Delayed Presentation of a Chronic Morel-Lavallée Lesion

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ABSTRACT

Morel-Lavellée lesions are soft tissue degloving injuries resulting from shearing trauma that induces separation of the superficial and deep fascias creating a potential space that becomes filled with hemolymph. Here we present a case of a 28-year-old male presenting with a persistent Type I Morel-Lavallée lesion 2.5 years after an automobile versus pedestrian accident. These lesions can be visualized via computed tomography, plain film and ultrasound, but magnetic resonance imaging is the modality of choice for their identification and characterization.

CASE REPORT

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A 28-year-old male presented with a 40 cm mass along the lateral aspect of the left thigh without fluid discharge or skin changes. He complained of difficulty ambulating due to the weight of the mass with pain in his left thigh and lower back. Over 2.5 years prior, the patient had been struck by a bus, resulting in a 2 cm laceration to the left ankle, superficial abrasions to left knee and swelling of the left lateral thigh, increasing pain and inability to ambulate without bony fracture. He had significant anterior ecchymosis with firmness in the left anterior thigh, normal joint range of motion and intact distal pulses. Based on physical examination, ultrasound (Figure 2a), and radiography (Figure 3a) at the time of injury, concern for a traumatic hematoma of the left thigh prompted placement of a 12 French interlocking pigtail catheter and drainage of 600 mL of blood (Figure 2b). Following removal of the catheter 1 day after placement, the left leg mass rapidly re-accumulated fluid and the patient was not rescheduled for drainage nor debridement.

The patient was lost to follow up until re-presenting 2.5 years later describing an enlarged, fluctuant mass in the left lateral thigh measuring approximately 40cm cranial to caudal with increased left leg diameter complaining of mobility impairment, hip and back pain, and inability to wear certain clothing. The mass had been stable in size and was not associated with any sensory, motor or vascular deficits. He was evaluated by anterior-posterior and lateral radiography (Figure 3b), coronal and axial computed tomography (CT) (Figure 4), and short tau inversion recovery (STIR), T1-weighted (T1WI), and T1 fat sat post-contrast magnetic resonance imaging (MRI) (Figure 5). After diagnosis of a Type I Morel-Lavallée lesion (MLL), the patient was scheduled for surgical resection.

Lower left extremity seroma evacuation and capsule resection was performed with 4000mL of fluid drained. The curvilinear incision measured 45cm and a multilayered primary closure was performed. Two 20 French Blake drains were placed. Postoperatively, as drain output decreased, the drains were sequentially removed, wound staples removed and activity resumed (Figure 1). The patient was discharged with wound care instructions but was lost to follow-up for two months before representing to the outpatient clinic with opening of the surgical incision and daily pus drainage from the surgical site. The wound was irrigated and packed with iodoform gauze and the patient received home wound care instructions. He attended a follow-up visit one week later and showed improved incision healing. Patient was instructed to return in two weeks, but did not attend the appointment and has been lost to follow-up.

Imaging Findings

At the time of injury, ultrasound identified a heterogeneous fluid collection with internal papillary projections in the left posterior thigh without evidence of flow (Figure 2). Anterior-posterior, lateral, and cross-table left lower femur radiographs indicated no bony, soft tissue or articular abnormalities (Figure 3a).

At follow-up, 2.5 years post-accident, anterior-posterior and lateral femur radiographs indicated a large soft tissue mass in the lateral thigh with no fracture, dislocation, osteolysis or abnormal periosteal reaction (Figure 3b). Left lower extremity computed tomography with contrast in the venous phase indicated a non-enhancing fluid collection that was superficial to the deep fascia in the left lateral thigh. Joint spaces were normal with anatomic alignment and unremarkable vascular structures and muscles without evidence of bone fracture or dislocation (Figure 4). Magnetic resonance imaging indicated a well-circumscribed fluid collection in the subcutaneous tissues of the left lateral thigh that demonstrated hypointensity on T1WI (Figure 5a,b) and an increased signal on STIR images (Figure 5c,d). The lesion showed no internal or capsular enhancement on T1 fat sat post-contrast MRI (Figure 5e,f). Lobules of fat were also identified within the lesion. The lesion was diagnosed as a Type I MLL.

DISCUSSION

Etiology & Demographics:

MLLs were first described in 1863 by Dr. Maurice Morel-Lavallée who characterized them as collections of fluid caused by soft tissue injury [1]. MLLs are closed, soft-tissue degloving lesions typically presenting in the upper portion of the lower limb. These lesions do not have a predilection for any specific age group. The incidence rate of these lesions has not been elucidated in the literature; however, the gender ratio has been found to be 1:1 [2]. The etiology of these lesions is a traumatic force occurring tangentially to the fascial planes causing a shearing between the superficial and the deep fascias [1]. This results in the creation of a potential space between the superficial and deep fascias that becomes filled with blood and lymphatic fluid (Figure 6). The most common areas of presentation have been found to be lateral to the greater trochanter of the femur and the thigh; however, these lesions have also been identified in the pelvis and knee as well as the lumbosacral and gluteal regions. Rarely these have been found in the calf and in the abdomen after abdominoplasty [3]. A review of the literature shows that 15 chronic MLLs have previously been described, however this report is the latest presentation at 2.5 years after injury.

