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Original Article

Epidemiology of Traumatic Peripheral Vascular Injury in Patients Presenting at Tertiary Care Center of Nepal

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ABSTRACT

Introduction: Traumatic peripheral vascular injury remains a significant cause of morbidity and mortality among the general population. Majority of peripheral arterial injury are caused by a blunt trauma with a concomitant soft tissue injury and fractures requiring multidisciplinary approach. Despite major efforts in establishing protocols and guidelines, optimal strategies of traumatic peripheral vascular injury are still under investigation and may vary depending upon the local setup and expertise available. The aim of this study was to identify the epidemiological profile of traumatic peripheral vascular injury presenting at tertiary care center of Nepal.
Method: This is a retrospective study of patients who underwent vascular surgery in College of Medical Sciences Bharatpur, from December 2018 and July 2021. Ethical approval was taken from the Institutional Review Committee of College of Medical Sciences (Registration Number 2020-081). Data for the study was retrieved from Emergency records, operation records and medical record department of the hospital. A total of 63 cases of all age and sex were included in the study. Only patients having traumatic peripheral arterial injury and undergoing surgical intervention were included in the study. Patient data was initially tabulated using Microsoft Excel and analysis was done in SPSS software version 22.0.
Result: Traumatic peripheral arterial injury was most commonly seen in 21-30 years (36.5%) age group with male preponderance (88.9%). Sharp injury mechanism accounted for (42.9%), followed by road traffic accidents (41.3%). Upper limb arterial injury was seen in 61.9% of patients and radial artery was the most common to be injured (34.9%). Associated tendon injury was seen in 63.5%, whereas nerve injury was seen in 20.6%. Complications were seen in 47.6% patients and wound infection was the most common ailment (12.7%).
Conclusion: Traumatic peripheral vascular injury has a male preponderance with road traffic incidents being the major mechanism of injury in Nepal. These injuries have a high rate of complications.

Keywords: Trauma, Peripheral Arterial Injury, Associated injuries, Complications

INTRODUCTION

Traumatic peripheral vascular injury remains a significant cause of morbidity and mortality among the general population. Injury mechanism includes penetrating trauma, blunt trauma and iatrogenic vascular injuries.[1] Blunt trauma is a common among civilian population while penetrating injuries are more common in warfare.[2] In the western world, peripheral vascular injuries are most commonly (75–80%) caused by ballistic injuries while, blunt trauma such as fractures, dislocations, crush injuries, and traction account for only 5% to 25%.[3] However the figures might be different in our scenario due to the restrictions of firearms among the civilians in our country.

In Nepal we see a majority of peripheral arterial injury caused by a blunt trauma with a concomitant soft tissue injury and fractures. So, a combined surgical team comprising a vascular surgeon and an orthopedic surgeon is often required. Concomitant soft tissue injury, bony injury and neurological injury can result in a relatively high morbidity in terms of prolonged hospital stays and higher rates of complications.[2] Popliteal arterial injury are often have a very high rates of amputation (up-to 65%).[4]

Despite major efforts in establishing protocols and guidelines, optimal strategies of traumatic peripheral vascular injury are still under investigation and may vary depending upon the local setup and expertise available.[2] There are limited studies done in Nepal which have evaluated the epidemiological aspects of peripheral vascular injuries. Therefore, this study aims to describe the epidemiological aspects namely: etiology, associated injuries, management and outcome of traumatic peripheral vascular injuries among patients presenting to the College of Medical Sciences-Teaching Hospital between December 2018- July 2021.

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METHODS

This is a retrospective study of patients who underwent vascular surgery in College of Medical Sciences Bharatpur, from December 2018 and July 2021. Ethical approval was taken from the Institutional Review Committee of College of Medical Sciences (Registration Number 2020-081). Data for the study was retrieved from Emergency records, operation records and medical record department of the hospital. All patients with any age and associated injuries with the diagnosis of traumatic peripheral arterial injury were included in the study. However, central vessel injuries and non-traumatic vascular incidents were excluded from the study. The demographics, clinical presentation, etiology, management, and complications were recorded.

