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60 Cases of Civilian Popliteal Artery Injury and their Clinical Outcome

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Abstract

Background: Popliteal artery injuries have been associated with highest rates of amputations after lower extremity vascular injuries. Early diagnosis of vascular injury, early revascularization of the ischemic limb and management of concomitant injuries are the key factors in preventing morbidity or mortality in such cases. The aims and objective of this study is to evaluate outcome following civilian popliteal vascular injury and identification of predicting factors for amputation.

Material and methods: Retrospective data of 80 patients over 5 yrs from January 2012 to December 2017 period was collected for patients admitted with popliteal artery injury with or without concomitant bone or other systemic injury. Patient's age, sex, mode of injury, mangled extremity severity score (MESS), associated venous and or neural injuries and other physiological parameters assessed. Time to operative intervention, requirement of multiple (more than 2) blood transfusions, other orthopedic or systemic injuries requiring need for concomitant other surgical intervention, timing of orthopedic intervention pre or post vascular interventions and outcome in the form of amputation or in hospital mortality were recorded.

Results: We studied 80 patients with civilian popliteal artery injury with median age of 35 yrs (range 8 to 65 yrs.) the median MESS was 6. Mechanism of injury was blunt for 58% and penetrating for 42%. Fasciotomy was performed in 80% of patients. Out of all 80 patients 56 patients (70%) patients underwent concomitant orthopedic surgical intervention of which 52 patients had undergone orthopedic intervention prior to vascular surgery. Higher rates of amputation were noted for patients with MESS more than 7, patients with poly trauma and patients presented to surgery after 12 hrs of trauma. Patients requiring multiple blood transfusions, age more than 50 and associated comorbid conditions had highest mortality rates.

Conclusion: Popliteal artery trauma is a major source of patient morbidity and is important cause of amputation after injuries to the lower extremity. Blunt trauma, Higher MESS, associated bony injuries requiring surgical intervention are important predictors of amputation but associated venous or neural injuries have no role as predictor of amputation. Higher blood transfusion requirement and concomitant other systemic injuries requiring surgical interventions have high risk of in hospital mortality. Timing of orthopedic intervention pre or post vascular repair does not impact clinical outcome.

Keywords: Popliteal artery injury; Blunt trauma; Amputation; MESS.

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Introduction

Popliteal vascular trauma is an uncommon but potentially devastating problem that carries the greatest risk of limb loss of any peripheral vascular

injury.[1] majority of civilian popliteal arterial injury are mostly due to blunt trauma which is also associated with worse outcome as compared to injuries with penetrating trauma.[2,3] Unfortunately these injuries are often fraught with destructive soft tissue defects, bone disruption, and nerve deficits, leading to relatively poor outcomes and amputations rates as high as 65%.[4,5,6]

Patients undergo vascular intervention for single or multiple times and many of them ultimately end up with amputations. In order to optimize patient outcomes and to avoid additional morbidity including in hospital mortality, it is very important to identify patients who require urgent vascular intervention to save the limbs and those who have unsalvageable extremities. Early diagnosis of vascular injury, early revascularization of the ischemic limb and management of concomitant injuries are the key factors in preventing morbidity or mortality in such cases. In addition many of these patients require concomitant orthopedic interventions. It is important to asses whether these patients will have any changes in outcome if they under goorthopedic interventions prior.

In this study we evaluated our experience with 80 patients of popliteal artery injuries with or without associated orthopedic or systemic injuries and tried to identify risk factors associated with high rates of morbidty including amputations and in hospital mortality.

Material and Methods

A retrospective review and analysis was conducted of all patients admitted with popliteal artery injuries over period of 5 yrs from January 2012 to December 2017 conducted. Variables analysed were patients age, gender, mechanism of injury, mangled extremity severity score (MESS), time to vascular interventions after injury, requirement of multiple (more than 2) blood transfusions, associated orthopedic and other systemic injuries requiring surgical interventions, timing of orthopedic intervention pre or post vascular repair and associated venous and neural injuries. Amputations were either primary (no attempt of vascular intervention) or secondary (after single or multiple attempts of vascular interventions). We defined major amputation as limb loss at or proximal to the ankle. Clinical outcomes noted including in hospital mortality and amputations.

