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Morel-Lavallée lesion in burned patients

Lesión de Morel-Lavallée en pacientes quemados

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Palabras clave:
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ABSTRACT

Morel-Lavallée injury is a closed traumatic injury that dissects soft tissues in anatomical planes. It is related to high energy mechanisms; it can involve only soft tissues or in combination with fractures. Burn patients may present within the group of traumatic injuries, whose external forces during impact cause separation between anatomical planes. Bibliographic research identifies the most recent publications that describe and treat this injury. It causes disruption of blood vessels and lymphatic vessels in the subcutaneous space overlying the muscle fascia, leading to fluid accumulation in burn patients with extensive surface areas and associated high-energy trauma. It can quickly go unnoticed due to deep burns, edema due to high volumes of crystalloids, and hemoderivatives used in the initial resuscitation phase, adding endothelial capillary leakage. Surgical debridement is the most effective treatment, and less invasive methods have been proposed for better esthetic and functional results; currently, there are few publications on the subject. The approach includes a structured evaluation, investigation of trauma kinematics, a high index of suspicion, and serial reviews.

RESUMEN

La lesión de Morel-Lavallée es una lesión traumática cerrada que diseca los tejidos blandos por planos anatómicos. Está relacionada con mecanismos de alta energía, y puede involucrar únicamente tejidos blandos o en combinación con fracturas. Se encuentra dentro del grupo de lesiones traumáticas que los pacientes quemados pueden presentar, cuyas fuerzas externas durante el impacto causan separación entre planos anatómicos. Mediante una investigación bibliográfica se identifican las publicaciones más recientes que incluyen la descripción y tratamiento de esta lesión. Condiciona interrupción de vasos sanguíneos y vasos linfáticos en el espacio subcutáneo que recubre la fascia muscular, lo que propicia acumulación de líquido en pacientes quemados con superficies extensas y trauma de alta energía asociado. Puede pasar fácilmente inadvertida debido a quemaduras profundizadas, edema por volúmenes altos de cristaloides y hemoderivados utilizados en la fase de reanimación inicial, agregándose fuga capilar endotelial. El desbridamiento quirúrgico es el tratamiento más efectivo, se han propuesto métodos menos invasivos buscando mejores resultados estético-funcionales; actualmente son escasas las publicaciones. El abordaje comprende una evaluación estructurada, investigar la cinemática de trauma, un alto índice de sospecha y revisiones seriadas.

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INTRODUCTION

The Morel-Lavallée lesion (MLL), first described in 1863 by the French surgeon Victor Auguste François Morel-Lavallée, consists of a closed traumatic injury that dissects soft tissues in anatomical planes, may be associated with high energy mechanisms and have variable presentations and involve only soft tissues and in combination with fractures. This soft tissue dissecting hematoma is often underestimated and may be an undiagnosed cause of a persistent state of shock in the critically injured patient in the initial approach.[1,2] The kinematics of trauma described correspond mainly to motor vehicle collisions; the most common anatomical location is the greater trochanter and hip, followed by the thigh, lumbosacral region, and abdominal wall. This injury

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usually results from high-energy trauma, also reported in contact sports, and postoperative complications.

The most common sites of clinical presentation of the lesion reported, are the greater trochanter or hip 30.4%; thigh 20.1%; pelvis 18.6%; knee 15.7%; buttock 6.4%; lumbosacral 3.4%; abdominal wall 1.5%; and lower leg 1.5%. Other authors suggest a higher prevalence of MLL in obese patients with body mass index (BMI) over 30.[3,4] Regarding the burn patient, there are few publications on the subject, limiting the information available for decision-making by a surgical team when this pathology occurs in the burn patient. The present research is focused on reviewing valuable data for the burns surgeon and commenting on clinical examples of patients in whom this lesion was documented in our burns center.[2]

Pathophysiology: MLL falls within the group of traumatic injuries, whose external forces during an impact cause separation between skin, subcutaneous fat, and underlying fascia creating a physical space between skin and fascia that can collect blood and inflammatory fluid with the possible risk of becoming infected or forming complex collections.[4,5] At the same time, the interruption of the blood vessels and lymphatic vessels in the subcutaneous space overlying the muscle fascia will promote this fluid accumulation leading to the separation of the soft tissue from the deep fascia, alteration of the vascular supply, lymphatic drainage, and perforating vessel connections between the tissue layers.[1,3,4] Special consideration should be given to interrupting the circulation of perforating vessels along the fascial planes as an essential source of continuous fluid accumulation, given the excellent capacity for fluid accumulation in the thigh, pelvis, and abdomen. These should be considered high-risk regions, especially in obese patients.[5,6] Burn injuries are underestimated in primary screening; patients with high energy mechanisms may mask more severe injuries. They involve both physical abrasion of the skin and thermal injury, so the precise extent can only be established once Jackson areas are delineated.

