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Diagnosis of Peptic Esophagitis in Children; Ultrasound versus Endoscopy

Background/Objectives: To investigate the value of transabdominal sonography for evaluation of esophagitis in children.

Materials and Methods: A total of 74 children with the clinical suspicion of esophagitis underwent transabdominal sonography of the gastroesophageal junction. Thicknesses of the anterior and posterior walls of the gastroesophageal junction were measured, as well as the thickness of the mucosa. This was followed by endoscopy and biopsy.

Results: In histopathologic examination 44 cases were diagnosed as having esophagitis (diseased group) and 30 were reported normal (normal group). The mean wall thickness was significantly higher in the diseased group. Sonography based on wall thickness using cut-off point of 6.9 mm had a sensitivity of 96%. Negative predictive value of 91% and accuracy of 84%. Sonography based on mucosal thickness using cut-off point of 1.8 mm had a sensitivity of 96%, negative predictive value of 81% and accuracy of 69%. Endoscopy had a sensitivity of 82%, negative predictive value 65% and accuracy of 69%. Despite the high accuracy of sonography, endoscopy due to its ability to perform biopsy cannot be superseded by sonography in evaluation of reflux esophagitis, but owing to high sensitivity and negative predictive value of sonography, it has the potential to be used as a screening test.

Conclusion: In the clinical setting of reflux esophagitis in children, if TAS of the GEJ showed a GEJ wall thickness of 6.9 mm or less and the mucosal thickness of 1.8 mm or less, and if there is no gastroesophageal reflux noted on sonography, the patient should be considered as normal and no endoscopy is required. On the other hand, if the patient showed a thickness of the wall of the GEJ 7 mm or more, or a thickness of the mucosa of GEJ 2 mm or more on TAS, an endoscopy should be performed and a biopsy should be obtained.

Keywords: Esophagitis, Gastroesophageal Reflux, Gastroesophageal Junction, Endoscopy, Transabdominal Sonography.

Introduction

Peptic esophagitis, secondary to gastroesophageal reflux (GER) is the most frequent type of esophagitis in childhood. It usually involves the lower third of the esophagus. The clinical symptoms include restlessness, poor feeding, failure to thrive, anemia, pneumonia, heartburn, anorexia, vomiting, gastrointestinal bleeding, chronic abdominal pain, dysphagia, and odynophagia. Diagnosis of esophagitis is based on the result of both endoscopic and pathologic findings. Even though contrast radiography has low sensitivity for mild and moderate esophagitis.[1, 2, 3]

Endoscopy and biopsy are the only reliable diagnostic method for the diagnosis of esophagitis, but this is an invasive procedure and a simpler and less expensive method to arrive at the diagnosis is desirable.

Evaluation of gastroesophageal junction (GEJ) with transabdominal sonography (TAS) is practical.[4,5] The gastrointestinal tract, including the esophagus, is composed of three layers on TAS: the central echogenic layer including mucosa and submucosa, the hypoechoic musularis propria, and the most peripheral layer, which is echogenic.[6]

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Few studies have been directed toward the ability of sonography in assessment of esophagitis. In one of these studies in adult group TAS showed significant difference between mean GEJ wall thickness in the patients with esophagitis and control group (6.5±1.9 mm versus 3.5±0.5 mm).[8] Another study in adults produced similar results regarding the mean wall thickness of the GEJ. (7.5±2.1 mm in diseased group versus 3.8±1.2 mm in control group).[7]
Even though these studies show significant difference between mean wall thickness in adults, no studies have been done in children and infants. In addition, neither of these studies provides any information about sensitivity, specificity, or accuracy of TAS in the diagnosis of esophagitis. Thus, we decided to evaluate the diagnostic accuracy of TAS in esophagitis in children using the pathologic results as the gold standard.

Materials and Methods

Seventy-four children, 6 months to 13 years of age (mean age of 6.4 years), admitted to Children's Hospital Medical Center from March 2001 to March 2002 were included in the study. All children had symptoms suggestive of esophagitis and had chronic abdominal pain. They were considered for endoscopy. The criteria for inclusion were: 1) chronic abdominal pain, 2) regurgitation, 3) chronic heartburn, 4) failure to thrive, 5) chronic recurrent vomiting, and 6) recurrent respiratory wheezing.

All patients were clinically examined by a pediatric gastroenterologist, and those who were candidates for endoscopy were referred for ultrasound.

