



ORIGINAL RESEARCH PAPER

Vascular Surgery

CHARACTERISTICS AND MANAGEMENT OF EXTREMITY VASCULAR INJURIES: A REVIEW OF CASES AT A TERTIARY CARE CENTRE

KEY WORDS: Vascular injuries, Extremities, Developing countries

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ABSTRACT
Background: Vascular injuries of extremities are very common in developing countries. The major causes are road traffic accidents, falls, workplace injuries with sharps and machines. **Objectives:** Through this study we would like to share our two years of experience in treating vascular injuries of extremities. **Methods and Material:** This is a retrospective study covering a period of two years from August 2020 to August 2022 conducted in the Institute of vascular surgery, Madras Medical College, Chennai. Case sheets were retrieved and reviewed. Patients with vascular injuries including upper limb and lower limb that presented with signs of salvageable limb were included in the study. Patients in whom primary amputation was done was excluded from the study. **Statistical analysis used:** SPSS SOFTWARE **Results:** There were 94 patients who presented with vascular injuries of the extremities that fell in the inclusion criteria. Limb salvage rate was 95%. The major cause of limb loss was delay in presentation of more than 12 hours of injury. Major vessels involved were popliteal artery (35 %), followed by brachial artery (20.2 %). **Conclusion:** Vascular injuries are a major cause for limb loss in developing countries. The major causes are RTA, fall and accidental sharp injuries. The major cause of limb loss is delay in presentation and unavailability of vascular facilities. The morbidity can be reduced by developing an emergency ambulatory system and by making available vascular services in remote areas so that delay factor can be minimized.

INTRODUCTION AND OBJECTIVES

- Vascular injuries of extremities are very common in developing countries.
- Lack of emergency ambulatory facilities result in delayed presentation to tertiary care centres, thus compromising results.
- Through this study we would like to share our two years of experience in treating vascular injuries of extremities

MATERIALS & METHODS

This is a retrospective study covering a period of two years from August 2020 to August 2022 conducted in the Department of vascular surgery, Madras Medical College, Chennai. Case records, OT registers and discharge summaries were retrieved and reviewed.

Inclusion Criteria-

Patients with vascular injuries affecting upper limb and lower limb that presented with signs of salvageable limb were included in the study.

Exclusion Criteria-

Patients who had to undergo primary amputation.

RESULTS

There were 94 patients who presented with vascular injuries

of the extremities who fell in the inclusion criteria. The data collected was analyzed using spss software

Gender distribution

Total no of cases- 94

Male – 84

Female- 10

Age

The mean age of presentation was 32.

Extremity Involved

Upper extremity- 51

Lower extremity- 43

Table 1: Major Vessels Involved

ARTERY INVOLVED	CASES(N=94)
POPLITEAL ARTERY	33 (35%)
BRACHIAL ARTERY	19 (20.2%)
RADIAL & ULNAR ARTERY	13 (13.8%)
ULNAR ARTERY	10
RADIAL ARTERY	6
SUPERFICIAL FEMORAL ARTERY	4
AXILLARY ARTERY	3

ANTERIOR TIBIAL & POSTERIOR TIBIAL ARTERY	3
COMMON FEMORAL ARTERY	2
POSTERIOR TIBIAL ARTERY	1

Major mechanisms of trauma include Road traffic accidents (37.2%), Fall (20.2%) & accidental sharp injuries (20.2%)

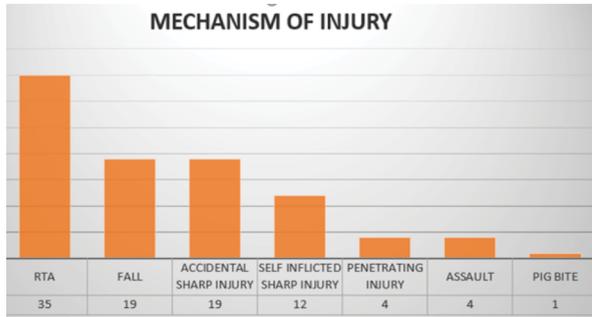


Figure 1: Mechanism Of Injury

Types of injury

- Transection (53%)
- Contusion thrombus (32.9%)
- Partial tear (8.5%)
- Spasm- 2%
- Pseudoaneurysm- 1%

Management

Majority of the cases were managed by reversed saphenous vein (RSV) Bypass (81.9%), followed by primary repair (10.6%). Two cases which were caused by spasm required no surgical repair

