

Vascular Trauma of the Lower Pelvic Limb: Revascularization or Amputation?

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ABSTRACT

Introduction: Vascular trauma is a surgical emergency that has become a public health problem in the world and in Mexico for decades, due to an increase in violence, the inability to generate security and impunity on the part of the government. **Objective:** To describe the experience of the Surgery service of the surgical treatment of vascular trauma of the lower limbs. **Material and method:** This is a retrospective, longitudinal, observational and descriptive study of all patients surgically treated for emergency vascular trauma in the Surgery service of the

"Balbuena" General Hospital of the Ministry of Health of Mexico City from January 2021 to January 2024. Results: 27 cases, all male with an average age of 28 years. Of the total number of records, 15 patients (56.6%) underwent vessel ligation, while 10 (37%) underwent vessel-vessel anastomosis. One primary amputation and seven additional amputations. Discussion: Obvious signs of vascular injury included bleeding or throbbing or expanding hematoma, murmur, thrill, etc. It is concluded that imaging helps in the diagnosis and planning of therapeutic intervention. Ultrasound is diagnostic and angiography by computed tomography in vascular mapping, or for intervention or punctuation in the 1st instance. Conclusions: vascular trauma of the lower limbs in Mexico is very frequent and becomes a challenge in decision-making, in the actions that have an impact on the rescue of the limb and the life of the patient, despite having a null hospital infrastructure installed.

Keywords: Trauma, Vascular injury, Amputation, Lower limb, Hematoma, Echography, Angioplasty, Ligature, Revascularization.

INTRODUCTION

Most patients with vascular injuries are secondary to penetrating trauma, such as stab wounds, those caused by high-velocity projectiles or firearms and even by explosion; as well as traffic accidents, among others; all of which represent a large percentage of these injuries and the most frequent arteries damaged in descending order. They are the femoral artery, brachial artery and popliteal artery. [1] These vascular injuries constitute a surgical emergency that for decades have become a public health problem in the world and in Mexico; this is due to an increase in violence, the inability of the Government to generate security and the impunity that prevails in the country. [2] It should be noted that the National Institute of Statistics and Geography in Mexico releases the preliminary figures of the statistics of deaths registered in the first half of 2023, where aggressions and homicides occupy eighth place with a number of 15,082 people, and the male sex exclusively alone rises to sixth place occupying 88% of the total registered population. By age groups, deaths due to aggressions and homicides in the age ranges are classified in third place of 15-24 years, second place of 25-34 years, as well as 35-44 years of age, which is in first place. [3]

With such a high level of violence, the real number of trauma to the arteries of the lower limb in our country is unknown. In addition, there are other causalities in a smaller proportion and more varied, such as the potential complications of self-expanding interlocking nitinol (nickel-titanium alloy) stent fractures of the femoral and popliteal artery, evaluating its reduced patency or vascular injury at 6, 12 and up to 18 months of follow-up, or depending on the case of failure that requires surgery for its repair. [4] Another reason for vascular lesions is iatrogenic lesions, which occur in the femoral artery as the most injured vessel with an incidence of up to 20%, due to diagnostic and therapeutic interventions, their frequency is rare or probably unreported. [5] In contrast to pediatric patients, which are rare, a mean age of 15 years due to trauma is documented, which in 87% required surgical exploration and where the most affected arteries were the superficial femoral and popliteal arteries. [6] Pseudoaneurysms of the femoral artery or its branches following intramedullary pinning in femur fractures have also been described as a cause of femoral vascular trauma, and until now, the appearance of a false aneurysm of the lateral femoral circumflex artery has never been described. [7] It should be noted that common femoral artery injuries are often associated with local fractures or other

common femoral artery injury mechanisms. Common femoral artery lesions include intimal disruption, intramural hematomas, and subintimal fibrosis; they can also result from blood clots or arterial emboli from a closed injury, which can eventually lead to acute renal failure, rhabdomyolysis and prolonged morbidity. [8] It has been reported that vascular injuries by firearm are exclusively caused in men in 97%, with an average age of 26 years, where the most common vascular lesion is in the lower extremity in 41.7%, in the abdomen in 18.9%, and finally in the thorax equally in 18.9%. The common femoral artery is the most injured vessel in 17.6%, followed by the superficial femoral artery in 7.1%. [9] In addition, other femoral artery injuries from complications secondary to procedures of misuse of femoral instruments have been reported, in the same reconstructive surgeries, such as screws, drill bits, retractors, and reduction instruments, such as clamps and cerclage wires, resulting in accidental injury to the femoral vessels, and in rare cases of femoral fracture the superficial femoral artery may be imprisoned in the cerclage during osteosynthesis. [10]

OBJECTIVE

To present and analyze the experience of the Surgery service, of the surgical treatment of vascular trauma of the lower limbs, in the emergency surgical exercise in a period of 3 years, of a Second Level Hospital of health care, of the public sector of the Ministry of Health of Mexico City.

