The Morel-Lavallée lesion and its management: A review of the literature[☆]

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ABSTRACT

Background: Morel-Lavallée lesions can occur in polytrauma patients. Post-operative seroma is more frequently encountered, holds many pathological similarities with MLLs and continues to challenge plastic surgeons. We aimed to provide a comprehensive overview of MLLs to increase awareness of optimum treatment options amongst plastic surgery teams, and to provide a management algorithm that may also be applied to post-operative seromas.

Methods: PubMed, Google Scholar and the Cochrane Library were searched using the terms “Morel-Lavallée”, “management” and “treatment”, which yielded 52 results. One reviewer screened titles and abstracts for relevance. Seventeen full text articles were retrieved. Review of reference lists provided a further three articles for inclusion.

Findings: Morel-Lavallée lesions (MLLs) represent closed injuries with internal degloving of superficial soft tissues from fascial layers. Main causes of MLLs include high-energy, blunt force trauma or crush injuries. They are commonly found overlying the greater trochanter. MLLs should be actively looked for when treating patients with pelvic trauma. MRI is the investigation of choice. Currently no guidelines for the management of MLLs exist. Compression bandaging, percutaneous aspiration, sclerodesis and mass resection have all been utilised.

Conclusions: Our algorithm recommends avoidance of conservative management. For chronic lesions, percutaneous aspiration should not be used in isolation. Sclerodesis using doxycycline is appropriate for lesions up to 400 ml, where evidence suggests high degrees of efficacy. Larger lesions should be treated with open surgery. Quilting sutures, curettage and low suction drains are useful adjuncts. We hypothesise this algorithm would also be effective for post-operative seromas.

1. Introduction

Morel-Lavallée lesions (MLLs) can occur in polytrauma patients alongside multiple and complex skeletal injuries. Plastic surgery teams often become involved in their management due to the complex nature of this soft tissue injury. They are rarely recognised early and delays in diagnosis can lead to increasing difficulty in management. Persistent lesions can lead to long-term morbidity in those affected.

Post-operative seroma is much more frequently encountered, holds many pathological similarities with Morel-Lavallée lesions and provides a continuing challenge to plastic surgeons. Here, we aimed to provide a comprehensive overview of MLLs in order to increase awareness of this little-known pathology amongst plastic surgery teams, who are likely to be involved in recalcitrant lesions, and also to provide an algorithm for their management that may also be suited to the management of post-operative seromas.

2. Methods

PubMed, Google Scholar and the Cochrane Library were searched using “Morel-Lavallée”, “management” and “treatment” as search terms. This initially yielded 52 results, of which those not in English were excluded, unless a translated version was available. One reviewer manually screened the remaining titles and abstracts for relevance. Individual case reports were excluded unless they discussed novel approaches for diagnosis or treatment. As a result, 17 full text articles were initially downloaded. Review of these articles' reference lists provided a further three articles for inclusion.

3. Findings and discussion

3.1. Background

Morel-Lavallée lesions (MLLs) were first described by Victor-

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Auguste-Francois Morel-Lavallée in 1853 and represent closed injuries with internal degloving of superficial soft tissues from the deeper layers of fascia.^{1–4} Within the modern literature, these lesions are also referred to as post-traumatic extravasations, Morel-Lavallée seromas, post-traumatic soft tissue cysts or Morel-Lavallée effusions.^{1,2,5}

The main cause of MLLs is high-energy, blunt force trauma or crush injuries.^{1,2,4–6} Overall, approximately a quarter of all patients who develop MLLs have been involved in a road traffic accident, with up to 82% being related to trauma.^{7,8} They are often associated with underlying fractures, especially of the acetabulum and pelvis. A less severe subset of these injuries has been described following direct-blow sports injuries to the knee.^{6,9} One study reported 27 MLLs across 24 players of one team in the National Football League in the USA, hinting this lesion may be more common than often realised within sport.⁹ It has also been described following abdominoplasty, making it all the more relevant to plastic surgical teams.¹⁰