All patients with suspected vascular injury underwent a Duplex study or a CT scan as per the hospital protocol. Once the diagnosis was confirmed, the patients were immediately taken for surgical intervention. Regional or the general anesthesia was given as per the decision made by the anesthesia team. Patient positioning was done as per the requirement and standard surgical approaches were used. After painting and draping open wound were debrided thoroughly, tendon injuries were addressed, fractures were managed either definitely or in an external fixator, vascular injuries and nerve injuries were addressed. In postoperative care, intravenous antibiotics were given for 3 days and continued with oral antibiotics, with duration of antibiotics depending upon the condition of the wound. Systemic anticoagulation was done with Unfractionated Heparin during surgery and continued with Low Molecular weight Heparin (subcutaneous) and Aspirin (oral) in the postoperative period. Antiplatelet agent was continued for few weeks depending on the type of injury. Physiotherapy was begun as per the hospital protocol. Patient data was initially tabulated using Microsoft Excel and analysis was done in SPSS software version 22.0.

RESULTS

The mean age of the patient was 32.43± 13.38years (6 - 65 years). There was a male predominance (%) (Table 1) with majority of patients from 21-30 years age group. This was the same age group having the highest number of complications (Figure 1). The most common etiology of injury was sharp cuts (42.9%) followed by road traffic accidents (41.3%). Pseudoaneurysms were seen in 4.8% of patients who were exclusively IV drug abusers.

Upper limb arterial injury was seen in 61.9% of patients, whereas, arteries of the lower limb were involved in 38.1%. Single artery was involved in 90.5% cases whereas more than one artery was involved in 9.5% cases. Radial artery was the most common to be injured (34.9%) followed by ulnar and popliteal injuries (11.1% each) (Figure 2).

Associated tendon injury was seen in 63.5% among whom, 67.5% had more two or more tendon injury, and 32.5% patients had single tendon injury. FCR was the most common tendon to be involved. Nerve injury was seen in 20.6% cases

Table 1 Demographics of the patients

Characteristics	Details	n (%)
Age	0-17 years	4 (6.34)
	>17 years	59 (93.66)
Sex	Male	56 (88.9)
	Female	7 (11.1)
Type of injury	Sharp cut	27 (42.9)
	Blunt injury	33 (52.4)
	Pseudoaneurysm	3 (4.8)
Mechanism of injury	RTA	26 (41.3)
	Sharp cut	27 (42.9)
	Fall from height	5 (7.9)
	IV induced pseudoaneurysm	3 (4.8)
	Crush injury	2 (3.2)
Site of injury	Upper limb	39 (61.9)
	Lower limb	24 (38.1)
Associated injury	Fracture/Dislocations	14 (22.2)

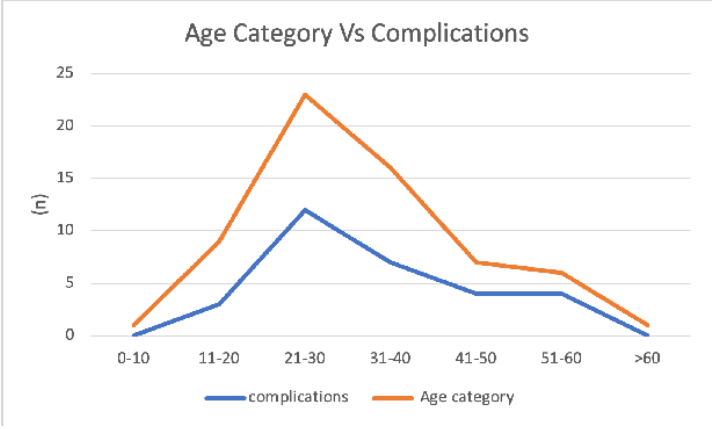

Figure 1. Age Category Vs Complications

and isolated ulnar nerve was the most common injury pattern (7.9%), followed by isolated median nerve injury (6.3%).