MATERIAL AND METHOD

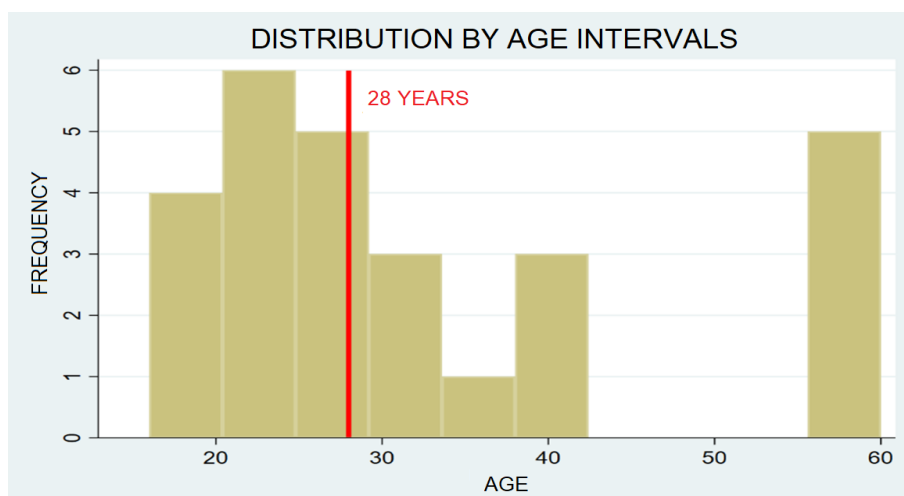
It is a study with a retrospective, longitudinal, observational and descriptive design. Where the files and files of all patients surgically treated for emergency vascular trauma of the lower limbs in the Surgery service of a second-level health care hospital in the "Balbuena" General Hospital of the Ministry of Health of Mexico City are reviewed, in a study period ranging from January 2021 to January 2024.

Age, sex, pathological history or associated factors or comorbidities, mean time of care from adverse event to surgical treatment, etiology of trauma of the types of vascular involvement of lower extremity trauma, surgical risk according to the ASA PS classification, [11] surgical time, intraoperative bleeding, number of surgical interventions, antimicrobial drug schedules used, days of hospital stay, days of stay in intensive care, morbidity and complications with the use of the MESS scale, [12] with the report of vascular lesions specific to the lower extremity, the surgical techniques used in this series of patients, as well as mortality. With a follow-up on discharge from the hospital together with the Vascular Surgery service externally of each patient at one week, one month, two months, six months and one year, until their definitive discharge.

The study and presentation of the results is carried out using descriptive biostatistics procedures.

RESULTS

The records of 35 patients were reviewed, but those who met the requirements for inclusion of surgical treatment of vascular trauma of the lower limbs, only 27 cases were collected, where 100% were male, with an age range of 15 years to 60 years, with an average of 28 years and a mode of 29 years. with an interquartile range of 23 to 40 years. See graph 1.



Graphic 1: Distribution in Frequency of Age Ranges of Patients with Vascular Trauma in Lower Limbs in The Surgery Service of the "Balbuena" General Hospital in The Period From 2021 To 2024.

We report 1 case of type 2 diabetes mellitus under control and two patients with arterial hypertension already under treatment. Three of the study group had a history of inguinal plasty surgery and one of them by appendectomy. The time of attention from the traumatic event to the beginning of surgical medical care was highly variable, with ranges from 35 minutes to 480 minutes, with an average of 74 minutes. Regarding the etiology or cause of vascular injury of the lower limbs, by incidence it is reported that the wound by high-velocity projectile by firearm was 19 cases that represent 70.4%. Figure 1.



Figure 1: Wounds from a high-velocity projectile by a firearm, with a bruise on the thigh in expansion and compartment syndrome.

In second place, the penetrating wound by a knife or sharp object in 6 patients, which is 22.2%. And finally, blunt trauma due to being run over in two patients, which would be 2.2%. Data is collected from the ASA PS classification, which is a 6-category scale and is widely used to assess patients' overall preoperative health. See Table 1.

