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Vascular trauma in the Amazon – the challenge of great distances

Trauma vascular na Amazônia – o desafio das grandes distâncias

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ABSTRACT

Objective: to evaluate the incidence of unfavorable outcomes in vascular trauma patients and their possible correlation to the distance between the city where the injury was sustained and the hospital where the patient received definitive treatment. **Methods:** descriptive and retrospective study. Data were collected from medical records of patients submitted to surgical procedures for arterial or venous injuries from February 2011 to February 2013 at the only trauma center providing vascular surgery in a vast area of the Amazon region. Trauma date, patient gender and age, mechanism and anatomic topography of injury, surgical management, need for surgical re-intervention, hospitalization period, postoperative complications, mortality and limb amputation rates were analyzed. The incidence of unfavorable outcomes was assessed according to the distance between the city where the vascular injury was sustained and the trauma center. **Results:** One hundred seventy-three patients with 255 vascular injuries were analyzed; 95.95% were male ($p<0.05$), mean age of 28.92 years; 47.4% were caused by firearm projectiles ($p<0.05$); topographic distribution: 45.66% lower limbs ($p<0.05$), 37.57% upper limbs, 6.94% abdominal, 5.2% thoracic and 4.62% were cervical vascular injuries; 51.42% of patients required hospitalization for seven days or less ($p<0.05$); limb amputation was necessary in 15.6% and the overall mortality was 6.36%. **Conclusion:** distances greater than 200Km were associated to longer hospitalization period; distances greater than 300Km were associated to increased limb amputation probability; severe vascular trauma have an increased death probability when patients need to travel more than 200Km for surgical treatment.

Key words: External Causes. Wounds and Injuries. Vascular System Injuries. Blood vessels. Ulnar Artery.

INTRODUCTION

Trauma due to violence and traffic accidents represents the major cause of mortality and morbidity related to external causes worldwide[1,2]. Besides limb amputation risk, vascular injuries are among the most frequent death mechanisms on traumatized patients, representing considerable demand on civilian and military hospitals[3-5].

Many studies have shown that penetrating mechanisms prevail in vascular lesions and that lower limbs are the most frequent sites of injury[6-8]. Blunt trauma has worse prognosis than penetrating ones; as external bleeding is commonly absent, there can be no obvious sing of vascular trauma at the initial evaluation of the multi injured patient, delaying the suspicion of the vascular injury, particularly in the patient with altered level of consciousness[9,10]. Concomitant non-vascular lesions are frequent. Fractures, nerve and muscle injuries are common associations that increase amputation probability even at specialized trauma centers[9-12]. That explains why limb amputation rate differs from penetrating (10%) to blunt (30%) vascular traumas[13].

Irreversible ischemia usually develops six hours after trauma, depending on the arterial injury anatomic level, trauma mechanism, collateral circulation, and hemorrhagic shock severity[14]. Aiming a better functional outcome, limb revascularization must be undertaken before this interval[8,15].

In Brazil, hospitalization due to trauma had a near 30% increase in the last five years[16]. Pará state is the second largest in Brazil. It has a 1.247.954.666km^2 area (twice the territory of France), and is the most populated state in the Brazilian Amazon region; its capital and surroundings concentrates a 2.1 million population[17]. A single trauma center with vascular surgeons team is available statewide. Long transportation periods to the hospital impact the severely injured victims survival [18].

This study aims to evaluate the outcomes of patients operated for vascular trauma at the only center providing specialized assistance in such a large area, which brings medical rescue and definitive care challenges.

METHODS

Descriptive and retrospective study. Data were collected from medical records of patients treated at the

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Hospital Metropolitano de Urgência e Emergência (HMUE) from February 2011 to February 2013. Individual patient consent forms were not obtained since this research concerned only retrospective analysis and the authors stated that no personal data that could lead to patient identification would by reviewed or published. This research was approved both by the University Center of Pará ethics committee (protocol number 309.707) and the Brazil Platform, a national electronic registration system with ethics committee that is currently a requirement for any study involving human data in Brazil. HMUE is the state reference for median and high complexity traumas and burn victims; around 2000 patients are monthly treated[19]. Trauma date, patient gender and age, the city where the trauma has occurred, mechanism and anatomic topography of injury, surgical management, outcome, need for surgical re-intervention and hospitalization period were analyzed.