Fracture/dislocation was the most common associated injury (22.2%), out of which, both bone fracture of leg was the most common (11.6%), followed by knee dislocation (6.3%). Patients operated within six hours of injury w 68.3%. Majority (57.1%) underwent surgery under brachial plexus block, followed by 31.8% under spinal anaesthesia. Mean hospital stay was 8.75 days+- SD. End to end anastomoses was performed in 71.4% cases. Venous grafting was done in cases with segmental defects (12.7%) to achieve tension free anastomoses. Arterial ligation was performed in 4.8%. Repair was performed in 6.3% of femoral artery pseudoaneurysm which was seen among IV drug abusers. Amputation was done in 4.8%. Dislocations of the joints were managed with closed relocation under anaesthesia. Fracture reduction and k-wire fixation was done in 3.2% cases. Temporary stabilization of fracture/dislocation with external fixator was performed in 15.9% cases. Fracture fixation with titanium elastic nailing system

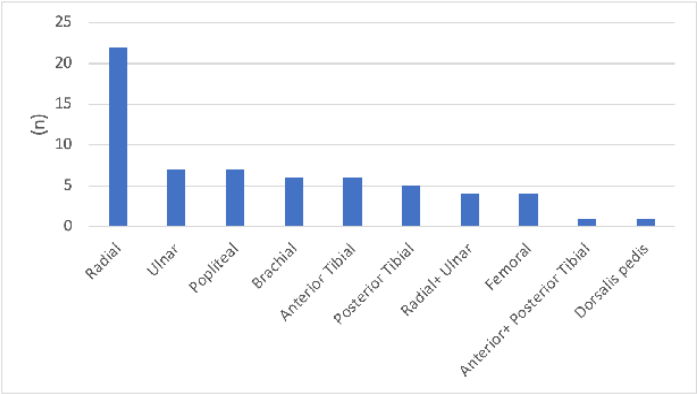

Figure 2. Arterial involvement

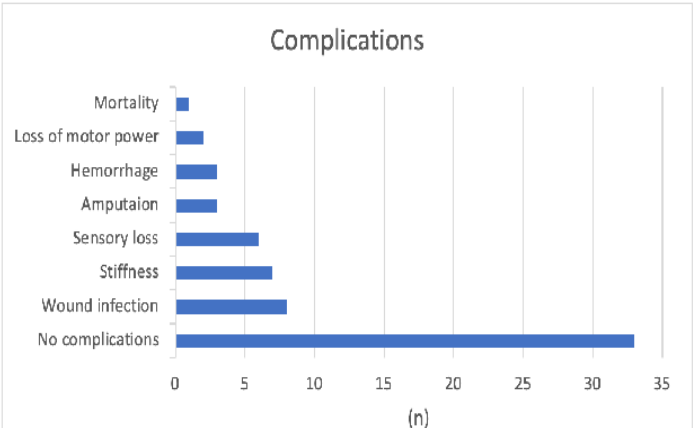

Figure 3. Complications

(TENS) was done in 1.6% cases. Primary amputation was done in 1.6 % whereas, secondary amputation was done in 3.2%. Repeat surgery was required in 25.4% cases. External fixator was converted to IMIL for leg both bone fractures in 8% cases. Knee ligaments reconstruction was performed in 3.2% cases. Wound debridement was done in 9.5% cases. Skin grafting was done in 1.6% cases. The most common complication was wound infection followed by joint stiffness (Figure 3). One case of crush injury of the leg with GA-Type-IIIC injury who underwent primary amputation had mortality in the 3rd post-op period due to hemodynamic instability.

DISCUSSION

Although stated as a rare entity in orthopedic trauma the incidence of peripheral vascular injury is in the rise globally as well as in Nepal where two wheelers are the primary means of transportation.[5] Vascular injury has been reported to be associated in 1-3% of general orthopedic trauma, however it can reach up-to 16% when associated with knee dislocations.[6,7] These injuries possesses a significant threat to the viability of the limb and life if not managed promptly. Young adults are more frequently involved in the injury since they are the active working members of the society. In this study the mean age was 32.43± 13.38yrs. These findings are similar to the study by Joshi et al, where the mean age of the patients was 28yrs.[8] Majority of the patients were males (88.9%) which is similar to the study by Cho et al, (75% male) and Joshi et al, (90% male).5,8 High incidence of these injuries among the younger patient population is due to the fact that they are more active and are the working class of the society so are more prone to injury.