Clinical & Imaging Findings:

The diagnosis of an MLL can be made using radiographs, CT, and ultrasonography, but MRI is the modality of choice for characterization and identification of the lesion [1]. MLLs can be classified into six different types, Types I-VI, based on their chronicity and the composition of the fluid collection (Table 1) [1].

Ultrasonography

On ultrasound, MLLs appear as nonspecific collections of fluid with heterogeneous echogenicity dependent on the stage of the blood. On color Doppler ultrasound, the lesions appear compressible. Acute lesions typically have a heterogeneous appearance with irregular margins while chronic lesions appear more homogeneous with smooth margins [4].

Radiograph

Radiography is not a highly effective method for diagnosis of an MLL. However, these lesions can be indicated by the appearance of irregular soft-tissue densities within the site of the lesion.

Computed Tomography

CT is often the first imaging modality used in the emergency department to identify an MLL. Acute lesions typically appear as subcutaneous, poorly marginated, hyperdense fluid containing structures that lack an enhancing capsule. The CT characteristics of these lesions change as they age. Chronic lesions have an enhancing capsule and appear as subcutaneous, well-marginated, heterogeneous structures containing fluid and fat. CT is especially useful in the localization of the lesions within the interfascial planes [5].

Magnetic Resonance Imaging

MRI is the most detailed method of imaging for diagnosis of a suspected MLL as it can distinguish between the six types of lesions and localize them between the fascial planes. Type I lesions are seromas and appear homogeneous and hypointense on T1WI and hyperintense on T2-weighted images (T2WI). Type II lesions are subacute hematomas and due to the presence of methemoglobin appear homogeneously hyperintense on both T1WI and T2WI. Sometimes these images can appear heterogeneous due to fat lobules or separation of blood products causing a false diagnosis of a soft tissue tumor. Type III lesions are organizing hematomas, which demonstrate hypointensity on T1WI and T2WI due to hemosiderin deposits, granulation tissue, necrotic debris, fibrin and blood clots. They also appear with a hypointense capsule due to hemosiderin deposition. These lesions demonstrate internal enhancement on post-contrast images due to the internal neovascularization and granulation tissue. Type IV lesions are closed lacerations and present with hypointensity on T1WI, hyperintensity on T2WI and the absence of a capsule. Type V lesions have a small, round, pseudonodular

appearance in addition to variable intensity on both T1WI and T2WI. These lesions also demonstrate areas of peripheral and internal enhancement. Type VI lesions are superimposed infections and demonstrate a thick, enhancing capsule [1,6].

Treatment & Prognosis:

Treatment for a MLL depends on the stage of the lesion and can include compression banding, aspiration and incision and evacuation with or without sclerotherapy. Cases that present with an underlying open bone fracture require open debridement. Compression banding can be attempted for acute cases with closed or no underlying bone fracture. If the acute lesion does not resolve, subsequent percutaneous drainage should be performed. Open debridement is required if the lesion persists. Chronic lesions should be treated with subcutaneous drainage in combination with sclerotherapy. Open debridement is necessary if a chronic lesion persists after drainage [1]. These lesions typically resolve after accurate identification and appropriate therapy. Percutaneous drainage and open debridement have both been shown to be safe and effective methods of treating MLLs [7].

Differential Diagnoses:

Other soft tissue masses can present near the fascial planes and demonstrate imaging findings similar to those found in MLLs. Specifically, bursitis, soft tissue sarcomas, and subcutaneous hematomas can appear similar to MLLs when these lesions appear in the appropriate locations. Bursitis is the inflammation of bursal sacs and typically presents in joints such as the knee and hip. It typically presents as hypointense on T1WI and hyperintense on T2WI, similar to the T1WI hypointense and T2WI hyperintense Type I MLL. Bursitis also commonly demonstrates enhancement on post-contrast MRI while a Type I MLL does not. Chronic hemorrhagic bursitis can resemble Type III MLLs with location and clinical history being helpful distinguishing factors [1]. On CT, bursitis typically presents with a thin rim of peripheral enhancement, which helps distinguish from a MLL [8]. Bursitis appears as a hypoechoic collection of fluid on ultrasound with possible peripheral fluid flow on Doppler imaging [9].

Hematomas are internal hemorrhages contained within the subcutaneous tissue. The distinguishing feature between a hematoma and a MLL is the location of an MLL in the interfascial plane, but the imaging findings can be similar. Acute hematomas typically demonstrate hypointensity on T1WI and hyperintensity on T2WI. Subacute hematomas show hyperintensity on both T1WI and T2WI due to the presence of methemoglobin within the lesion. Chronic hematomas appear hypointense on both T1WI and T2WI due to the accumulation of hemosiderin [10]. On CT, acute hematomas appear predominantly hyperdense; however, the density decreases over time giving chronic hematomas a variable appearance [11]. The appearance of hematomas on ultrasound can be highly variable when both acute and chronic. Acute lesions can be hypoechoic, hyperechoic or as a complex, cystic mass with internal avascular septations. Chronic lesions can be anechoic, hypoechoic with low-level internal echoes, or mildly hyperechoic [13].

