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SURGICAL MANAGEMENT OF TRAUMATIC ARTERIAL OF LIMBS IN ANTANANARIVO

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Abstract:

Background: *The prevalence of traumatic arterial of limbs in Antananarivo is unknown, and there is not a protocol for management of vascular trauma. The aim of this study was to describe epidemiology and surgical management of traumatic arterial of limbs in Antananarivo.*

Material and methods: *This was a retrospective and descriptive study for a period of 10 years from January 2008 to December 2017 performed at the Cardiovascular Surgery Unit in JRA Teaching Hospital Antananarivo, including all patients who underwent a surgery for traumatic arterial injury of limbs.*

Results: *Ninety-two cases of traumatic arterial of limbs has been recorded. The most victims were young (mean age=34.68), male (88.04%). The most mechanism of arterial injury was a civilian liability accident (63.04%) which 53.26% was due to stabs wounds. There were 82 cases of arterial wounds and 10 cases of blunt arterial trauma. Clinical signs were bleeding (89.12%), pulseless (46.73%) and hematoma (10.86%). Lesion were laceration (n=36), complete transection (n=32), avulsion (n=7), pseudoaneurysm (n=5), arteriovenous fistula (n=2), contusion (n=10). The most involved vessel were the brachial artery (29.34%) in the upper extremity and the femoral artery (15.21%) in lower extremity. Surgical procedure were revascularization (84.78%), ligation (9.78%) and primary amputation (5.43%). The overall limb salvage rate was 96.73% of arterial injuries successfully repaired.*

Conclusion: *Revascularization is important in traumatic arterial injury of limbs. It must giving early to prevent an amputation of limbs.*

Key words:- *Trauma, Artery, Vascular injury, Limbs, Revascularization*

INTRODUCTION

In British Trauma Center, traumatic vascular injury accounts for 4% of admissions [1]. Vascular trauma of limbs constitute a surgical emergency due to risk of vital and functionnal involvement of limbs and vital prognosis. In Africa, Vascular trauma of limb responsible for 6.7% mortality and 3% amputation [2]. In Madagascar, the prevalence of a traumatic arterial injury is unknown and there is no yet a protocol for the management of vascular trauma. So there are an uncoordinated management of victims**.** The aim of this study was to describe epidemiology and surgical management of traumatic arterial of limbs in Antananarivo.

Materials and methods

We conducted a retrospective and descriptive study on arterial traumatism of limbs in civilian practice supported in Cardiovascular Surgery Unit in Joseph Ravoahangy Andrianavalona Teaching Hospital in Antananarivo, including all patients who underwent a surgical procedure for a traumatic arterial injury of limbs. The data were collected from patient folder stored in Cardiovascular Surgery Unit, including all prehospital management, the management in the Surgical Emergency department, surgical treatment and postoperative management. Prevalence, demographic data, mechanism of injury, prehospital haemostasis gesture, clinical signs, type and location of arterial injury, associated injury, all management (prehospital and preoperative management, surgical management and postoperative management). Statistical analysis was performed by use of the SPSS® 21 statistics software program.

