Injury, Int. J. Care Injured xxx (2018) xxx–xxx

Contents lists available at ScienceDirect

Injury

journal homepage: www.elsevier.com/locate/injury

# Risk factors associated with amputation in civilian popliteal artery trauma

Michael J. Ramdass*, Alyssa Muddeen, Patrick Harnarayan, Richard Spence, David Milne

*Department of Clinical Surgical Sciences, University of the West Indies, St. Augustine, Trinidad, West Indies*

ARTICLE INFO

*Article history:*
Accepted 23 April 2018

*Keywords:*
Popliteal artery trauma
Civilian trauma

ABSTRACT

Popliteal artery trauma is uncommon but is associated with a high risk of limb loss depending on the scenario involving blunt or penetrating trauma as well as the severity and extent of injury that has occurred. In our setting there is a significant amount of gang and civilian warfare resulting in Vascular Trauma. There were 32 patients over a decade who sustained traumatic injury to the popliteal artery consisting of 30 males (94%) and 2 females with an age range 16–59 years with a mean of 32. There were 20 cases of penetrating trauma (63%) and 12 cases of blunt trauma (37%). Of the penetrating trauma, 18 were due to gunshot wounds (GSWs) (90%) and 2 stabs. The majority (7/12; 58%) of blunt trauma was due to falls, and 42% (5/12) secondary to motor vehicular accidents (MVAs). In terms of extent of injury, 21 of 32 patients (65%) sustained an isolated popliteal artery injury, whilst 6 (19%) had injury to both the popliteal artery and vein and another 5 (16%) had combined popliteal artery, vein and nerve injuries. There were 14 cases with associated orthopaedic injuries: 7 posterior knee dislocations, 1 fracture/dislocation of the knee, 2 femoral fractures, 2 tibial plateau fractures and 2 tibia/fibula fracture. Methods of repair included 14 reversed vein grafts, 16 polytetrafluoroethylene (PTFE) grafts and 2 primary. The overall amputation rate was 28% (9 patients). Of the penetrating trauma patients 25% required amputations composed of 5 GSWs, 33% of the blunt trauma patients required amputations. It was noted that factors associated with (but not statistically significant) poor outcomes included combined artery/vein injury, artery/vein/nerve injury, concomitant fracture/dislocation and delayed transfer to a Vascular Surgery Unit. The type of graft or repair did not affect outcome. The incidence of popliteal artery trauma was calculated at 2.46 per 100,000 population per year.

© 2018 Elsevier Ltd. All rights reserved.

## Introduction

Injury to the popliteal vessels has long been recognized as the most limb-threatening injury to the lower limb [1] (Fryberg, 2002). This is due to the fact that the popliteal artery has a limited collateral blood supply and the popliteal vein provides the bulk of lower limb drainage. Historically, Popliteal Artery Injury (PAI) was associated with high amputation rates as demonstrated during World War II, where limb loss was as high as 73% [2] (Debakey ME) as ligation was the standard of care. In current civilian practice, amputation rates range from 14.5–25% [1,3,4], but higher rates of 29% and 37.5% have been reported in other series by *Nair* et al. in 2000 [5] and *Banderker* et al. in 2012 [6] respectively. The aim of this study is to determine the incidence of popliteal artery trauma in Trinidad and Tobago, its amputation rates and related factors where the trauma is related to gang and civilian warfare [7,8].

## Patients & methods

A retrospective review was conducted over a 10-year span from January 2007–January 2017 at the General Hospital, Port-of-Spain (POSGH) and the San Fernando Teaching Hospital (SFTH). The POSGH and SFTHs are the main public hospitals in the largest cities in the North and South of Trinidad and Tobago.

Trinidad & Tobago are the southern-most islands in the Caribbean island chain just off the coast of South America and Venezuela. As a result it has an active drug and illegal arms trade occurring which results in a high percentage of gang and civilian-related trauma [9]. The two teaching hospitals which are included in this study are in the North and South of the islands and have a catchment of 1.3 million persons including Tobago. The general time of transfer varies significantly within Trinidad, however when trauma does occur in Tobago or in the East of Trinidad requiring

* Corresponding author at: University of the West Indies, General Hospital, Port of Spain, Trinidad, West Indies.
*E-mail address:* michael.ramdass@sta.uwi.edu (M.J. Ramdass).

https://doi.org/10.1016/j.injury.2018.04.028
0020-1383/© 2018 Elsevier Ltd. All rights reserved.

Please cite this article in press as: M.J. Ramdass, et al., Risk factors associated with amputation in civilian popliteal artery trauma, Injury (2018), https://doi.org/10.1016/j.injury.2018.04.028

transfer, the delay can be as much as 12 h at times. With appropriate Ethical approval granted, patient data was extracted from the operating theatre medical records and patient medical records with regard to demographics, mechanism of injury, type of repair done, associated injuries, transfer time and outcomes. The primary end point was defined as limb salvage at 1 month where there was no attempt to revascularize. Secondary amputation was defined as those performed after failure after revascularization. There were no scoring systems applied to the patient data which was analysed using SPSS verson 22.

## Results

There were 32 patients over a decade who sustained traumatic injury to the popliteal artery, 15 from POSGH and 17 from SFTH. There were 30 males (94%) and 2 females with an age range 16–59 years and a mean of 32. All patients were explored and had a repair done to the popliteal artery.

There were 20 cases of penetrating trauma (63%) and 12 cases of blunt trauma (37%). Of the penetrating trauma, 18 were due to gunshot wounds (GSWs) (90%) and 2 stabs. The majority of the blunt trauma was due to falls, 7 (58%) and 5 (42%) secondary to motor vehicular accidents (MVAs).