Soft tissue sarcomas can present with variable signal on both T1WI and T2WI, which allows them to resemble different types of MLLs [1]. With CT and radiographs, variable characteristics such as internal calcifications and bone and blood vessel involvement provide distinguishing features from MLLs [14]. On ultrasound, sarcomas often appear as complex, solid, cystic masses exhibiting flow on Doppler imaging. The distinguishing characteristic of sarcomas from MLLs is their heterogeneous internal enhancement on post-contrast imaging [1]. A myxoid liposarcoma is one specific type of sarcoma that can resemble a MLL. It is the second most common type of liposarcoma and typically presents in the extremities, especially the thigh. These lesions contain 10-25% fat and, therefore, can have a cystic appearance. It typically presents predominantly hypointense on T1WI with foci of hyperintensity. On T2WI, it usually presents homogeneously hyperintense and it can show homogeneous, heterogeneous, or no enhancement on post-contrast imaging [15].

TEACHING POINT

Morel-Lavallée lesions are soft tissue degloving lesions often caused by trauma that result in a collection heterogeneous fluid between the deep and superficial planes. These lesions may persist for extended periods of time and can become symptomatic if not properly diagnosed and treated.

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FIGURES

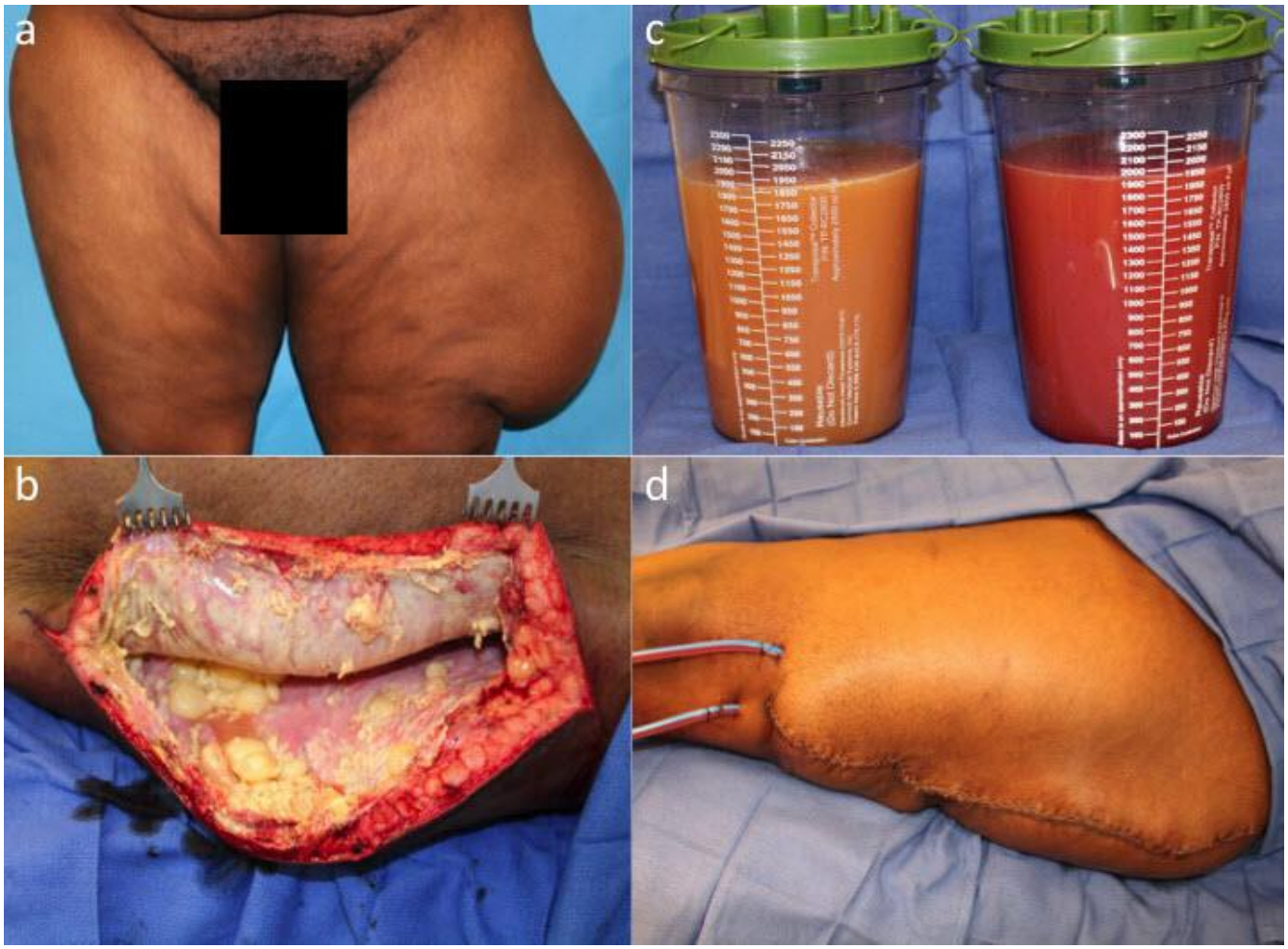

Figure 1: 28 year-old-male with a Type I Morel-Lavallée lesion in the lateral left thigh. (a) Patient presented 2.5 years after trauma with an obvious mass in the lower left extremity. (b) Intra-operative image indicating the fat lobules located within the lesion. (c) Approximately 4000 mL of fluid drained from the lesion. (d) Post operative image indicating the length of the incision and 2 Blake drains placed for remaining discharge.

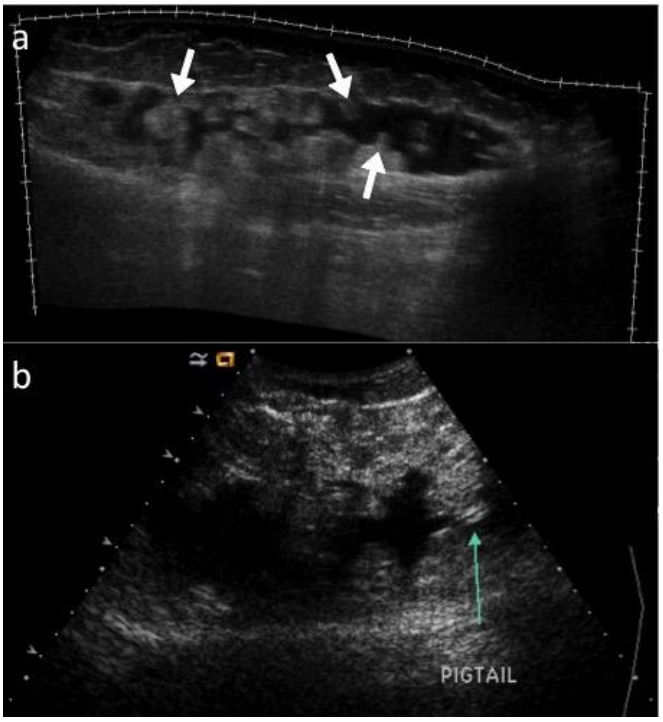

Figure 2 (left): 28 year-old-male with a Type I Morel-Lavallée lesion in the lateral left thigh. (a) Panoramic ultrasound from the day of trauma of the lateral thigh demonstrates a complex subcutaneous fluid collection with internal papillary projections (white arrows). (b) Transverse view of the fluid collection demonstrates subsequent placement of a drainage catheter within the collection. Technique: (a) Curvilinear transducer with harmonic imaging at 4MHz. (b) Curvilinear transducer with harmonic imaging at 3MHz.