Table 1: Classification of Asa Ps, In Number and Percentage, Evaluating the Preoperative Risk of Patients with Vascular Trauma in The Lower Limbs in The Surgery Service of the "Balbuena" General Hospital in The Period From 2021 To 2024.

ASA RATING	NUMBER / %
ASA I	0
ASA II	0
ASA III	3 / 11.11
ASA IV	16 / 59.25
ASA V	7 / 25.92
ASA VI	1 / 3.70
TOTAL	27

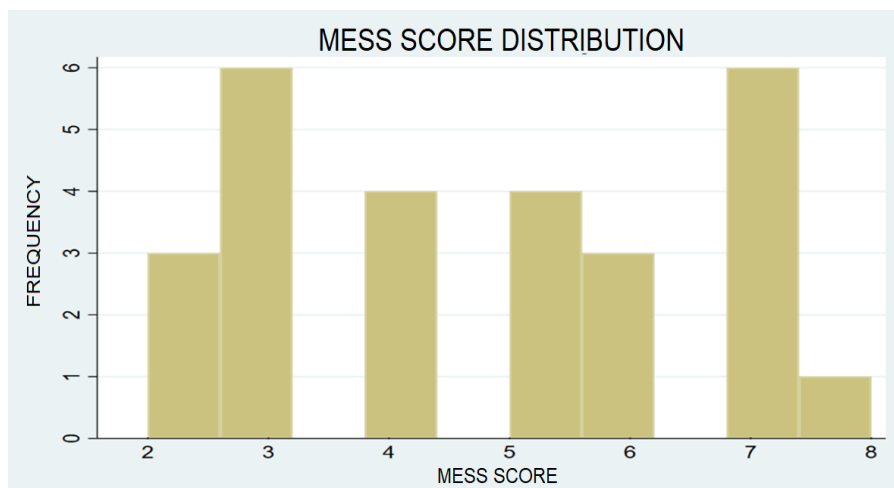
Surgical time was highly variable, ranging from 45 to 330 minutes, with an average of 142 minutes and a mode of 130 minutes. **See Figure 2.**



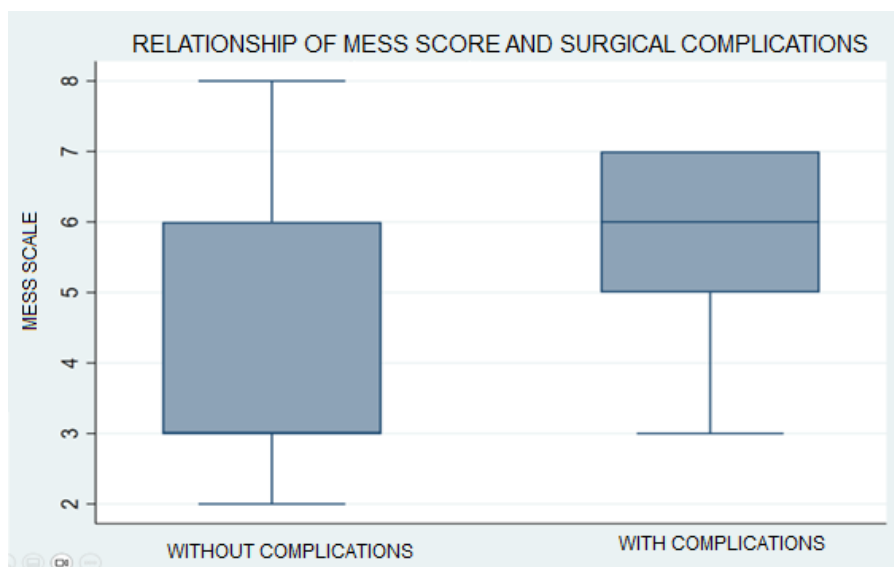
Figure 2: Vascular examination of the right pelvic limb, where the common, superficial, lateral and deep femoral artery is observed.