3.2. Epidemiology

In general, these lesions are uncommon.⁷ One busy American trauma centre reported 79 cases of MLL over eight years, with another paper quoting a prevalence of 8.3% in the context of pelvic trauma.^{7,11} A large review identified an approximate 2:1 male to female ratio, which likely represents the male predominance seen in polytrauma.¹²

3.3. Pathology

Morel-Lavallée lesions develop as a result of shearing of superficial subcutaneous tissues away from underlying fascial layers, creating a cavity in the pre-fascial plane.^{1,4,6} Areas where these lesions occur most frequently have mobile overlying skin and tough underlying fascia, such as the fascia lata in the proximal lateral thigh and the quadriceps fascia superior to the knee.^{6,9} As a result of the separation of these layers, transaponeurotic capillaries and lymphatic vessels become disrupted.^{2,4,5} These avulsed channels leak lymph and blood into the newly formed cavity and a haemolymphatic collection develops.^{1,2,4,6,9,13} The rate at which this collection forms depends on the number of vessels disrupted and the flow into the cavity.^{1,2,6,9,13}

Over time, blood within the cavity is reabsorbed to leave serosanguinous fluid surrounded by a haemosiderin layer.^{5,6,13} This layer induces inflammation in peripheral tissues and a fibrous capsule forms, preventing further fluid reabsorption and resulting in the establishment of a chronic MLL.^{5,6,11,13} This process can be likened to the establishment of a persistent post-operative seroma.

3.4. Signs and symptoms

Most commonly these lesions are found overlying the greater trochanter of the femur in the anterolateral thigh and are mostly unilateral.^{2,5} Cases of Morel-Lavallée lesions of the lumbar, prepatellar, scapular, buttock and trunk regions are also reported.^{2,5,9} They present as enlarging, tender lesions with associated pain and tightness.^{6,9} Patients usually seek attention within hours to days of the inciting injury but up to a third present later.^{5,6}

The key clinical feature to aid diagnosis, along with an accurate history, is the presence of fluctuance within the lesion.^{2,5,6,8} Patients may also experience decreased skin sensation and increased skin mobility.^{6, 11} Ecchymosis, road-rash and abrasions may give clues to the diagnosis.

Potential differential diagnoses include fat necrosis, haematoma, haemangioma, soft tissue sarcoma, early myositis ossificans or bursitis.^{2,8}

3.5. Investigations

The presence of a Morel-Lavallée lesion should be actively looked

for when treating patients with pelvic trauma.¹¹ They are often diagnosed incidentally during surgical intervention for fractures but can be retrospectively identified on admission imaging.¹¹

MRI is the investigation of choice should clinical suspicion arise. Appearances vary depending on the content and chronicity of the lesion but one study has suggested lesions appear homogenous and smooth if chronic, whereas acute lesions are heterogeneous and irregular.^{2,6} If the lesion is chronic, a capsule is often present and appears as fibrous tissue with a hypointense ring of haemosiderin.^{2,6} The edges of the lesion may be seen to taper and eventually fuse with surrounding fascial layers.⁵

Ultrasound is less useful but may strengthen clinical suspicion by confirming the lesion's location as superficial to the muscle fascia and deep to the hypodermis.^{2,5} Ultrasound can also demonstrate compressibility and exclude the presence of flow through Doppler imaging.⁶

Computed tomography has limited value, as aside from confirming the presence of a fluid collection, it adds little to refining the differential diagnosis.^{2,5}

3.6. Classification

The most comprehensive classification system proposed for MLLs comes from Mellado and Bercandino.¹⁴ It divides lesions into six types based on shape, MRI characteristics and whether a capsule is present.¹⁴ However, aside from providing a concise way of categorising lesions, this framework does not provide guidance on management or potential outcome of each class.¹²

Shen et al. have suggested the use of a simple acute versus chronic classification, becoming chronic once a capsule is present, which accurately divides lesions and forecasts which treatment strategies may be best employed and what potential outcome is to be expected.¹²

3.7. Complications

Complications associated with Morel-Lavallée lesions occur often as a result of delayed or incorrect diagnosis. Progressive expansion of untreated lesions can cause pressure necrosis of overlying skin.^{2,5,12} This can result in large areas of skin breakdown and leave underlying fractures exposed. Several cases report surgical site contamination with lesion contents, following inadvertent entry to the MLL cavity during fracture fixation.^{8,11}

