European Journal of Molecular & Clinical Medicine

ISSN 2515-8260 Volume 09, Issue 01, 2022

Limb Salvage Percentage in Patients with Lower Extremity Arterial Injury

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ABSTRACT

Background: Recognition of the vascular injury is often obscured by the difficulties of examining the painful, swollen extremity that accompanies bone injury. More often than not, however, it is the failure to assess the status of the distal extremity or to appreciate the significance of a large hematoma, recurrent bleeding and distal ischemia that causes delay in recognition of arterial injury. The aim of this study was to evaluate the limb salvage percentage of lower limb trauma with respect to amputation rate.

Patients and methods: This prospective study involved 18 patients with lower limb vascular who conducted at Zagazig University Hospitals. All patients were subjected to clinical examination including general examination for vital signs and local examination to determine site and type of the vascular injury. Laboratory investigations are done including full laboratory tests and radiologic imaging (duplex or CTA). Follow up of patients depended on mangled extremity severity score, linjury severity score and the Gustillo Anderson classification for maximum 2 to 4 weeks postoperatively.

Results: Time interval from trauma to hospital admission was distributed as 7.113.32, major Mechanism of accident was RTA, ischemic limb founded in 77.8%, 66.7% had associated injury, 44.4% had nerve injury, the major type of vascular injury was SFA. MESS was distributed as 5.05±1.89 and the majority 61.1% had ATA & PTA Pulse post-operative. Concerning the relation between outcome and other demographic and clinical characters, bad outcome significantly associated with higher MESS. There was a significant association between bad outcome and longer interval from trauma till hospital admission

Conclusion: Reduced amputation rates for traumatic lower limb arterial injuries have been achieved with improved revascularization and resuscitative techniques.

Keywords: Lower Extremity Arterial Injury; MESS; Limb Salvage.

INTRODUCTION

Traumato the vascular system can be devastating. Vascular trauma can come in three forms: blunt, penetrating, or combination. These injuries can occur in the civilian or military setting. However, in the civilian setting, it is an uncommon injury that presents to the traumabay. Penetrating extremity trauma(PET) is the main cause of peripheral vascular injuries, as they account for 75 to 80% of these injuries. Blunt trauma (fractures, dislocations, crush, and traction) account for the other 20-25% of peripheral vascular injuries. In the civilian setting, this accounts for less than 1% of all fractures**(1).**

Vascular injuries of the lower extremities remain a major cause of limb amputation, if not treated early and promptly. Blunt traumas and gunshot wounds are more likely to affect the arterial supply at more than one level. More extensive injury to the vessel and surround in structures leads to severe interruption of the main as well as collateral blood supply, complicating the management of these injuries and likely explaining the high eramputation rates compared with stab wounds**(2).**

Patients with partially severed arteries who are no longer bleeding and who have no evidence of distal ischemia have less emergent nonetheless urgent problems. These pulsating hematomas are subject to recurrent bleeding. Delay of repair of large arteriovenous fistulas may cause acute, near-lethal congestive heart failure. Thus, these patients should be treated as soon as possible following diagnosis and localization of their injuries **(3).**

Tissue coverage of vascular reconstruction can usually be achieved by mobilization of adjacent soft tissue. In large tissue defects, a transposed muscle flap or free tissue transfer may be required **(4).**

Rapid restoration of perfusion distal to a vascular injury is even more critical in complex wounds. In major orthopedic injuries, and in the patient in shock from multiple injuries, occasionally, definitive treatment of the vascular injury, orthopedic injury, and wound or soft tissue injury will compromise the patient survival because of concurrent injuries and systemic acidosis, hypothermia and coagulopathy. The placement of a shunt also allows a more controlled evaluation and treatment of orthopedic and soft tissue injuries without ongoing ischemia **(5).**

Endovascular treatment of vascular trauma includes the placement of embolization coils and intravascular stents or the employment of stented grafts. The potential advantages include decrease blood loss, less invasive insertion procedure, reduced anathesia requirements, and limited for an extensive dissection in a traumatic wound **(6).**

This study aimed to evaluate the limb salvage percentage of lower limb trauma with respect to amputation rate.

