

Outcome of popliteal arterial injuries presenting to the Teaching Hospital, Anuradhapura

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Abstract

Introduction

Popliteal artery (PA) injury is an emergency that has a high limb threat potential.

Methodology

This is a retrospective study of those with documented PA injuries in bed head tickets among those presenting with arterial injuries to the Teaching Hospital, Anuradhapura (THA) from January 2017 to June 2019. Demography, anatomical details of injury, concomitant injuries, type of surgical intervention and perioperative outcomes were assessed.

Results

Twenty case records were studied. Eighteen (90%) were males, with a mean age of 38.7 years (18-69). Eight (40%) were following motorcycle accidents and 7 (35%) were trap gun injuries. Median ischemic time was 9.5 hours (3-29). Seventeen (85%) had associated fracture or dislocation (p0.003). Four (20%) had associated venous injury. Seven arteries (35%) were contused, 6 (30%) were lacerated. Eleven (55%) underwent reversed saphenous vein graft repair, end to end anastomosis was done in 1 (5%) and ligation was done in 2 (10%). None of the patients underwent fasciotomy at the hospital where they were admitted first. Nine of fourteen patients (64.3%) had all compartments viable on fasciotomy. Two (10%) patients following trap gun injury who also had associated venous injury underwent amputation. Concomitant venous injury had a significant association with amputation rate (p 0.0316)

Conclusion

Motorcycle accidents and trap guns were the leading cause of PA injury. PA injury was significantly associated with fractures around the knee joint. Concomitant popliteal venous

injury, which is common after trap gun injury, had significant association with poor outcome.

Introduction

Popliteal arterial injury is a potentially life or limb threatening vascular emergency. The close anatomic relationship of the popliteal artery to the distal femur, proximal tibia and knee joint apparatus makes it extremely vulnerable to injury in the case of skeletal and joint injuries in the knee region. Popliteal arterial injury is commonly associated with fractures of the tibial plateau, supracondylar femur fractures and knee joint dislocations from road traffic accidents.

Trap gun injuries are also common in rural Anuradhapura and adjacent districts. There are approximately 200 admissions annually to Teaching Hospital, Anuradhapura following trap gun injuries which is one of the leading causes of popliteal arterial injury with associated musculoskeletal trauma (1).

Paucity of Sri Lankan literature is noted regarding civilian popliteal arterial injuries. Available studies regarding popliteal arterial injury describe mainly the war time experiences. The aim of this study is to describe the injury pattern, associated factors, treatment and perioperative outcome of popliteal arterial injuries presenting to THA.

Methodology

This was a retrospective study from available hospital records of those treated for PA injury at the Teaching Hospital, Anuradhapura from 01st January 2017 to 31st June 2019. Patients with arterial injuries, but poor documentation were excluded from this study.

Patient demographics, mechanism of injury, arterial level of injury, associated fractures or dislocation, muscle viability, definitive vascular surgical intervention, ischaemic time, orthopaedic intervention and outcome were included as study variables.

The data analysis was done using SPSS v.21. Categorical data was analysed using Fisher Exact Test and one sample Binominal test. A 'p' value of less than 0.05 was taken as statistically significant.

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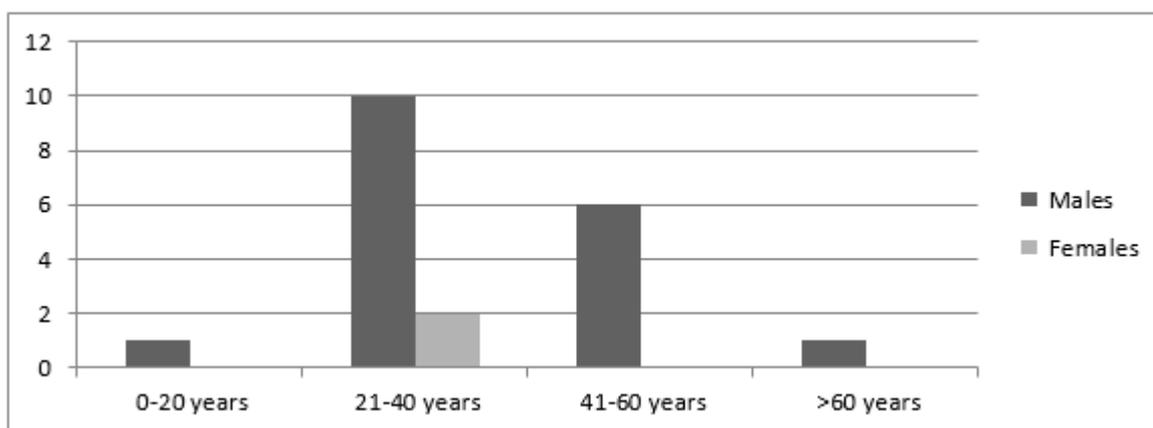
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Graph 1. Age and gender of study population

