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Post-Traumatic Lower Limb Arterial Spasm: A Common Entity and an Important Cause for Diagnostic Dilemma: A Case Series

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Abstract

Introduction: Spasm of arteries result from contraction of the smooth muscles in the arterial media results in transient distal ischemia following trauma. This causes diagnostic dilemma. This study presents a series of lower limb arterial spasms following trauma.

Methods: This is a prospective study of patients admitted to the National Hospital of Sri Lanka Colombo (NHSL) with lower limb arterial injuries for five months duration. The arterial spasm was diagnosed if the pulse was absent or of low volume in the injured limb and; The pulse reappeared after a period of observation or Angiography demonstration spasm was demonstrated or Visual confirmation of spasm on surgical exploration.

Confirmed arterial injuries (e.g. on surgical exploration or on angiography), mangled limbs, compartment syndrome and patients with hemodynamic instability were excluded. All others who did not undergo surgical exploration underwent angiography confirmation of arterial spasm.

Results: 18 patients with arterial spasm were included. 16 (88.9%) were males. Median age was 27.5 years (13 to 70). The causes of injuries were road traffic accidents in 17 (94.4%) and iatrogenic in one. There were 9 (50%) tibia, 5 (27.8%) popliteal, 2 femoral and 2 iliac artery spasms. All had fractures or joint injuries or underwent a joint intervention. 3 (16.7%) patients underwent exploration and Fogarty dilatation of the arteries. In all patients the distal pulses appeared following a period of observation or after surgical exploration.

Conclusion: This study shows that young males are prone to develop spasms following trauma especially in tibial and popliteal arteries. Confirmation of spasm with more angiographies will help to avoid unnecessary surgical explorations.

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Introduction

Vascular injuries following trauma occur at a rate of 1% to 2% following civilian injuries and in 6.8% to 10.8% of cases following war related injuries [1-3]. Spasm of arteries result from contraction of the smooth muscles in the arterial media following trauma and results in transient distal ischemia. Diagnosis of distal ischemia following arterial trauma is difficult due to multiple factors and arterial spasm adds to this difficulty. This study presents a series of patients who had traumatic arterial spasm in the lower limb arteries.

Methodology

This is a prospective study done on consecutive patients presenting to a single vascular unit at the National Hospital of Sri Lanka Colombo (NHSL) which is a tertiary care center. Study was done from October 2019 to February 2020. Consecutive patients with lower limb injuries with absent or reduced distal pulses were assessed. Patient demography, cause of injury, the artery involved with spasm, associated injuries, angiography findings, interventions and outcome were recorded.

Patients with limb injury at a single site and absent distal pulses, with threatened limb viability (presence of numbness and weakness of muscles) were taken for surgical exploration immediately. Among the other patients, those needing immediate surgical care for other reasons (e.g. bleeding) were also taken for surgical exploration immediately. Patients who were hemodynamically unstable were excluded. In addition, patients who were found to have obvious arterial injuries at surgical exploration (laceration, contusion, transaction) and those showing angiography evidence of arterial

Table 1: Summary of patients presenting with post-traumatic arterial spasm.

Total limb injuries	81
Upper limb injuries	47
Lower limb injuries	34
Exclusion – Total	63
Proven arterial injuries	54
Mangled limbs	2
Non-viable limbs	4
Traumatic amputations	2
Incomplete record	1
Number included (patients with spasm)	18

injury (abrupt cutoff of the arterial lumen, irregular intima, contrast extravasation) were also excluded. In addition, mangled limbs and non-viable limbs on admission were also excluded.

All other patients underwent angiography (Computed Tomographic Angiography (CTA) or Digital Subtraction Angiography (DSA)). All underwent CTA except one patient with knee joint prosthesis on whom a DSA was done). The arterial spasm was diagnosed if the pulse was absent or of low volume in the injured limb soon after injury and;

The pulse reappeared after a period of observation (in mid and lower leg injuries) or

Demonstration of smooth tapering and narrowing of the arteries without other arterial injuries on angiography or

In patients who underwent surgical exploration, visual confirmation of uninjured and contracted arterial wall with narrow arteries (spasm).

All angiographies were interpreted by both the radiologist and the surgeon. The angiography findings and the clinical pulse status findings were considered when determining the anatomical location of the spasm.