Results

A total, 92 patients were included in 2326 admissions in this period of study, giving 3.95% rate of admission; of which 82 patients presented a penetrating arterial injury and 10 a blunt trauma. There were 81males (88.04 %) and 11 females (11.95 %), giving sex ratio equal to
7.36. The age group ranged from 07 years to 69 years with the mean age being 34.68±14.23years. The most victims (81.30%) were younger men under 41 years. Mechanism of injury were 58 civil liability accident (63.04%), 6 works accident (6.52%), 10 road accident (10.86%), 06 domestic accidents (06.52%) and 01 sport accident (1.02%) (Table 1). Among the 58 civil liability accident, the arterial injury was due to 49 stabs wounds (53.26%), 06 gunshots wounds (06.52%) and 3 broken bottle stabs (03.26%). The most domestic accidents was due to bullfighting usually named « savika » in Madagascar. Provisionnal haemostasis gesture were performed before their admission to control the damage mainly by using compression dressing (n=62, 67.39%), makeshift tourniquets (n=19, 20.65%) and suture (n=4, 4.34%). Most patient has been treated in less than 6 hours (84.78%). Externalized bleeding were the most clinical manifestations (82 cases, 89.12%) (Table 1). Other clinical manifestations were 43 cases of pulseless and 10 cases of hematoma. Seventeen patients (13.82%) were hypotensive (systolic blood pressure <90mmHg) on arrival to the Emergency room while 43 patients (81.52%) were haemodynamically normal on presentation. The lesions are 64.13% in the upper limb and 35.86% in the lower limb. Brachial artery (29.34%) were the most affected in the upper limb while the femoral artery (15.21%) were the most affected in lower limb (Table 2). The types of arterial injuries showed in Table 3. Laceration was the most frequent type that was occurred in 36 cases (39.13%). Complete transection was occurred in 32 cases (34.78%). Avulsion was occured in 7 cases (4.34%), pseudoaneurysm was occurred in 5 cases (5.43%), contusion was occured in 10 cases (10.86%) and arterioveinous fistula was encountered in 2 cases (2.17%). Coexisting lesions were observed in 25 cases (17.88%). Venous injuries were encountered in 18 cases (19.56%). Bone fractures were occurred in 6 cases (6.52%). Nerve injuries were occurred in 11 cases (11.95%) and tendinous injuries were occured in 5 cases (5.43%). Eighy-seven patients (94.56 %) underwent provisional haemostasis before their admission (compression in 70.65%, makeshift touniquets in 20.65%, and suture in 3.26%). The management was medicosurgical. Medical treatment has been started at the Surgical Emergency departement before the surgical procedure including cristalloïd perfusion (92 patients), colloïd perfusion (6 patients) and blood transfusion (14 patients). Surgical revascularization (84.78%) were the most surgical procedure encountered in our study. Lateral arteriorrhaphy and end-to-end anastomosis were the commonest procedures performed, respectively in 37 cases (40.21%) and 25 cases (27.17%). Ligation was carried out in 9 cases, saphenous vein graft interposition in 7 cases, use venous patch in 4 cases, thrombectomy in 3 cases, fistula ligation in 2 cases and primary amputation in 5 cases (Table 4). Primary amputation were 1 transhumeral, 1 transradioulnar and 3 transfemoral. Discharge aponevrotomy were performed in 3 cases of compartment syndrom in the leg. Osteosynthesis were performed in 3 cases of bone injury. The overall limb salvage rate was 96.73% of arterial injuries successfully repaired. Howether, three complications were encountered after surgical repaired: 2 thrombosis and 1 pseudoaneurism. The mean leght of stay in hospital were 6 days (range: 1– 58 days) and 70.65% of our patient were stayed in less than 5 days in hospital.

Discussion

The prevalence of vascular trauma in civilian practice is usually lower than in wartime. Determine the prevalence of vascular trauma in civilian practice has been carried out by some authors [3-6]. In civil practice in Dakar, arterial injury represented 90.6% of all traumatic vascular injuries of limbs [7]. For 10 years period of study, total cases of vascular trauma in civilian practice were variable according the study and countries: 120 cases in Kosovo [3], 3948 in India [4], 47 cases in United Kingdom [5] and 328 cases in Pakistan [6]. In our study, ninety-two cases of traumatic arterial of limbs were encountered in Antananarivo for the same period of study. This prevalence 3.95% of arterial injury of limbs in Antananarivo is underestimated because there were many victims died before their admission in hospital. This high mortality rate before the admission would be explained by the weakness of the emergency care system in the middle of the accident and the delay of hospital treatment. In Antananarivo, there were usually no carrying system of victims. So, there is a delay in hospital care for the victims.
The predominance of young male in victims is almost observed in the various series of african studies on vascular trauma. Mean age and sex ratio were respectively 31.98years and 5.66 in Nigéria [2], 27.8years and 7.92 in Sénégal [7]. In non-

african studies, there are still the predominance of young male as in Perkins's study (United Kingdom) [1], in Jaha's study (Kosovo) [3] and in Sharma's study (India) [4]. In our study, mea nage and sex ratio were respectively 34.68years and 7.36. This predominance of male could be explained by the higher level of activity or mobility of the male gender that exposes them to various traumatisms.

In non-african countries, road accident were the most etiological mechanism of traumatic vascular injury of limbs. This hypothesis has been demonstrated in some studies as in Magee's study [5], in Joshi's study [8] and in Yan's study [9]. Howether, stabs wounds is the most etiological mechanism of vascular trauma of limbs in african countries: 36.70% in Nigeria [2], 53.45% in Cameroun [10] and 44.3 in Ivory Coast [11]. Our study is similar of these african study with predominance of stabs wounds (53.26%). This predominance of stabs wounds in our study could be explained by the high prehospital mortality rate in arterial injury by gunshots wounds and road accident where arterial injury appeared in the context of polytrauma. It could be too explained by the predominance of brawls and aggression related to insecurity and interpersonal violence in our city. In our study, workrelated injuries represented 6.52% aetiology of traumatic arterial of limbs. This could be explained by the lack of protection and safety in the practice of these professions in our regions. We identified some risk professions as carpentry, machinist and handworker. The bullfighting usually named « savika » in Madagascar are an uncommon etiological circumstance of vascular trauma in Antananarivo, represented 6.52% of the etiological mechanism of arterial injury in our study. The bullfighting « savika » is a traditional sport, practiced periodically in countryside in Madagascar. Some authors in Madagascar has been reported some cases of traumatism by bullfighting « savika » in Antananarivo [12, 13].

