



ACUTE MESENTERIC LYMPHADENITIS: A MIMIC OF APPENDICITIS IN CHILDREN.

General Surgery

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KEYWORDS

INTRODUCTION

Acute mesenteric lymphadenitis (AML) is a self-limiting inflammatory condition affecting the mesenteric lymph nodes, often presenting clinical features akin to acute appendicitis in pediatric patients. It is a common alternative diagnosis for right lower quadrant pain in children and makes it very hard for doctors to figure out what is wrong with patients in emergency rooms. The disease causes inflammation and swelling of the mesenteric lymph nodes, which are mostly found in the ileocecal area. This leads to abdominal pain that can be hard to tell apart from appendicitis both clinically and radiologically. It is very important to tell the difference between AML and appendicitis so that unnecessary surgeries and their risks do not happen, especially in children, where a negative appendectomy can have serious long-term effects (1,2).

The epidemiology of AML shows geographical differences, but most cases are reported in kids and teens between the ages of 5 and 15. There is a slight male bias in the data, but this difference is not always statistically significant. There is a clear seasonal pattern, with more cases in the winter and spring months. This is in line with the fact that upper respiratory tract infections are most common during these times (3). The disease can be categorized as primary, arising without any identifiable underlying pathology, or secondary, when it develops as a consequence of another intra-abdominal or systemic inflammatory condition, such as gastroenteritis, inflammatory bowel disease, or systemic viral infection. (4) Primary acute myeloid leukemia (AML) is usually linked to viral infections, but secondary cases may be linked to bacterial infections like *Yersinia enterocolitica* and *Yersinia pseudotuberculosis*, which are known to cause mesenteric lymphoid hyperplasia (5).

It is believed that the pathophysiological process of AML involves the immune system activating mesenteric lymphoid tissue after being exposed to viral or inflammatory stimuli. The mesenteric lymph nodes are important for the immune system because they filter lymphatic fluid from the digestive system. When pathogens or inflammatory agents enter these nodes, a series of immune reactions begins, causing lymphoid hyperplasia and inflammation in the area. Histologically, the nodes show hyperplastic follicles with active germinal centers, and sometimes necrotic changes depending on how bad the inflammation is (6). Interleukin-6 (IL-6) and tumor necrosis factor-alpha (TNF- α) are two cytokines that play a key role in making lymph nodes bigger and more sensitive.

Clinically, AML presents with acute abdominal pain, usually confined to the right lower quadrant or periumbilical area, accompanied by mild fever, nausea, and, at times, vomiting. The discomfort may be less severe and more generalized than in appendicitis, with some patients possibly reporting antecedent upper respiratory symptoms such as pharyngitis, rhinorrhea, or cough. Diarrhea can also happen, especially when it is caused by viral or bacterial gastroenteritis (7). During a physical exam, discomfort is usually mild, with no severe rebound tenderness or guarding, which helps tell it apart from appendicitis. However, these distinctions are frequently unclear, leading to

persistent misinterpretation. Laboratory findings frequently exhibit nonspecific characteristics, including mild leukocytosis and elevated C-reactive protein (CRP) levels, although to a lesser degree than observed in appendicitis. The neutrophil-to-lymphocyte ratio (NLR) has emerged as a potential biomarker for differentiation, exhibiting lower values in AML compared to appendicitis (8).

Imaging is very important for telling AML apart from appendicitis. Ultrasonography (USG) is the main way to diagnose because it is easy to get to, does not hurt, and does not use ionizing radiation. The key ultrasonographic sign of AML is the presence of three or more swollen, clustered, hypoechoic lymph nodes with a short-axis diameter greater than 8 mm, mostly in the right lower quadrant, and no inflamed appendix. The appendix is typically seen as normal or not enlarged, which sets AML apart from appendicitis. Doppler imaging may show that inflammatory lymph nodes have more blood vessels than normal. When ultrasonography produces ambiguous results, computed tomography (CT) or magnetic resonance imaging (MRI) may be employed for further assessment of the mesenteric region; however, their use in pediatric patients is generally limited due to concerns about radiation exposure (9).