Longitudinal and transverse gray scale ultrasonography of the gastroesophageal junction were obtained utilizing an ALOKA-SSD 1700 sonography unit, with a curved 3.5 MHz or linear array 7.5 MHz transducer, depending on the age of the patient and the body thickness. Thickness of the wall and thickness of the mucosa of the GEJ were measured. Thickness of the wall of GEJ was measured from the inner border of the anterior serosal layer to the inner border of the posterior serosal border. The GEJ mucosal thickness was measured as the diameter of the central echogenic line. The patients underwent endoscopy and biopsy was obtained from the lower esophagus in less than a week after TAS examination. The diagnosis of esophagitis on endoscopy was based on erythema, erosion, ulcer or exudates in lower third of the esophagus. The histological diagnosis of esophagitis was based on more than 15% increase in basal layer thickness of the epithelial thickness, increase in length of the papillae (presence of at least two papillae in middle third and one papilla in the upper third of the epithelium), and presence of mixed inflammatory cells in submucosal layer. The study was triple blind and the radiologist, endoscopist and pathologist were unaware of each other's findings.

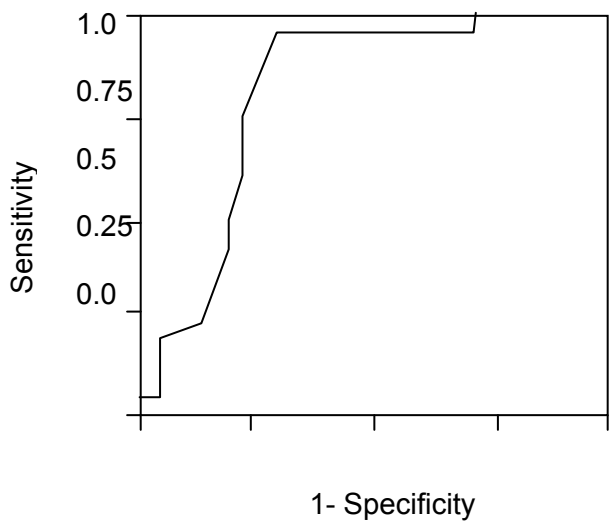
Considering the histological diagnosis, there were 44 patients out of 74 diagnosed as having esophagitis (the diseased group), and 30 as normal individuals (control group). On analysis of the raw data, the mean wall thickness and the mean mucosal thickness in the diseased group were compared with their counterparts in normal group (using t-test and SPSS software). Then ROC curves were constructed for GEJ wall and mucosal thickness (SPSS software) by using selected cut-off points. Accuracy of TAS was determined using number of true and false positive and true and false negative according to histopathologic findings.

Results

1. The mean GEJ wall thickness on sonography in diseased group was significantly higher than the corresponding value in normal group (8.8 ± 0.76 mm in diseased group versus 6.8±0.86 mm in normal group, P=0.001, df =72 and t= 3.58).
2. The mean GEJ mucosal thickness in diseased group was significantly higher than the corresponding value in normal group (3.1 ± 0.32 in diseased group versus 2.4 ± 0.34 mm in normal group, P=0.004, df =72 and t=2.95). The results of the above two categories are shown in table 1.
3. The area under the curve in ROC curve for GEJ wall thickness on TAS was 0.78 (±0.124). Using this curve, cut-off point of 6.9 mm was selected which yielded a sensitivity of 96%, specificity of 67%, positive predictive value of 81% and negative predictive value of 91% for TAS diagnosis of esophagitis. The accuracy of TAS based on GEJ wall thickness measurement was 84%. The corresponding ROC curve and various sensitivities and specificities based on the various cut-off points are shown in graph (1).

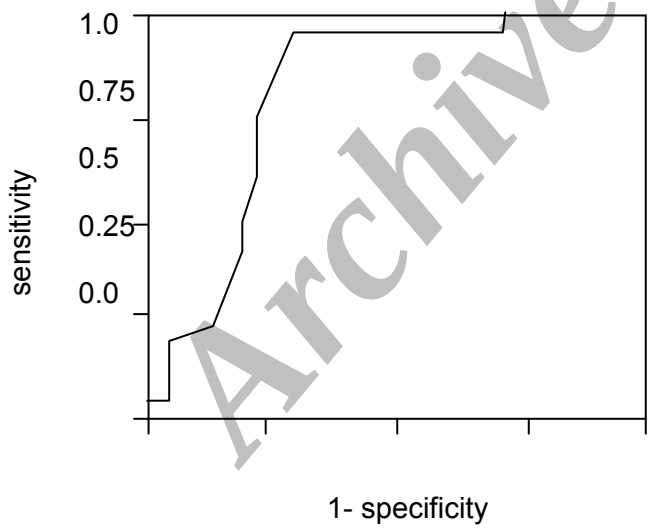
GEJ Measurements		Mean	Significant Difference	T	DF	P
Wall Thickness	Diseased	8.8±o.8	+	3.58	72	0.001
	Normal	6.8±0.86				
Mucosal Thickness	Diseased	3.1±0.32	+	2.96	72	0.004
	Normal	2.4±0.34				

Table 1: Mean wall thickness and mucosal thickness in patient group and normal group.