PATIENTS AND METHODS

This prospective study involved 18 patients with lower limb vascular trauma who enrolled at Zagazig University Hospitals. Informed consent was taken from all patients included in the study.

Inclusion and exclusion Criteria:

Patients (age between 20-40 years) with lower limb vascular trauma either penetrating or blunt. While, patients with iatrogenic vascular injury and lower extremity venous injury at any age below or above 20-40 years were excluded.

Preoperative evaluation:

All patients were subjected to clinical examination including general examination for vital signs and local examination to determine site and type of the vascular injury. Laboratory investigations are done including full laboratory tests and radiologic imaging (duplex or CTA).

Operative Assessment:

The type of intervention that used to perform vascular repair was determined on a case–by-case basis according to the situation.Limb salvage percentage wasassessed among patients with traumatic arterial injury whether in common femoral artery, superficial femoral artery, popliteal or tibial arteries. The results of mortality and amputation rates are recorded.

ISSN 2515-8260 Volume 09, Issue 01, 2022

Postoperative follow up:

Follow up of patients depended on mangled extremity severity score, linjury severity score and the Gustillo Anderson classification for maximum 2 to 4 weeks postoperatively.

Statistical analysis

Data analyzed using Microsoft Excel software and Statistical Package for the Social Sciences (SPSS version 20.0) **(**Statistical Package for the Social Sciences) software for analysis. According to the type of data qualitative represent as number and percentage, quantitative continues group represent by mean ± SD , the following tests were used to test differences for significance;. difference and association of qualitative variable by Chi square test (X^2). Differences between quantitative independent groups by t test paired by paired t. P value was set at <0.05 for significant results &<0.001 for high significant result.

RESULTS

The present study showed the mean age was 32.22 years **(Figure 1)**. Most of patients were males in percentage of 66.7% **(Figure 2)**.

Time interval from trauma to hospital admission was distributed as 7.11±3.32, major Mechanism of accident was RTA, ischemic limb founded in 77.8%, 66.7% had associated injury,44.4% had nerve injury, the major type of vascular injury was SFA**(Table 1).** MESS was distributed as 5.05±1.89 and the majority 61.1%had ATA & PTA Pulse post-operative **(Table 2).**

Regarding overall outcome, there was 66.7% overall had good outcome and 33.3% had bad outcome **(Table 3).**

Concerning the relation between outcome and other demographic and clinical characters**,** bad outcome significantly associated with higher MESS **(Figure 3)**. There was a significant association between bad outcome and longer interval from trauma till hospital admission**(Figure 4)**.