The treatment of AML is often conservative. The illness gets better on its own in one to four weeks. In general, supportive care, such as getting enough water, sleep, and painkillers, is a good idea. Most of the time, antibiotics are not needed until a bacterial infection is confirmed or strongly suspected. The outlook is good, and almost everyone is expected to fully recover. Nonetheless, accurate diagnosis is crucial to prevent unnecessary surgical procedures. Research suggests that approximately 20% of children undergoing appendectomy for suspected appendicitis have normal appendices, with many likely experiencing AML as the underlying etiology of their symptoms (10). The aim of this study was to evaluate and compare the clinical, laboratory, and ultrasonographic features of acute mesenteric lymphadenitis and acute appendicitis in children to identify key parameters that aid in accurate differentiation and reduce unnecessary surgical interventions.

METHODOLOGY

The present study was conducted as a prospective observational study at the Department of from January 2021 to December 2024. Ethical approval for the study was obtained from the Institutional Review Board and all procedures were performed in accordance with the Declaration of Helsinki. Written informed consent was obtained from the parents or legal guardians of all participants prior to enrollment.

A total of 240 children aged between 5 and 15 years who presented to the pediatric emergency department with acute right lower quadrant abdominal pain were recruited. Only patients with a clinical suspicion of acute appendicitis were included. Based on the final diagnosis, participants were categorized into two groups: Group A, comprising patients diagnosed with acute mesenteric lymphadenitis, and Group B, including those with confirmed acute appendicitis. Children with a

history of abdominal surgery, chronic gastrointestinal diseases such as Crohn's disease or ulcerative colitis, immunodeficiency disorders, or other identifiable causes of acute abdomen such as intussusception, perforation, or malignancy were excluded.

On admission, a detailed medical history was obtained from each patient or caregiver. The history focused on the onset, location, and duration of abdominal pain; associated symptoms such as nausea, vomiting, diarrhea, fever, or upper respiratory tract symptoms; and any similar previous episodes. All patients underwent thorough physical examination, including assessment of abdominal tenderness, guarding, rebound tenderness, and other peritoneal signs. Vital signs such as temperature, pulse rate, and blood pressure were recorded. The Pediatric Appendicitis Score (PAS) was calculated for each child using standard parameters, including right lower quadrant tenderness, fever, anorexia, nausea or vomiting, leukocytosis, and polymorphonuclear predominance. Based on the total score, patients were categorized into low (≤ 4), intermediate (5–7), or high (≥ 8) probability for appendicitis.

Laboratory investigations were performed for all patients at the time of presentation. Blood samples were analyzed for complete blood count (CBC), including total leukocyte count (TLC), differential count, and platelet count. The neutrophil-to-lymphocyte ratio (NLR) was calculated as an additional inflammatory marker. C-reactive protein (CRP) was measured using a high-sensitivity immunoturbidimetric assay, and erythrocyte sedimentation rate (ESR) was determined by the Westergren method in selected cases. Abnormal results were defined as TLC $> 11 \times 10^9/L$, NLR > 3.5 , and CRP > 10 mg/L. These laboratory parameters were later analyzed to assess their diagnostic utility in distinguishing AML from appendicitis.

All patients underwent abdominal ultrasonography (USG) using a high-resolution ultrasound machine equipped with a 5–12 MHz linear transducer (Philips Affiniti 70G). Each scan was performed by an experienced radiologist who was blinded to the clinical findings to minimize observer bias. For cases of acute appendicitis, diagnostic criteria included an appendiceal diameter greater than 6 mm, wall thickening, non-compressibility, and peri-appendiceal fat changes. Doppler imaging was utilized to assess vascularity in enlarged lymph nodes where required. In equivocal cases, contrast-enhanced computed tomography (CECT) was performed using pediatric radiation protocols for further evaluation.

The final diagnosis of acute appendicitis was confirmed either intraoperatively following appendectomy and histopathological examination or through clinical progression and imaging findings in conservatively managed cases. In contrast, AML was diagnosed based on typical ultrasonographic and clinical findings. Patients diagnosed with AML were followed up for two to four weeks to ensure complete resolution of symptoms and regression of lymphadenopathy on repeat ultrasound examination. Those with persistent or worsening symptoms were reassessed to rule out alternative diagnoses.

Data collected included demographic information, clinical features, laboratory results, ultrasonographic findings, treatment approach and outcomes. The primary outcome measures were the identification of clinical, laboratory, and imaging parameters that could effectively differentiate AML from appendicitis. Secondary outcomes included the evaluation of diagnostic accuracy of NLR, CRP, and USG findings, as well as analysis of negative appendectomy rates and hospitalization duration.

