

Femoral Artery Trauma: It is a Challenge

Bertha Zenaida Acevedo Martínez

Medical specialist in Surgery. Attached to the Department of Surgery of the General Hospital "Dr. Rubén Leñero" from the Ministry of Health of Mexico City
Graduated from the Universidad del Valle de México. Mexico City. Country: México

Morelos Adolfo García Sánchez

Corresponding author: morelosadolfo@hotmail.com

*Medical specialist in Surgery and with a subspecialty in Colon and Rectal Surgery assigned to the Surgery department of the General Hospital Secretariat of Health of Mexico City "Dr. "Ruben Leñero." Graduated from the National Autonomous University of Mexico, Mexico City. Country: México

Andrés Armendáriz Rodríguez

Medical specialist in Surgery. Assigned to the Surgery department of the General Hospital "Ticomán" of the Ministry of Health of Mexico City and Graduated from the National Autonomous University of Mexico. Mexico City. Country: Mexico

Mariana Cuapio García

Medical specialist in Anesthesiology. Attached to the Anesthesia department of the General Hospital "Xoco" from the Ministry of Health of Mexico City and Graduated from the National Polytechnic Institute. Mexico City. Country: Mexico

Diana Lizette Estrada Álvarez

Medical. Assigned to the Surgery department of the General Hospital "Ticomán" of the Ministry of Health of Mexico City and Graduated from the National Autonomous University of Mexico. Mexico City. Country: Mexico

Juan Pablo Rayas Vázquez

Medical. Assigned to the Consultation service of the private clinic "I am your health Tlalpan" Graduated from the University of the Valley of Mexico. Mexico City. Country: Mexico

Susana Alejandra Arzate Muñoz

Medical specialist in Surgery. Assigned to the Surgery service of General Hospital "Dra. Columba Rivera Osorio" Institute of Security and Social Services of State Workers and Graduated from the University of the State of Hidalgo. Pachuca, Hidalgo. Country: Mexico

Carlos Héctor Eguía Contreras

Medical specialist in Surgery. Assigned to the Surgery service of General Hospital "Dra. Columba Rivera Osorio" Institute of Security and Social Services of State Workers and Graduated from the University of the State of Hidalgo. Pachuca, Hidalgo. Country: Mexico

Francisco Javier Juárez Delgado

Medical specialist in Surgery. Assigned to the Surgery department of the General Hospital "Ticomán" of the Ministry of Health of Mexico City and Graduated from the National Autonomous University of Mexico. Mexico City. Country: Mexico

ABSTRACT

Introduction: in Mexico there is a high rate of violence in men, as there is throughout the world, with a mortality rate from homicides as alarming as the sixth cause of death in 2023; furthermore, those who become survivors of aggression consequently have temporary or mostly permanent and disabling consequences. **Objective:** presentation of a case. **Method:** 26-year-old male who is attacked by third parties, on the left thigh he has a cutting wound in the left inguinal region with dimensions of 2 x 1 cm, with the presence of an evolving hematoma of more than 10 cm., he undergoes surgery. emergency and in the vascular examination a lesion of the superficial femoral artery was identified 5 cm from the division of the common femoral artery complex. **Discussion:** in most cases the diagnosis of femoral artery trauma is immediately apparent, however, deep rupture of the femoral artery must also be considered. The surgical options regarding femoral artery repair technique will depend on each case: vein graft, end-to-end anastomosis, Fogarty thrombectomy, ligation, arterial repair, use of prosthetic graft, use of patch and arterial bypass. At the level of the femoral vein, its repair is ligation and venous repair, anecdotally. **Conclusions:** vascular injuries of the femoral arteries are a real challenge for the Trauma Surgeon of this Country, since they put in check the ability to resolve the surgical emergency in a correct, technical, and ethical way. However, despite the lack of supplies and poor infrastructure conditions of the Health System, it still manages to make a difference.

Keywords: Vascular trauma, Femoral artery, Anastomosis, Thrombectomy, Ligation, Arterial repair, Vascular injuries, Arterial bypass.

