

Assessment of Vascular Injuries and Reconstruction

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Abstract

Background: Trauma is the third leading cause of death. In this regard, vascular injury plays a leading role in of morbidity and mortality rates.

Objectives: The present study aimed to assess the prevalence of vascular injuries and results of vascular reconstruction at a referral hospital in northern Iran.

Patients and Methods: A retrospective observational study assessed 88 consecutive patients with vascular injury admitted to Poursina Hospital, Rasht in northern Iran, from October 2007 to October 2009. All study information was collected retrospectively from hospital charts.

Results: Most of the affected patients (87/88) were male with a mean age of 29.12 ± 11.20 years. The mechanism of injury in 39.8% was blunt trauma and penetrating trauma in the rest. Of the 53 injured by penetrating trauma (60.2%), the most common cause was stabbing (94.3%). The most common cause of blunt trauma was road traffic accidents (93.1%). The most common mechanism for vascular injuries in upper extremities was penetrating trauma (86.0%) and in lower extremities was blunt trauma (60.0%). Fasciotomy was performed in 16 patients (18.2%) mostly in the lower extremities. Major amputation was required in 10% of the patients. In upper extremities, the most common type of revascularization was end to end anastomosis, followed by inter-position graft. The most common type of reconstruction in the lower extremity was bypass graft. All patients who underwent major amputation were admitted to the center with a delay of more than 6 hours after injury.

Conclusions: Major vascular injuries in our center occurred in young men, frequently because of stab wounds. Popliteal injuries mostly caused by motor vehicle accidents was the second most common arterial injury, followed by combined ulnar and radial injuries. Vascular reconstruction in the first hours after trauma may prevent many unnecessary and preventable amputation procedures.

Keywords: Trauma, Amputation, Fasciotomy, Popliteal Injuries, Vascular Injuries

1. Background

Trauma is the third leading cause of death. In this regard, vascular injury plays a leading role in increased rates of mortality and morbidity (1-3). Peripheral vascular trauma makes up 80% of vascular injuries manifested by fatal hemorrhagic or limb-threatening ischemia. However, open peripheral vascular injuries are associated with a high mortality at the scene of the accident; closed vascular injuries present danger of developing critical tissue ischemia with a high risk of amputation and limb loss. Vascular injuries in Extremities may result from penetrating trauma (e.g. bullets, and knives), blunt trauma (such as due to motorcycle accidents, falls from heights, etc.) or iatrogenic injuries. The prevalence and mechanisms of vascular injury differs in various parts of the world (3, 4).

2. Objectives

The aim of this study was to assess the prevalence of dif-

ferent types of vascular injuries and results of vascular reconstruction in patients referred to our hospital in northern Iran. Our center is one of the few centers for vascular reconstruction in northern Iran that admits a significant number of patients each year, even from the neighboring provinces.

3. Patients and Methods

In this retrospective observational study, records of all consecutive patients with vascular injury admitted to Poursina Hospital in Rasht northern Iran, were studied from October 2007 to October 2009. The inclusion criterion in this study was vascular injury. All were reconstructed by one vascular surgeon. In this study, only arterial injuries were evaluated. Among upper extremity injuries, isolated injury in ulnar or radial arteries ligated in other services were not included. Relevant demographic char-

acteristics including age, gender, mechanism of trauma, causes of trauma, anatomical site of injury and length of hospitalization were collected. Results were reported as percentages for categorical variables. The groups were compared using the chi-square test or Fisher's exact test for categorical variables. Also, the t-test was used to compare the length of hospitalization between upper and lower extremity injuries. P values of 0.05 or less were considered statistically significant. All the statistical analyses were performed using SPSS version 19.0 (SPSS Inc. Chicago, Illinois, USA).

4. Results

Eighty-eight patients including 87 men and 1 woman were evaluated with an average age of 29.12 ± 11.20 years. Most of the patients (50%) were between 21 to 30 years-old and only 1.1% of the cases were in the age range of 51 - 60 years (Figure 1). The mechanism of injury in 53 patients (60.2%) was penetrating and in 35 patients was blunt trauma. Of 53 penetrating trauma cases, the most common cause was stab injuries (94.3%), followed by gunshot injuries (5.7%). Among vascular injuries caused by stab injuries, the most frequent injuries were related to knives (48.6%), followed by glass injuries (40.0%). The most common cause of blunt trauma was accidents (93.1%) and falling from heights was next. Fifty patients (56%) had upper limb arterial injuries and 38 had lower limb vascular injuries. The most common mechanism for vascular injuries in upper extremities was penetrating trauma (82.0%) and in lower extremities was blunt trauma (68.4%). Most common vascular injuries in upper extremities were ulnar and radial arterial injuries in 32 patients (64%), followed by brachial arterial injuries in 17 patients (34%) and subclavian arterial injury in one case. In the lower extremity, popliteal artery was the most frequently affected artery as it was injured in 23 cases (60.5%), followed by femoral artery in 11 and tibial arteries in 4 cases. Thirty patients (34.1%) underwent vascular reconstruction in less than 6 hours after injury and the rest were reconstructed later. Fasciotomy was performed in 16 patients (18.2%), mostly in the lower extremities and only one of was done in the upper extremity. Major amputation was required in 10% of the patients (one in the upper extremity following prolonged subclavian arterial injury and 8 cases in the lower extremity). Among 8 amputated lower extremities, primary amputation without vascular reconstruction was required in 5 patients. All 9 patients who underwent amputation, referred to the center with delay of more than 6 hours after injury ($P = 0.023$). In the upper extremity, the most common type of reconstruction was end to end anastomosis (54.0%), followed by inter-position grafting (38.0%). The most common type of reconstruction in lower extremity was bypass graft (65.8%). The mean length of hospitalization was 7.26 ± 6.62 days (range 1 to 34 days). The length of hospitalization was significantly longer in lower extremity injuries (11 ± 8) compared to upper extremity injuries (4.4 ± 3.2 , $P < 0.0001$).