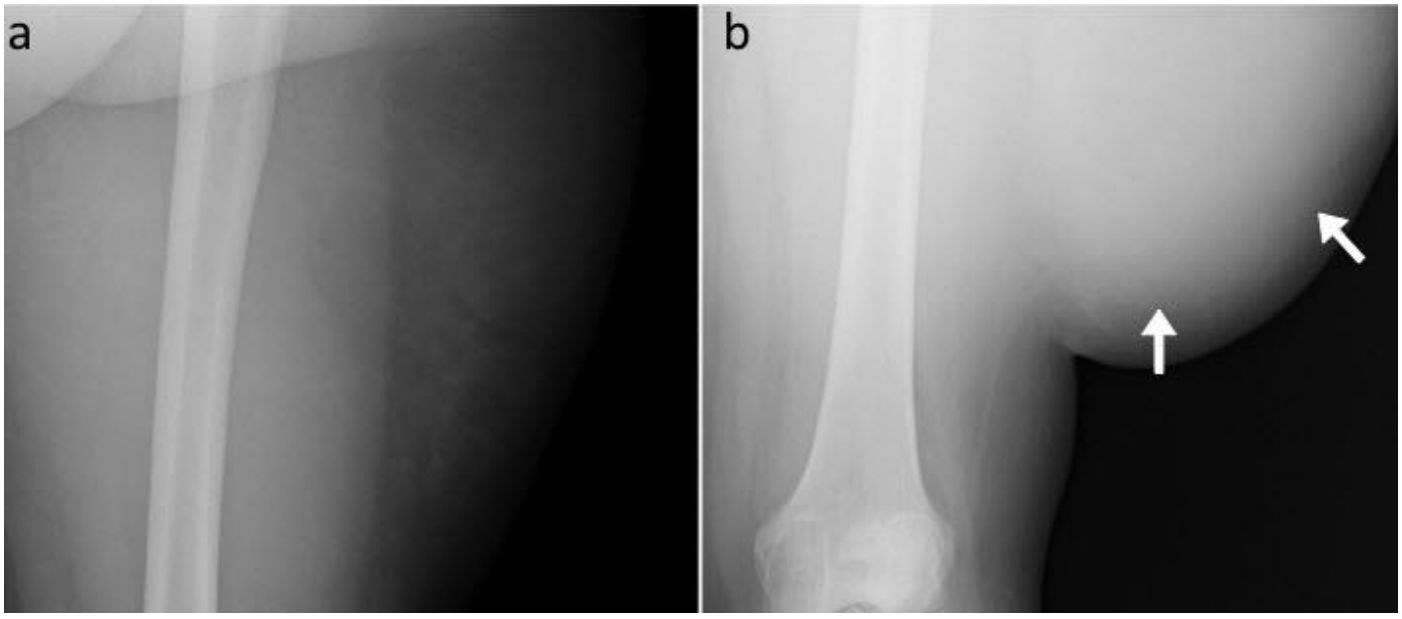

Figure 3: 28 year-old-male with a Type I Morel-Lavallée lesion in the lateral left thigh. Anterior-posterior radiograph from the day of trauma (a) was reported without soft tissue or osseous abnormality. Anterior-posterior radiograph at 2.5 years post-trauma (b) demonstrates a large superficial soft tissue mass in the lateral thigh (white arrows) without evidence of fracture, dislocation, osteolysis, or abnormal periosteal reaction.
Technique: 75 kVp; 4mAs.

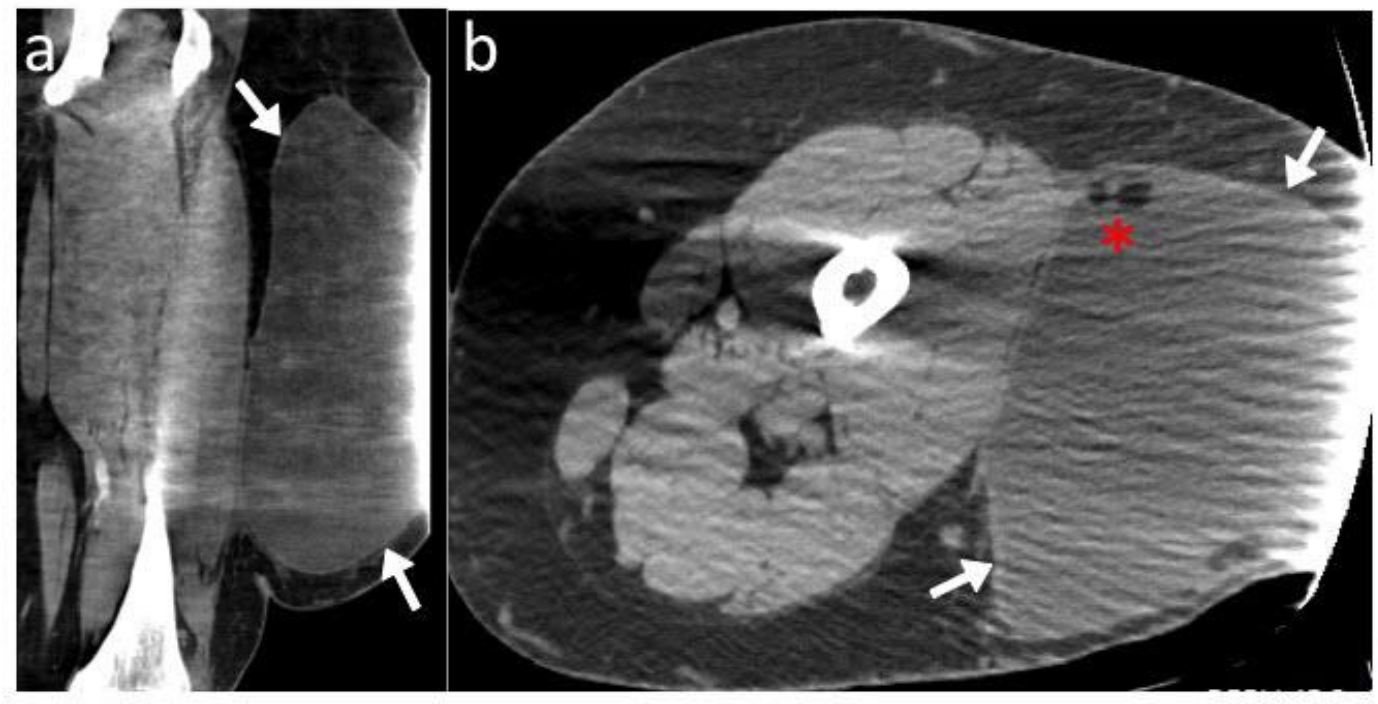

Figure 4: 28 year-old-male with a Type I Morel-Lavallée lesion in the lateral left thigh. Coronal (a) and axial (b) CT taken 2.5 years post-trauma of the left lower extremity with contrast in the venous phase demonstrates a non-enhancing fluid collection in the left lateral thigh located superficial to the deep fascia (white arrows). Lobules of fat within the collection are also identified (red asterisk). Technique: 120 kvp; 600 mAs; 3mm slice thickness; Dose: 100mL lohexol 350mg/mL.

