

A. Alamdaran MD<sup>1</sup>.  
M. Hradfar MD<sup>2</sup>.  
B. Zandi MD<sup>3</sup>.  
M. Orei MD<sup>4</sup>.  
R. Taheri<sup>5</sup>

1. Assistant professor, Department of Radiology, Dr. Sheikh Children Hospital, Mashhad University of Medical Sciences, Mashhad, Iran.

2. Assistant professor, Department of Surgery, Dr. Sheikh Children Hospital, Mashhad University of Medical Sciences, Mashhad, Iran.

3. Associate professor, Department of Radiology, Imam Raza Hospital, Mashhad University of Medical Sciences, Mashhad, Iran.

4. Assistant professor, Department of Radiology, Mashhad University of Medical Sciences, Mashhad, Iran.

5. Mashhad University of Medical Sciences, Mashhad, Iran.

**Corresponding Author:**

Ali Alamdaran  
Address: Department of Radiology,  
Dr. Sheikh Children Hospital  
Taheri St., Mashhad, Iran  
Tel: 0098- 511-7283033  
Mobil: 0098-915-5112578  
E.mail: SA\_Alamdaran@mums.ac.ir

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## Diagnostic Value of Ultrasound Findings in Mesenteric Lymphadenitis in Children with Acute Abdominal Pain

**Backgrounds/Objective:** The aim of this study was to compare abdominal sonographic features of patients with mesenteric lymphadenitis versus sonographic features of the asymptomatic children, in order to identify diagnostic criteria for mesenteric lymphadenitis.

**Patients and Methods:** Ultrasound data from 113 children with acute abdominal pain whose suspected sonographic diagnosis was mesenteric adenitis or ileitis was inspected in a child hospital in March 2004 to March 2005. The final diagnoses were established after patient management and follow-up. As for the control group, a hundred asymptomatic children were referred from health centers or kindergartens.

**Results:** No para-aortic lymphadenopathy was found in any of the subjects from the study and the control groups. The number of enlarged mesenteric lymph nodes observed in symptomatic children was significantly greater than the figure in asymptomatic children ( $P<0.0001$ ). The highest rate of sensitivity was seen with the presence of RLQ lymphadenopathy (94.7%) and the highest rate of specificity was seen with the presence of lymphadenopathy in two or three areas of LUQ or mid-abdomen together; lymphadenopathies larger than 6mm in RLQ; presence of more than 4 lymph nodes (with any size) in a sonographic image from RLQ; or thickening of terminal ileum more than 8mm (92%-100%) in the diagnosis of mesenteric lymphadenitis.

**Conclusion:** In children with acute abdominal pain due to causes such as appendicitis which cannot be confirmed by ultrasound and the findings consist of only enlarged mesenteric lymph nodes ( $\geq 4$ mm) and/or mural thickening of the terminal ileum ( $\geq 8$ mm), the probable diagnosis would be mesenteric adenitis-ileitis and surgery is not required; but close observation is recommended.

**Keywords:** child, mesenteric lymphadenitis, ultrasound, abdominal pain

### Introduction

Acute abdominal pain is one of the most common yet challenging complaints in children, often presenting as a diagnostic dilemma. Most patients with abdominal pain have self-limited conditions. In some patients, rapid diagnosis and treatment are required to minimize morbidity.<sup>1</sup> The most common medical cause is mesenteric lymphadenitis<sup>2</sup> and the most common surgical problem is appendicitis.<sup>1,3</sup> Appendicitis is responsible for a great number of errors in surgical diagnosis and the majority of children referred for suspected appendicitis do not actually suffer from appendicitis.<sup>3</sup> The diagnosis of appendicitis based on clinical findings has an accuracy of about 70%, and therefore, usually one out of five patients with suspected acute appendicitis undergoes unnecessary laparotomy.<sup>3,4</sup> The persistent challenge is to establish the diagnosis of acute appendicitis early enough to prevent perforation, and also to reduce the frequency of unnecessary laparotomy.<sup>1,3</sup> Mesenteric lymphadenitis, on the other hand, is the single most common diagnosis easily confused with appendicitis.<sup>1,4</sup> Differentiating

this self-limiting condition from appendicitis will thus spare unnecessary surgery. The sonographic criteria for diagnosis of appendicitis were first described by Puylaert et al. in 1987.<sup>3</sup> the diagnosis of mesenteric adenitis, however, is still mainly by exclusion of other surgical causes of acute abdomen. Therefore, establishing some criteria for diagnosis of mesenteric adenitis will help physicians understand and be reassured of the benign nature of acute abdominal pain.