Published data regarding whether bacterial colonisation occurs in these lesions is inconclusive. A large collated case series of 153 MLLs found 29 to be colonised (19%), with a wide range of organisms isolated on culture.¹² However, this is in contrast with several smaller case series, which report negative fluid cultures in all cases following aspiration.¹³ Current consensus among pelvic surgeons is that a higher risk of deep infection exists if the approach to fracture fixation traverses an MLL. Knowledge of this is useful to the plastic surgical team, as it should defer definitive management of MLLs until after fracture fixation is complete and the wound healed, in order to reduce the risk of infection of metalwork or osteomyelitis.

3.8. Management

There are currently no guidelines for the management of Morel-Lavallée lesions. Several small cohort studies have investigated the variable efficacy of conservative management, percutaneous aspiration, sclerodesis and open surgery but no high quality evidence exists for any one approach.

i. Conservative Management

Compression bandaging alone has been advocated in small, acute lesions, where no capsule is present, with good effect when used in lesions affecting the knee.^{2,9,12} However, effective compression bandaging is difficult to apply to areas affected by MLLs associated with

polytrauma, such as over the greater trochanter, and all patients within a large collated cohort study who received compression alone subsequently required further intervention.¹² Strong data is available to show healing time is significantly less for those who receive a surgical intervention over those where compression alone is used.¹² Taken together, our recommendation would be that compression bandaging alone has no role, unless for acute lesions located over the knee.

ii. Percutaneous Aspiration

A second option is percutaneous drainage although the majority of lesions recur following aspiration, with four out of five patients failing treatment using this approach.¹² A series of 79 patients revealed that lesions treated with percutaneous aspiration were more likely to recur than those treated surgically, and that lesions with a volume greater than 50 ml had a higher likelihood of recurring.⁷ Given this, and that multiple aspirations are often required, we would recommend avoidance of isolated percutaneous aspiration for treatment of Morel-Lavallée lesions. Similar experience is seen in the use of aspiration alone for post-operative seromas.

iii. Sclerodesis

The use of sclerosing agents to close off pathological cavities is widely used in cases of persistent pericardial effusion and malignant pleural effusion and this method has been successfully applied to MLLs. It is most often recommended as the next step if percutaneous aspiration alone fails, which as discussed above is common.^{8,9} Suggested agents include doxycycline, erythromycin, bleomycin, vancomycin, absolute ethanol, tetracycline and talc, with the majority of data being derived from the use of doxycycline.^{6,9,11–13,15,16} A summary of published data for the most commonly used agents is given in Table 1. The majority of sclerodesis agents cause cell destruction within the periphery of the lesion, which subsequently induces fibrosis.¹⁶

The doxycycline protocol described by Bansal et al. uses a solution of 500 mg doxycycline in 25 ml 0.9% saline, which is autoclaved at 121 °C for 15 min.¹³ The lesion is completely aspirated through two 21G needles placed proximally and distally. The solution is infiltrated through the same needles and left in situ for 60 min, with the patient turning every 10 min to ensure adequate dispersion.¹³ Complete aspiration of the solution is performed and application of tight compression bandaging for 4 weeks follows. This ensures the cavity is obliterated by the ensuing fibrotic process.

Sclerodesis has been shown to be efficacious in lesions up to 700 ml in volume, although mean volume of treated lesions is closer to 400 ml.¹³ Although the presence of a capsule is often not mentioned in these case series, all patients had lesions for greater than three months and so this technique can be considered appropriate in chronic lesions.^{13,16} Overall, sclerodesis efficacy has been reported as 95.7% in treating Morel-Lavallée lesions.¹² As such, we would recommend this as first line for acute lesions or for chronic lesions up to a volume of 400 ml. Reported complications include infections if using talc and mild post-procedural pain.

iv. Open Drainage and Mass Resection

If skin overlying the lesion is necrotic, following severe blunt trauma or crush injury, then debridement of dead tissue is required with subsequent reconstruction.