All patients who were included in the study had distal saturation (SaO_2) recordable by pulse oximeter. In patients where the toe moments and the sensation were impaired the viability of the muscles was confirmed by fasciotomy and electrical stimulation of the muscles. All patients had their distal circulation monitored (by measuring SaO_2) continuously until the acute phase was over.

Results

There were a total of 81 limb injuries during the above period. 47 of them were upper limb injuries and 34 were lower limb injuries. 63 patients were excluded. Of the excluded patients, 54 had proven arterial injuries (laceration, contusion, transaction, etc.) and nine other patients had the following (mangled limb-2, non-viable limb-4, traumatic amputation-2 and incomplete record-1). Therefore 18 (22.2% of total traumatic limb vascular injuries) patients were diagnosed to have arterial spasm and were included (Table 1).

16 (88.9%) were males. Median age was 27.5 years (13 to 70). The causes of injuries were Road Traffic Accidents (RTA) in 17 (94.4%) and iatrogenic in one. The spasm due to iatrogenic cause was in a 45-year-old female who underwent knee joint replacement. The distal pulses were absent soon after the surgery. DSA was done; it showed intact arteries with evidence distal arterial spasm. Pulse reappeared spontaneously after a period of observation. There were 9 (50%) tibial, 5 (27.8%) popliteal, 2 femoral and 2 iliac arterial spasms (Table 2).

Table 2: Summary of cause and arteries involved.

Case No	Gender	Age	Cause	Fractures	Artery involved
1	23	M	RTA	Proximal Tibia	Popliteal
2	49	M	RTA	Pelvic	Iliac
3	16	M	RTA	Proximal Tibia	Popliteal
4	45	F	IAT	KJ Injury	Popliteal
5	52	M	RTA	Distal Tibia	Tibial
6	44	M	RTA	Mid Femur, Mid Tibia	Tibial
7	20	M	RTA	Distal Femur	Femoral
8	24	M	RTA	Distal Tibia	Tibial
9	13	M	RTA	KJ Injury	Popliteal
10	25	M	RTA	Distal Femur	Popliteal
11	22	M	RTA	Distal Tibia	Tibial
12	51	M	RTA	Distal Femur	Femoral
13	50	M	RTA	Distal Tibia	Tibial
14	25	M	RTA	Pelvic	Tibial
15	52	M	RTA	Femur, Proximal Tibia	Tibial
16	30	M	RTA	Pelvic	Iliac
17	70	F	RTA	Distal Tibia	Tibial
18	17	M	RTA	Proximal Tibia	Tibial

No: Number; M: Male; F: Female; RTA: Road Traffic Accidents; IAT: Iatrogenic; KJ: Knee Joint

All patients had fractures or joint injuries or underwent joint intervention. 3 (16.7%) patients underwent exploration and Fogarty dilatation of the arteries. In all patients the distal pulses appeared following a period of observation or after Fogarty dilatation. None of the patients in this series had secondary arterial thrombosis or lost their limbs due to arterial spasm.

Discussion

Arterial trauma, if not properly managed can result in loss of limb or loss of life. Signs and symptoms of vascular injury following trauma are traditionally divided into “hard signs” and “soft signs”. Hard signs include, active bleeding, expanding hematoma, thrill and bruit at the site of injury and signs of distal ischemia.

Signs of distal ischemia include 6"p"s. They are absent pulse, pain, perishing cold, pallor, paresthesia and paresis. Diagnosing distal ischemia following trauma is difficult due to multiple other factors contributing to the above signs and symptoms. For example, absent distal pulses, pallor and cold extremities could be due to hemorrhagic shock. The pain following trauma is often due to associated injuries. The paresis and paresthesia can be due to associated nerve or spinal injuries. In addition, all these signs are difficult to assess in a patient who is unconscious. In addition, the arterial spasm resulting from trauma adds to the difficulty of diagnosing distal ischemia further.

The first descriptions of the arterial spasm were among the ballistic injury victims of World War I [4]. At exploration of these patients the arterial wall was non-injured, but the arteries appeared contracted with minimal flow through them causing distal ischemia.