In the present study, we evaluated abdominal ultrasound findings of patients with mesenteric lymphadenitis presenting with acute abdominal pain and compared them with the sonographic features of asymptomatic children in order to identify useful criteria in the assessment of mesenteric lymphadenitis.

### Patients and Methods

During a 1-year period from March 2004 to March 2005, 213 children with acute abdominal pain underwent full abdominal and pelvic ultrasound examination (USE) in Doctor Sheikh Children Hospital, in Mashhad. USE was performed in all children using a Siemens unit (Adara) with convex-array of 2.5-5 MHz, and linear of 7-10 MHz. Nearly half of the patients were excluded from the study because their final diagnosis was diseases such as gastroenteritis, acute appendicitis, intussusception, obstruction, and ovarian torsion. In the remaining 113 patients whose suspected sonographic diagnosis was mesenteric adenitis (mesenteric adenitis-ileitis), sonographic findings included the presence of para-aortic lymphadenopathy (A-P diameter > 4mm),<sup>5, 6</sup> mural thickening of the terminal ileum, presence of Peyer's patches as hypoechoic foci in the submucosal layer of terminal ileum, spleen size and especially the size of mesenteric lymph nodes in three areas of right upper quadrant (ileocecal), mid-mesenteric (anterior or lateral to the aortic bifurcation), and left upper quadrant. In patients with generalized thickened intestinal wall and fluid retention, the diagnosis was gastroenteritis, and in patients with

sonographic findings of localized mural thickening of the terminal ileum and enlarged mesenteric lymph nodes (A-P diameter > 4mm)<sup>2,5,6,7</sup> the diagnosis was mesenteric adenitis (mesenteric adenitis-ileitis). The final diagnosis was established by surgical and histological evaluations, and clinical follow-ups in non-surgical cases. The follow-up of these children was done at 2-week intervals through repeated clinical examinations or telephone contacts.

During the same period, 100 asymptomatic children age- and gender-matched with the cases served as the control group. Children of the control group were referred from the health centers (referrals for growth surveillance or vaccination) or kindergartens. None of them had common cold or other infectious diseases in the past month. Statistical analyses of nominal variables were performed using the Chi-square test by SPSS-11.5.

### Results

Mesenteric lymphadenitis (mesenteric adenitis-ileitis) was the most common diagnosis (53%) in all 213 patients with acute abdominal pain.

Demographic and clinical data of our 113 patients with mesenteric lymphadenitis are shown in Table 1. As shown, most of the referred patients with mesenteric lymphadenitis had presented with acute abdominal pain in the 4-7 year of age group having a present or recent history of common cold and normal pharyngeal exam, and a clinical picture similar to acute appendicitis or intussusception. The male-to-female ratio was 1.68.

Para-aortic lymphadenopathy was not found in any of the subjects in the case and control groups. Results are summarized in Table 2. As shown, there was a significant difference between the two groups (P=0.001) when considering the presence of lymphadenitis.

**Table 1.** Demographic and clinical data in 113 patients with mesenteric lymphadenitis

Sex	boys (62.8%); girls (37.2%)
Age	Mean age (6.1±0/2 y); the smallest (16 m), the oldest (12 y)
Common cold history	60.2%
Pharyngeal exam	Normal (46.9%), Erythema (44.2%), Exudate (8.8%)
Low grade fever	31.9%, other normal
Pain site	RLQ (28.3%), Peri-umbilical (41.6%), Generalized (30.1%)
Duration of symptoms	Mean (1.7±0/8 d), Minimum (8 h), Maximum (4 d)
Abdominal tenderness	83.1%
Referral diagnosis	Appendicitis (64.3%), Intussusception (8.8%), Non-specific (16.8%)

**Table 2.** Results of the US examinations of mesenteric lymphadenopathy (A-P diameter > 4 mm) in the study and control groups.