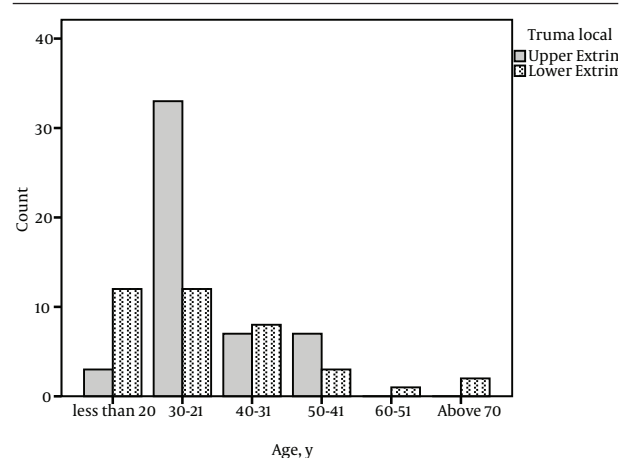


Figure 1. Age Distribution of Patients With Upper and Lower Extremity Trauma

5. Discussion

Vascular surgery has the highest priority in resuscitation after the airway and breathing have been protected. Nowadays, vascular trauma is increasing (2, 4-9). In our study, most of the patients were male with a mean age of 29 years that was consistent with other studies. The large number of cases in young men can be explained by the fact that they are at their peak of their activity and are subjected to the hazards of accidents and injuries. However, the mechanisms of trauma vary in different societies (5). In our study, the most common cause of vascular injuries was penetrating trauma (60.2%), commonly caused by stabbing. Blunt trauma was observed in 39.8% of affected patients, commonly by motorcycle accidents and other vehicles, followed by falling. These findings are similar to many studies in different parts of the world that reported penetrating trauma caused by stabbing was the most common cause of vascular injuries (1, 2, 4, 10-12), although in other studies gunshot wounds were more common (6, 9, 12-15). In a study by Franz RW most commonly, stabbing was by glass shards (10); however, in our study the most frequent stabbings were related to knives (48.6%), followed by glass (40.0%). In one study from Pakistan 93% of vascular injuries were caused by fire-arms (16). There are some studies that reported a higher prevalence of blunt trauma. In one study from India 84% of vascular injuries were caused by blunt mechanisms and in other study from Iran Dr. Salimi and his colleagues reported that blunt injuries were more common than penetrating trauma (56.1% vs. 43.9%) (7, 8). In our study, vascular injuries occurred in upper extremities were more often caused by penetrating trauma and vascular injuries in lower extremities were more often caused by blunt trauma. Anatomic site of injuries are variable in different studies. In most studies, especially studies of war injuries and road traffic injuries, most of the vascular injuries injured the femoral

artery, followed by popliteal and brachial arteries (2, 4, 9, 11, 13, 17). However, in other studies such as in one study in Turkey the brachial artery was the most common injured (9). In the present study, ulnar and radial arteries were the most common injured (36.3%) but in some studies such as Dr. Singh's study from India and Dr. Salimi from Iran ulnar and radial injuries were not common (3.1% and 0.5%, respectively) (5, 8). This observed discrepancy may be due to the difference in mechanisms of injuries in our society including occupational hazards, street fights, and self-immolation. The popliteal artery was the second most common affected artery as it was injured in 23 patients (26%), followed by brachial in 17, femoral artery in 11 and tibial artery in 4 patients.

In our study, the most common applied method for vascular reconstruction was end to end anastomosis, followed by interposition graft and bypass graft. In upper extremity, the most common method used for reconstruction was end to end anastomosis and in lower extremities was bypass graft. Type of reconstruction is usually selected on mechanisms of injury and anatomical site of injury. Thus, the frequency of reconstruction methods are varied depending on these two factors (1, 2, 5, 11).

The time interval between occurrence of trauma and arrival to hospital and vascular reconstruction was more than 6 hours in most of the patients with an average interval of 10.31 ± 9.5 hours (range 3 to 48 hours). This delay was related to the fact that most of the patients were referred from distant towns. In the similar studies, in most cases, amputation was performed in patients who underwent vascular reconstruction for 6 to 12 hours after injury (2, 5, 9, 16).

In our observation, amputation was performed in 9 cases, primary amputation in 5 and secondary amputation in 4 cases. Amputation rate is variable in different studies. In some reports, rate of amputation was as low as 2.6% and in others it was as high as 56% (18-20). Delayed vascular reconstruction and severe musculoskeletal injuries were the most important prognostic factors in vascular injuries in extremities.

In our survey, fasciotomy was performed in 18.2% of the cases commonly in those with injuries of lower extremities. In some studies, the fasciotomy rate was 7% - 10% and in other studies it was as high as 61% (5). The difference in the rate of fasciotomy in published studies is considerable probably due to different thresholds in performing fasciotomy at different centers (4, 5, 9).

In conclusion, most vascular injuries in our center were seen in young men, frequently caused by stabbing and in upper extremity. Popliteal artery injuries mostly caused by motor vehicle accidents were the most common injuries. Vascular reconstruction in the first hours after trauma may prevent many unnecessary and preventable amputation procedures.

Footnote

Authors' Contribution: Iraj Baghi developed the original idea and reviewed the manuscript. Mohammad Rasool Herfatkar: reviewed the manuscript. Leila Shokrgozar: wrote the manuscript. Fatemeh Aghajani: collected the data and co-authored. Zahra Poor-Rasuli: analyzed the data.

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