

## **CORRELATION BETWEEN KIDNEY AND LIVER IMPAIRMENT WITH OUTCOME IN LIMB VASCULAR TRAUMA**

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**CORRELATION BETWEEN KIDNEY AND LIVER IMPAIRMENT WITH OUTCOME IN LIMB VASCULAR TRAUMA (Abstract):** Vascular trauma represents one of the most challenging surgical emergencies. The management starts in the prehospital phase and is completed by the intervention of the vascular surgeon. Vascular trauma has a high mortality and morbidity rate, depending on the type of mechanism, localization and associated lesions and it is frequently associated with long term complications. **Material and methods:** This paper includes 146 consecutive patients with limb trauma admitted to the Department of Vascular Surgery of the “Sf. Spiridon” County Clinical Emergency Hospital, between 2011 and 2022. From the total number, 79.59% were male patients, 73.28% from rural area, mean age 45 years old. **Results:** The most frequent trauma involved the upper limb with 93 cases (brachial artery - 51 cases, axillary artery - 23 cases), followed by lower limb with 54 cases. Thirty-four cases had vascular lesions involving the nerves and 47 cases were associated with venous lesions. The most frequent mechanism was penetrating lesions via stabbing or cutting (59.59%). Intra operatively, the following procedures were performed: simple exploration and hemostasis, end-to-end anastomosis, interpositions, and bypass. Seventeen patients required amputation, and 10 had decompression fasciotomies. **Conclusions:** The prolonged time of ischemia (> 6 hours), hemorrhagic shock, reperfusion syndrome with renal or hepatic impairment are highly correlated with an increased risk of amputation and mortality. **Keywords:** VASCULAR TRAUMA, ACUTE ISCHEMIA.

Vascular trauma represents one of the most challenging surgical emergencies for the vascular surgeon because the outcome is very much time dependent. The management of trauma patients starts in the prehospital phase and is completed with the revascularization of the affected segment. There are two therapeutic management musts: first, to achieve hemostasis and

secondly, to perform reconstruction of the injured artery and through that to ensure remission of the acute ischemia (1). Vascular trauma has a high mortality and morbidity rate (50-60%) (2), depending on the type of mechanism, localization and secondary lesions, and it is frequently associated with long term complications.

Vascular injury has a higher incidence

in younger patients and has a high impact on years of productive life lost (YPLL). This index is directly correlated with disability secondary to limb amputation or the loss of limb functionality contributing to increasing the number of young patients unable to work. YPLL is higher in trauma compared to deaths caused by cancer or cardio-vascular pathologies. For every traumatic death, the average YPLL is 36 years compared with 16 years for cancer and 12 years for cardio-vascular disease.

In Romania, statistic data on vascular trauma are limited and outdated.

## MATERIAL AND METHODS

We included 146 consecutive patients with limb trauma admitted to the Department of Vascular Surgery from “Sf. Spiridon” County Clinical Emergency Hospital from Iasi, between 2011 and 2022. Patient demographics, time from injury to hospital, clinical presentation aspects, biological parameters, management, intraoperative findings and evolution were analyzed in a retrospective fashion. All data were recorded and were statistical analyzed using *Microsoft Excel* and *SPSS* software. Chi square descriptive test was used to identify correlations between patient evolution and type of lesion or biological parameters at admission in the attempt to prove that patients with prolonged time of ischemia, with extensive lesions and critical biological parameters have poor outcome. End point evolution parameters were limb salvage and mortality. A p-value < 0.05 was considered significant.

## RESULTS

In our study the prevalence of male patients (79.59%), majority coming from rural area (73.28%), with an age median of 45 years, and 115 patients were active

workers, raising the potential impact of trauma on YPLL.

With a median of 12 patients with vascular trauma/year the Department of Vascular Surgery “Sf. Spiridon” County Clinical Emergency Hospital from Iasi can be considered an important vascular trauma center. Majority of patients (N=50; 34.24%) were from Iasi, but the addressability was from all over Moldova region (Bacău, Botoșani, Galați, Iași, Neamț, Suceava, Vrancea and Vaslui counties).

Study group general information are summarized in first table.

Trauma mechanisms were diverse, 59.59% of the vascular lesions were caused by penetrating injuries (stabbing /cuts), the rest were due to polytrauma, crush and car accidents, or following dislocations and fractures. 2 cases of iatrogenic lesion caused by catheterization were documented (fig. 1).

There is a higher percentage of the vascular trauma in the upper limb, more frequently affecting the brachial artery (51 cases), axillary artery and its branches (28 cases), comparing with lower limbs vascular trauma, with vascular lesions more frequently affecting the popliteal artery (21 cases) (fig. 2).

In 34 cases there were also major nerve lesions and in 47 cases venous lesions. In all cases, the deep vein was ligated, while neuroorrhaphy was performed in 30 cases. 9 out of 10 cases with injury of the entire vasculo-nervous bundle were at the brachial level.

