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MR imaging characteristics of Morel-Lavallee lesions in pediatric patients

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ABSTRACT

Aim: Morel-Lavallée syndrome (MLS) is a serious posttraumatic soft tissue injury in which the subcutaneous tissues are separated from the underlying fascia by glove-finger (closed type) peeling and replaced by a cavity filled with hematoma and fat. It is most commonly seen in the trochanter major, but it can also be found in the flank, hip, and lumbodorsal regions. The goal of this study is to define the typical findings of MLS in order to avoid misdiagnosis and delay in patient treatment.

Material and Method: This retrospective study was approved by the Institutional Review Board. Informed consent was waived due to the retrospective nature of the study. Between 2015 and 2021, MR images and clinical follow-ups of 22 pediatric patients with clinical and radiological Morel-Lavallée lesions (MLL) were reviewed retrospectively. All patients were evaluated using 1.5T or 3T power MR devices (Siemens Healthineers, Erlangen, Germany).

Results: Of 22 patients diagnosed with MLS, 77% (n=17) were male and 23% (n=5) were female. Patients ranged in age from 7 to 18 years, with a mean of 13.2 years (+/-2,3). The locations of MLL were knee (77%, n=17, 15 patients had anterior knee and 2 patients had posterior knee involvement), hip (14%, n=3) and thigh (9%, n=2) in order of frequency. These lesions all had a similar ovoid shape. The majority of patients (18/22) received solely conservative management but three patients underwent percutaneous drainage.

Conclusion: In our study, the importance of differential diagnosis of MLL from traumatic collections and the importance of MRI findings in diagnosis and treatment were discussed. Accurate diagnosis and treatment of MLL are critical, as the lesion's size may increase as a result of delayed treatment, causing skin necrosis and denervation due to the mass effect.

Keywords: Morel-lavallée, MRI, traumatic collection

INTRODUCTION

Morel-Lavallée syndrome (MLS) is a serious posttraumatic soft tissue injury in which the subcutaneous tissues are separated from the underlying fascia by glove-finger (closed type) peeling and replaced by a cavity filled with hematoma and fat. It is most commonly seen in the trochanter major, but it can also be found in the flank, hip, and lumbodorsal regions (1).

MLS is a trochanter major lesion first described in 1863 by Victor-Auguste-François Morel-Lavellée (2). It is the preferred term for all degloving injuries, including many bone spurs (3-5). Pathological examination of MLS reveals fat lobules within the lesion, which aids in distinguishing MLS from traumatic pathologies such as hematoma and bursitis (3,6).

MLS reduces lymphatic circulation and causes blood vessel damage. The formed cavity collects blood and lymphatic fluid. These fluids' metabolic and inflammatory content increases cellular permeability. As a result, the leakage from the vessels and lymphatics into the formed space becomes more pronounced. This cycle is thought to be responsible for the lesions' continuous growth and development. Because MLS lesions are rare and their diagnosis may be delayed due to trauma history, approximately half of the patients' diagnoses are missed (6,7).

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The goal of this study is to define the typical findings of MLS in order to avoid misdiagnosis and delay in patient treatment.

MATERIAL AND METHOD

This retrospective study was approved by the Erzincan Binali Yıldırım University Clinical Researches Ethics Committee (Date: 25.01.2021, Decision No: 02/21). Informed consent was waived due to the retrospective nature of the study. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Between 2015 and 2021, magnetic resonance imaging (MRI) and clinical follow-ups of 22 pediatric patients with clinical and radiological Morel-lavallée lesions(MLL) were reviewed retrospectively.

All patients were evaluated using 1.5T or 3T power MR devices (Siemens Healthineers, Erlangen, Germany). Although the modalities used in each patient differed, all patients received fat-suppressed and non-fat-suppressed sequences. Fat-suppressed axial proton density, non-fat-suppressed coronal T1 spin echo (SE), fat-suppressed proton density (PD) turbo spin echo (TSE), fat-suppressed sagittal T2 TSE and PD sequences are available in the standard knee imaging protocol.

A 5-year-experienced pediatric radiologist and a 3-year-experienced radiologist examined subcutaneous collections for location, shape, and signal properties such as the presence of fat, blood products, septations, and thick capsules.

Internal fat droplet presence in the collection was used as a diagnostic criterion for MLL. Furthermore, it was determined which patients required drainage treatment and which MRI findings aided in determining the treatment plan.

Statistical analysis: The data was analyzed using the SPSS package for social sciences (version 20) for Windows (IBM SPSS Inc., Chicago, IL). The Kolmogorov-Smirnov test was used to determine whether the data had a normal distribution. Numerical variables with a normal distribution are reported as mean±standard deviation, while variables with a non-normal distribution are reported as medians with minimum and maximum values. Numbers and percentages are used to report categorical variables. The difference of the variables between conservative and percutaneous treatment subgroups was defined via Chi-square test.

A two-tailed P-value of <0.05 was considered significant.

RESULTS

Of 22 patients diagnosed with MLL, 77% (n=17) were male and 23% (n=5) were female. Patients ranged in age from 7 to 18 years, with a mean of 13.2 years (+/-2,3).

The locations of MLL were knee (77%, n=17, 15 patients had anterior knee and 2 patients had posterior knee involvement)(**Figure 1**), hip (14%, n=3) and thigh (**Figure 2**) (9%, n=2) in order of frequency. These lesions all had a similar ovoid shape. Twenteen (55%) had septation, 8 of them had one and 4 of them had multiple septations. Six (27%) had internal blood products and percutaneous drainage was performed in 3 of these patients. 2 (9%) had thick capsule (>2mm) both of them was treated by percutaneous drainage.