Results

Twenty patients with case records were studied. Eighteen (90%) were males ($p < 0.000$). Mean age was 38.7 years (Range 18-69). Eighteen (90%) patients were in the 21-60 year age group (Graph 1).

All had been transferred from another hospital. Mean distance of transfer was 102km (Range 28-195). Distance between THA and other hospitals was less than 50km in only 6 (30%), from 51km to 100km in 4 (20%), from 101km to 150km in 8 (40%) and more than 150km in 2 (10%). Median ischaemic time was 9.5 hours (Range 3-29)

Eleven (55%) of PA injuries were following road traffic accidents. Eight (40%) were in motorcyclists and one was a pedestrian. Of the remaining 9, seven (35%) were from trap guns and two (10%) were iatrogenic during orthopaedic internal fixations. PA injuries were significantly associated with fractures ($p < 0.003$) Details of the type of skeletal and joint injuries associated with PA injuries is depicted in table 1.

Spanning external fixation was done in 13/17 (76.5%) prior to vascular repair. 2/17 (11.8%) had internal fixation of tibial

Table 1. Associated skeletal injuries

Fracture / Dislocation	Open fractures	Closed fractures	Number of cases
Tibial plateau fracture	0	7	7
Tibial plateau fracture with knee joint dislocation	1	1	2
Tibial plateau fracture with supracondylar	0	1	1
femur fracture	0	1	1
Supracondylar femur fracture	0	2	2
Extra-articular proximal tibial fracture	1	0	1
Extra-articular proximal tibial fracture	2	1	3

plateau fracture during which procedure iatrogenic injury of popliteal artery occurred. Plaster of Paris back slab immobilization was done in 2/17 (11.8%) who had fibular head fracture.

PA injury was associated with popliteal vein injury in 4 (20%) and common peroneal nerve injury in 1 (5%). Concomitant popliteal venous injury, 3/7 were more commonly seen following trap gun injuries ($p = 0.1011$). Traffic accidents had a significant association with PA contusions ($p = 0.04$) while trap guns caused significantly more arterial lacerations ($p = 0.04$).

Reversed saphenous venous graft repair was done in 11 (55%) patients. Five (25%) underwent thrombectomy only. End to end anastomosis was done in 1 (5%) patient. Venous patch repair was done in 1 (5%) patient. Ligation was done in 2 (10%) patients who had concomitant popliteal artery and vein injury following trap gun injury.

None had a fasciotomy prior to transfer to THA. Fourteen patients were subjected to fasciotomy at THA prior to vascular repair. Nine (64.3%) had all 4 compartments viable with a mean ischaemic time of 8.5 hours. One (7.1%) had three compartments viable with 17 hours of ischaemia. Another (7.1%) had two compartments viable after 13 hours of ischaemia and one (7.1%) had only one viable compartment with 7 hours of ischemia. All the compartments were non-viable with a mean ischemic time of 9.5 hours in 2/14 (14.2%) who also had concomitant popliteal vein injury and both were from trap gun injuries.

Table 2. Arterial level injury

Arterial level injury	Trap gun injury	RTA	No of cases
Documented			15
Contusion	1	6	7 (46.7%)
Laceration	5	1	6 (40 %)
Spasm	1	1	2 (13.3%)
Not assessed due to fibrosed popliteal fossa			2

Only those two were subjected to primary amputation. Details of the type of arterial injury, concomitant injuries, ischaemia time, compartment viability, revascularization and early outcomes are depicted in table 3.

Discussion

The data presented shows that young males (mean age - 38.7 years), particularly motorcyclists (40%) are at risk of PA injury. Such injuries are likely to have a major economic impact on young families. Similar data has been reported in other regional and international studies on injuries to PAs (1, 2, 3, 4). Preventive measures targeting vulnerable motorcyclist needs emphasis. Trap gun injuries are still a major cause (35%) and a continuing concern in rural Sri Lanka. THA has attributed approximately 200 admissions annually to injuries from trap guns (5). The only two primary amputations were following trap gun accidents and must have been due to the extent of soft tissue injuries, contamination and associated popliteal venous injuries. Implementation and enforcement of the existing legal framework against trap gun

users is mandatory to prevent trap gun injuries and associated morbidity and mortality.