Inclusion criteria: patients submitted to surgical procedures for arterial or venous injuries (blunt or penetrating) at the HMUE from February 2011 to February 2013. Exclusion criteria: if surgical exploration revealed no vascular injury; iatrogenic vascular injuries; traumatic limb amputation; primary limb amputation burns and vascular injuries treated by surgeons other than vascular.

Regarding the trauma mechanism, injuries were classified as firearm's projectile wound (FPW) (inflicted by firearms of any kind), cutting wounds (CW) and traffic accidents (TA). Arterial and venous lesions were classified as compressible vascular injuries (CVI), if hemorrhage could be interrupted by direct wound compression or by tourniquet, and as non-compressible vascular injuries (NCVI), if bleeding could not be contained by neither of these maneuvers as suggested by Markov *et al.*[20].

Postoperative complications: operative site hematoma and infection that required abscess or clot surgical drainage, debridement and/or limb amputation. Concerning surgical re-interventions, only those related to vascular injury, as for example, fasciotomies or amputations after revascularization failure, were included. Any second non-vascular procedure was excluded for this analysis (second look laparotomy, e.g.).

To establish vascular injuries mortality, patients who sustained non-vascular injuries at a different topography, (for example, a patient with a superficial femoral artery and a brain injury secondary to firearm's projectile) were excluded. Death, limb amputation and hospitalization for more than seven days were considered as unfavorable outcomes. The distance between the city where the vascular injury was sustained and the hospital was measured in Kilometers (Km) with Google Maps® on line application (www.maps.google.com.br/maps). Distances ranges were classified as 50Km or less, between 51 and 100 Km, between 101 and 200 Km, between 201 and 300 Km and more than 300Km. The non-parametric χ^2 test was used; statistical significance was considered when $p<0.05$.

RESULTS

There were 304 patients operated by the HMUE vascular surgery team from February 2011 to February 2013; 131 were excluded; the remaining 173 patients (255 vascular injuries) were analyzed. Patient's characteristics regarding gender, age, trauma mechanism and injury topography are exposed in table 1.

Isolated arterial injury was found in 97 patients (56.07%), while exclusively venous trauma happened in 20 patients (11.56%). Simultaneous arterial and venous trauma was found in 56 cases (32.37%). Compressible vascular injuries (CVI) accounted for 143 (86.67%) of all arterial and 63 (70%) of all venous injuries. Among non-compressible vascular injuries (NCVI) there were 22 arterial lesions (13.33%) and 27 venous traumas (30%). Difference between CVI and NCVI for arterial and venous lesions was statistically significant ($p<0.0001$ and $p=0.0002$, respectively). The most frequently injured arteries were the superficial femoral and the ulnar, each accounting for 26

Table 1 - Patients characteristics.

Age (years)	(n)	(%)	Trauma Mechanism	(n)	(%)	Topography	(n)	(%)
< 12	2	1.16	Firearms projectile wounds	82	47.40	Abdominal	12	6.94
13 – 18	25	14.45	Cutting wounds	71	41.04	Cervical	8	4.62
19 – 24	43	24.86	Traffic accidents	15	8.67	Lower Limb*	79	45.66
25 - 49*	95	54.90	Fall	2	1.16	Upper Limb	65	37.57
50 – 60	6	3.47	Others	3	1.73	Thoracic	9	5.20
> 60	2	1.16						
p-value	< 0.0001*		p-value	< 0.0001*		p-value	<0.0001*	
Total	173	100	Total	173	100	Total	173	100

Source: Hospital Metropolitano de Urgência e Emergência.
Statistical Test: χ^2; n: Number of cases p-value = < 0,0001; %- Percentage of cases

cases (15.75% of all arterial lesions – p<0.0001). The most frequently injured veins were the superficial femoral with 16 cases (17.77%) and the popliteal with 13 (14.44%) of all venous lesions. Others venous injuries are listed below. There was no statistical difference between the venous injuries rates (P>0.05 χ^2 test). The anatomic distribution of the vascular injuries is presented on table 2.

Nonvascular injuries were found in 75 patients (43.35%, P=0.09). Bone fractures were the most common ones among them (44 patients or 25.43% of all patients) and accounted for 49.07% of all nonvascular injuries (p=0.0008). Other concomitant injuries included peripheral nerves (15.6% of all patients), thoracoabdominal organs (7.51% of all patients).