The functional prognosis of traumatized limb is directly correlated with the delay in management, as well as the patient's vital prognosis. In our serie, 84.78% of patients were treated in less than 6 hours while 60.7% were treated in less than 6 hours in Adama's study. Mean of timing to treatment is 3 hours in Iriz's study [14] and 2.5hours in Topal's study [15]. According Fingerhut's publication, a delay of more than 6 hours is a sign of poor prognosis in arterial injuries [16].

Penetrating arterial trauma was the most clinical presentation in our serie. So, external bleeding (89.13%) were the most clinical signs encountered in our study. It's the common hard signs of penetrating vascular trauma. Hard signs include the following: external bleeding, a rapidly expanding hematoma, any of the classical signs of arterial occlusion (pulselessness, pallor, paresthesias, pain, paralysis) and a palpable thrill/audible bruit [17]. Our results are similars on those found in the literature on the predominance of bleeding, as in Foukou's study [10] with 78.04% of external bleeding, as in Adama's study [7] with 71% of external hemorrhage. The evidence diagnosis of an arterial injury with hard signs could explained the rarity of requests for paraclinical examinations for the diagnosis. For a blunt arterial trauma, diagnostic imaging (doppler ultrasound artery and multidetector computed tomography angiography) is recommended to assists in determining injury location and extent and aids in staged planning for reconstruction, as in penetrating injuries for diagnosed a clinical soft signs.

Location of traumatic vascular injury is different according the study. They were most located in upper limb in our study (64.13%), in Adeoye's study (58.3%) [2] and in Adama's study (81.3%) [8] While some study showed predominance location in the lower limb as in

Ganapathy's study (66%) [18], Joshi's study (60%) [8], Singh's study (58%) [19] and Soames's study (45.45%) [20]. in the literature, brachial artery injury were the most involved artery in upper limbs trauma [2, 5, 8, 15, 20, 21, 22, and 23] while the femoral artery injury were the most involved artery in lower limbs trauma [16, 20, 21]. How ether, some study showed the predominance of popliteal artery injury in lower limbs trauma [4, 6, 18, and 19].

In our serie, laceration and complete transection were the most type of arterial injury. It could be explained by the predominance of stabs wounds in our serie (53.26%). Our result is similar of some author's study, as in Foukou's study where laceration (46.34%) and complete transection (36.58%) were the most type of arterial injury [10]. Soare's study showed again a result similar with 47.35% of laceration and 19.32% of complete transection [20]. Howether, Katche's study showed the predominance of pseudoaneurysm (44.3%) [11], as in our study with 5.43%.

Provisionnal haemostasis gesture has been used in majority of our patient before their admission to control the externalized bleeding. Using compression dressing (67.39%) and makeshift tourniquets (20.65%) were the commonest haemostasis gesture in our study. In Foukou's study, there were 46.34% of compression dressing and 41.46% of makeshift tourniquets [10]. Provisionnal haemostasis gesture are often choosed by the victim or their family to reduce the damage before their admission in hospital.

Traumatic arterial injury of limbs constitute a medico-surgical emergency. Usually, victims has been received medical treatment in surgical emergency department before the surgical precodure inclunding cristalloid or colloid perfusion, blood transfusion and heparinotherapy. In our practice, surgical management are determined according the type of arterial injury, the location of injury, the coexisting lesions, the collateral circulation, the surgeon's experience. Revascularization were the most surgical procedure encountered in our serie (84.78%). Lateral arteriorrhaphy and end-to-end anastomosis were the commonest procedure performed in our series, respectively 40.21% and 27.17%. These results could be explained by the predominance of laceration (39.13%) and complete transection (34.78%) in our serie. End arteries injury were treated by ligation while the truncal artery must be repaired to avoid ischemia of limbs. Our results were similar of Foukou's study [10] and Adeoye's study [2] in the predominance of lateral arteriorrhaphy and end-to-end anastomosis. Howether, other studies, particulary Shalabi's study [23], Joshi's study [8] and Singh's study [19], showed a high rate of venous bypass (saphenous vein graft interposition) with respectively 53%, 49% and 35.2%. According Wani's study, a venous bypass is indicated when the avulsion is greather than 2cm [24]. Primary amputation (5.43%) were indicated for an advanced ischemia, for a nonreconstructable arterial injury and when arterial injury associated for a complex fractures (severe soft tissue damage associated). In our serie, the overall limb salvage rate was 96.73% of arterial injuries

successfully repaired. This result is similar in Franz's study which the overall limb salvage rate was 96.4% of arterial injuries successfully repaired. In Size study, the limb salvage rate was 94.2% [19].