Statistical analysis was performed using Statistical Package for the Social Sciences (SPSS) version 26.0 (IBM Corp., Armonk, NY, USA). Quantitative variables were presented as mean \pm standard deviation (SD), while categorical variables were expressed as frequencies and percentages. The Student's t-test was used for comparing continuous variables between groups, and the Chi-square (χ^2) test was applied for categorical data. A Receiver Operating Characteristic (ROC) curve analysis was performed to determine the diagnostic accuracy of NLR and CRP in distinguishing AML from appendicitis. A p-value of less than 0.05 was considered statistically significant.

RESULTS

A total of 240 pediatric patients presenting with acute abdominal pain suggestive of appendicitis were enrolled in the study. Of these, 110 (45.8%) were diagnosed with acute mesenteric lymphadenitis (AML) and 130 (54.2%) with acute appendicitis (AA). The mean age of the study population was 10.1 ± 2.5 years, with no statistically significant

difference between the two groups ($p = 0.18$). The male-to-female ratio was 1.5:1 in the AML group and 1.7:1 in the AA group, showing a slight male predominance in both conditions ($p = 0.32$).

Clinically, fever, anorexia, and vomiting were more common in children with appendicitis, while diarrhea and upper respiratory tract infection (URTI) symptoms were significantly more frequent in AML cases ($p < 0.001$). Abdominal tenderness was present in all patients, though tenderness in AML was typically mild to moderate and less localized compared to appendicitis, where marked right lower quadrant tenderness and rebound tenderness were common findings. The mean Pediatric Appendicitis Score (PAS) was 4.1 ± 1.2 in the AML group and 7.8 ± 1.5 in the appendicitis group, showing a statistically significant difference ($p < 0.001$).

Laboratory investigations revealed notable differences between the two groups. The mean total leukocyte count (TLC) was significantly higher in appendicitis patients ($13.8 \pm 3.1 \times 10^9/L$) than in AML patients ($10.2 \pm 2.0 \times 10^9/L$, $p < 0.001$). Similarly, the neutrophil-to-lymphocyte ratio (NLR) and C-reactive protein (CRP) levels were elevated in appendicitis cases (NLR: 5.8 ± 2.1 ; CRP: 46.8 ± 17.5 mg/L) compared to AML (NLR: 2.5 ± 1.1 ; CRP: 22.1 ± 10.8 mg/L), both with strong statistical significance ($p < 0.001$).

Ultrasonographic evaluation provided critical diagnostic distinctions. In the AML group, the appendix was visualized as normal or not visualized in all cases, and the hallmark finding was the presence of multiple (≥ 3) enlarged mesenteric lymph nodes in the right lower quadrant, with a mean short-axis diameter of 9.1 ± 1.2 mm. In contrast, all appendicitis cases demonstrated a non-compressible, dilated appendix (> 6 mm in diameter) with peri-appendiceal fat stranding in 88% of cases and appendicolith in 26%. No AML patient showed signs of peri-appendiceal fluid collection.

When the diagnostic performance of the NLR and CRP was evaluated using ROC curve analysis, NLR demonstrated an AUC of 0.91, while CRP had an AUC of 0.88, both indicating excellent discriminative ability between AML and appendicitis. The optimal cutoff value for NLR was found to be 3.4, yielding a sensitivity of 89% and specificity of 82%.

Table 1. Demographic and Clinical Characteristics of the Study Population

Variable	Acute Mesenteric Lymphadenitis (n=110)	Acute Appendicitis (n=130)
Mean age (years)	9.8 \pm 2.6	10.3 \pm 2.4
Male : Female ratio	1.5 : 1	1.7 : 1
Fever (%)	61 (55.4%)	110 (84.6%)
Vomiting (%)	57 (51.8%)	105 (80.8%)
Diarrhea (%)	42 (38.1%)	13 (10%)
URTI symptoms (%)	51 (46.3%)	10 (7.7%)
Mean PAS score	4.1 \pm 1.2	7.8 \pm 1.5

Table 2:- Ultrasonographic Findings and Outcomes

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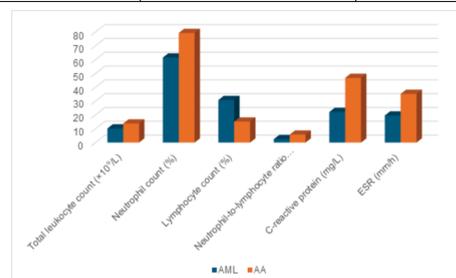