INTRODUCTION

In Mexico there is a high rate of violence in men as there is throughout the world, with a mortality rate from homicides as alarming as the sixth cause of death in 2023; furthermore, those who become survivors of aggression consequently have temporary or mostly permanent and disabling consequences, not to mention the cost in health, human and economic resources. [1] Penetrating traumatic vascular injuries induced by high-velocity projectiles, explosions, knives, and firearms have the greatest impact of a significant proportion in patients with vascular trauma. [2] The trauma surgeon must know how to correctly identify the patient who deserves immediate/emergent or only urgent surgical attention; the prognosis depends on this in terms of morbidity or mortality of the patient. [3] The anatomical locations of vascular injuries occur most frequently in the lower extremity (41.7%), followed by the abdomen (18.9%) and thorax (18.9%), and dominant vascular trauma of the lower extremity, it is the

common femoral artery in 17.6%, secondly the superficial femoral artery in 7.1%. [4] Femoral artery injuries have been reported due to complications secondary to events of misuse of instrumentation, such as screws, drills, retractors, and reduction instruments, such as clamps and cerclage wires, which cause iatrogenic injuries to the femoral vessels, and in rare cases of femoral fracture the superficial femoral artery may become incarcerated in the cerclage during osteosynthesis. [5] Iatrogenic vascular injuries due to medical procedures, diagnostic and therapeutic interventions, are rare or no warning is given, where the common femoral artery is consequently the most injured (20%). [6, 7] In vascular trauma of the femoral artery, nosocomial infections and massive hemorrhages remain the main causes of late mortality in trauma patients and are a leading cause of permanent disability or death among young people. [8]

The vascular structure of the external iliac artery passes anteriorly along the pelvic edge and ends in the common femoral artery, it is divided into superficial and internal, and the superficial branch supplies the popliteal artery, which is "terminal"; [9] on the other hand, the internal iliac artery through the sacroiliac joint divides into anterior and posterior, ending in the obturator and superior gluteal arteries. The corona mortis or pelvic ring is an anastomosis between the obturator artery and the external iliac artery or the deep inferior epigastric artery. Young people suffer from high-energy trauma, including falls from heights and motor vehicle collisions, where the incidence of associated trauma includes long bone fractures in 50 % with femoral vascular injury. [10]

OBJECTIVE

Case report and literature review.

METHOD

26-year-old male patient: height 1.70 m, weight 82kg, BMI: 28.3. He denies a history of allergies and chronic-degenerative diseases; his condition began when he was attacked by third parties on a public street with a sharp instrument in the left inguinal region, with immediate onset of profuse active bleeding. The family member placed a tourniquet on the left lower extremity, arriving at the hospital unit on his own 3 hours later, going to the hospital emergency department.

Vital signs on admission, with vital signs: blood pressure. - 80/70 mm Hg., heart rate: 106 beats per minute, respiratory rate: 26 per minute, temperature: 36.2°C., oxygen saturation: 97 %. At the time of the conscious evaluation, he was sleepy, with an anemic appearance, and cooperative, cardiopulmonary without apparent compromise, abdomen with no data to comment on, in the left pelvic limb he had a cutting wound in the left inguinal region with dimensions of 2 x 1cm., with the presence of an evolving hematoma of more than 10 cm in diameter on average, with profuse active bleeding, generalized pallor of the left lower extremity, no distal pulses palpable: popliteus, pedis, posterior tibial, capillary refill lasting 9 seconds. Laboratories: TPT 11.8 x'. INR 1.03. TTP 29.6 x', leukocytes 7.4 / mm³, neutrophils 70.6%, hemoglobin 10.9 g/dl, hematocrit 30.4%, mean corpuscular volume 88.6 x 10⁶ / u/l, platelets 165 u/l, glucose 94 mg/dl, BUN 10 mg/ dl, urea 21 mg/dl, uric acid 4.7 mg/dl, creatinine 0.4 mg/dl, sodium 139 meq/l, potassium 3.9 meq/l, chlorine 106.6 meq/l. Emergency surgery is performed and vascular exploration identifies a lesion of the superficial femoral artery 5 cm from the division of the common femoral artery complex: the circumflex

femoral artery, the lateral femoral artery and the femoral artery. deep and its perforators, an adhered clot is detected in an artery measuring 1.5 cm., the ends of the vessel are dissected and the arterial repair is performed with 3 simple stitches separated with 5-0 polypropylene vascular suture. See figures 1 and 2.