Table 2: Management

SURGERY	CASES (N=94)
RSV BYPASS	77 (81.9 %)
PRIMARY REPAIR	10 (10.6%)
PRIMARY REPAIR WITH PATCH PLASTY	1
VEIN PATCH REPAIR	1
PSEUDOANEURYSM SAC LIGATION WITH RSV BYPASS	1
RSV BYPASS AND PRIMARY REPAIR	2
NO SURGICAL REPAIR	2

Time Of Presentation

- Total no of cases-94
- < 12 hours- 70
- > 12 hours- 24

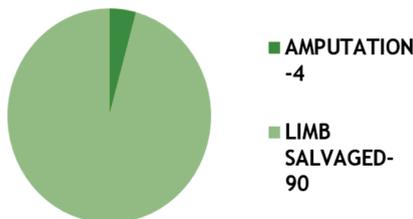


Figure 2: Limb Salvage

The overall limb salvage rate was 95%.

Table 3: Summary Of Study Results

ARTERY INVOLVED	MECHANISM OF INJURY	TYPE OF INJURY	MAJOR ASSOCIATED INJURY	MANAGEMENT
POPLITEAL ARTERY (N=33)	RTA (23) FALL (10)	CONTUSION THROMBUS (23) TRANSECTION (9) PARTIAL TEAR (1)	FRACTURE BOTH BONE LEG (13) FRACTURE TIBIA (8) FRACTURE FEMUR (7) POPLITEAL VEIN INJURY (4) KNEE DISLOCATION (3)	RGSV BYPASS IN ALL CASES (4 LATER UNDERWENT AMPUTATION)
BRACHIAL ARTERY (N=19)	FALL (9) ROAD TRAFFIC ACCIDENT (RTA) (6) ACCIDENTAL SHARP INJURY (4)	TRANSECTION (12) CONTUSION THROMBUS (4) SPASM (2) PARTIAL TEAR (1)	FRACTURE HUMERUS (8) MEDIAN NERVE INJURY (8)	RGSV BYPASS (15) PRIMARY REPAIR (1) PRIMARY REPAIR WITH PATCH PLASTY (1) NO SURGERY (2)

DISCUSSION

Vascular injuries are relatively uncommon yet significant injuries.^[1]

In our study, upper extremity and lower extremity vessels were involved comparably. Among the individual vessels, popliteal artery followed by brachial artery were the most common vessels involved.

In the study by Khan et al, lower extremity vessels were more involved than upper extremity, with popliteal artery being most common vessel involved.^[2] In a study at British trauma centre, vascular injuries contribute to 4% of the admissions with central vascular injuries being most frequent followed by extremity injuries and then junctional injuries. Among the extremity injuries, upper and lower limb injury frequencies were comparable.^[1]

Vascular injuries were more common in males in our study. Similar ratios were seen in studies conducted by Perkins et al, Khan et al and Usman et al. ^[1,2,3]

In our study, majority of vascular injuries of extremity have resulted from road traffic accidents, fall and accidental sharp injuries. In a study by Khan et al on vascular injuries, major mechanisms included road traffic accidents followed by injuries by firearms and bomb blasts.^[2] This is in contrast to western studies where most injuries are contributed by penetrating trauma and blunt trauma.^[1]

The difference in mechanism of injuries could be explained by injury occurring in civilian vs military personnel or war zones.

In our study, the major types of injuries were transection followed by contusion thrombus and partial tear. Partial laceration followed by contusion thrombus were the most common types of arterial injury in the study by Usman et al.^[3]

In our study, among cases of popliteal artery injury, majority of the cases were attributed to road traffic accidents. The major type of injury was contusion thrombus. The associated injuries mainly involved fractures of lower limb bones. All the cases were managed by reversed great saphenous vein (RGSV) Bypass. In a six-year study by Sciarretta et al conducted at a level I trauma centre, majority of the injuries were caused by penetrating injury (gunshot and stab wounds) and blunt injuries (motor vehicle collision). The associated injuries were mainly bony fractures, permanent nerve injury, and soft tissue defects requiring muscle flaps. Majority of the cases were managed by RGSV Bypass as in this study, with polytetrafluoroethylene graft used in patients with unsuitable greater saphenous vein. In the six year study by Cooper et al, majority of cases (70.7%) were managed by reversed saphenous vein interposition grafting. Polytetrafluoroethylene grafting was done in two patients due to unsuitable autogenous graft. Temporary shunts were used in 10.6% of cases.^[5]