Quantified bleeding without textile weight was estimated in the ranges of 150 ml to 1,450 ml, with an average of 390 ml. The most commonly used antibiotics were cefotaxime or ciprofloxacin in combination with metronidazole at a prophylactic dosage, no infectious process was reported in this series. The average number of bed-days in the hospital was 9, with ranges from 5 to 23 days, as well as 4 days in the critical care service in two patients. With regard to morbidity, it occurs in five cases that represent 18.5%; Independent of surgical management, two urinary tract infections, two seromas without infection in surgical wounds, and one rhinopharyngitis were described. Regarding the severity of trauma to the lower extremity, the Shattered Limb Severity Score Scale (MESS) is used for the severity of the lower limb in the encrypted damage; where the variants of age, degree of hypovolemic shock, evolution or type of ischemia and damage to the limb at the bone, muscle and soft tissue level are considered, arrogating the following results: the average score on the MESS scale was 5 points, with an interquartile range of 3 to 7 points, this is interpreted that most of the injuries they presented were of moderate severity. However, it is relevant that 25.9% of the patients

had a score higher than 7, which indicates a high probability of amputation according to the scale, of these patients 85.7% developed postoperative complications, confirming the validity of the MESS scale to predict poor outcomes in patients with severe vascular trauma. Particularly, 71.4% of these patients required amputation of the affected limb, which reinforces the need for early and precise intervention to prevent adverse outcomes. See graphs 2 and 3.



Graphic 2: Distribution of The Mess Scale of Patients with Vascular Trauma in The Lower Limbs in The Surgery Service of the "Balbuena" General Hospital in The Period From 2021 To 2024.



Graphic 3: Relationship of The Mess Scale and Postoperative Complications of Patients with Vascular Trauma in Lower Limbs in The Surgery Service of the "Balbuena" General Hospital in The Period From 2021 To 2024.

It is specified that traumatic injuries of the lower extremity, both veins and arteries are significantly affected. In nine patients, 33.3%, lesions were present in both veins and arteries. In the case of veins, the most affected were the femoral vein in 17 patients representing 61.1%, followed by the popliteal vein in 7 patients representing 27.8%. As for the arteries, the superficial femoral artery was the most affected in 18 cases, which are 61.66%, see Figure 3., followed by the incidence of the popliteal artery in 6 individuals, which were 22.2%.



Figure 3: Common femoral artery injury from stab/stab trauma.

Of the total number of records, 15 patients (56.6%) underwent vessel ligation, while 10 individuals representing 37% underwent vessel-vessel anastomosis. **See figures 4 and 5.**

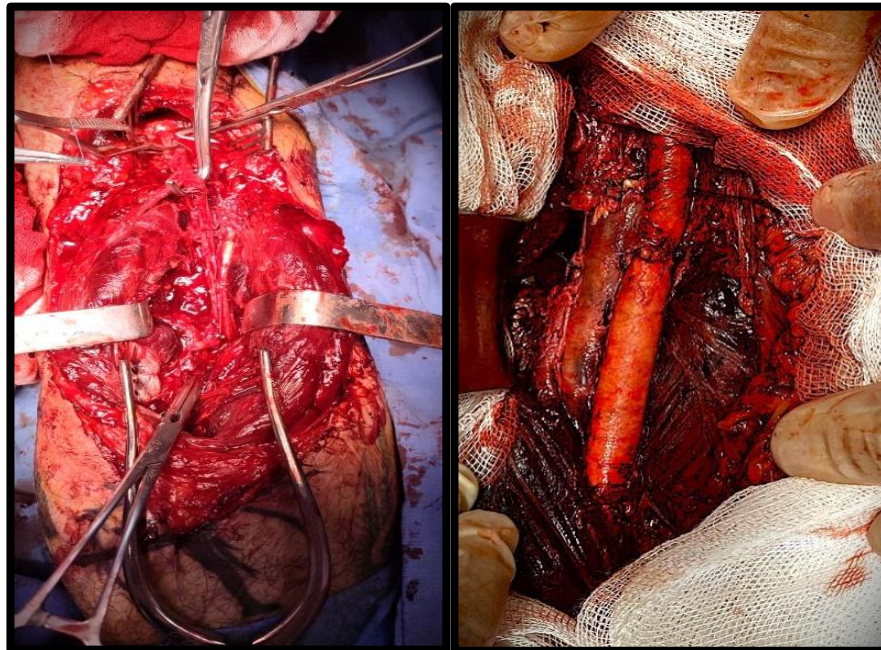


Figure 4

Figure 5

Surgical repair of superficial femoral artery due to trauma with a high-velocity firearm projectile, in two different cases.

Other surgical procedures performed included fasciotomy, raffia, and muscle hemostasis. In 17 patients, 63%, they required more than one surgical procedure. Although only one amputation was performed as the primary surgical intervention, seven additional amputations were performed after the first surgery. Of these, only two cases had a MESS score of less than 7. No mortality is reported.