The most frequently used surgical technique for arterial injuries was autologous vein graft interposition (64 cases = 36.57% – P<0.0001 χ^2 test) and the great saphenous vein was the most frequently used vessel for this procedure (57.14%). The superficial femoral (33.33%), brachial (23.33%) and popliteal (18.33%) arteries were the most common sites of vein graft interposition. No synthetic graft was used. Arterial ligature was performed in 51 cases (29.14%), most of than were radial or ulnar injuries (22 cases) or below the knee arteries (21 cases).

Other surgical procedures for arterial injuries included 30 end-to-end anastomosis (17.14%), throboembolectomies, arteriorrhaphies and one case of temporary intravascular shunt as damage control technique. In two cases arterial injury management was not completed because of patient's death during surgery. In six patients, operated for bone fractures, an arterial injury was not promptly diagnosed; these patients developed limb ischemia and were amputated. For venous injuries treatment, ligature was the most frequent surgical technique (85% – p<0.0001). Venorrhaphy was performed in 11 cases (13.75%). In one case venous injury management was not completed because the patient died during surgery (Table3).

Patients were followed only during hospitalization period. Almost half of them were hospitalized for a maximum seven days period (51.42% – p=0.0064), 20.8% hospitalizations last for eight to 14 days, 17.34% last for 15 to 30 days and 10.39% of patients were hospitalized for more then 30 days. Most patients, 63%, developed no postoperative complications and the remaining 37% presented at least one postoperative complication (p<0.0001). Infection was the most common complication (40.74% – p<0.0001). Postoperative limb ischemia was present in 22.22% and neurological deficit in 16.04% of patients (Table 4).

Among all patients, 84 required more than seven days of hospitalization (48.55%). Five patients with abdominal injuries (41.66%), two patients with cervical injuries

Table 2 - Anatomic distribution of the vascular injuries.

Arterial Injuries	Artery	(n)	(%) Art.**	Venous Injuries	Vein	(n)	(%) Vein**
	Axillary	8	4.84		Inferior Vena Cava	6	6.66
Non-compressible	Subclavian	7	4.24	Non-compressible	Axillary	5	5.55
	ONCA	7	4.24		ONCV	16	17.77
	p-value***	1.00			p-value***	1,00	
	Superficial Femoral*	26	15.75		Superficial Femoral *	16	17.77
	Ulnar*	26	15.75		Popliteal	13	14.44
	Brachial	24	14.54		Brachial	12	13.33
Compressible	Popliteal	18	10.90	Compressible	Common Femoral	7	7.77
	Posterior Tibial	14	8.48		Posterior Tibial	5	5.55
	Radial	12	7.27		OCV	10	11.10
	Anterior Tibial	12	7.27		p-value	0.1048	
	Deep Femoral	5	3.03				
	OCA	6	3.62				
	p-value***	< 0.0001*					
Total of non-compressible		22	13.33	Total of non-compressible		27	30.00
Total of compressible *		143	86.67	Total of compressible *		63	70.00
	p-value		<0.0001*		p-value	0.0002*	

Source: Hospital Metropolitano de Urgência e Emergência.
*Statistical Test: χ^2; n – Number of cases; * = p-value < 0.05; % - Percentage of cases.*
*ONCA: Other non-compressible arteries. Each one presents less than five cases (common carotid, external carotid, hypogastric, external iliac and renal); OCA: Other compressible arteries. Each one presents less than five cases (tibiofibular trunk, fibular and common femoral); ONCV: Other Non-Compressible Veins. Each one presents less than five cases (external iliac, external jugular, internal jugular, common iliac, internal iliac, subclavian and hypogastric); OCV: Other Compressible Veins. Each one presents less than five cases (fibular, anterior tibial, ulnar, basilica, cephalic, deep femoral and radial; ** - Percentage of total affected arteries and veins; *** - p-value obtained by comparison of arteries with at least five cases.*

Table 3 - Surgical techniques used for vascular injuries treatment.