Patients underwent surgical artery repair via one of the following procedures: patch-plasties with autologous graft, end-to-end anastomosis, interpositions or bypass (fig. 3). Patients that required primary amputation, without an attempt of limb salvage due to mangled extremity were excluded from the study.

TABLE I  
Patient general information

Patient characteristics		Number	Percent (%)
<b>Sex</b>			
	M	116	79.59%
	F	30	20.41%
<b>Age (years)</b>			
	median	45	-
	≤ 17	3	2.05%
	18-45	77	52.73%
	46-65	38	26.02%
	≥ 66	27	18.49%
<b>Provenience</b>			
	R	107	73.28%
	U	39	26.72%
<b>Affected limb</b>			
	Upper limb	92	63.01%
	Lower limb	54	36.99%
<b>Injured structure</b>			
	Artery	122	83.56%
	Vein	47	32.19%
	Nerve	34	23.28%
<b>Time from injury</b>			
	First 6 hours	123	84.25%
	Between 6-24 hours	12	8.22%
	More than 24 hours	11	7.53%

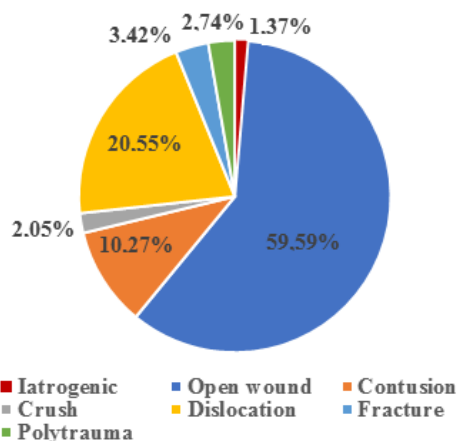
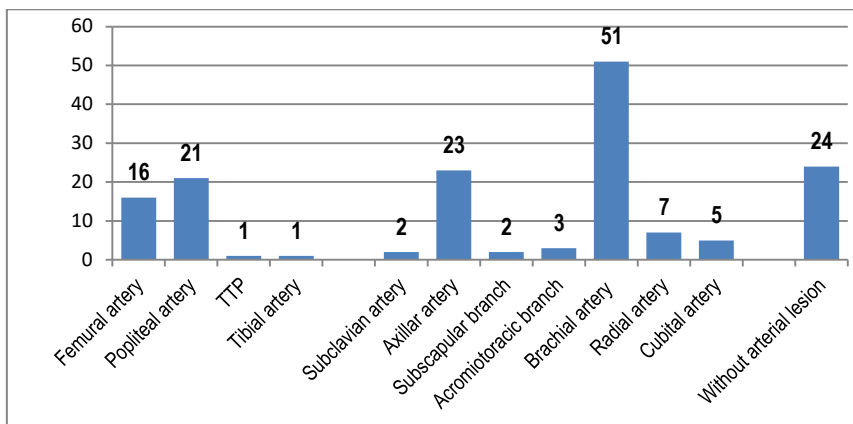
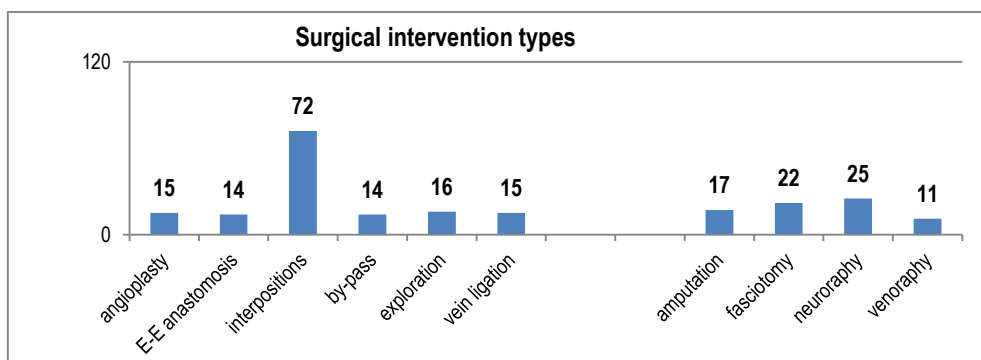


Fig. 1. Types of trauma mechanisms in the study group



**Fig. 2.** Injured artery



**Fig. 3.** Types of surgical intervention

84.83% patients had favorable evolution with peripheral pulse. Patients that underwent amputation (11.03%) or died (4.10%) were considered to have unfavorable evolution. The death causes were multiple organ failure (3 cases) and hemorrhagic shock (3 cases).