DISCUSSION

The symptoms of vascular trauma of the lower limbs are sometimes evident, but in cases that do not, it refers to a sudden and dull intense oppressive pain, which decreases when the limb is lowered, secondary to a mass effect or due to the wound itself or due to limb ischemia, accompanied by paresthesia and intermittent claudication. [13] Obvious signs of vascular injury included bleeding or pulsatile or expanding hematoma, murmur, thrill, with absence of a distal pulse and/or signs of distal limb ischemia, including poikilothermia, paralysis, pallor, paresthesia, and severe pain. [14] Handlebar vascular syndrome with closed femoral artery lesion common with clinical presentation ranged from asymptomatic to acute limb ischemia. The grade of acute ischemia was mainly Rutherford class I, while acute ischemia II a, chronic ischemia, or no ischemia were also observed. The correct diagnosis was revealed by clinical examination alone. [15] On the other hand, orthopedic fractures showed significantly higher rates of vascular injury, requiring blood transfusion, and compartment syndrome compared with patients with non-orthopedic injuries. [16, 17]

Ultrasound is the study that is presumably the highest point in terms of the diagnosis and early treatment of arterial pseudoaneurysms of the lower limb due to trauma. The use of in-place ultrasound as the primary imaging modality for early detection of the diagnosis of partial thrombosis, postoperative arterial pseudoaneurysms, and that allows for efficient planning of further imaging and accelerated surgical consultation, leading to timely and definitive treatment. [18] Patients should undergo intraoperative angiography, if the surgeon is unable to identify a pulse in the injured limb after vascular repair, this study allows evaluation of vascular lesions in the injured limb at the completion of revascularization, with immediate revision and vascular reintervention during the same surgery. [19] Computed tomography, compared with angiography, is the most efficient diagnostic evaluation of patients with superficial femoral artery stenosis; the percentage determined by computed tomography was 48.68% versus 81.41% by angiography, and the difference observed between the 2 modalities was statistically significant. However, resources are sometimes scarce and the indication for each study is different depending on whether it is urgent or a chronic and programmed pathology. [20] Presumably better and more specific diagnostic device is computed tomography angiography of the lower extremity, as it can measure the distance from the femoral artery to the anterior border, the mid-sagittal axis, and the posterior border of the femur and from the popliteal artery to the medial, lateral, and medial posterior cortex of the proximal tibia in two- and three-dimensional images. allowing a better diagnosis, a well-planned surgical approach for optimal treatment. [21] For a more detailed diagnosis, MRI of the leg reveals a limb-induced muscle injury by rhabdomyolysis, evidencing peripheral nerve injury that will improve with rehabilitation on electrodiagnostic study. [22] It is concluded that imaging aids in diagnosis and planning of therapeutic intervention. Ultrasound is often diagnostic, while computed tomography angiography helps in the necessary and specific vascular mapping to obtain the best options in the surgical therapy to be performed. [23]

With regard to treatment, a triage of the patient who comes to the emergency room should be carried out primarily, where the trauma surgeon has the competence, however, the care of traumatisms depends on a transfer system to guarantee timely and adequate treatment in the main trauma centers, since the multidisciplinary treatment of the third and fourth level hospitals make a marked difference due to the infrastructure with which they are treated. However, the distance of transfer or the increase in time of this was associated with an increase

in mortality. [24] A viable option still present is the use of tourniquets in extremities with vascular injury to the lower extremities, which was reported in this study with an incidence of up to 84.4%, using a single tourniquet in 1,538 cases or 61.6%, while two tourniquets were applied in 533 patients in 21.4% and three tourniquets in 425 individuals representing 17.0%. however, the Esmarch tourniquet was the most commonly used. [25] The use of the tourniquet should not exceed 6 hours of ischemia, as it can cause muscle, nerve, vascular lesions and cause the syndrome called "tourniquet paralysis" (which causes weakness, paresthesia, pallor, and rigidity of the affected limb and usually disappears within 3 weeks after revascularization and adequate rehabilitation) or the already irreversible ischemic injury that fully determines an amputation surgical. [26]