After surgical repair, the outcome of an arterial injury were often favorable despite 3 complications. In our serie, the mean lenght of stay in hospital were 6 days and 70.65% of our patient were stayed in less than 5 days in hospital. Some patients stayed beyond 10 days in hospital for reason of complications or an associated bone injury. In Soares's study, 56.86% of patients stayed in hospital in less than 1 week [20]. In Adeoye's study, 50% of patient stayed in less than 10 days at hospital and the mean lenght of stay was 13 days [2].

Conclusion

The prevalence recorded of traumatic arterial injury of limbs in our serie was 3.95%.

Revascularization is important in traumatic arterial injury of limbs. It must be giving early to prevent an amputation of limbs. This prevalence is underestimated because it's just the prevalence recorded in JRA Hospital.

Bibliographie

[1]. Perkins ZB, De'Ath HD, Aylwin C, Brohi K, Walsh M, Tai NR. Epidemiology and outcome of vascular trauma ata British Major Trauma Centre. Euro J Vasc Endovasc Surg 2012;44(2):203-9.

[2]. Adeoye PO, Salami MA, Oyemolade LA, Adegboye VO. Civilian Vascular Injuries in an Urban African ReferralInstitution. East African medical journal 2013;90(12):404-8.

[3]. Jaha L, Andreevska T, Rudari H, Ademi B, Ismaili-Jaha V. A decade of civilian vascular trauma in Kosovo. World journal of emergency surgery 2012;7(1):24.

[4]. Sharma D, Goyal G, Singh A, Sisodia A, Devgarha S, Mathur RM. Management of Vascular Trauma: A Single Center Experience. Indian Journal of Vascular and Endovascular Surgery 201;1(1):3.

[5]. Magee TR, Collin J, Hands LJ, Gray DWR, Roake J. A Ten Year Audit of Surgery for Vascular Trauma in a BritishTeaching Hospital. Eur J Vasc Endovasc Surg 1996 ; 12 : 424-427.

[6]. Khan FH, Yousuf KM, Bagwani AR. Vascular injuries of the extremities are a major challenge in a third world country. Journal of trauma management & outcomes 2015;9(1):5.

[7]. Adama DP, Sokhna DM, Magaye G. Vascular Traumatism of Limbs in Civil Practice in Dakar. Cardiol Vasc Res. 2018; 2(4); 1-4.

[8]. Joshi SS. Peripheral Arterial Injuries: an Indian Experience. Indian Journal of Surgery 2016;78(3):187-91.

[9]. Yan H, Zhao B, Kolkin J, Li Z, Chen X, Chu T, Gao W. The Management of Lower Extremity Multilevel ArterialInjuries: A 10-Year Experience. PLoS ONE 2015 ; 10(3): e0121769.

[10]. Foukou M, Chichom M, Eyenga V, Nguifo MI, Ngo Nonga B, Bahebeck J, Teyang A, Pagbe JJ. Les traumatismesvasculaires périphériques en pratique civile : à propos de 41 lésions opérées au Cameroun. Chirurgie ThoraciqueCardio-Vasculaire 2011;15(3):14549.

[11]. Katche E, Souaga A, Amani K, Kirioua-kamenan A, Degre J, Kouame J. Traitement chirurgical des traumatismes des arteres périphériques: aspects étiopathogeniques, thérapeutiques et résultats chirurgicaux. Rev Int Sc Med 2016;18,2:104-108.

[12]. Randrianambinina F, Jonatana AD, Randrianambinina H, Razafimanjato NN, Rakotoarisoa AJ, Rakotovao HJ. Les traumatismes thoraciques par encornement de zebu à Antananarivo Madagascar. J Func Vent Pulm 2018; 26(9): 14-18.

[13]. Ratsimandresy DA, Rakototiana A. Avulsion péno-scrotale par encornement de zébu. Pan Afr Med J 2015;20(1): 91.

[14]. Iriz E, Kolbakir F, Sarac A, Akar H, Keceligil HT, Demirag MK. Retrospective assessment of vascular injuries: 23 years of experience. Ann Thorac Cardiovasc Surg 2004;10(6):373-8.

