolaou G, Yellin AE. Difficult peripheral vascular injuries. *Surg Clin North Am*. 1996;76(4):843-59. doi: 10.1016/s0039-6109(05)70484-9.
18. Adeoye PO, Adebola SO, Adesiyun OA, Braimoh KT. Peripheral vascular surgical procedures in Ilorin, Nigeria: indications and outcome. *Afr Health Sci*. 2011;11(3):433-7.

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