On the other hand, a study of 162 cases describes revascularizations in the lower extremities, where the most affected artery was the superficial femoral artery, followed by the common femoral artery and the popliteal artery; Reconstruction with a bypass duct was inverted vein in 76.7%, prosthetic in 15.2%, and orthograde vein use in 4.9%. Morbidity at 30 days was bypass occlusion in 4.9%, wound infection in 3.6%, and lymphocele/seroma in 3.1%; early limb amputations were 5.8% and late limb amputations reached 8.7%. The total operative mortality was 9 patients, which is 4%. [27] In another report of 73 patients with vascular lesion of the lower extremity in decreasing order of the common, superficial and popliteal femoral arteries, revascularization was carried out with autologous venous bypass, where the greater saphenous vein was the conduit in 96% of cases, with a return rate to the operating room of 15.9%. with graft thrombosis in 47.1% and wound infections in 23.5% being the most common reasons. With a follow-up of 3.6 years, it was evident that patients present with functional deterioration at 6 months in 62.9% due to concomitant nerve injuries and 60% concomitant orthopedic injuries. [28] Another study is reported in 94 cases with the predominance of combined arterial and venous lesions in 57.5 % and the superficial femoral vessels were the most affected in 61.7 %. Arterial lesions were treated with venous graft in 59.6 % or with end-to-end anastomosis in 23.6 %, venous lesions with ligation in 81.4 % or venous repair in 13.6 %. Inappropriate surgical decisions were detected in 15% of patients:

- The use of the greater saphenous vein of the injured limb as venous graft material is the most frequent, but the use of the ipsilateral internal saphenous vein for arterial reconstruction.
- Perform arterial repair and thrombectomy, without resection of the injured segment.
- An incomplete vascular examination that did not detect lesions that were present and diagnosed later.

Amputation occurred in 23.8%, and reoperation occurred in 11.9%. And it resulted in a mortality of 11 patients. [29]

Early diagnosis is essential with timely revascularization, which can improve outcomes; in 46 pediatric patients, arterial lacerations were detected in 36% of which were repaired with a reverse saphenous vein graft and 36% with polytetrafluoroethylene "PTFE" graft. The rest were reconstructed in 11%, ligated in 14% and in other patients the trauma was repaired with Dacron graft or polyester in 2.8%. These patients should be safely cared for in trauma centers with a multidisciplinary team composed of trauma, vascular, and orthopedic surgeons, with the potential to decrease the morbidity and mortality associated with these injuries. It should be

noted that of those who underwent arterial repair, they received systemic heparinization. [6, 30] Lower extremity success rates are high, reported as high as 92% to 99%, however, there are no defined clinical guidelines for diagnostic imaging, the surgical specialties involved, and the competence of nursing or physician staff. [31]

In a meta-analysis of 222 patients, primary repair of femoral artery vascular trauma was the most frequently reported surgical intervention, followed by interposition grafting, and finally bypass grafting. The use of synthetic graft was reported less frequently (in an incidence range of 0.5% to 33%). Fasciotomies and lower limb amputations were not frequently reported (incidence range 0 to 23% and 0 to 13%, respectively). The mortality rate appeared low, as 23 studies reported no deaths (with an incidence range of 0 to 4%). [32] Another option is in the scenario as in the lack of adequate receptor vessels, which in certain complex clinical situations of vascular injury of the lower limbs, continues to be a limitation for the success of advanced reconstructive microsurgical transfer, reusing the extraanatomical peduncular redirection technique, as an alternative solution to obtain healthy receptor vessels in anatomically and surgically unfavorable clinical situations. [33]

In addition, it has been described that in iatrogenic femoral artery trauma, the following types of repairs: direct suture of the vessel with or without endarterectomy 71.4%, placement of synthetic patch 25.7%, ligation 8.6%, bypass or interposition graft 14.3% and thromboembolectomy 5.7%. Vascular repair was successful in 32 cases, or 91.4% and in three 8.6% patients died. Complications occurred in 7 operated patients, 20%, of which superficial wound infections were the most common complication (11.6%), and antibiotic therapy was treated. Iatrogenic vascular lesions seem to increase on a daily basis. Early and appropriate treatment can save a limb or the patient's own life. [5, 34]

Before forgetting to mention that we must think about the whole scenario that involves patient care, which cannot be left aside, is that uncontrolled bleeding is the main cause of death in vascular trauma. Hemostatic agents effective in junction hemorrhage may slow blood loss and improve survival, as a new starch and chitosan hemostatic foam would improve hemostasis and thus increase survival in a femoral artery hemorrhage model, compared to the CombatGauze. [35] Hemostatic foam has been documented to give excellent biocompatibility, degradability, hemostasis, and antibacterial properties of chitosan and its unique sponge-like morphology, with a high rate of fluid absorption and priority blood cell/platelet aggregation that achieves rapid hemostasis. [36] In addition, there are several rapid hemostatic materials. New rapid hemostatic composite sponges have been developed by incorporating kaolin into carboxymethylchitosan/sodium alginate, with the combination of methods such as ionic crosslinking, polyelectrolytic action and freeze-drying. [37]