The known association between PA injury and fracture-dislocations around the knee was confirmed in this small study. However, our patients with PA injuries had more closed injuries as opposed to most other series that have reported open injuries (1, 2, 3, 4, 6). Interestingly, the poor outcomes reported when PA injuries were associated with fracture dislocations (10) were not seen our series.

In our study population 4 (20%) had concomitant PA and vein injury. Two of these patients presented with dead muscle in all four compartments and underwent primary amputation. Another with concomitant venous injury had three nonviable muscle compartments after only 7 hours from injury pointing to the understandably adverse influence on muscle viability. Primary amputation had a significant association with concomitant PA and vein injury ($p=0.0316$) in our series and is in keeping with results reported elsewhere (7).

Table 3. Summary of Outcome (No - number, Sex - Male, F - Female, RTA - Road Traffic Accidents, PA - Popliteal Artery, PV - Popliteal Vein, NV - Non Viable, ND - Not Documented, IT - Ischemic Time, RSVG - Reversed Saphenous Vein Graft, EE - End To End Repair, LR - Lateral Repair, TG - Trap Gun, IJ - Iatrogenic Injury, Comp - Compartment Viability, AV - All Compartments Viable, T - Thrombectomy, VP - Venous Patch)

No	Age	Sex	Mechanism	Vessel	IT	Comp	Surgery	outcome
1	37	M	RTA	PA + PV	7.0	3NV	RSVG, VEIN - LR	Healing & salvaged
2	69	M	RTA	PA	13.0	AV	RSVG	Healing & salvaged
3	60	M	RTA	PA	29.0	ND	RSVG	Healing & salvaged
4	37	M	TG	PA	6.0	AV	RSVGR	Healing & salvaged
5	35	M	TG	PA + PV	5.0	AV	T + VEIN LR	Healing & salvaged
6	37	M	TG	PA	8.0	AV	RSVG	Healing & salvaged
7	41	M	TG	PA + PV	9.0	4 NV	LIGATION	Amputated
8	40	M	RTA	PA	7.0	AV	T	Healing & salvaged
9	18	M	RTA	PA	18.0	ND	RSVG	Healing & salvaged
10	33	M	RTA	PA	11.0	AV	RSVG	Healing & salvaged
11	58	M	RTA	PA	15.0	ND	T	Healing & salvaged
12	47	M	TG	PA	8.0	AV	T	Healing & salvaged
13	42	M	RTA	PA	6.5	AV	EE	Healing & salvaged
14	36	F	RTA	PA	17.0	1 NV	T	Healing & salvaged
15	24	M	RTA	PA	3.0	ND	RSVG	Healing & salvaged
16	26	M	TG	PA + PV	10.0	4 NV	LIGATION	Amputated
17	42	M	TG	PA	6.0	ND	RSVG	Healing & salvaged
18	28	M	IG	PA	13.0	2NV	RSVG	Healing & salvaged
19	27	F	IG	PA	13.0	ND	RSVG	Healing & salvaged
20	37	M	RTA	PA	12.0	AV	VP	Healing & salvaged

Considering the long distances patients had to travel to get to the THA following PA injuries it is not surprising that ischemia times reaching 29 hours, median 9.5 hours, were well beyond the commonly taught 6 hour cut off. Immediate fasciotomy and an aggressive approach to revascularise and to deal with reperfusion whenever did pay off in the short term in not having to amputate in the perioperative period. Of course a long-term follow up is needed to establish if revascularizing severely damaged limbs is worthwhile.

Finally, four compartment fasciotomy at the primary hospital may have minimised ischaemic damage to skeletal muscle (8) during transfer of patients to THA. Unfortunately none of those treated at the THA had the benefit of a pre-transfer fasciotomy and it may be necessary to make fasciotomy a prerequisite in all instances where a patient with an extremity arterial injury is transferred.

All authors disclose no conflict of interest. The study was conducted in accordance with the ethical standards of the relevant institutional or national ethics committee and the Helsinki Declaration of 1975, as revised in 2000.

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