Arterial Injuries Treatment	(n)	(%)
Vein graft*	64	36.57
Ligature	52	29.14
End-to-end anastomosis	30	17.14
Thromboembolectomy	13	7.42
Arteriorrhaphy	7	4.00
ANIVI	6	3.42
Intraoperative death**	2	1.14
Temporary intravascular shunt	1	0.57
p-value	< 0.0001*	
Total***	175	100
Venous Injuries Treatment	**(n)**	**(%)**
Ligature*	68	85.00
Venorrhaphy	11	13.75
Intraoperative death**	1	1.25
p-value	< 0.0001*	
Total***	80	100

Source: Hospital Metropolitano de Urgência e Emergência.
** = p-value <0.05%; % = Percentage of cases; n = Number of cases; ** - Intraoperative death without arterial or venous treatment; ANIVI: Amputation for non-identified vascular injuries; Statistical Test: χ^2; *** - 80 venous injuries detected in 173 patients; *** - 175 arterial injuries detected in 173 patients.*

(25%), 49 patients with lower limb's injuries (62.02%), 24 patients with upper limb's injuries (36.92%) and four patients with thoracic injuries (44.44%).

Forty-four patients needed surgical re-interventions (25.43%), most of them because of ischemia, infectious complications and compartmental syndrome. The majority of patients were re-operated for limb amputation (39.13% – p<0.0001); debridement was performed in 31.88%, skin grafts in 11.59% and fasciotomies in 7.25% of re-operations.

Table 4 - Postoperative complications in patients treated for vascular trauma.

Postoperative Complications	(n)	(%)
Infection*	33	40.74
Limb ischemia/ Arterial thrombosis	18	22.22
Neurological deficit	13	16.04
Compartmental Syndrome	5	6.17
Acute renal failure	3	3.7
Enteric fistula	2	2.46
Hematoma	2	2.46
Iatrogenic injuries**	2	2.46
Intestinal adhesions	1	1.23
Disseminated intravascular coagulation	1	1.23
Urinary fistula	1	1.23
TOTAL	81	100
p-value	< 0.0001*	
Patients without complications*	109	63.00
Patients with complications	64	37.00
p-value	< 0.0001*	
TOTAL	173	100

Source: Hospital Metropolitano de Urgência e Emergência.
*Statistical Test: χ^2; n – Number of cases; * = p-value <0.05; % - Percentage of cases.*

Limb amputation was necessary in 27 patients (15.6%); 21 cases presented lower limb's vascular injuries (26.58%) and six patients with upper limb's vascular injuries (9.23%). Popliteal arteries were injured in 33.33% of lower limb's amputation, superficial femoral arteries were injured in 23.8% and below the knee arteries trauma was present in 14.29%. In 28.57% of all lower limb's amputation cases, patients presented limb ischemia but the injured artery was not informed.

Eleven patients died; hence, the overall mortality was 6.36%. Two patients had isolated arterial injuries (18.18%), five had isolated venous traumas (45.45%) and four presented combined arterial and venous injuries (36.36%). It was not possible to apply statistical tests to these data because of the low incidence of lethal injuries in this series. Three patients died during surgery (27.27%), three during the first 24 hours after surgery (27.27%), two between two and seven days after surgery (18.18%), one between ten and 15 days after surgery (9.09%) and one patient died more than 25 days after surgery (9.09%). Cause of death was hypovolemic shock and sepsis (Table 5).

Concerning the travelled distance from the city where the trauma was sustained to the hospital (Table 6), 102 patients came from a distance of 50Km or less; 16, travelled between 51 and 100 Km; 30 came from a distance between 101 and 200 Km; 18 came from a distance between 201 and 300 Km; and seven came from a distance greater than 300Km. Patients covering 50Km or less were statistically more frequent (p<0.0001).

When unfavorable outcomes were assessed concerning the distance ranges, it was found that amputation incidence was directly proportional to distance, especially for patients who travelled more than 300Km; this distance range was statistically associated to higher limb amputation probability (p=0.0197).

Hospitalization for more than seven days was observed in 48.04% of patients who were less than 50Km away (Table 6). The incidence of hospitalization longer than seven days was statistically different according to the distance range from the city where the trauma was sustained and the hospital (P<0.0001).