We identified correlations between patients with reperfusion syndrome, who needed fasciotomy and patients who later suffered above knee amputation ( $p < 0.05$ ). Out of 17 patients with amputation 10 had previous fasciotomies. Regarding the evolution, there was no correlation with the trauma mechanism or the affected limb (upper or lower), but the more proximal the artery was affected, the higher the risk for

amputation and mortality.

The time from the traumatic event until presentation (from index symptom to surgery) and revascularization was noted. Most patients were admitted within the first 6 hours from index symptom to surgery. Higher risk of amputation and death was noted in those patients that had prolonged time of hemorrhage or ischemia ( $p < 0.001$ ) (tab. II).

We identified strong correlations and unfavorable evolution in patients with both kidney and liver impairment ( $p < 0.001$ ). Creatinine higher than 35 mg/dL and urea higher than 1.3 mg/dL are signs of kidney impairment. For the liver function the

## Correlation between kidney and liver impairment with outcome in limb vascular trauma

transferases values and creatine kinases (CK) were being analyzed, the cut off values being 100 U/L, respectively 250 U/L (tab. III). CK elevated values were also a sign of poor outcome and were inde-

pendently correlated with unfavorable evolution ( $p=0.002$ ) (tab. III).

Organ failure as a consequence of both prolonged ischemia and reperfusion as conjunct mechanisms or independently.

TABLE II.  
Correlation between time and evolution

		EVOLUTION		PATIENTS
		unfavorable	favorable	
TIME	>6 hours	8 (5.47%)	13 (8.90%)	21 (14.38%)
	</=6 hours	14 (9.58%)	111 (76.02%)	125 (85.61%)
Total		22 (15.06%)	124 (84.94%)	146
$p < 0.001$				

TABLE III.  
Correlation between kidney and liver function with evolution

		KIDNEY PARAMETERS		TRANSFERASES LEVELS		PATIENTS
		elevated	normal	elevated	normal	
EVOLUTION	favorable	14 (9.58%)	110 (75.34%)	46 (31.50%)	78 (53.42%)	124 (84.94%)
	unfavorable	13 (8.90%)	9 (6.16%)	19 (13.01%)	3 (2.05%)	22 (15.06%)
Total		27 (18.49%)	119 (81.50%)	65 (44.52%)	81 (55.47%)	146
		$p < 0.001$		$p < 0.001$		

TABLE IV.  
Correlation between CK levels and evolution

		CK LEVELS		PATIENTS
		elevated	normal	
EVOLUTION	favorable	65 (44.52%)	59 (40.41%)	124 (84.94%)
	unfavorable	20 (13.69%)	2 (1.36%)	22 (15.06%)
Total		85 (58.21%)	61 (41.78%)	146
$p = 0.002$				

### DISCUSSION

In this group almost 24% of the vascular lesions were a consequence of dislocations and fractures. The real percentage is higher. The group was formed only from patients admitted in the Vascular Surgery

Department leaving out a part of the patients that had type III C fractures usually admitted in the Orthopedic Department. The study group can be extended and reviewed after the inclusion of those patients.

Vascular Surgery Department from "Sf.

Spiridon” County Clinical Emergency Hospital from Iasi is the single most important trauma center in the region of Moldova and a reference center for vascular trauma. At the same time, it highlights the insufficient vascular surgeons in the region that can be a cause of delayed intervention on vascular trauma patients. The median of 12 patients/year is comparable with other notable vascular surgery centers (i.e. At a university teaching hospital in Australia, Tobin (3) reported 10 cases per year of extremity vascular injuries; in Tbilisi, Georgia, Razmadze (4) reported 10.5 cases per year; in Sweden, Kjellstrom and Risberg (5) reported 8.2 cases per year; and in Oxford, United Kingdom, Magee *et al.* (6) reported 4.7 cases per year), but the injury mechanisms are markedly different from those reported all around the world (6). Most of the traumatic lesions were due to stabbing or agricultural accidents while in other countries the main cause of trauma are car accidents or gun shots. Being mainly a consequence of agricultural accidents, this can be an explanation why the involvement of the upper limb is higher. This aspect is particular to this study, literature

mostly reports lower limb trauma (7).

## CONCLUSIONS

The prolonged time of ischemia (> 6 hours), hemorrhagic shock, reperfusion syndrome with renal or hepatic impairment are highly correlated with an increased risk of amputation and mortality.

The management of patients with traumatic vascular lesions is challenging, involving a multidisciplinary approach (vascular surgeon, emergency doctor, anesthesiologist, orthopedic surgeon and plastic surgeon). Reducing ischemia time by addressing the patient rapidly to the vascular surgeon is mandatory. More centers of vascular surgery have to be established all over Moldova region in order to reduce the transportation time and improve the patient survival rate and limb salvage prognostic.

## CONFLICT OF INTEREST AND FUNDING

The authors declare that there is no conflict of interest, and they received no specific funding regarding this scientific research.

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