[15]. Topal AE, Eren MN, Celik Y. Lower extremity arterial injuries over a six-year period: outcomes, risk factors, and management. Vasc Health Risk Manag 2010; 6:1103.

[16]. Fingerhut A, Leppäniemi AK, Androulakis GA, Archodovassilis F, Bouillon B, Cavina E et al. The Europeanexperience with vascular injuries. Surg Clin 2002; 82(1):175-88.

[17]. Callcut RA, Mell MW. Modern advances in vascular trauma. Surg Clin 2013; 93(4):950951

[18]. Ganapathy A, Khouqeer AF, Todd SR, Mills JL, Gilani R. Endovascular management for peripheral arterial trauma: The new norm?. Injury 2017; 48(5):1025-30.

[19]. D Singh, P Rk. Management Of Peripheral Vascular Trauma: Our Experience. The Internet Journal of Surgery 2004 ; 7(1) : 1-7.

[20]. Soares LT, Bastos CC, Junior AK, Pereira AJF. Vascular injuries in the state of Pará, Brazil, 2011-2013 and their relation with demographic and clinical variables. J Vasc Bras 2015;14(2):123-32

[21]. Hafez HM, Woolgar J, Robbs JV. Lower extremity arterial injury: Results of 550 cases and review of risk factors associated with limb loss. Journal of vascular surgery 2001 ; 33(6) : 1212-9.

[22]. Franz RW, Goodwin RB, Hartman JF, Wright ML. Management of Upper Extremity Arterial Injuries at an Urban Level I Trauma Center. Annals of Vascular Surgery 2009 ; 23(1) : 8-16.

[23]. Shalabi R, Al Amri Y, Khoujah E. Vascular injuries of the upper extremity. J Vasc Bras 2006;5(4):271-6.

[24]. Wani ML, Ahangar AG, Ganie FA, Wani SN, Wani N. Vascular Injuries: Trends in Management. Trauma Mon2012;17(2):266-9.

Table 1 : Mechanisms of injury and clinical signs

Mechanisms and clinical management	Numbers (n)	Percentage (%)
Circumstance / Mechanism of injury		
○ Civil liability accident	58	63.04
• Stabs wounds	49	53.26
• Gunshots wounds	06	06.52
• Broken bottle stabs	03	03.26
○ Works accident	06	06.52
○ Road accident	10	10.86
○ Domestic accidents	06	06.52
• Zebu encornment	05	05.43
• Others	01	01.08
○ Sports accident	01	01.08
Clinical signs		
• External bleeding	82	89.12
• Pulseless	43	46.73
• Hematoma	10	10.86

Table 2 : Distribution of arterial injury

Artery	Numbers (n)	Percentage (%)
○ **Upper limb**		
• Axillary	**59**	**64.13**
• Brachial	5	5.43
• Radial	27	29.34
• Ulnar	19	20.65
○ **Lower limb**	8	8.69
• Femoral	**33**	**35.86**
• Tibial (ATA/PTA)	14	15.21
• Popliteal	9	9.78
• Dorsalis Pedis Artery	7	7.60
	3	3.26

Table 3 : Type of arterial injury and associated injury

Type of arterial injury / associated injury	Numbers (n)	Percentage (%)
○ **Type of arterial injury**	36	39.13
• Laceration	32	34.78
• Complete transection	7	4.34
• Avulsion	2	2.17
• Arteriovenous fistula	10	10.86
• Contusion	5	5.43
• Pseudoaneurysm	**25**	**17.88**
○ **Associated injury**	18	19.56
• Venous injury	6	6.52
• Bone fractures	11	11.95
• Nerve injuries	5	5.43
• Tendinous injuries		

Table 4 : Management and surgical procedure

Management and surgical procedure	Numbers (n)	Percentage (%)
Provisional haemostasis gesture		
• Compression dressing		
• Makeshift tourniquets		
• Suture		
Delay of surgical management		
• < 6 hours	**87**	**94.56**
• 6 – 12hours	62	67.39
• 12 – 24 hours	19	20.65
• > 24 hours	6	6.52
Surgical procedure	78	84.78
Revascularization	3	3.26
• Lateral arteriorrhaphy	1	1.08
• End-to-end anastomosis	10	10.86
	78	**84.78**
• Venous patch	37	40.21
• Saphenous vein graft interposition	25	27.17
	4	4.34
• Thrombectomy	7	7.60
• Fistula ligation	3	3.26
Ligation	2	2.17
Primary amputation	**9**	**9.78**
	5	**5.43**