When the hospitalization period was compared among the distance ranges, hospitalizations of three days or less were more frequent among patients who travelled 50Km or less (26.47%) and those who travelled from 51 to 100 Km (43.75%); hospitalizations period of 15 to 30 days were more frequent among patients who covered distance ranges of 101 to 200 Km (23.33%) and 201 to 300 Km (38.89%). For distances greater than 300Km the most common hospitalization period was from eight to 14 days (57.14%). Statistical difference was observed for the 15 to 30 days hospitalization period among patients who travelled between 201 to 300 Km (p=0.0167) and for the eight to 14 days period among those who covered distances of more than 300Km (p=0.0228). No lethal injuries were treated in

Table 5 - Anatomic distribution of lethal vascular injuries, cause and time of death.

LLethal injuries		(n)	(%)	Total		Cause and Time of Death		(n)	(%)
Injuried / Vessels**				(n)	(%)	Cause of death	Shock Hypovolemic*	9	81,82
Arterial injury	Common Carotid	1	9,09				Septic shock	2	18,18
	Subclavian	1	9,09				p-value	0,0348*	
				2	18,18		Total	11	100
Venous Injury	Inferior vena cava	3	27,27			Time of death**	Intraoperative	3	27,27
	External iliac	2	18,18				IPO	3	27,27
				5	45,45		2° to 7° PO	2	18,18
	Popliteal a. and v.	1	9,09				10° to 15° PO	1	9,09
	Renal a. and Inferior vena cava	1	9,09				20° to 25° PO	1	9,09
Arterial and Venous Injury	Sup. Fem. a. and Com. Fem. v.	1	9,09				Aver 25° PO	1	9,09
	Subclavian a. and v.	1	9,09				Total	11	100
				4	36,36				
				11	100				

Source: Hospital Metropolitano de Urgência e Emergência.
*Statistical Test: χ^2; n – Number of cases; * = p-valor <0.05; % - Percentage of cases; **- The low frequency of death prevented the statistical test application; PO – Postoperative; IPO – Immediate Postoperative.*

patients who travelled more than 200Km to the hospital (Table 6).

When unfavorable outcomes were assessed concerning injury topography six deaths were detected among the abdominal lesions (50%), two among lower limbs injuries (2.53%), one lethal neck injury (12.5%) and two among thoracic traumas (22.22%), no upper limbs lethal injury (0%) (Table 7). Hospitalization longer than seven days happened in five abdominal injuries (41.66%), two neck injuries (25%), 49 lower limbs injuries, 24 upper limbs traumas (36.92%), and four thoracic lesions (44.44%). When amputation and hospitalization longer than seven days rates were assessed, there was significant statistical difference between lower limbs traumas and the other topographies (p=0.0071 and <0.0001, respectively). Statistical evaluation regarding death data was not possible due to low occurrence of these events (Table 7).

DISCUSSION

Vascular injuries can be a surgical challenge because of the aggressive trauma mechanisms and increasing severity of associated lesions. It's association to hemorrhagic shock, according to experimental researches, decreases the probability of limb functional recovery if blood flow restoration is delayed for more than three hours[21-23]. As early diagnosis and treatment of vascular injuries is of paramount importance to prevent limb functional limitation, amputation and death. The fact that a single center in such a vast area is capable to provide specialized treatment for these injuries rises a valid concern regarding patients clinical outcomes.

Male patients prevailed among those operated for vascular injuries (95.95%). This is probably justified by the fact that men are more exposed to violence and traffic accidents risky situations[8,21,24]. The mean age of 28.92 years old, also matches the literature[9,11,12,21]. Most patients sustained penetrating traumas (88.44%), mainly firearm's projectile wounds (FPW) (47.4%), a data supported by other studies[12,21]. Nevertheless, an author found an equal incidence of FPW and blunt trauma and other detected cutting wounds (CW) as the most frequent mechanism[5,8]. Such a high incidence of FPW highlights the fact that the majority of vascular injuries at the Amazon region were caused not by accidental mechanisms but for violence.

The predominance of isolated arterial injuries over isolated venous ones here presented is similar to other reports and also the fact that extremities, specially lower limbs, sustained most of vascular traumas (83.24%)[4,21,25,26]. For most authors the superficial femoral artery is the most commonly traumatized and the present study agrees with this. However, diverging from previous papers, the frequency of ulnar artery injury was as high as the superficial femoral artery (15.75%)[5,11,15,21]; this is related to the high incidence of cutting wounds (41.04%) in the present series, a mechanism frequently associated to upper limb's trauma and is surely due to the fact that victims usually use the

Table 6 - Occurrence of unfavorable clinical outcomes according to the distance range between the city where the trauma was sustained and the hospital.