Fig 1:- Laboratory Findings in Acute Mesenteric Lymphadenitis and Acute Appendicitis

Table 3:-Diagnostic Accuracy of Laboratory and Imaging Parameters in Differentiating AML from Appendicitis

Diagnostic Parameter	Cutoff Value	Sensitivity (%)	Specificity (%)	Positive Predictive Value (PPV, %)	Negative Predictive Value (NPV, %)
Neutrophil-to-Lymphocyte Ratio (NLR)	>3.4	89.0	82.0	86.3	85.2
C-Reactive Protein (CRP, mg/L)	>30	83.0	78.0	81.2	80.0
Total Leukocyte Count ($\times 10^9/L$)	>11.5	76.0	70.0	73.2	73.1
Ultrasonography (USG) – Appendix >6 mm	—	92.0	95.0	94.2	93.1
Combined NLR + CRP	—	91.0	84.0	88.7	87.1

DISCUSSION

The present study sought to evaluate the clinical, laboratory, and ultrasonographic characteristics of acute mesenteric lymphadenitis (AML) and compare them with those of acute appendicitis (AA) in children presenting with acute abdominal pain. The study aimed to identify distinguishing parameters that could facilitate accurate diagnosis and reduce unnecessary surgical interventions. The findings of this study reaffirm that acute mesenteric lymphadenitis is a benign, self-limiting condition that closely mimics appendicitis both clinically and radiologically. However, through the integration of clinical scoring systems, inflammatory biomarkers, and ultrasound imaging, differentiation between the two can be achieved with high accuracy, thereby preventing unwarranted appendectomies.

The demographic profile of the present cohort showed a mean age of approximately 10 years in both AML and AA groups, with a slight male predominance in each. This observation aligns with the findings of Babayigit et al. (2025), who reported a mean age of 9.7 years and a male-to-female ratio of 1.6:1 among children with acute mesenteric lymphadenitis, suggesting that the condition predominantly affects school-aged boys.(1) Similarly, Swischuk (1998) and Manafova et al. (2025) reported that AML most frequently affects children between the ages of 5 and 15 years, likely due to increased exposure to viral and bacterial pathogens during early school years.(11,2) The lack of significant gender difference in our study, however, corroborates Asadi et al. (2023), who suggested that while mild male predominance exists, gender is not a statistically strong determinant in disease distribution.(12)

Clinically, the present study found that children with AML often presented with diffuse or periumbilical pain, mild fever, and symptoms of upper respiratory tract infection (URTI), while vomiting and localized right lower quadrant tenderness were more suggestive of appendicitis. (13) These findings are consistent with the observations of Manafova and Yıldız (2025), who highlighted that respiratory symptoms were present in nearly 50% of children with AML, supporting the hypothesis of post-infectious lymphoid hyperplasia as the underlying mechanism.(2) Saadat (2025) also reported that concurrent respiratory or gastrointestinal infections serve as important clinical clues differentiating AML from appendicitis. The present study reinforces this association, as almost half of the AML patients reported recent or concurrent URTI symptoms compared to less than 10% among appendicitis patients.(14)

In contrast, studies such as Rao et al. (1997) and Sabal et al. (2017) found that clinical features alone often fail to differentiate AML from appendicitis, emphasizing the necessity of imaging and laboratory evaluation.(15,16) While our results acknowledge this diagnostic overlap, they demonstrate that subtle distinctions—such as the presence of diarrhea and lack of rebound tenderness—can still guide clinical suspicion towards AML when interpreted alongside laboratory and sonographic data.

Regarding laboratory parameters, the present study demonstrated significantly higher total leukocyte count (TLC), neutrophil-to-lymphocyte ratio (NLR), and C-reactive protein (CRP) levels in children with appendicitis compared to those with AML. These findings are consistent with the work of Dreznik et al. (2024), who reported mean NLR values of 5.7 in appendicitis and 2.3 in AML, closely mirroring our results.(17) The elevation of inflammatory

markers in appendicitis reflects its bacterial etiology and more pronounced inflammatory response, whereas AML, being largely viral or reactive in nature, induces a milder leukocytic response.

Interestingly, Shabha et al. (2024) observed similar CRP trends but found limited diagnostic reliability for TLC alone, a finding echoed in our cohort, where TLC showed lower sensitivity (76%) and specificity (70%) compared to NLR and CRP.(18) This underscores that while leukocytosis is a common finding, the NLR remains a more robust and easily obtainable biomarker for differentiating between the two conditions.