The majority of patients (18/22) received solely conservative management but three patients underwent percutaneous drainage. All of the patients who received treatment were over 11 years old.

Older age (over 11 years), the presence of thick capsule and hemorrhagic content of subcutaneous collection were risk factors for treatment and were statistically significant (p<0.05).

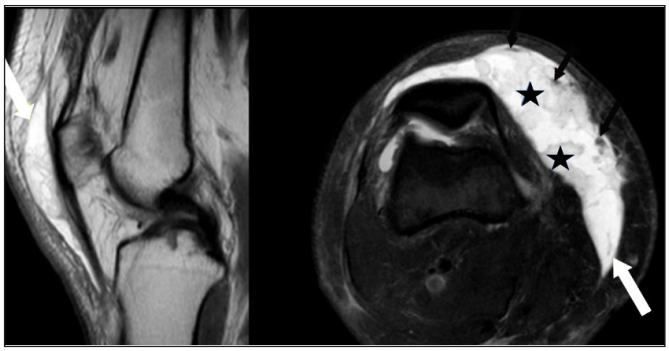

Figure 1. 15 year old boy had post traumatic pain and swelling at the knee. Sagittal proton density without fat saturation demonstrate a fluid containing lesion over the medial retinaculum, with a thin tail extending superficially over the patella (white arrows) with hemorrhagic content (asterix) and fat droplets (black arrows)

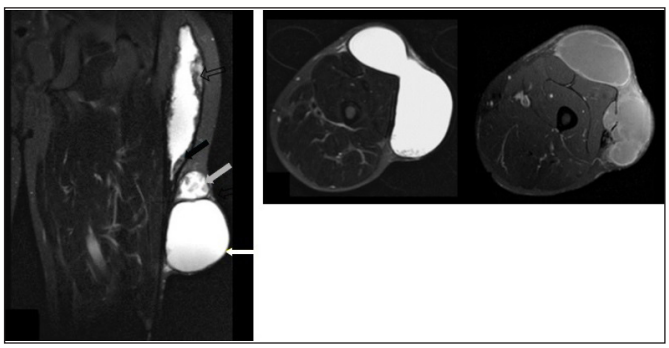

Figure 2. 13-year-old boy with swelling and pain at the level of the thigh. Coronal and axial T2 with fat saturation and contrast enhanced T1 with fat saturation demonstrate a large fluid collection containing a fluid-fluid level (white arrow), dark T2 fat droplet (grey arrow) and septations (open arrows) with a thicker capsule (black arrow).

DISCUSSION

Morel-Lavallée is a closed degloving injury, which results from shearing injury that separates the subcutaneous layers from the fascia and it represents a potential space. Then, hemolymphatic collection fills the potential space. Although it is mainly defined in adults when located at the hip in the literature, a limited number of cases in the pediatric age group have been reported. Unlike adults, Morel-Lavallée lesions most commonly affect the knee and especially the anterior knee in children. Lesions are usually ovoid shape and may contain septa, internal blood products and thick capsule. The presence of the internal fat droplet in the collection is an important criteria for the diagnosis of the Morel-Lavallée and it is required for differential diagnosis from other post-traumatic pathologies such as hematoma and prepatellar bursitis (7,8).

Early detection of Morel-lavallée lesions prevents delays in treatment and shortens recovery time. If patients do not comply with treatments such as compression cuffs and do not avoid doing sports, the probability of recurrence and worsening of the lesions increases. The continued growth of the lesion may result in denervation by causing fat and/or skin necrosis as a result of the mass effect (6,9). It is critical to better understand the imaging findings of these traumatic degloving injuries because approximately half (44%) of MLL are misdiagnosed during the initial examination (7).

The majority of patients receive conservative management but older age (>11 years old), the presence of the hemorrhagic content and thick capsule in the collection are MRI findings that can guide the clinician in determining the need for percutaneous drainage. MLL can be misdiagnosed by clinicians-radiologists since they are not very common in the pediatric age group, so Morel-Lavallée should definitely be considered in the differential diagnosis, especially in the presence of a subcutaneous collection in the anterior knee(7,8).

Although there is no definitively accepted treatment for MLL, compression bandages, percutaneous aspiration, drainage, and open debridement have been reported (10-14) In small and acute MLL lesions without fracture, compression bandaging, NSAID, bed rest, and physical therapy can be used as first-line treatments (10-13). When a compression bandage is insufficient and the lesion is large, percutaneous drainage can be used. Sclerotherapy, in addition to percutaneous drainage, may be used if the lesions are chronic (15,16). In patients with long-standing MLL with pseudocapsules that do not respond to percutaneous drainage and may cause recurrence, surgical intervention is indicated (6,17).

Our study's limitations are that it is primarily a retrospective study with a small sample size. Only the patients' MRI findings were presented in our study, and there is a need for large studies in which the patients are evaluated alongside other findings. Children with MLS have a very low cure rate. Our findings on this subject should be validated by increasing the number of children who are eligible for treatment.

CONCLUSION

The importance of differential diagnosis of MLL from trauma collections was determined in our study, and MRI findings aided in treatment planning. Accurate diagnosis and treatment of MLL are critical, as the lesion's size may increase as a result of delayed treatment, causing skin necrosis and denervation due to the mass effect.

ETHICAL DECLARATIONS

Ethics Committee Approval: This study was approved by the Erzincan Binali Yıldırım University Clinical Researches Ethics Committee (Date: 25.01.2021, Decision No: 02/21).

Informed Consent: Because the study was designed retrospectively, no written informed consent form was obtained from patients.

Referee Evaluation Process: Externally peer-reviewed.

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