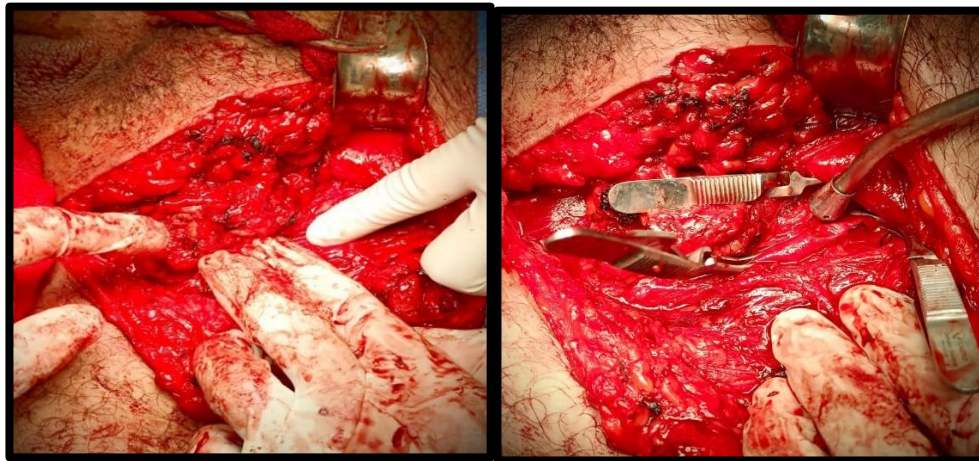


Figure 1

Figure 2

Figure 1 and 2. Images that show the vascular injury of the superficial femoral artery, vascular control and its arterial repair are successfully achieved.

Two video links of the surgery are added.

- <https://youtube.com./shorts/F3m3K4Q9UfQ?si=IWNWxsAVKH1zQQd3>
- https://youtube.com./shorts/IJ6oPdJBTw4?si=hgw-sSU3R5Kfz_s0

Once the vascular repair of the injured superficial femoral artery is completed, comparatively 5/5 distal vascular pulses are evident in the popliteal, tibial and pedis arteries, with instantaneous capillary refill. In his postoperative period there were no complications, prophylactic anticoagulation was performed and his evolution being satisfactory, he was discharged from the hospital and sent to the vascular surgery service externally.

DISCUSSION

In the diagnosis of femoral vascular trauma, the symptoms are sometimes obvious, but in cases that are not, a sudden, intense oppressive dull pain is reported, which decreases when the limb is lowered secondary to a mass effect or due to the injury itself or due to ischemia of the limb, accompanied by paresthesia's and intermittent claudication. [11] Obvious signs of vascular injury included pulsatile bleeding, pulsating or expanding hematoma, murmur, thrill, with absent distal pulse, and/or signs of distal limb ischemia, including poikilothermic, paralysis, pallor, paresthesia, and pain. [12] In most cases the diagnosis of femoral artery trauma is immediately apparent, however, deep rupture of the femoral artery must also be considered, which can cause life-threatening outcomes, such as compartment syndrome, tissue ischemia, necrosis, infection, etc., so early identification and diagnosis should be essential. [13] The availability of doppler ultrasound is essential, where the diagnostic suspicion of damage to the femoral vessel can be confirmed and in the spectral modality low signs of the distal blood supply can be identified, as well as identifying the exclusive arterial lesion, venous or mixed, since it is then considered the 1st line in the diagnostic protocol, [14] or failing that angiography

by computed axial tomography and/or nuclear magnetic resonance, which is at the discretion of the Trauma Surgeon to carry out. [12, 13, 15]

Regarding the behavior to be followed or the treatment, it will depend on the scenario in which the patient is, the vessels (femoral vein and artery); [16] where it is best to ligate the femoral vein in the 1st surgery (due to the risk of venous thromboembolism) [17] and/or anatomical structures involved, the etiology of the trauma, the effects of ischemia, as well as, if there is a syndrome compartment of the lower limb, bone fracture, [18] abrasion with loss of specialized tissue (muscle, nerve, bone or their combination), use of tourniquet (time, type, cycles, etc.) and finally, the general condition of the subject such as, age, comorbidities and hemodynamic stability at the time of surgical evaluation. [19]

Resuscitative endovascular balloon occlusion of the aorta (REBOA) is a tool for controlling bleeding from the distal injured vessel, thus allowing surgical repair of the femoral artery. The interventional radiology team using computed tomography demonstrated extravasation of the inferior epigastric artery as a complication of the use of this therapeutic option. To achieve angioembolization through an effective contralateral access, where the REBOA catheter was placed and controlling the hemorrhage. [20] The efficacy and safety of a minimally invasive treatment modality, with percutaneous ultrasound-guided thrombin injection (PUGTI) and combined with balloon occlusion, achieves a high technical success rate and may also offer a safer alternative to direct thrombin injection without occlusion, as it potentially minimizes the risk of complications such as distal thromboembolism. [21]