There are many alternatives today for the management of vascular lesions and that not having access to them does not excuse not knowing them, which is why some of them are exposed. In the case of pseudoaneurysms of the superficial femoral artery, they are a potentially fatal complication secondary to vascular interventions or trauma; That is why a minimally invasive treatment modality is the injection of thrombin guided by percutaneous ultrasound combined with balloon occlusion, with high technical success in larger pseudoaneurysms and which avoids distal thromboembolism, being safe and effective. [38] Open revascularization surgery has now been considered controversial, due to several challenges such as infection, dehiscence,

lymphatic leakage, hematoma, and neural dysesthesia. Such high rates of amputation and recurrent early mortality have been reported. [39] The choice of preparation tool and treatment will depend on the experience of the treating physician, the availability of vessel preparation tools of stenting devices.

The available resources are:

- Traditional balloon angioplasty.
- Peripheral cutting balloons.
- Percutaneous chocolate balloon angioplasty.
- Balón Angiosculpt.
- Atherectomy.
- Litotricia intravascular.

In addition, there are subjective factors, such as installed capacity, the doctor's preferences, as well as the patient's characteristics. [40]

The formation of an arteriovenous fistula after vascular trauma injury underscores a challenging complication, where the open surgical approach is the most commonly used repair method, but the advancement of endovascular techniques has been increasingly used over the past three decades, techniques such as coil embolization and covered stents, it has been increasingly implemented with shorter hospital stays, lower costs, and lower complication rates. [41, 42] Endovascular options may include stenting or stent-grafting and complementary techniques such as coil or gelatin sponge embolization. Its success has been verified with follow-up Doppler ultrasound at 1, 3 and 6 months, with evidence of unobstructed arterial and venous blood flow in the lower limb. [43]

In the contexts of traumatology and prehospital medical emergencies, temporary control of non-compressible truncal hemorrhage, since endovascular occlusion of the aorta with balloon for resuscitation, can prevent lethal exsanguination and support cardiopulmonary resuscitation. [44, 45] The use of self-expanding nitinol stent is the most commonly used to perform a reconstruction of arterial lesions due to femoral artery trauma or in the use of pseudoaneurysms, with a certain risk of fracture of the same. [46] On the other hand, the Innospring stent is reported to be safe and effective. This interlocking nitinol stent can provide superior integrity and fracture resistance, as well as serve areas subjected to extreme mechanical stress. [47] It is necessary to describe that explore the feasibility and clinical effect of digital technology in the use of lobed perforator flaps to repair complex soft tissue defects in the extremities, with a 3D reconstruction of the lobed perforator flap model. Mimics 20.0 software was used to visualize vascular anatomy, virtual design, and flap collection prior to surgery. Intraoperative design and excision of the lobed perforating flap by the preoperative digital design. [48]

Another therapeutic option is the use of the human acellular vessel, which was carried out in 29 patients who underwent limb-salvage surgery using this non-immunogenic conduit composed of collagen, elastin and extracellular matrix shunt. Shunts were performed in the tibial arteries of 23 patients (79 %) and in the popliteal artery in 6 patients, which are 21 %. Technical success was 100% and the 30-day mortality rate was 7% in 2 patients; This resource

has demonstrated its safety, short- and medium-term efficacy as an arterial bypass conduit in a complex cohort of patients with limb-threatening ischemia and no options to autologous resources, thus providing survival without major amputations [49, 50]

With regard to the major amputation of the lower limbs, which is always latent. Data from 67 male patients were analyzed, of whom two died (3%) and three (4.5%) had a lower limb amputation after a failed revascularization.

The following findings were analyzed in a univariate statistic in a predictive way:

- The location of the lesion in the superficial femoral artery or popliteal artery increases the risk.
- In the multivariate analysis, the need for a venous bypass graft was the only significant or highest-value predictor of limb loss and mortality.
- The length of hospital stay was also a significant predictor, with the greater the risk being the longer the stay.