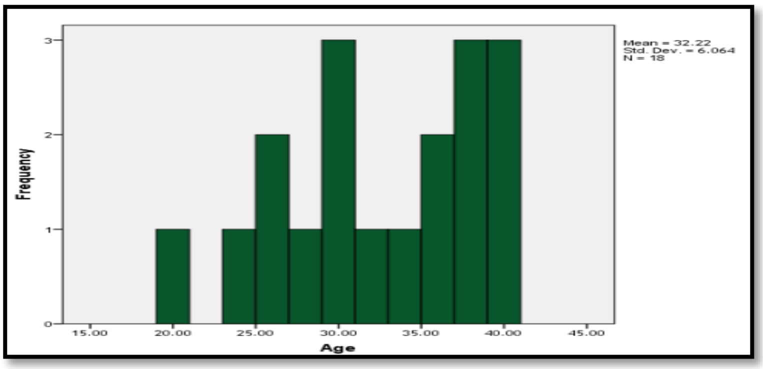

Figure (1): Mean Age distribution among studied group

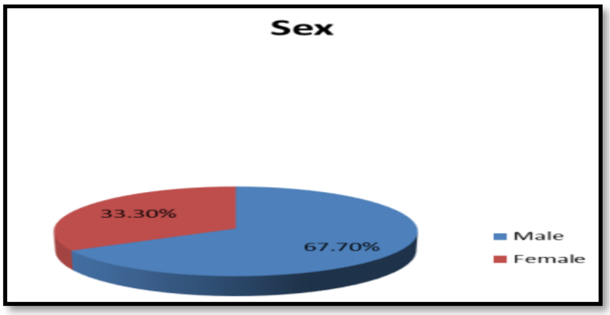

Figure (2): Sex distribution among studied group

Table (1): Trauma characters distribution among studied group

		Time interval from trauma to hospital admission	
Mean± SD		7.11±3.32	
Median (Range)		6.5 (2-16)	
		N	%
Mechanism of accident	Fall from height	1	5.6
	Gun shot	2	11.1
	Motor cycle accident	2	11.1
	RTA	6	33.3
	Run over accident	3	16.7
	Stab	3	16.7
	Trauma with blunt object	1	5.6
Limb side	Left	9	50.0
	Right	9	50.0
Limb ischemic or not	Ischemic	14	77.8
	Not ischemic	4	22.2
Associated fracture or not	No	6	33.3
	Yes	12	66.7
Nerve injury	No	10	55.6
	Yes	8	44.4
Type of vascular injury	ATA	2	11.1
	ATA and PTA	3	16.7
	CFA and CFV	2	11.1
	Contusion of p3	2	11.1
	Crushed trifurcation	1	5.6
	Cut in p2	2	11.1
	P1 injury	1	5.6
	SFA	5	27.8
	Total	18	100.0

Table (2): Outcome assessment distribution among studied group

		MESS	
Mean± SD		5.05±1.89	
Median (Range)		5.0 (2-9)	
		N	%
Pulse post-operative	NA	5	27.8
	ATA and PTA	11	61.1
	Popliteal	1	5.6
	PTA pulse	1	5.6
	Total	18	100.0

Table (3): Overall outcome assessment distribution among studied group

		N	%
Group	**Bad outcome**	**6**	**33.3**
	Good outcome	**12**	**66.7**
	Total	**18**	**100.0**

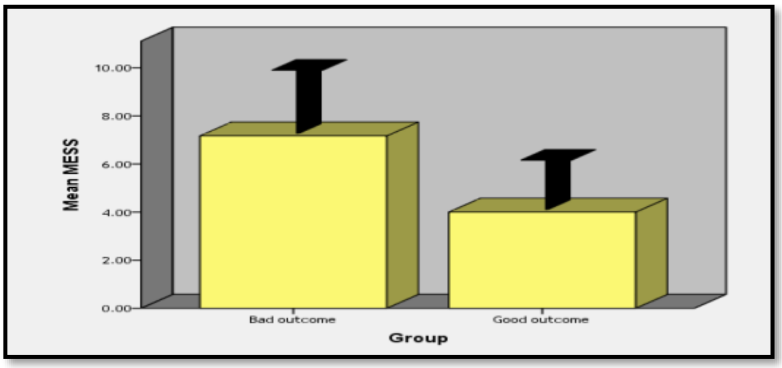

Figure (3): Relation between outcome and mean MESS

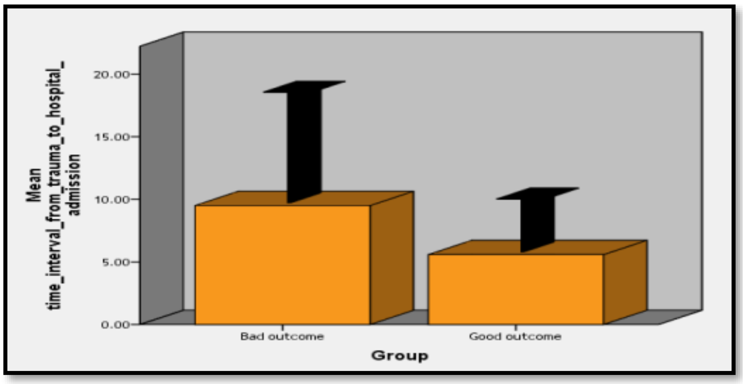

Figure (4): Relation between outcome and mean time interval from trauma till hospital admission

DISCUSSION

The management of lower-extremity trauma remains challenging and is highly associated with limb loss. Amputation following lower-extremity trauma has been variously ascribed to extent of soft tissue damage or bone defect, ischemia-related vascular injuries, and development of compartment syndrome. Among many factors, traumatic artery injury presents the most significant threat to limb survival, with amputation rates reported as high as 70%, particularly in resource-limited developing countries. Overwhelmingly, saving the patient's life and improving the rate of limb salvage are the goals **(7)**.