It should not be forgotten that bleeding remains the leading cause of death, potentially preventable, both in the trauma setting with conventional extremity tourniquets, which do not control bleeding, if an iliac artery or common femoral artery is injured. These tourniquets are special ones that require specific training for these connecting vessels, unlike the common ones for distal vessels, where the task of putting a tourniquet is to "do it well and quickly, if possible." [22] The use of the tourniquet is the last resort, since its improper use, with excessive tension or its exponentially prolonged application (more than 1.5-2 hours) can cause muscle, nerve and vascular injuries, with a syndrome called "tourniquet paralysis" (weakness, paresthesia's, paleness and rigidity that usually disappears within 3 weeks after revascularization) or irreversible ischemic injury determined for more than 6 hours and that is conducive to surgical amputation, so the tourniquet operating time no longer than 60-90 minutes, the objective is for the use of this method to be safe. [23, 24, 25]

Furthermore, in the surgical management of femoral artery vascular injury, the trauma surgical rule teaches that patients should undergo intraoperative angiography if the surgeon cannot identify the pulse in the injured extremity after vascular repair, this is a valuable tool for trauma surgeons, without a documented palpable pulse after repair, they were significantly more likely to need immediate review before leaving the operating room by 22% versus 9% than if they had a pulse. [26] There is the option of a temporary silastic stent technique in microvascular anastomosis, in which it is placed in the vessel before creating the anastomosis, it is useful for precise formation of the anastomosis, in injury to the vessel, however, its problem is its introduction and removal from the guides of the access blood vessels. [27]

Furthermore, surgical techniques for microvascular repair have been sought to avoid surgeon errors and to facilitate surgical intervention, as occurs in conventional microvascular anastomosis; the posterior wall technique and the separated fixed suture method in femoral artery trauma since it allows a better view of the vascular lumen, concluding to be effective for trauma surgeons, and consequently in the results there were no differences that impact, both for the conventional technique that causes suture errors or deterioration of blood flow, compared to the simple stitch technique. [28]

The mechanism of trauma, the state and degree of hypovolemic shock, additional injuries, the treatment of vascular injuries, whether to perform fasciotomy or not, or whether a bone fracture occurs at the same time, the intraoperative decisions of the surgeon must be evaluated. trauma and severity of vascular injury; all of these factors influence the type of repair to be performed, where hospital infrastructure and surgical competence play a determining role, which is why in this study arterial injuries were treated most frequently with a venous graft in 59.6% and venous injuries underwent ligation in 81.4%, and the unfavorable results reported are estimated at 44.7%: surgical reintervention was necessary in 21.3% and limb amputation in 25.5%, and finally, 9.5% of patients died. [17, 29] The surgical options regarding the technique of repair or not of the femoral artery will depend on each case, which are: vein graft, end-to-end anastomosis, Fogarty thrombectomy, ligation, repair of the artery, use of prosthetic graft, use of patch and arterial bypass. At the level of the femoral vein, its repair is ligation and venous repair is anecdotal. [17, 30]

Management after vascular repair surgery is essential, since monitoring, control and constant evaluation of the patient is extremely vital. Thus, evidencing the success rates or complications, coupled with the risk factors of each individual that lead to reoperation, graft failure or even limb amputation. [31, 32, 33]

CONCLUSIONS

Vascular injuries of the femoral arteries are catastrophic, in all their variants and despite having an optimal response, the best surgical technique and the excellent skills of the surgical team, failure due to thrombosis, infection or amputation of the limb and even the death of the patient is always latent.

Vascular injuries of the femoral arteries are a real challenge for the Trauma Surgeon of this Country, since they put in check the ability to resolve the surgical emergency in a correct, technical and ethical manner. However, despite the lack of supplies and poor infrastructure conditions of the Health System, it still manages to make a difference.

Finally, the poor compliance with long-term surveillance of patients who present femoral artery trauma and achieve successful revascularization is worrying and may require adjustments in health protocols and policies for the surveillance of these cases.

Conflict of Interests

The authors declare that they have no financial interests or personal relationships that could have influenced the work presented in this article.

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