It should be noted that technical difficulties during the operation can lead to postoperative thrombosis of a repair, including too much stress on an end-to-end anastomosis, the inability to remove any thrombus or emboli in the distal arterial tree with a Fogarty embolectomy catheter, narrowing of a circumferential suture line, and the inability to lavage the proximal and distal arteries with heparin prior to final closure of the repair. [51]

Lesions of the vascular system are one of the main causes of preventable mortality and morbidity in trauma patients and it is necessary to point out the hard and soft signs, with respect to initial management.

Mild signs:

- Non-expansive hematoma.
- Injury to an adjacent nerve.
- Penetrating injury near a major vessel.
- Unexplained hypotension.

Hard signs:

- Throbbing bleeding.
- Absence of pulse,
- Signs of distal ischemia.
- Expanding hematoma.
- Thrill

Patients with two or three hard signs faced a severe outcome more often. For this reason, 76% of patients were sent to the operating room without imaging. And those who present soft signs take the time for their protocol and study, usefulness of this evaluation at the discretion of the trauma surgeon. [52]

Finally, it is necessary to know the criteria of an amputation in a severe trauma of the lower extremity, where they have been overly detailed, with several and numerous severity scales to

determine or not a 1st instance amputation or not. The 1985 scale by Langey et al. details the absolute and relative indications for amputation. [53] Another scale is the Mangled Extremity Syndrome Index (ISEL) or MESI (Mangled Extremity Syndrome Index), with these measures Gregory and his team, as in 1985, describe the combination of a score according to soft tissue injury, nerve injury, vascular injury, bone injury, injury severity index, age, pre-existing medical condition, and time it took for revascularization. [54] On the other hand, in 1987, Howe created the Predictive Index of Salvation (SPI) for use in patients with joint orthopedic and vascular lesions. [55] Johansen and her relatives in 1990 described a scale with four clinical criteria for: bone and soft tissue injury, ischemia, shock, and age. It is the only system statistically validated by protocols. [12] In 1991, Russell and colleagues pointed to the Limb Salvation Index (ESI) where the duration of ischemia, injury and severity of injury of 6 types of tissues are assessed: artery, bone, muscle, skin, nerve and deep veins, its application is not practical [56] In 1994, Mc Namara and others introduced the NIPBOSE scoring system which is derived from the following words: nerve injury (N), ischemia (I), soft tissue contamination (PB), bone injury (O), shock (S) and age, is of great predictive value to determine amputation, even more sensitive and specific to conclude or not the amputation, but it is very complex. [57] In 1998, Hannover published its Fracture Scale, which assesses the damage to the extent of fracture bone loss, skin and muscle, such as percentage of limb circumference, wound contamination, degree of deperiostization, local circulation, systolic blood pressure and neurological damage. [58] "Recent sensitivity and specificity studies demonstrate that HFS-98 is superior to the MESS scale in predicting limb salvage or amputation with data close to 0.99 predictive value – positive." [59] This report notes that the MESS system may be useful for the surgical classification of lower limb trauma injuries in 79 cases performed in 19 amputation patients, with a total of 24%, corroborating its specificity and accuracy. [60] The combined sensitivity and specificity for the MESS scale were comparable to those reported for the lower extremities. Specificity suggests that limb salvage was achieved in at least 20% of patients whose MESS score was above the threshold beyond which amputation is indicated; Not to mention that the goal of scoring systems is to help in the decision-making process about whether to save or amputate mutilated limbs. [61]

CONCLUSIONS

Vascular trauma of the lower limbs in Mexico is very common and that is why it becomes a challenge in decision-making, in actions that have an impact on the rescue of the limb and life. of the patient with the scarce or no installed hospital infrastructure. And without a multidisciplinary support team. However, it makes a marked difference in offering an opportunity for life and function to the patient due to the surgical work of the Surgeon.

There is the idiom that has taken root for the last two decades and driven by pharmacological emporiums, of not formally anticoagulating patients treated with revascularization with heparin in Mexico, being so crucial (since the so-called "fractionated heparin of low molecular weight" does not have a serious or real control) and the true statistics to date of the failure or success of this behavior are unknown. in the efforts to save the patient's limb and end or not, in an amputation and even put his life at risk due to embolisms and or thrombosis.

It is decisive to promote an acculturation of continuous surgical training and logistics in response to the deadly emergencies faced by the trauma surgeon on a daily basis, without resources and without viable health policies.

Conflict of Interest

The authors declare that they have no conflict of interest.

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