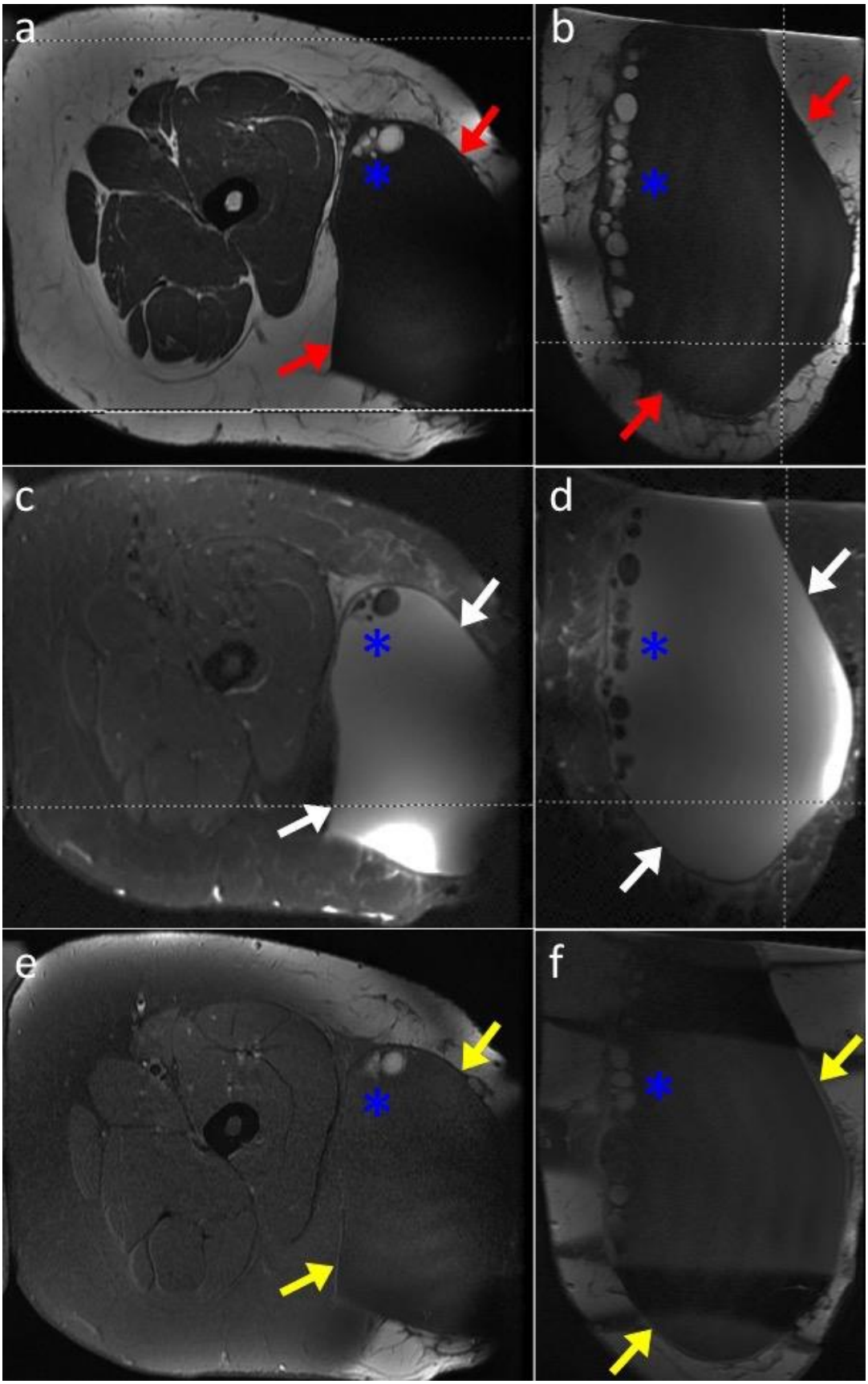

Figure 5: 28 year-old-male with a Type I Morel-Lavallée lesion in the lateral left thigh taken 2.5 years post-trauma. T1-weighted spin-echo MRI images in the axial (a) and sagittal (b) planes demonstrate a subcutaneous, well-circumscribed, predominantly hypointense collection (red arrows) in the lateral thigh located superficial to the fascia. Axial (c) and sagittal STIR images of the collection (d) demonstrate predominantly increased corresponding signal (white arrows). Axial (e) and sagittal (f) T1 fat sat post-contrast images lack internal enhancement and an enhancing capsule (yellow arrows). Internal lobules of fat are identified in all images (blue asterisks). Technique: 1.5 Tesla; T1: (TR: 467 msec; TE: 22 msec), STIR: (TR: 4599 msec, TE: 35 msec, TI: 150 msec); Dose: 20mL gadobenic acid