	50Km		51-100 Km		101-200 Km		201-300 Km		>300 Km		p-value
	n=102	(%)	n=16	(%)	n=30	(%)	n=18	(%)	n= 7	(%)	
Amputation	12	11.76	2	12.5	6	20	4	22.22	3	42.85	0.0197*
Death	7	6.86	1	6.25	3	10	0	0	0	0	STNA
Hospitalization> 7 days	49	48.04	5	31.25	15	50	10	55.55	5	71.42	<0.0001*
Total	68		8		24		14		8		

Source: Hospital Metropolitano de Urgência e Emergência.
*Statistical Test: χ^2; n – Number of cases; * = p-value <0.05; % - Percentage of cases; STNA: statistical test is not applicable.*

Table 7 - Unfavorable clinical outcomes regarding vascular injury topography.

	Abdomen		Neck		LL*		UL		Thorax		p-value*
	(n=12)	(%)	(n=8)	(%)	(n=79)	(%)	(n=65)	(%)	(n=9)	(%)	
Amputation	0	0.00	0	0.00	21	26.58	6	9.23	0	0.00	0.0071*
Death	6	50.00	1	12.50	2	2.53	0	0.00	2	22.22	STNA
Hosp.> 7 days	5	41.66	2	25.00	49	62.02	24	36.92	4	44.44	< .0001*
TOTAL	11		3		72		30		6		

Source: Hospital Metropolitano de Urgência e Emergência.
*UP= upper limbs; n – number of cases; % - percentage of cases Statistical test: χ^2; * = p-value < 0.05; STNA: statistical test is not applicable; Hosp. = hospitalization; LL= lower limbs.*

ulnar forearm border to defend themselves from machete inflicted injuries, a particularly common mechanism in the Amazon region that has not been described before[8,27]. Venous injuries were also more frequent on the lower limbs, which was reported by many authors[5,24]. In this study the superficial femoral vein was the most injured (17.77%) and the popliteal vein, the second most injured (14.44%), similarly to many references report[24]; nevertheless, other researchers pointed the popliteal vein as the most injured one in their prepares[5].

Although a few authors consider end-to-end anastomosis the most common management for arterial trauma, our data, in consonance with some articles pointed autologous vein graft interposition as the most adopted surgical technique[14,11,21,24]. Ligature was the most performed technique for venous injuries, similarly to other study[24] and although the best surgical strategy for venous injuries management remains uncertain, for hemodynamically unstable patients, ligature is still considered the best choice.

In this study 15.6% of patients were amputated. The popliteal artery injury is usually described as the most related to limb amputations due to vascular lesions[5,11]. In this study, it presented the highest limb amputation rate (33.33%).

The overall mortality of 6.36% is similar to many reports on the literature. As previously described, the hypovolemic and septic shocks were the most common causes of death[20,21,24]. Agreeing with previous data, among lethal cases, isolated arterial injuries or it's association to venous injuries were found in nearly half of cases; it has been show that NCVI carry higher mortality rates than CVI. NCVI caused 45.45% of deaths, mainly the inferior vena cava trauma, which accounted for 60% of these cases. The lethality of this specific injury corroborates previously published data[28]. Although this study has analyzed only civilian patients, the incidences of CVI for arterial (86.67%) and venous (70%) trauma were similar to the ones reported by Markov *et al.* concerning Middle East military conflicts[20]. The facts that NCVIs are associated with higher mortality and that many patients were brought from long distances likely explain why all deaths in NCVI patients in this study occurred in patients traveling less than 200km. Patients with NCVI coming from further away likely died before reaching the hospital and, therefore, were not included in our data.