Blunt injury mechanism (secondary to RTA) was the most common etiology involved (52.4%). This might be due to the fact that the study center was located nearby the major national highway and our institution being a tertiary referral canter for trauma cases. Sharp or penetrating injury mechanism was involved in 47.6% cases, among which 4.8% cases involved recreational IV drug use. Majority of penetrating injuries in the upper extremity involved punching on a glass window, mirror or a glass table during an anger episode. Although blunt injury mechanism was the most common etiology, sharp injury mechanism was not that uncommon. Gokhan et al, reported 53.8% cases sustaining injury around the wrist and hand who punched on the glass during an angry episode. Men were more frequently involved (97.6%), right hand being the most common side (78.3%) and neurovascular injury was common among these cases.[9] This highlights the fact that the issues related to poor anger management is more common among young adults. Also, the fact that there were cases with pseudoaneurysm following parenteral IV drug use indicates the social impact of the condition and the increasing incidence of IV abuse especially among youngsters. Western literature reports a higher incidence of penetrating injury associated with firearm use.[10] However, there were no cases associated with firearm use in our study, as the use of firearms is prohibited in our country.

Upper limb was more frequently involved than the lower limb. Similar results were seen in a recent study in another tertiary care center of Nepal.[11] Right side was more frequently involved than the left side. Radial artery was the most common to be injured (34.9%), followed by ulnar artery (11.1%). Popliteal artery was the most common to be injured in the lower limb 11.1%. Similar findings were noted in another study by Parajuli et al, from eastern part of Nepal, however in contrast to our study ulnar artery was more frequently involved than radial artery.[12] Nerve injury was more frequently associated in our study (20.6%) compared to the study done in Dhulikhel Hospital (10%).[11] Approximately every 1 in 5 cases had associated bony involvement. However, in contrast to our study more cases (40%) had bony fractures in a study by Wang et al,.[13] This high incidence of bony fractures in their study can be attributed to the injury mechanism where blunt trauma was frequently sustained by the cohorts compared to the penetrating trauma.[13]

One third of the cases were operated after 6 hrs. Late referral or increased transportation time especially when being referred from neighboring districts were the major factors for delayed surgery. End to end anastomosis (71.4%) was the primary modality of treatment in this study. Ligation was performed only in 4.8% cases of radial or ulnar arterial injury who presented very late but the limb was viable. As per our center's protocol, repair is performed for most of the arterial injuries (including single arterial injuries of forearm), therefore our cohorts had a low rate of arterial ligation. Whereas, in a study by Parajuli et al, a large number

of cases (36.4%) of forearm single arterial injury underwent arterial ligation after the confirmation of viability of the limb.[12]

Schipper's et al, in their meta-analysis reported that there was no clear benefit to attempting repair of a single vessel.[14] Although few literatures have suggested ligation as a cost-effective and safe therapeutic modality in cases when there is no ischemia, others have suggested that single arterial ligation may have problems related to poor wound healing, sensitivity to cold and atrophy of muscles or bone.[15]

High rates of complications (43.2%) have been reported in similar study conducted in eastern Nepal.[12] Similar findings are noted in our study where 47.6% cases had complications. Infection rates were highest in the age group of 21-30 years, since this age group had highest number of patients (Figure 1). Wound infection was a common ailment and required debridement and prolonged antibiotic use. Sensory impairment (9.5%) and loss of motor function (3.2%) was seen in cases with associated nerve injury. Joint stiffness was a common complication among those undergoing tendon repair especially when multiple tendons were involved.

Most literature report joint stiffness and loss of grip as common complications following tendon repair surgeries.16 The reported incidence of amputation in literature varies anywhere between 2%–33%, and the variability lies in the injury mechanism and sites of injury.[17] Keeley et al, reported a very high incidence of amputation (20%) among patients with popliteal artery injury.[18,19] In a recent study by Lee et al, 20% cases underwent amputation, where all amputated limbs were lower extremities and involving blunt injury mechanism.[20] In our study 4.8% underwent amputation/disarticulation of which all cases had involvement of the lower extremity due to blunt injury mechanism.

One of the limitations of this study is retrospective observational study design. There is also a possibility of selection bias since only patients undergoing operative intervention were included. Also, this study was conducted in a single center and has a limited number of cohorts which precludes generalization of the results.

CONCLUSION

Traumatic peripheral vascular injury has a male preponderance with road traffic incidents being the major mechanism of injury in Nepal. These injuries have a high rate of complications. Therefore, it possesses a significant challenge in managing vascular injuries in a resource limited country like ours. Policies to enhance precise and timely management of vascular injuries should be formulated to mitigate the complications and have a better chance of limb survival.

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