This is somewhat low given the fact that most of the revascularizations were done after the golden period had passed. Due to technical and medical limitations or delays in diagnosis at local primary hospitals, most patients were transferred to tertiary care centers for revascularization later than 6 h after injury **(8)**.

In addition to a higher amputation rate, delayed revascularization is associated with a poor prognosis for sensory and motor function. Nonetheless, recent studies suggest that delayed intervention (later than 6 h) also presented acceptable outcomes. Silva et al. studied the retention of limb motor function after vascular time-out reconstruction (mean, 10 h) in selected cases. However, the reasons why muscles remain viable after prolonged ischemia have been largely unclear **(9)**.

This prospective cohort study is the evaluation of amputation rates in 18 patients with traumatic lower limb arterial injury. All subjects gave a complete full history and past history of any previous operations or chronic diseases. The type of intervention used to perform vascular repair was determined.

In our study, age was distributed as 33.22 and major of them were males. **Kim et al. (10)** evaluated the outcomes and risk factors of limb loss in 24 patients treated for femoropopliteal artery injury (FPAI). Of the patients, 20 male (83.3%) and 4 female (16.7%) were included. The first age quartile was 28 years, and the third age quartile was 45 years (range, 15–68 years).

Major mechanism of accident was blunt trauma. **Jang et al. (11)** found that the mechanism of injury was blunt trauma in 13.6% of patients, gunshot wound in 56.4%, and stab in 30%, and significant differences existed between these groups.**Kim et al. (10)** found that the mechanisms of injury were blunt trauma (21/24, 87.5%) and penetrating trauma (3 of 24, 12.5%).

Naziri et al., (12) performed initial limb salvage in 41 patients (93.2%) and achieved definite limb salvage in 36 patients (81.8%). Depending on the mechanism of injury, there are significant differences between patients concerning MESS and limb salvage. **Kim et al. (10)** found that the common femoral, superficial femoral, and popliteal arteries were injured in 4 patients (16.7%), 16 patients (66.6%), and 4 patients (16.7%), respectively.

In our study, most of the patients were subjected to repair only, then repair with graft. **Pountos and Panteli, (13)** analyzed data regarding patients with lower limb arterial injuries (LLAI). Venous repair was possible in 61% of the venous injuries. The remaining injuries were ligated.

Jang et al. (11) found that the most common repair technique used was saphenous vein graft interposition (84 cases, 48.55%), followed by primary repair by end-to-end anastomosis (31 cases) or lateral arteriorrhaphy (20 cases). Thirty-five crural arteries were ligatured because of poor hemodynamic status and large segment defect, yet at least 1 of the crural arteries was patent or revascularized.

Regarding outcome, 66.7% overall had good outcome and 33.3% had bad outcome. Bad outcome was significantly associated with shorter interval, higher MESS, associated fracture and amputation. No significant association was found between intervention and outcome. Also, **Jang et al. (11)** found that the differences between outcomes were not statistically significant.

The severity of tissue ischemia depends not only on its duration but also on the level of arterial injury, the extent of soft tissue damage, and the efficiency of collateral circulation **(14)**. This explains the lack of correlation between ischemia time and outcomes.

Pountos and Panteli, (13) considered that it is more relevant to identify signs of severe ischemia such as compartmental hypertension or loss of sensation or function than to rely on the absolute ischemia time for predicting outcome. The sequelae of compartment syndrome are thought to be due to impairment of the microcirculation within the compartment leading to ischemia and irreversible damage to muscles and nerves. Ischemia tolerance of muscle tissue without irreversible damage is generally agreed to be 4 to 6 hours. They summarized that LLAI carries a high amputation rate. Stab injuries are the least likely to lead to amputations, whereas high-velocity firearm injuries are the most likely to do so.