The issue that 41.05% of patients came from cities outside the capital metropolitan area and 33.51% of them needed to travel more than 100Km to be operated highlight the need for vascular surgery assistance at more distant locations from the metropolitan area. This affirmation is confirmed by the 2013[29] published Brazilian Medical Demography that shows the north region of Brazil as the one with the lowest vascular surgeons concentration allover the country and by the Regional Medical Council, which stands that 79.16% of the 24 vascular surgeons registered on Pará state work at the metropolitan capital area[30]. Even thought there are two helicopters and one speedboat available for patients rescue, the most common mean of victim's transportation was the ambulances from the city where the trauma was sustained (52.02%). Even thought no air or water rescues have ben registered during this study, it surely happened since four patients came from Marajó island, which has no bridges connections to the continental portion of the state. These patients were probably rescued by helicopter but landed at nearby areas (an heliport is not available at the hospital) and from there they were removed by ambulance to the hospital and only the last mean of transportation was recorded. Such low frequency of air transportation may be due to difficult in communication between isolated locations and the capital or the fact that these resources availability is unknown by doctors assisting patients at such distant locations.

This study presents some limitations such as a bias selection, as patients constituted a convenience sample, as the HMU is the only regional specialized center for vascular trauma cases and patients sometimes arrive after a delay that can lead to unfavorable clinical outcomes. Unfortunately the elapsed time from the trauma until transportation to the hospital was found in only 38.15% of the cases. Other limitations include the fact that the two-year-period that was studied didn't allow a more significant amount of cases and patients were not followed after hospital discharge, thus late post-operative evaluation has not been analyzed.

Nevertheless, databases research (Pubmed, Scielo, Bireme, Medline and Lilacs) didn't provide similar studies concerning vascular trauma in the Amazon region. Researches like this highlight the fact that patients are at risk of a worse prognosis after suffering vascular injuries due to the fact that specialized assistance is not available at a reasonable distance from the city where the injury was sustained. If providing vascular surgeons availability is not short term possible solution, mainly because of the scarce number of specialists at the Amazon region or geographic isolation of some cities, perhaps a strategy using general surgeons trained on vascular trauma damage control techniques staying at strategic locations and expedite air rescue to the trauma center can benefit vascular trauma patients in this area.

In conclusion, the overall mortality related to vascular trauma was 6.36% and the main cause of death was hypovolemic shock. Limb amputation was required in 15.6% of vascular trauma cases. Distances greater than 200Km between the city where the trauma was sustained and the hospital where the definitive treatment was accomplished were associated to prolonged hospitalization period and distances greater than 300Km were associated to increased limb amputation probability. Severe vascular trauma have an increased death probability when patients need to travel more than 200Km for surgical treatment.

R E S U M O

Objetivo: *avaliar a incidência de desfechos desfavoráveis, em pacientes operados por trauma vascular, e sua relação com a distância entre o local do acidente e o hospital onde o paciente recebeu o tratamento definitivo.* ***Métodos****: estudo descritivo e retrospectivo. Dados coletados nos prontuários de pacientes operados por lesões vasculares, entre fevereiro de 2011 e fevereiro de 2013, no único hospital de trauma com atendimento especializado em cirurgia vascular em uma vasta área da Amazônia. Foram analisados data do trauma, sexo, idade, mecanismo e topografia da lesão, tratamento cirúrgico, reintervenção, período de internação, complicações, amputação e mortalidade. A incidência de desfechos desfavoráveis foi avaliada de acordo com a distância entre a cidade onde ocorreu a lesão vascular eo hospital.* ***Resultados****: foram estudados 173 pacientes, com 255 lesões; 95,95% do sexo masculino (p<0,05), média de idade de 28,92 anos; 47,4% das lesões por projéteis de arma de fogo (p<0,05); distribuição topográfica: 45,66% (p<0,05) nos vasos dos membros inferiores, 37,57% nos membros superiores, 6,94% de lesões abdominais, 5,2% torácicas e 4,62% lesões do pescoço; 51,42% tiveram hospitalização por sete dias ou menos (p<0,05); amputação foi necessária em 15,6% e a mortalidade 6,36%.* ***Conclusão****: distâncias superiores a 200km foram associadas à internação prolongada; distâncias superiores a 300km foram associadas à maior probabilidade de amputação de membros; traumatismos vasculares graves estiveram associados a uma maior probabilidade de óbito quando os pacientes precisaram ser transportados por mais de 200km para o tratamento cirúrgico.*

Descritores: *Causas Externas. Ferimentos e Lesões. Lesões do Sistema Vascular. Vasos Sanguíneos. Artéria Ulnar.*

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