The smooth muscles in the arterial media contract in response to local stimulation and systemic factors. Local factors include trauma,

stretch and surgical exploration [5]. Systemic factors include the presence of shock, drugs and environmental factors like cold. Spasm of the muscular arteries is well known to occur in cerebral vessels e.g. after subarachnoid hemorrhage, and also in coronary arteries resulting in ischemia. In case of lower limb, the vasospasm occurs mainly in muscular arteries like the popliteal and distal arteries as in this series (77.8% of the spasm cases were popliteal and tibial arteries). In older patients due to the presence of atherosclerosis, the arteries cannot contract effectively. Therefore, transient ischemia due to arterial spasm in older patients is rare. In this series most of the patients were young and all the patients had associated fractures or joint injuries or intervention to the joint. This probably resulted in stretching of the adjacent artery and subsequent spasm. Usually the arterial spasm resolve spontaneously after the insult is over [4].

All patients who were suspected of having arterial spasm following trauma and was decided to manage conservatively should have angiographic confirmation of the spasm and exclusion of any injuries to the arteries. In this series all patients who did not have distal pulse and was decided manage conservatively as arterial spasm, underwent angiography confirmation of the spasm. On angiography the vessels in spasm shows smooth tapering and concentric narrowing [6]. Any other findings like intimal irregularities and acute cutoff and shouldering should not be interpreted as evidence of spasm.

Literature on the management of traumatic arterial spasm of the lower limb is scanty. But several techniques and drugs have been described in the management of the arterial spasm of the cerebral and coronary vessels. Intra-arterial injection of calcium channel blockers such as nifedipine, nitrates and papaverine has been described for cerebral vasospasm occurring as a result of subarachnoid hemorrhage [7]. Fogarty balloon dilation of the segments under spasm has also been tried. Again, this technique is used mainly to dilate grafts following coronary artery bypass [8].

In this series three patients who underwent arterial exploration and found have arterial spasm were treated with Fogarty balloon dilation. Balloon dilation results in immediate release of spasm.

Therefore, arterial spasm occurs in significant number of patients following trauma (in 22.2% of limb injuries in this series). It results in diagnostic dilemma. All the patients suspected of having arterial spasm should undergo angiography confirmation of the spasm before planning to manage non-operatively. In addition, in situations where the viability of the limb is difficult to assess (due to associated nerve injuries and in unconscious patients) the viability should be confirmed by fasciotomy and electrical stimulation of the muscles before managing spasm conservatively following trauma.

Conclusion

This study shows that young males are prone to develop spasms following trauma especially in tibial and popliteal arteries. Confirmation of spasm with more angiographies will help to avoid unnecessary surgical explorations in the future.

References

1. Clouse WD, Rasmussen TE, Michael AP, Eliason JL, Cox MW, Andrew NB, et al. In-theater management of vascular injury: 2 years of the Balad vascular registry. J Am Coll Surg. 2007;204(4):625-32.
2. Mattox KL, Feliciano DV, Burch J, Beall AC, Jordan GL, De Bakey ME. Five thousand seven hundred sixty cardiovascular injuries in 4459 patients. Epidemiologic evolution 1958 to 1987. Ann Surg. 1989;209(6):698-705.
3. Nitecki SS, Karram T, Ofer A, Enge A, Hoffman A. Vascular injuries in an urban combat setting: Experience from the 2006 Lebanon war. Vascular. 2010;18(1):1-8.
4. Lindbom A. Arterial spasm caused by puncture and catheterization; an arteriographic study of patients not suffering from arterial disease. Acta radiol. 1957;47(6):449-60.
5. Goerlich CE, Challa AB, Malas MM. Acute limb ischemia from gunshot wound secondary to arterial vasospasm. J Vasc Surg Cases Innov Tech. 2019;5(2):99-103.
6. Jennifer LK, Stephan WA, Akira MM, Sabrina P, James TR, Jorge AS. Detection of vascular injuries in patients with blunt pelvic trauma by using 64-channel multidetector CT. Radiographics. 2009;29(1):151-64.
7. Brian LH, Christopher SO. Endovascular treatment of cerebral vasospasm: Transluminal balloon angioplasty, intra-arterial papaverine, and intra-arterial nicardipine. Neurosurg Clin N Am. 2005;16(3):501-16.
8. Cable DG, Caccitolo JA, Pearson PJ, O'Brien T, Mullany CJ, Daly RC el al. New approaches to prevention and treatment of radial artery graft vasospasm. Circulation. 1998;98(19 Suppl):II15-21.