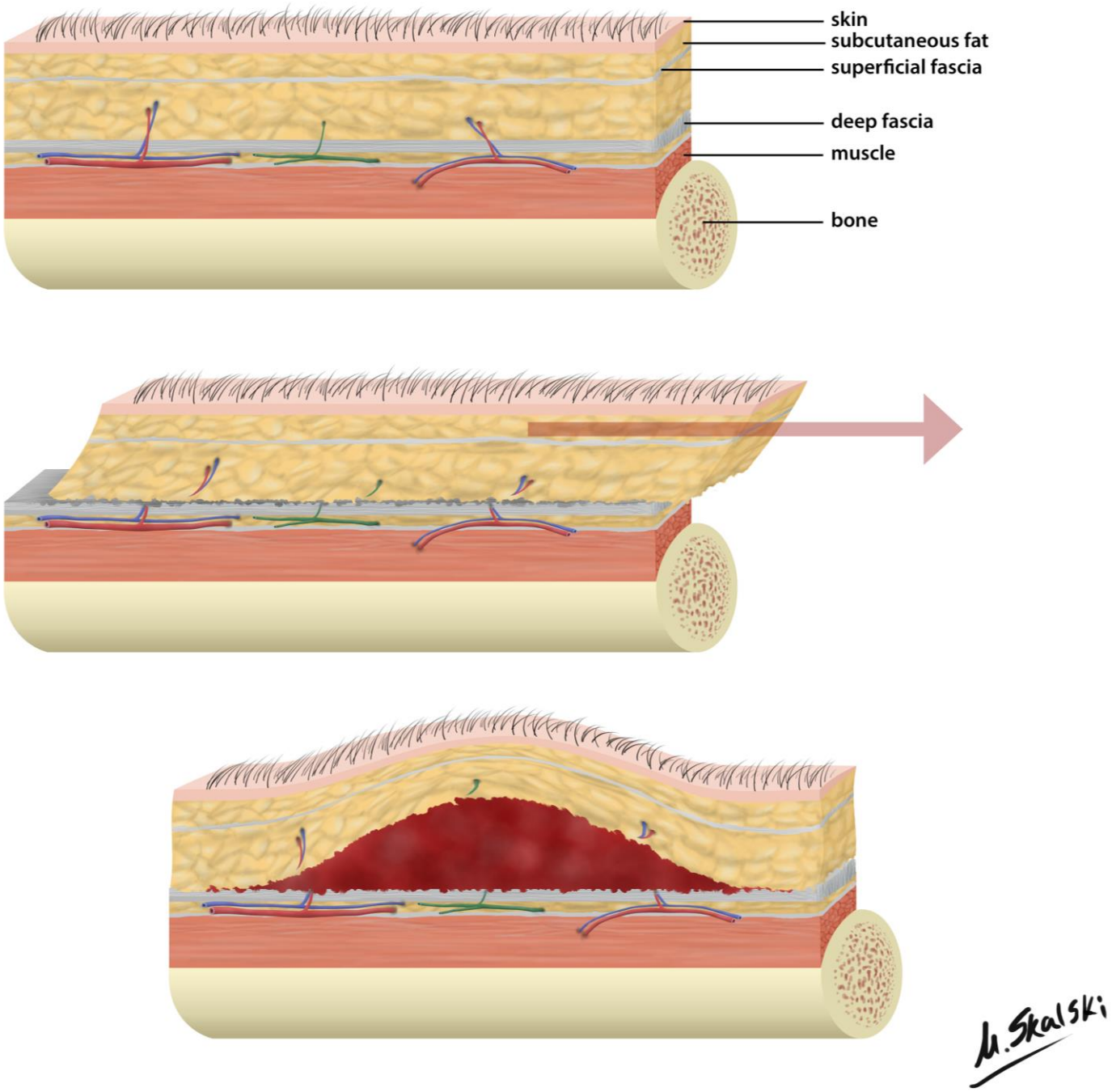

Figure 6: Mechanism of a Morel-Lavallée lesion. The illustrations show a shearing force separating the subcutaneous tissue from the deep fascia and the disruption of arteries (red), veins (blue) and lymphatics (green) causing a collection of hemolymphatic fluid in this potential space. This figure is reproduced with permission from the publisher [1].

	Lesion Description
Type I	Seroma caused by a shearing force leading to a serous/lymph collection
Type II	Subacute hematoma with the presence of methemoglobin. May have fat lobules, internal septations, or fluid-fluid levels
Type III	Chronic organizing hematoma with hemosiderin deposits, granulation tissue, necrotic debris, fibrin, and blood clots
Type IV	Closed laceration with absence of capsule
Type V	Perifascial pseudonodular lesion
Type VI	Lesion with a superimposed infection and thick capsule

Table 1: Descriptions of Morel-Lavallée lesion types [1].