The limb was salvaged in 95% of cases in our study. In the

COMBINED RADIAL & ULNAR ARTERY (N=13)	ACCIDENTAL SHARP INJURY (6) SELF INFLICTED SHARP INJURY (6) ASSAULT (1)	TRANSECTION (13)	MULTIPLE TENDON INJURY (13) MEDIAN NERVE INJURY (11) ULNAR NERVE INJURY (5) RADIAL NERVE (3)	RGSV BYPASS (10) PRIMARY REPAIR (1) BOTH RGSV BYPASS AND PRIMARY REPAIR (2)
ULNAR ARTERY(N=10)	ACCIDENTAL SHARP INJURY (5) SELF-INFLICTED SHARP INJURY (2) ASSAULT (2) ROAD TRAFFIC ACCIDENT (1)	TRANSECTION (8) PARTIAL TEAR (2)	TENDON INJURY (10) ULNAR NERVE (8) MEDIAN NERVE (4)	RGSV BYPASS (6) PRIMARY REPAIR (4)
RADIAL ARTERY (N=6)	SELF-INFLICTED SHARP INJURY (4) ACCIDENTAL SHARP INJURY (2)	TRANSECTION (4) PARTIAL TEAR (2)	TENDON INJURY (3) MEDIAN NERVE INJURY (1)	PRIMARY REPAIR (4) RGSV BYPASS (2)
AXILLARY ARTERY (N=3)	RTA (2) ASSAULT (1)	CONTUSION THROMBUS (2) PSEUDO ANEURYSM (1)	AXILLARY VEIN INJURY (1)	RGSV BYPASS (ALL CASES) PSEUDO ANEURYSM SAC LIGATION (1 CASE)
SUPERFICIAL FEMORAL ARTERY(N=4)	PENETRATING INJURY (2) RTA (1) PIG BITE (1)	PARTIAL TEAR (2) CONTUSION THROMBUS (1) TRANSECTION (1)	SUPERFICIAL FEMORAL VEIN INJURY (3) FRACTURE FEMUR (1)	RGSV BYPASS (4)
COMMON FEMORAL ARTERY(N=2)	PENETRATING INJURY (2)	PARTIAL TEAR (2)	COMMON FEMORAL VEIN INJURY (1)	RGSV BYPASS (1) VEIN PATCH REPAIR (1)
ANTERIOR & POSTERIOR TIBIAL ARTERY (N=3)	RTA (2) ACCIDENTAL SHARP INJURY(1)	TRANSECTION (2) CONTUSION THROMBUS (1)	FRACTURE BOTH BONE LEG (2) TENDON INJURY (2)	RGSV BYPASS (3)

Sciarretta et al series limb salvage rate was 83%.^[4] Hafez et al had a limb salvage rate of 83.8%.^[6] For Usman et al, limb salvage rate was 82.7%.^[3]The better limb salvage rates in our study can be accounted for by presence of full-fledged vascular surgery department in this tertiary hospital. The major reason for limb loss in our study was delay in presentation of more than 12 hours. In the Sciarretta et al study, delay in vascular repair greater than seven hours, arterial transection, associated bone fracture, and compartment syndrome were considered risk factors for limb loss.^[4] For Hafez et al, independent risk factors for amputation were occluded graft, combined above- and below-knee injury, tense compartment, arterial transection and associated compound fracture.^[6] Time of presentation is a crucial parameter in limb salvage.

In our study, brachial artery injuries were caused by fall, RTA and accidental sharp injuries. Major associated injuries were Fracture humerus and median nerve injury. Majority of the cases were managed by RGSV bypass while two cases involving spasm of the artery required no surgical repair. In the study by Ergunes et al, majority of patients with brachial artery injury had penetrating injuries followed by blunt trauma injuries and gunshot injuries. Major associated injury was peripheral nerve injury. Most of the cases were managed by end-to-end anastomosis followed by reversed saphenous vein interpositional grafts.^[7] In the study by Nagre SW et al, majority had penetrating injuries followed by blunt trauma injuries (traffic accidents). The most common associated injury was peripheral nerve injury. The cases were managed by end-to-end anastomosis and reversed saphenous vein interpositional grafts.^[8]

CONCLUSIONS

Vascular injuries are a major cause for limb loss in developing countries. The major cause of limb loss is delay in presentation and unavailability of vascular facilities.

The morbidity can be reduced by developing an emergency ambulatory system and by making available vascular services in remote areas so that delay can be minimized.

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