However, if overlying skin is viable then open drainage can be achieved through either a single longitudinal incision or several small incisions proximally and distally.¹¹ Both approaches require curettage of the cavity to induce fibrosis.¹⁷ A recurring theme throughout the literature is that closure of dead space within the lesion is vital to success.^{8,12} Quilting sutures, fibrin sealant and low suction drains are all reported as successful adjuncts to achieving this aim.^{4,8,11,12,17} Minimally invasive techniques for this approach have also been described.^{18,19} Use of low suction drains has also been linked with reduced infection rates.¹² Drains can usually be removed once they are collecting less than 30 ml over 24 h.¹¹ Aponeurotic fenestrations to aid internal drainage fail to produce resolution in up to 60%.⁸

En masse resection of the lesion with its capsule intact is a final option. Jones et al. reported an interesting variant to this procedure, whereby Patent blue dye was infiltrated distally to identify feeder vessels to the lesion, which were subsequently ligated.⁴ This is an elegant solution for large established lesions, when more straightforward approaches have failed.

3.9. Similarities to post-operative seroma

With the increasing use of sentinel lymph node biopsy in the management of malignant melanoma, the incidence of small post-operative seromas is rising. These are often very difficult to treat and have a high risk of infection, given their locations within the groin and axilla. It is also a frequent complication of lymph node clearance and resection of soft tissue tumours.

Review of the pathology underlying MLLs demonstrates several macroscopic similarities with post-operative seromas. Both lesions feature areas of dead space filled with serosanguinous fluid, which once chronic develops a fibrous capsule. There is a lack of data on the histological similarities of these capsules but the overall similarities in pathology would suggest success with similar management strategies. Despite the prevalence of this problem, there is no consensus on their optimal management, with anecdotal strategies often being used on a unit-by-unit basis. Given the discussed similarities, we hypothesise that an algorithm for management of MLLs may also be of use for post-operative seromas.

3.10. An algorithmic approach

The key factors in deciding on appropriate management of these lesions is volume and chronicity. Based on this and the literature regarding management discussed above, we propose an algorithm for the management of both MLLs and post-operative seromas, as illustrated in Fig. 1.

Table 1

A summary of published data for the use of doxycycline, talc and ethanol as sclerodesis agents in the treatment of Morel-Lavallée lesions.

Paper	Sclerosing Agent	Number of Patients	Lesion Characteristics	Complete Resolution Rate	Follow up	Reported Complications
Bansal et al., 2013	Doxycycline	16	Present for > 6 months Mean volume 387 ml	94%	50 months	Mild-moderate pain, tight sensation.
Tejwani et al., 2007	Doxycycline	3	Failed to resolve following 3 aspirations	100%	Not given	Induration of the skin.
Penaud et al., 2011	Ethanol	5	Present for 3 months Absent capsule on MRI	80%	6 months	Leak causing second degree skin burn
Luria et al., 2006	Talc	4	Present for 3 months	100%	27 months	One infection.

Fig. 1. Algorithm showing the recommended management of Morel-Lavallée lesions and post-operative seromas.

4. Conclusions

Morel-Lavallée lesions are often misdiagnosed or diagnosed late and clear consensus on treatment is lacking. Given that prevalence among patients with pelvic trauma approaches 10%, plastic surgery teams exposed to regular polytrauma must be aware of the diagnosis of MLL and options for management. Early diagnosis simplifies treatment and reduces complications.

Lessons learnt from the management of MLLs may be useful and applicable to the management of post-operative seromas. As a result of this review, we would recommend avoidance of conservative management, except in cases of acute lesions involving the knee, and then only in patients who will be compliant with tight compression bandaging. For chronic lesions, percutaneous aspiration should not be used in isolation. Sclerodesis using doxycycline is appropriate for acute and chronic lesions up to 400 ml, where current evidence suggests high degrees of efficacy. Lesions larger than this should be treated with open surgery to either drain the contents or remove the lesion and capsule en masse. Quilting sutures and curettage of the cavity should be used to close off dead space and low suction drains left in situ post-operatively until draining less than 30 ml over 24 h.

Future trials investigating the efficacy of our proposed algorithm and further comparative analysis of MLLs and post-operative seromas provide areas of interesting future research.

Conflicts of interest and source of funding

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