Etiology	Shearing force that causes separation of the superficial and deep fascias
Incidence	Unknown
Gender ratio	1:1
Age predilection	None
Risk factors	Trauma
Treatment	Compression banding can be attempted for acute lesions and percutaneous drainage should be performed if the lesion does not resolve after compression. Chronic lesions can be treated with subcutaneous drainage in combination with sclerotherapy. Open debridement should be performed if the lesion persists after drainage
Prognosis	Lesions typically resolve after treatment without serious complications. Even open debridement has been shown to be safe and successful for treating these lesions.
Findings on Imaging	Acute lesions appear hypointense on T1WI and hyperintense on T2WI MRI. Subacute lesions demonstrate hyperintensity on both T1WI and T2WI MRI caused by the presence of extracellular methemoglobin. Chronic lesions are hypointense on T1WI and T2WI with a hypointense fibrous capsule due to hemosiderin deposition.

Table 2: Summary table of Morel-Lavallée lesions (MLL).

	MRI	**CT**	**Plain Radiography**	**Ultrasound**
Morel-Lavallée lesion	Type I: Homogeneous, hypointense signal on T1WI and hyperintense signal on T2WI. No capsule. Type II: Usually homogeneous, hyperintense signal on T1WI and T2WI. Can exhibit internal enhancement on post-contrast imaging. Septations and debris may be present. Type III: Hypointense signal on T1WI and T2WI. Hypointense peripheral ring corresponding with a capsule may be seen. Can have internal areas of post-contrast enhancement. Type IV: Hypointense on T1WI, Hyperintense on T2WI, and variable post-contrast enhancement. Type V: Small, round morphology with variable signal on T1WI and T2WI. May have post-contrast enhancement. Type VI: Thick, capsular enhancement with possible sinus tract [1, 18].	Acute lesions present as poorly marginated, blood and fluid containing structures that lack an enhancing capsule. Chronic lesions present with an enhancing capsule and are heterogeneous structures containing fluid and fat. Lesions may show fluid-fluid levels from settling of blood products. [5, 18].	Soft tissue density [19].	Age dependent. Can appear as a complex, heterogeneous fluid collection. Hyperechoic fat globules may be present. Typically has no flow on Doppler imaging [1].
Bursitis	Usually hypointense signal on T1WI and hyperintense signal on T2WI and located in typical bursal locations. Bursitis often shows enhancement on post-contrast images while type I Morel-Lavallée lesions do not. Chronic hemorrhagic bursitis can resemble Type III Morel-Lavallée lesions [1].	Typically hypodense with fluid attenuation and a thin rim of peripheral enhancement [8].	Soft tissue density at expected bursal locations.	Distended, hypoechoic lesion in expected bursal location. Depending on degree of inflammation, there can be increased wall thickening and internal debris. Can demonstrate peripheral flow on color Doppler imaging [9].

Table 3 (continued next page): Differential table for Morel-Lavallée lesions (MLL).

	MRI	CT	Plain Radiography	Ultrasound
Hematoma	Age dependent. Acute hematomas appear hypointense on T1WI and hyperintense on T2WI. Subacute hematomas can appear hyperintense on T1WI and T2WI due to methemoglobin. Chronic hematomas demonstrate hypointensity on both T1WI and T2WI due to the accumulation of hemosiderin [10].	Age dependent. Hyperdense in the acute setting. Density decreases with time, but can have a variable appearance depending on underlying liquefaction [11].	Soft Tissue density [12].	Age dependent. Acute hematomas can appear hypoechoic, hyperechoic, or appear as a complex, cystic lesion with avascular internal septations and mural nodularity. Chronic hematomas can appear anechoic, hypoechoic with low-level internal echoes, or predominantly mildly hyperechoic [13].
Soft Tissue Sarcoma	Variable signal characteristics on T1WI and T2WI. Post-contrast imaging can show more pronounced heterogeneous internal enhancement than a Morel-Lavallée lesion. Myxoid liposarcoma is one specific type of sarcoma that can appear similar to a MLL. It is predominantly hypointense on T1WI, but often have foci of hyperintensity. Typically homogeneously hyperintense on T2WI. Enhancement pattern can be homogeneous, heterogeneous, or no enhancement [1, 15, 17].	Soft tissue mass with variable characteristics such as bone and vessel involvement, heterogeneous appearance, and internal calcifications [14, 17].	Soft tissue mass with variable characteristics such as bone involvement and internal calcifications [17, 19].	Variable appearance. Can appear as a complex solid and cystic mass that exhibits flow on Doppler imaging [1].

Table 3 (continued): Differential table for Morel-Lavallée lesions (MLL).

ABBREVIATIONS

CT = Computed tomography
MLL = Morel-Lavallée Lesion
MRI = Magnetic resonance imaging
STIR = Short tau inversion recovery
T1WI = T1-weighted imaging
T2WI = T2-weighted imaging

KEYWORDS

Morel-Lavellée lesion; seroma; closed degloving injury; left lower extremity; magnetic resonance imaging