In terms of the extent of injury, 21 of the 32 patients (65%) sustained isolated popliteal artery injury, whilst 6 patients (19%) had injury to both the popliteal artery and vein and another 5 patients (16%) had combined popliteal artery, vein and nerve injuries. There were 14 cases with associated orthopaedic injuries: 7 posterior knee dislocations, 1 combined fracture/dislocation of the knee, 2 femur fractures, 2 tibial plateau fracture and 2 tibia/fibula fracture. Methods of repair included 14 reverse vein grafts, 16 polytetrafluoroethylene (PTFE) grafts and 2 primary.

The overall amputation rate in this study was 28%. There were no primary amputations performed and 9 patients (28%) required secondary amputations. Of the penetrating trauma patients 25% (5 of 20) required amputations composed of 5 GSWs, 33% (4 of 12) of the blunt trauma patients required amputations.

Table 1 shows the raw patient data from 2007 to 2016 with reference to year of injury, age, gender, injury sustained, the procedure done and outcome. The incidence rate of popliteal artery injury requiring intervention was calculated at 2.46 per 100,000 population per year.

Fig. 1 shows the number of amputations associated with different factors. Delayed transfer to a Vascular Unit, associated fracture/dislocations, combined artery/vein as well as combined artery/vein/nerve injuries were associated with higher rates of amputation but did not achieve statistical significance (Table 2).

With regard to the use of PTFE vs Reversed Vein vs Primary repair, the outcomes were not statistically significant using Fisher's Exact Test (Table 2). There were 16 PTFE graft repairs with 6 amputations, 14 Reversed Vein Graft Repairs with 3 amputations and 2 Primary Repairs with no amputations.

## Discussion

Popliteal artery injury (PAI) is the second most common infrainguinal arterial injury worldwide [10] and more likely to result in limb loss compared with other peripheral vascular injuries. In our study, we found a higher incidence of amputation with combined artery/vein and artery/vein/nerve injuries, concomitant fracture/dislocations and delayed transfer to Vascular Surgery. From the literature, the factors associated with increased risk of amputation included combined injuries, delayed transfer/revascularization, blunt trauma, transfusions of more than 5 units intraoperatively and high Injury Severity Score (ISS) and Mangled Extremity Scores [10–12]. In a retrospective review of amputation rates associated with this injury in Los Angeles, *Keeley* et al. found 41 patients over a 14 year period with an amputation rate of 20% [11]. In another study, the largest published series of PAI done by *Mullenix* et al. [12] on review of the National Trauma databank, concluded that an amputation rate of 14.5% was associated with PAI: Amputation rates were 15% with combined arteriovenous injuries, 21% for associated nerve injuries, 12% for major soft-tissue disruptions, 21% for femoral, 12% for knee, and 20% for tibia-fibula fractures or dislocations. In our study we had an overall amputation rate of 28%: 33% with combined arterio-venous injuries, 60% for combined arterial/venous/nerve injuries, 36% of the patients with orthopaedic injury mainly dislocation, 57% with associated fractures and 100% of patients with delayed transfer (Fig. 1).

The mechanism of injury is an important factor that has been shown to directly affect patient outcomes. Blunt trauma is usually associated with an increased rate of amputation compared with penetrating trauma [13–16]. As noted by *Mullenix* et al. [12] blunt trauma usually results in posterior knee dislocations with traction and disruption of the vessels, however they did note that penetrating trauma is not as commonly seen as blunt trauma. Also, blunt injuries are more likely to result in orthopedic injuries [16]. From our study we did not find a statistical difference in amputation rates between penetrating trauma (25%) and blunt trauma (33%). In our setting penetrating trauma is more common and directly related to GSW-type injuries. In 78% (14/18) of these cases there was a pure arterial component with the remainder being associated with venous, nerve or bony injuries. All these patients were immediately explored with no delay in reconstruction. They were also mostly healthy young and fit males.

Orthopedic injuries also complicate the management of PAIs, often occurring as a results of blunt injuries with occult PAI, damage to multiple structures and extensive soft tissue injury [16]. Similarly in our study, 36% (5/14) of the patients with orthopedic injuries required amputation and 57% (4/7) of the patients with an associated fracture required an amputation. It is also now well established that vascular repair should precede orthopedic intervention either in the form of definitive arterial repair or temporizing shunts [17,18], however in our series we always arranged to quickly stabilize any fractures first with an external fixator device.

Another important principle in the management of PAI is prompt revascularization to prevent prolonged ischemia. The exact time interval between injury and intervention was difficult to assess but in our study there were 4 cases with a documented delayed transfer to vascular surgery and all 4 cases (100%) subsequently resulted in secondary amputations. Though the surgeon has limited control over transfers, methods in hospital to reduce the delay include a high index of suspicion and immediate surgical exploration without delay for angiography in patients with clinical signs of limb ischaemia [15].

From our study, combined artery/vein and artery/vein/nerve injuries were associated with higher rates of amputations (75% of the patients in each group). This is also reflected throughout literature with similar findings by *Keeley* et al. [11] *Mullenix* et al. [12] and *Lang* et al. [16]. This increased rate of amputation is likely because these combined injuries are usually associated with a higher amount of trauma delivered to the tissues [19]. Vein ligation has also been associated with higher rates of amputation, lower limb oedema, increased risk of compartment syndrome and thrombosis of arterial repair. Some studies however have now shown that venous ligation does not change outcomes and can be performed safely [20]. It has also been postulated that patient's with an increased calf muscle mass have a higher risk of amputation [8].

Please cite this article in press as: M.J. Ramdass, et al., Risk factors associated with amputation in civilian popliteal artery trauma, Injury (2018), https://doi.org/10.1016/j.injury.2018.04.028

Download English Version:

https://daneshyari.com/en/article/8718622

Download Persian Version:

https://daneshyari.com/article/8718622

Daneshyari.com