Clinical picture: we identified the most recent publications that describe and treat this lesion through bibliographic research in PubMed. MLL in the burn patient often goes unnoticed in the initial evaluation. In addition to the fact that these patients require resuscitation with higher volumes of crystalloids and blood products in the initial phase, they present a significant capillary leak that can condition fluid collection in anatomically at-risk areas such as the extremities and abdomen *(Figure 1)*. Although MLL is a closed lesion, possible complications include soft tissue or bone infection, wound dehiscence, and skin necrosis.[1] MLL evolves from a few hours to days after injury. Physical examination is based on several factors, including skin mobility, subcutaneous fluctuation, decreased skin sensation, generalized edema, and friction burns *(Figure 2)*. In the clinical evaluation, local pain is documented, and it is common to refer to hypoesthesia in the affected region due to damage to cutaneous nerve branches.[7]

Diagnosis: timely diagnosis will allow establishing an adequate surgical treatment, but should be mainly considered in patients with traumatic injuries associated with high energy mechanisms since these can present in combination with fat necrosis, lymphatic leakage, and hematomas with the possibility of evolving to infection, even presenting late *(Figure 3)*.[7,8] The separation of the vascular supply due to the shear mechanism can cause skin necrosis, also contributing to the mass effect caused by the accumulation of fluid, which further compresses the vascular plexus supply, increasing the pressure-related ischemia of a specific anatomical area.[8] Timely diagnosis and treatment are essential, as late diagnosis can lead to infection, formation of complex collections, and can even be misinterpreted later as a soft tissue neoplasm.[9]

Diagnostic imaging: they are usually classified into three different subtypes based on imaging: seroma, subacute hematoma, and chronic hematoma. The latter, chronic fluid accumulation, may become infected and eventually develop into an acute abscess or be encapsulated by a fibrous capsule if the collection remains sterile.[8,9] Several

Figure 1: *Initial assessment of a 69-year-old female patient with fire burn secondary to an explosion at home, presenting high-energy trauma kinematics that caused burns and contusion in the lumbar region, with clinical data of the Morel-Lavallée lesion. The total burned surface area was estimated at 15% (13% of the entire thickness of the third degree and 2% of the partial thickness of the second degree).*

imaging modalities can help diagnose an MLL, including ultrasound, CT, and MRI. Ultrasound is an effective tool for diagnosis and follow-up. However, due to the stages of evolution of the lesion: seroma, subacute hematoma, and chronic organized hematoma, its presentation can vary over time, and these lesions can be challenging to visualize. There are also published reports of MLL in the clinical context of high-energy trauma in combination with a collection of fluid in the subcutaneous tissues overlying the deep fascia with skin preservation.[9,10] In the acute setting, computed tomography may demonstrate a small, superficial hematoma; it allows the characterization of hematomas with the limitation that only one-third of lesions show active contrast or extravasation at the initial scan.[9] MRI is the gold standard in imaging diagnosis of MLL in its different stages. Hemoglobin appears hyperintense in T2 images; in a later stage, hemoglobin causes greater intensity in T1 images, with the limitation of being unable to be performed in critical patients or with hemodynamic instability.[9]

Treatment: surgical debridement is the treatment of an MLL; currently, less invasive methods have been proposed for better aesthetic and functional results, including non-surgical treatment or minimally invasive drainage. Scolaro et al. believe treatment can be based on lesion size, severity, and proximity to a planned surgical incision for coexisting lesions.[7,8] Smaller lesions may be amenable to non-surgical treatment or minimally invasive drainage. Larger lesions should be approached with debridement and bleeding control, especially when proximal to planned surgery, to avoid complications such as necrotizing fasciitis of surgical or traumatic wounds.[1,11] Burn patients present compromised epidermal circulation and subcutaneous tissue in the injured segment and the periphery of the lesion, making it difficult

Figure 2: *Shock cubicle assessment of a 45-year-old male patient with fire burns secondary to an explosion in his work area, accompanied by high-energy trauma to the arms, thorax, abdomen, and lumbar region with clinical data of Morel-Lavallée lesion in the lumbar region. The total burned surface area was estimated at 30% (25% third-degree total thickness, 5% second-degree partial thickness).*