Location	SG No.	CG No.	Sens.	Spec.	P
RLQ	107	24	94.7%	76%	.0001
Mid-abdomen	57	2	50.4%	98%	.0001
LUQ	49	8	43.4%	92%	.0001
RLQ and Mid-abdomen	57	2	50.4%	98%	.0001
RLQ and LUQ	47	0	41.6%	100%	.0001
LUQ and Mid-abdomen	33	0	29.2%	100%	.0001
Three areas together	33	0	29.2%	100%	.0001

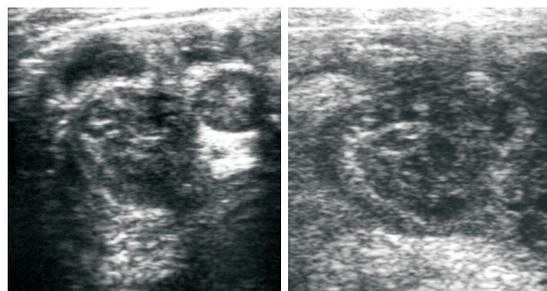
SG: Study Group; CG: Control Group; Sens.: Sensitivity; Spec.: Specificity

denopathy only in one, two and/or three areas. The number of enlarged mesenteric lymph nodes in symptomatic children, too, was considerably more than in asymptomatic children. The mean number of RLQ mesenteric lymph nodes (of any size) on sonography was  $3.1 \pm 0.8$  in the study group and  $1.2 \pm 1.1$  in the controls. The average of terminal ileum thickness was  $8.9 \pm 2.5$  mm in the study group and  $5.6 \pm 1.6$  mm in the controls (Figure 1 A). The mural thickness of terminal ileum was significantly greater in the children with mesenteric lymphadenitis than in the asymptomatic children ( $P=0.001$ ). Thickness more than 8 mm had a sensitivity of 57.4% and specificity of 94% in the diagnosis of mesenteric lymphadenitis.

Peyer's patches in the terminal ileum were observed in 23% of the study group (Figure 1 B); none of the subjects in the control group had Peyer's patches. The difference was statistically significant ( $P=0.001$ ).

Based on our findings, the presence of lymphadenopathy in RLQ had the highest sensitivity (94.7%); and the presence of lymphadenopathy in LUQ or mid-abdomen in two or three areas together, or larger than 6 mm lymphadenopathies in RLQ, or the presence of more than 4 lymph nodes (of any size) on the ultrasound of RLQ, or terminal ileum thickening of more than 8 mm had the highest specificity (92% - 100%) in the diagnosis of mesenteric lymphadenitis.

There was no significant difference in the spleen size between two groups. In our study group, there was no significant difference in the mean age of the patients, mesenteric lymph node size or terminal ileum thickness. In three patients with high clinical suspicion of appendicitis who had undergone surgery, pathologic examination disclosed a normal appendix and non-specific inflammatory changes in the enlarged mesenteric lymph nodes. At 2-week follow-up of our 113 subjects with mesenteric lymphadenitis, in 112 patients (99.1%), the acute abdominal pain



**Fig 1.** Mural thickening of terminal ileum and the adjacent mesenteric lymph nodes (A). Hypertrophied Peyer's patches are observed as hypoechoic foci in the submucosal layer adenitis of terminal ileum (B).

had resolved spontaneously, indicating correct diagnosis of mesenteric adenitis-ileitis. In one patient, however, acute appendicitis occurred 3 days later.