Univariate analysis were used to identify predictors of amputations. Continuous variables were summarized using means and standard deviations and compared using student t test. Categorical data were compared using Fischer's test or Chi square test as appropriate or as odds ratio with 95% confidence intervals.

Results

80 patients had popliteal artery injuries with median age of 35 yrs. Of these 80 patients 68 patients were male and 12 patients were female. Mechanism of injury was blunt trauma in 70 patients and penetrating injury in 10 patients. 56 patients required orthopedic interventions including 4 patients requiring laparotomy for hemoperitoneum and 2 patients required craniotomy. Out of 56 patients 52 patients underwent orthopedic interventions prior to vascular repair. There was no incidence of amputations for those who underwent orthopedic interventions prior to vascular repair compared to those who underwent vascular repair first. Out of 80 patients 36 had associated venous and 15 had associated neural injuries. Ultimately 20 patients required amputations out which 6 immediate and 14 after single or multiple attempts of vascular surgeries. Of these 20 patients 18 had blunt trauma and 2 patients had penetrating injuries. There was no difference in patient age, sex or associated venous and or neural injuries but these patients had higher MESS (9.5 vs 4.8), higher transfusion requirements ($p<0.05$). 4 patients died in hospital, all of which had concomitant systemic injuries requiring surgical intervention (3 patients required laparotomy and 1 required craniotomy).

Discussion

Trauma is the leading cause of morbidity and mortality around the world. The overall incidence of trauma and vascular injuries is increasing, and although vascular injuries are present in only 1 to 2% of injured patients,[1] these patients account for a far greater share of morbidity, mortality and resource utilization than those without such injuries.[2,3] Popliteal artery injury (PAI) is considered to be rare, with a reported incidence of <.2%.[5] It is the second most common vessel injury in the lower extremity and is associated with significant amputation rates when compared to other lower-extremity artery injuries.[1,2]

Demography

As is typical for the general population of injured patients, those with extremity vascular injuries

tend to be young, with average ages in the 30s, and predominantly (70%–90%) male.[2,3,8]

In our study the median age of studied patients was 35 years and out of 80 patients 68 patients (85%) were male.

Of 20 patients who had amputations (primary or secondary) 19 were male and 1 female which suggest no significant association with gender. (p=0.43)

Mode of Injury

Blunt popliteal artery injury is most commonly a result of posterior knee dislocation with traction/ avulsion of the vessel or injury due to bony fragments. Blunt injury to the popliteal vessels is typically associated with significant transmission of force to the lower extremity that can result in associated soft tissue, bony, and nerve injury. The more extensive injury to the vessel and surrounding structures complicates the management of blunt injuries and likely explains the higher amputation rates compared with penetrating injury. In a review of published series of blunt popliteal artery injuries, the average amputation rate was 28% vs 11% for penetrating injury and ranged as high as 71%.[6]

Our study group had 70 blunt (87.5%) and 10 penetrating (12.5%) injuries. Of the amputation group 18 had blunt and 2 had penetrating injuries suggesting higher incidence of amputation with blunt injuries (p=1 >0.05).

Venous and neural injuries

Different studies showing 40%–50% of popliteal arterial injuries are associated with popliteal vein injuries and 7% to 25% patients have associated nerve injuries with popliteal arterial injuries.[4,9]

in our group 36 out of 80 (45%) patients had popliteal vein injury and 15 out of 80 (18.7%) patients had associated nerve injuries. In amputation group out of 20 patients 7 patients had associated venous and 4 patients had associated neural injuries. There is no significant association between amputation and venous injuries (p=0.4) and neural injuries (p=1) noted.