Ultrasonography (USG) proved to be the cornerstone of diagnosis in the present study, exhibiting the highest diagnostic accuracy with an AUC of 0.96, sensitivity of 92%, and specificity of 95%. All AML patients exhibited multiple (>3) enlarged mesenteric lymph nodes in the right lower quadrant with a mean short-axis diameter of 9.1 mm, while appendicitis cases were characterized by a non-compressible, thickened appendix (>6 mm) and peri-appendiceal fat stranding. These findings are in agreement with those of Swischuk (1997), who identified clustered, hypoechoic mesenteric nodes with a normal appendix as pathognomonic of AML. (11) Similarly, Desoky et al. (2023) reported ultrasonographic sensitivity of 91% and specificity of 94% in differentiating AML from appendicitis, which nearly parallels our findings.(19)

Shrestha et al (2021) highlighted that sonographic lymph nodes in AML are typically oval, hypochoic, and demonstrate preserved fatty hila—features that were also consistently noted in our study. The diagnostic utility of ultrasound is further enhanced by its non-invasive nature and absence of radiation, making it the preferred modality in children. However, false-positive findings can occur in early appendicitis or in cases with overlapping inflammatory changes.(20) In our cohort, only 7.7% of appendectomy specimens showed reactive lymphoid hyperplasia without true appendiceal inflammation, consistent with the reported negative appendectomy rate of 5–10% in literature (Erez et al., 2019). This supports the clinical relevance of AML as a common cause of non-appendiceal right lower quadrant pain.

The integration of ultrasonography with laboratory parameters notably improved diagnostic accuracy. The combination of NLR and CRP achieved an accuracy of 88% in distinguishing AML from appendicitis, supporting the multimodal approach recommended by Rentea et al. (2017) (10). They proposed that combining clinical scoring systems such as the Pediatric Appendicitis Score (PAS) with objective biomarkers and imaging leads to the most accurate and cost-effective diagnosis. In our study, the mean PAS score was 4.1 in AML and 7.8 in appendicitis, showing a significant distinction ($p < 0.001$), thereby validating its continued clinical utility.

In terms of management, all AML cases in our study were successfully treated with conservative therapy, including hydration, analgesia, and antipyretics, with spontaneous recovery within 1–4 weeks. This aligns with the outcomes described by Helbling et al. (2017) and Zinczuk et al. (2015), who found no indication for surgical intervention in uncomplicated AML.(21,22) The mean hospital stay in our study was significantly shorter in AML patients (1.8 days) compared to appendicitis patients (4.6 days), reflecting the benign and self-limiting nature of AML. This difference is consistent with the findings of Babayigit et al. (2025), who also observed a shorter hospitalization duration in conservatively managed AML cases.(1)

The relatively high prevalence of AML among children presenting with suspected appendicitis in this study (45.8%) mirrors the findings of Hyenget al. (2000) and Kim et al. (2013), who reported rates between 15–40% depending on the diagnostic criteria and population studied. (23,3) This emphasizes the importance of clinician awareness, as misdiagnosis may lead to unnecessary appendectomies. Although appendectomy remains a relatively safe procedure, avoiding unwarranted surgery spares children from anesthesia exposure, postoperative complications, and psychosocial distress.

The limitations of the present study include its single-center design, moderate sample size, and lack of microbiological confirmation for infectious etiologies such as *Yersinia enterocolitica*. Additionally, ultrasonography is operator-dependent, and variations in expertise may influence diagnostic accuracy. Future multicentric studies with larger sample sizes and the incorporation of molecular diagnostic

techniques could provide deeper insights into the etiopathogenesis of AML. Furthermore, artificial intelligence-assisted ultrasound interpretation may enhance diagnostic precision and reduce inter-observer variability in the future.

CONCLUSION

The findings of this study reinforce that acute mesenteric lymphadenitis is a frequent and benign mimic of appendicitis in children. It is characterized by milder clinical symptoms, lower inflammatory markers, and distinct ultrasonographic features. The use of non-invasive diagnostic tools such as NLR, CRP, and ultrasonography, in conjunction with clinical scoring systems, significantly enhances diagnostic accuracy and minimizes the rate of negative appendectomy. This study contributes valuable evidence supporting the need for a structured, evidence-based diagnostic approach to acute abdominal pain in children.

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