## Discussion

Acute abdominal pain is one of the most common complaints in children, often leading to hospital admission for observation, further testing, proper treatment, and even occasionally unnecessary surgeries.<sup>3</sup> In recent years, however, the advances in quality of sonographic images have improved their diagnostic value in acute abdominal pain<sup>8</sup>, especially in mesenteric adenitis that is easily confused with acute appendicitis. Because of the association of *Yersinia* and *Campylobacter* infections with enlarged mesenteric lymph nodes and ileal wall thickening, some patients with mesenteric adenitis (-ileitis) are categorized under the gastroenteritis subgroup in some studies. Therefore, gastroenteritis is sometimes referred to as the most common cause of acute abdominal pain.<sup>3, 4, 9</sup> However, since the clinical and sonographic findings of these two entities are different, it's better to study them apart. Against the generalized increase in the thickness of mucosal and submucosal layers in gastroenteritis or ileocectis<sup>9</sup>, bowel wall thickening in mesenteric adenitis (-ileitis) is mainly confined to submucosal layer of terminal ileum. Hypertrophied Peyer's patches are also observed in mesenteric adenitis; likewise grossly hypertrophied Peyer's patches in terminal ileum were observed in 23% of our patients. It is thus better or more correctly called mesenteric adenitis- ileitis.<sup>4</sup> Although Watanabe et al. detected ileocecal mesenteric lymph nodes in almost all the children,<sup>5</sup> in our study, and the study by Sivit et al and also Vayner et al, mesenteric lymph nodes greater than 4 mm in short axis were observed mostly in symptomatic patients and only a few (less than

10%) were seen in asymptomatic children.<sup>6,7</sup>

In this study, para-aortic lymphadenopathy (A-P diameter > 4 mm) was observed in none of the subjects in the study and the control groups. In the study by Watanabe et al., the presence of para-aortic lymphadenopathy (A-P diameter > 4 mm) was denoted in some of the asymptomatic children.<sup>5</sup> The figure is probably affected by the assessment of mesenteric lymph nodes whether anterior or lateral to aorta as the para-aortic lymph nodes.

Although, the enlarged and inflamed mesenteric nodes form a nonspecific finding and are associated with a variety of pathologic states such as adenoviral infections, Crohn's disease, appendicitis, gastroenteritis, Yersinia infections, cat scratch disease, AIDS, or occasionally as an incidental finding in asymptomatic children<sup>1,4,5,6,10,11</sup>, our observations disclosed that regarding the size, number, and location of the nodes, they are also likely to be seen quite frequently in symptomatic children. Hence, when they are demonstrated as the sole abnormality, they could be linked to the abdominal pain and probably its etiology. This suggests the stimulation of the lymphatic system in the current infectious process and ensuing abdominal pain. Therefore, enlarged mesenteric lymph nodes (A-P diameter > 4mm), and/or associated mural thickening of the terminal ileum on sonographic examination as the sole abnormalities without demonstration of other organic diseases such as appendicitis in children with acute abdominal pain, is considered abnormal and could be thought of as the cause of acute abdominal pain, having high sensitivity and specificity in the diagnosis of mesenteric adenitis (-ileitis). These findings could serve as an important parameter in the diagnosis of mesenteric lymphadenitis and shouldn't lead to unnecessary surgery.

Recently, mesenteric lymphadenitis is mentioned as a cause of chronic or recurrent abdominal pain.<sup>7</sup> However, as it is riskful to overlook other surgical causes of acute abdomen or coexistent appendicitis and ileitis,<sup>9</sup> or other complications of mesenteric lymphadenitis like acute appendicitis (as occurred in one of our patient), it is always mandatory to keep searching for other surgical causes of acute abdomen and the patient should be closely observed and even the further ultrasound studies. The limitations of the present study include the small number of patients, a

relatively short period of follow-up, and probably a selective referred patients bias for sonographic examination that should be taken into account and indicate the need for further larger researches.

## Conclusion

In children who present with acute abdominal pain, surgical causes such as appendicitis are not visualized on sonography, and US findings consist of enlarged mesenteric lymph nodes ( $\geq 4\text{mm}$ ) and/or mural thickening of the terminal ileum ( $\geq 8\text{mm}$ ), especially in association with upper respiratory tract infection symptoms, the diagnosis is probably mesenteric adenitis-ileitis; surgery is not required but close observation and even repeat US for the evaluation of later complications of mesenteric lymphadenitis are recommended.

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