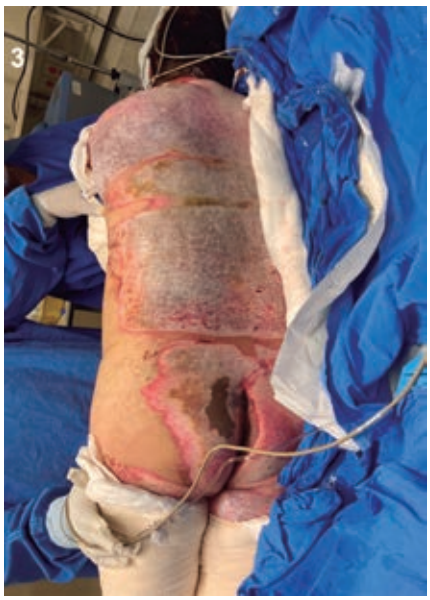

Figure 3: *56-year-old female patient with fire burn secondary to an explosion in an enclosed space, accompanied by high-energy trauma to the posterior thoracic and lumbar region, presenting Morel-Lavallée lesion in the left thoracolumbar region. The total burned surface area was estimated at 40% (30% third-degree total thickness, 10% second-degree partial thickness).*

to determine the long-term viability of the overlying tissue. The Mayo Clinic presented its experience with 87 patients with MLL from trauma caused mainly by motor vehicle collisions.[7,12] The investigators compared surgical debridement, minimally invasive drainage, and nonoperative management. They concluded that surgical debridement was less likely to have a recurrence than nonoperative management and minimally invasive drainage (15, 19, and 56%, respectively). They reported 50 ml of aspirated fluid more likely to recur (83% vs 33%, $p = 0.02$), suggesting considering this cutoff as a starting point for large lesions.[7,12] Negative pressure therapy following surgical debridement aids resolution and prevention of fluid accumulation, application of autograft to replace the skin defect offers the most predictable results. Another strength of our study is the ability to document the microorganisms present in a secondary infection and accompanying clinical data, such as fever, leukocytosis, cellulitis, pain, and morbid obesity.[13,14]

The treatment algorithm for MLL most useful in the burn patient requires evaluation between acute or chronic injuries with or without infection data and with associated fractures; it establishes three types of damage and their treatment:

1. Acute injuries can be treated with compression and surveillance.
2. Injuries with infection or fracture can be treated with surgical debridement and wound closure with negative pressure therapy.
3. Chronic lesions can be treated initially with percutaneous drainage, and if they do not improve, surgical debridement with negative pressure therapy and secondary closure is recommended.

Recommendations

When it is in the lumbar region and shows hemodynamic stability, hematoma delimitation with marking and compression of the patient's body weight can be a valuable initial resource. It can be complemented with a CT scan.

DISCUSSION

MLL occurs in patients with traumatic injuries associated with high-energy mechanisms, whose large tangential forces displace subcutaneous adipose tissue and superficial fascia from the underlying deep fascia. This mechanism damages perforating arteries, veins, and lymphatic vessels, accumulating fluid in the inter-fascial plane.[3] The damage often goes unnoticed in initial care because of the larger, more visible lesions; the lumbar region and trochanter are the most common sites because of their prominence, large surface area, skin mobility, and rich capillary network in the soft tissue.[4] A detailed interrogation diagnoses the trauma film, a detailed physical examination, a clinical evaluation, and with the support of some imaging methods. Ultrasound can be used in the acute phase, where CT and MRI are unavailable. Fluid collections with

heterogeneous echogenicity are seen in the acute phase; the lesion is usually compressible and without flow on Doppler imaging. Chronic lesions tend to be more homogeneous with capsule formation. MRI is the gold standard for imaging diagnosis of MLL.[3,6,7] In burn patients with extensive surface areas and associated high-energy trauma, MLL can easily be missed due to deepening burns, high crystalloid volumes, blood products required in the initial resuscitation phase, and capillary leakage into the extracellular space. In the burn patient, it is essential to consider this type of injury during serial reviews to identify burned areas that occur in combination with this injury.[14]

Controversy exists regarding the timing and type of subsequent treatment in extensive lesions involving the different layers of the skin in patients with aggregate complications and data of hemodynamic instability, such as the large burn, so more research is needed to provide standardized, evidence-based methods.[15]

CONCLUSIONS

It is an infrequent lesion for randomized controlled trials; publications are institutional case reports, surgical group experience, and retrospective treatment analyses. MLL can be easily missed in burn patients with extensive surface and traumatic injuries associated with high-energy mechanisms. In the approach to these patients, detailed investigation of trauma kinematics, structured and systematized evaluation according to the initial management protocol of the Advanced Trauma Life Support (ATLS) course or any burn patient approach course. Maintaining a high index of suspicion of associated traumatic injuries together and performing serial revisions by the same team are the safest and most efficient strategies.

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