Compartment syndrome has itself been linked to delay in restoration of blood flow, presence of associated venous injuries, lower extremity fractures, intraoperative blood loss, multiple arterial injury, and preoperative pulse deficit. Early decompressive fasciotomy prevents this neuromuscular damage. The outcome after prophylactic fasciotomy was reported to be superior to that of early therapeutic decompression **(15)**.

Feliciano, (1) performed fasciotomy on all patients suffering lower extremity vascular injury during the Iraq War. **Tisherman, (3)** reported that temporary shunting and early fasciotomy assist timely definitive repair. **Jang et al. (11)** showed limb loss may be decreased by performing prophylactic fasciotomy more often and by repairing at least 2 cruralarteries.

CONCLUSION

Reduced amputation rates for traumatic lower limb arterial injuries have been achieved with improved revascularization and resuscitative techniques.

The MESS seems to be suitable to aid in decision making for limb salvage or amputation. In such cases, we were careful to make maximum efforts for limb salvage among patients with traumatic lower extremity arterial injury.

No Conflict of interest.

REFERENCES

1- **FelicianoDV, MooreFA,Moore EE et al.,(2011):**Evaluation and management of peripheral vascular injury. Part 1. WesternTrauma Association/criticaldecisions intrauma. J Trauma.70(6):1551-6.
2- **KohliA and SinghG (2008):** Management of extremity vasculartrauma: Jammu experience. Asian Cardiovasc Thorac Ann.16(3):212-4.
3- **Tisherman SA (2016):** Management of major vascular injury: open. OtolaryngolClin N Am; 49:809–17.
4- **Beranger F, Lesquen HD and Aoun O (2017):** Management of war-related vascular wounds in French role 3 hospital during the Afghan campaign. Injury; 48:1906–10.
5- **Claes KE, Roche NA, Opsomer D et al. (2019):** Free flaps for lower limb soft tissue reconstruction in children: Systematic review. J PlastReconstrAesthet Surg. May;72(5):711-728.
6- **Sanna B, Henry BM, Vikse J et al., (2018):** The prevalence and morphology of the corona mortis (Crown of death): A meta-analysis with implications in abdominal wall and pelvic surgery. Injury. Feb;49(2):302-308.
7- **Maithel S, Fujitani RM, Grigorian A, et al., (2020):** Outcomes and predictors of popliteal artery injury in pediatric trauma. Ann Vasc Surg.; 66:242–49.
8- **Azouz SM, Castel NA and Vijayasekaran A (2019):** Lower-limb reconstruction with chimeric flaps: The quad flap. Microsurgery.; 39(2):182–87.
9- **Mitchell SL, Hayda R, Chen AT, et al., (2019):** The Military Extremity Trauma

Amputation/Limb Salvage (METALS) Study: Outcomes of amputation compared with limb salvage following major upper-extremity trauma. J Bone Joint SurgAm. ;101(16):1470–78.

10- **Kim JH, Jeon YS, Cho SG et al., (2019):** Risk factors of amputation in lower extremity trauma with combined femoropopliteal arterial injury. Vasc Spec Int; 35(1): 16-21.

11- **Jang Y, Nguyen K and Rocky S (2018):** The Aberrant Anterior Tibial Artery and its Surgical Risk. Am J Orthop (Belle Mead NJ). Jul;47(7) .

12- **Naziri Q, Beyer GA, Shah NV et al., (2018):** Knee dislocation with popliteal artery disruption: A nationwide analysis from 2005 to 2013. J Orthop. Sep;15(3):837-841.

13- **Pountos I, Panteli M and Giannoudis PV (2018):** Cuboid Injuries. Indian J Orthop. May-Jun;52(3):297-303.

14- **Rusu MC, Ilie AC and Brezean I (2017):** Human anatomic variations: common, external iliac, origin of the obturator, inferior epigastric and medial circumflex femoral arteries, and deep femoral artery course on the medial side of the femoral vessels. SurgRadiol Anat. Nov;39(11):1285-1288.

15- **Zlotorowicz M, Czubak-Wrzosek M, Wrzosek P et al., (2018):** The origin of the medial femoral circumflex artery, lateral femoral circumflex artery and obturator artery. SurgRadiol Anat. May;40(5):515-520.