Bony injuries

Several lower extremity orthopedic injuries, including *knee dislocations*, displaced *medial tibial plateau* fractures, other displaced bicondylar fractures around the knee, open or segmental distal *femoral shaft fractures*, and mangled extremities, are associated with a high index of suspicion for vascular injuries.[10]

The popliteal artery, by virtue of its ligamentous fixation and anatomic relationships to the femur, tibial plateau, and knee joint apparatus, is uniquely susceptible to injury with blunt extremity trauma around knee joint.[11]

We had 56 out of total 80 patients with concomitant orthopedic injuries and out of 20 patients with amputations we had 17 patients with concomitant bony injuries. Statistical analysis showed strong association with concomitant bony injuries and risk of amputation (p<0.05).

Mangled Extremity Severity Score (MESS)

Many predictive scoring systems have failed to provide definitive criteria for limb salvage success. Mangled Extremity Severity Score (MESS) is one of the widely studied and widely used predictive scoring system for amputations in extremity trauma which comprise of soft tissue damage, shock, limb ischemia and age. MESS more than 7 is associated with high rates of amputations in extremity trauma.[12]

In our study patients with amputations had mean MESS 9.5 in comparison to the limb salvage group with mean MESS 4.8. our data correlated that higher MESS is important predictor for amputation which is also supported by literature.

MESS

• Skeletal/soft-tissue injury:	
low energy (stab, simple fracture, civilian gunshot)	1
medium energy (open or multiple fracture, dislocation)	2
high energy (shotgun, military gunshot injury, crush injury)	3
very high energy (as above, plus soft-tissue avulsion)	4
• Shock:	
stable (systolic RR maintained > 90mmHg)	0
transient hypotension	1
persistent hypotension	2
• Limb ischaemia: (* doubled for limb ischaemia > 6h)	
no ischaemie (puls present)	0
mild ischaemia (pulse reduced or absent, but normal perfusion)	1*
moderate ischaemia (reduced capillary refilling)	2*
severe ischaemia (no capillary refilling)	3*
• Age:	
< 30 years	0
30 – 50 years	1
> 50 years	2
Score range:	**1 - 14**

Timing of orthopedic intervention pre or post vascular repair:

Recent literature reveals controversial opinions about the sequence of surgical repair in cases where fracture fixation and vascular repair are required.[14,15] Some authors support the concept of urgent revascularization in case of critical perfusion or present severe ischemia of the affected leg. The primary argument of this concept is to decrease warm ischemia time.[13,14] Otherwise, it seems to be obvious that successful revascularization of the limb in case of artery injury might be affected by a completely unstable limb. We had 4 patients who underwent orthopedic fixation post vascular repair out of which 2 patients had amputation while 52 patients had prior orthopedic intervention out of which 10 had amputations. No significant association noted with timing of orthopedic intervention pre or post vascular repair (p=0.19).

Requirement of multiple blood transfusions and associated systemic injuries

Our study group showed that out of amputated group had higher rates of multiple blood transfusion (all 20 of amputated as compared to 34 out of 60 of non amputated group). While all 4 patients who were having concomitant systemic injuries and underwent concomitant other surgical interventions died in hospital.

Trauma to popliteal artery can be associated with popliteal venous injuries in addition to the arterial injury. These vascular structures can bleed profusely and associated soft tissue injuries including large muscular hematoma can be significant source of haemorrhage. More over associated bony injuries, systemic injuries and loss of blood during amputation surgeries it self can be significant too. Patients with vascular and multi organ injuries, active hemorrhage and shock have a poor prognosis and demand more urgent management than do patients with isolated limb injuries in which perfusion and blood pressure remains optimal. Shock is associated with a significant rate of amputation. These patients, whether with multi-organ or isolated vascular injuries, need judicious treatment for hypovolumic shock during surgical intervention and post-operative period.[13]

So all these conditions put our patients in more critical situations and lead to higher blood transfusion requirements and in 4 patients to death.

Conclusion

Popliteal artery trauma is a major source of patient morbidity and is important cause of amputation after injuries to the lower extremity. Blunt trauma, Higher MESS, associated bony injuries requiring surgical intervention are important predictors of amputation but associated venous or neural injuries have no role as predictor of amputation. Higher blood transfusion requirement and concomitant other systemic injuries requiring surgical interventions have high risk of in hospital mortality. Timing of orthopedic intervention pre or post vascular repair does not impact clinical outcome.

Conflict of Interest: No.

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