Graph 1: ROC curve for sonographic GEJ wall thickness in the diagnosis of childhood esophagitis

4. The area under the curve in ROC curve for GEJ mucosal thickness on sonography was 0.695(± 0.126). Using this curve, cut-off point of 1.8 mm was selected which yielded a sensitivity of 96% , a specificity of 30%, a positive predictive value of 67% and a negative predictive value of 81% for TAS in the diagnosis of esophagitis. The accuracy of TAS based on GEJ mucosal thickness measurement was 84%. The corresponding ROC curve and various sensitivities and specificities based on various cut-off points are shown in graph (2).



Graph (2): ROC curve for sonographic GEJ mucosal thickness in the diagnosis of childhood esophagitis

5. On endoscopic evaluation, there were 36 true positive, 8 false negative, 15 true negative and 15 false positive cases. These results were indicative of a sensitivity of 82%, a specificity of 50%, a positive predictive value of 71% and a negative predictive value of 65%. The accuracy of endoscopy in diagnosis of esophagitis was 69%. The various diagnostic indices of TAS and endoscopy are shown in table (2).

Diagnostic Test	Sensitivity	Specificity	PPV	NPV	Accuracy
TAS Wall thickness>6.9mm	96%	67%	81%	91%	84%
TAS Mucosal thickness>1.8mm	96%	30%	67%	81%	69%
Endoscopy	82%	50%	71%	65%	69%

*Table 2:*Various diagnostic indices of TAS and endoscopy.

Discussion

Our results demonstrate that GEJ wall and mucosal thicknesses on TAS are significantly different in diseased group than in normal children. This finding is in accordance with the previous studies in adults, but the mean wall thickness in our study is higher than the ones in the previous two studies. This is due to the fact that the previous studies took into account just one side of esophageal wall (for example anterior wall), but in our study GEJ wall thickness has been considered as the sum of anterior and posterior wall thickness; so in our study the mean normal GEJ wall thickness is 6.8 ± 0.86 mm. The same value was 3.5 ± 1.2 mm in Rahrooh study [8] and 3.8 ± 1.2 mm in Hse and Changchien study. [7] Comparison of these results shows that the values in our study are slightly less than the values mentioned in previous studies, due to the lower age of the patients in our study.

Our study showed that the mean GEJ mucosal thickness in the diseased group was significantly higher than the corresponding value in the normal group (3.1± 0.32mm versus 2.4 ± 0.34 mm). This finding has not been evaluated in the previous studies.

The presence of significant difference between the mean GEJ wall and mucosal thickness in the diseased group indicates the potential application of TAS as a diagnostic tool for evaluation of esophagitis. In addition, the area under the curve (0.78 in ROC curve based on GEJ wall thickness and 0.695 in ROC curve based on GEJ mucosal thickness, which are both more than 0.5) is a confirmatory evidence for TAS potential use in the diagnosis of esophagitis.

Although our study showed high accuracy for TAS in the diagnosis of esophagitis, but due to ability of endoscopy in taking biopsy and providing histologic diagnosis and the ability to diagnose different degrees of the disease, TAS cannot supersede endoscopy in evaluation of reflux esophagitis. In spite of the high sensitivity and negative predictive value of TAS, especially based on GEJ wall thickness that was 96% and 91% respectively, it can be used as a screening tool in patients with the clinical suspicion of esophagitis.

In regards to the above discussion, it is recommended in patients who undergo evaluation for clinical suspicion of esophagitis that if the esophageal wall thickness on TAS is less than 6.9 mm and the mucosal thickness is less than 1.8 mm, and if there is no gastroesophageal reflux on sonography, the patient should be regarded as normal and no further endoscopic evaluation should be conducted. Furthermore, it is also recommended that patients with the clinical picture of esophagitis—having GEJ wall thickness of 7mm or more or GEJ mucosal thickness of 2 mm or more on TAS—should undergo endoscopy and biopsy to evaluate the presence of esophagitis.

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