The diagnosis of gastroesophageal reflux disease in children

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ABSTRACT

Objective: Gastroesophageal reflux disease is a common disorder affecting children worldwide. The objective of this study is to report our experience on the accuracy of tests used for the diagnosis ofgastroesophageal reflux disease with emphasis on the advantages and disadvantages of each of them.

Methods: This study took place in the Pediatric Gastroenterology Division, Department of Pediatrics, College of Medicine and King Khalid University Hospital, Riyadh, Kingdom of Saudi Arabia, during the period of 1994 through to 1999. Results of barium meal, 24-hour esophageal pH monitoring, endoscopy, and gastrointestinal scintigraphy are analyzed and compared in children with and without gastroesophageal reflux disease.

Results: One hundred and forty-four children were investigated. The diagnosis was confirmed in 85 and excluded in 59 children, who will be considered as patients without gastroesophageal reflux disease. The results of barium meal, 24 hour pH monitoring, endoscopy, and gastrointestinal scintigraphy were positive in 80%, 78%, 92%, and 70% of the patients with gastroesophageal disease. The same studies were falsely positive in 29%, 9%, 19%, and 0% of those without gastroesophageal reflux disease. Esophageal pH was the most specific diagnostic study (91%), whereas endoscopy was the most sensitive (92%) and had the best positive predictive value (95%).

Conclusion: The results of this study are similar to reports from other parts of the world. It is stressed that all procedures have important advantages and disadvantages indicating that the selection of procedures should be individualized and based on the clinical situation.

Keywords: Gastroesophageal reflux, diagnosis, barium meal, pH-metry, endoscopy, scintigraphy, children.

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Gastroesophageal reflux disease (GERD) is a common disorder, affecting children worldwide.[1-3] When the clinical presentation is typical, such as with chronic vomiting, the diagnosis is usually easy with or without minimal investigations such as barium study.[4] However, unusual clinical presentations like recurrent aspiration, stridor, heartburn, or apnea, and in patients presenting with a complication such as hematemesis, specialized diagnostic procedures are needed to confirm or exclude GERD.[5] There are several methods commonly used in the diagnosis of GERD in children with the barium meal being the oldest study followed by esophageal pH measurement and scintigraphy.[6-8] Manometry, although useful in identifying the site of lower esophageal sphincter, the study of mechanism of reflux and possible associated esophageal motility disorders,[9] is not considered a diagnostic method for GERD. Similarly, endoscopy is useful in the diagnosis of complications such as esophagitis but it is not a diagnostic study for reflux per se.[10] More

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recently, ultrasonography has been reported to be useful in the diagnosis of reflux disease.[11] To our knowledge, reports on the accuracy of these methods are from Western countries, a setting that may be different from the developing world. It is hoped that this will help physicians gain more of an insight into the indications and limitations of these procedures.

Methods. The patients in this study include all children from 0-12 years investigated in the Pediatric Gastroenterology Division, Department of Pediatrics, College of Medicine and King Khalid University Hospital (KKUH) in Riyadh. They were referred by general pediatricians or other subspecialists to exclude GERD as a cause of their clinical condition. The children were evaluated under the supervision of pediatric gastroenterology consultants using history and physical examination and a combination of diagnostic procedures. These included barium swallow, 24 hour pH monitoring, scintigraphy, endoscopy and histopathology in certain cases. The children were investigated and managed in a way similar to the recommendations of the European Society for Pediatric Gastroenterology and Nutrition.[12] Furthermore, the location of the pH probe was confirmed by the agreement of at least 2 of the following methods: Manometry, endoscopy, radiology, Stroebel formula, or pH change A retrospective review of the medical records was performed. For data analysis purposes, the diagnosis of GERD was considered confirmed when the 24 hour intraesophageal pH study, performed properly, was unequivocally abnormal, or when esophagitis (grade II or above) was clearly present on endoscopy (grade I endoscopic esophagitis was considered significant only if confirmed by histopathology). The presence of reflux on barium studies was considered diagnostic of GERD, only if confirmed by another investigation such as scintigraphy. The children in whom the diagnosis of GERD was not confirmed according to the above criteria were thought not to have the disease and are designated, for the purpose of this study, as children without GERD. The results of diagnostic procedures in patients with GERD will be compared to those performed on patients without GERD. Statistical analysis consists of percentages of positive and negative studies as well as calculation of sensitivity, specificity, positive and negative predictive values.

Results. Between 1994-1999, 144 children were referred for suspected GERD. The diagnosis was confirmed in 85 children. The pattern of clinical presentation of GERD in these children has been reported.[13] In summary, the male to female ratio was 1.6, the median age of onset of symptoms was 10 months, whereas the median age at referral was 20 months. Vomiting is the most common presentation occurring in 82% of the children, followed by respiratory disease in 38%. An underlying condition was found in 41% of the children (35/85) the most frequent of which was neurological impairment. The diagnosis of GERD was excluded in the remaining 59 children and therefore will be considered as patients without GERD.

Barium meal was performed on 53 children, 24 hour pH study on 80, endoscopy on 80, endoscopic biopsies on 50, scintigraphy on 15 children. **Table 1** summarizes the results of these procedures in patients with and without GERD. Barium meal was performed in 49 patients with GERD. It was positive in 39 (80%), and falsely negative in 10 (20%). Four out of the 14 children without GERD who underwent barium meal (29%) had false positive results. Twenty-four hour pH monitoring was satisfactorily performed on 45 patients and was positive in 35 (78%) but falsely negative in 10; whereas this study was falsely positive in only 3 out of the 35 (9%) and negative in 32 (91%) who do not have the disease. Gastroesophageal scintigraphy showed clear reflux in 9 (70%) of the 13 children with GERD who had the study and was negative in the 2 patients who do not have the disease. Endoscopy clearly showed esophagitis in 59 (92%) out of the 64 children with

Table 1 - Results of studies used in the diagnosis of gastroesophageal reflux disease.

Results	Barium Meal (%)	Esophageal pH (%)	Endoscopy (%)	Scintigraphy (%)
Patients with GERD				
Positive study	39/49 (80)	35/45 (78)	59/64 (92)	9/13 (70)
Negative study	10/49 (20)	10/45 (22)	5/64 (8)	4/13 (30)
Patients without GERD				
Positive study	4/14 (29)	3/35 (9)	3/16 (19)	0/2 (0)
Negative study	10/14 (71)	32/35 (91)	13/16 (81)	2/2 (100)
GERD-gastroesophageal reflux disease				

Table 2 - Accuracy of different studies.

Accuracy of tests	Barium meal (%)	Esophageal pH (%)	Endoscopy (%)
Sensitivity	80	78	92
Specificity	71	91	81
Positive predictive value	91	92	95
Negative predictive value	50	76	72

GERD and was falsely positive in 3 (19%) out of the 16. **Table 2** expresses the accuracy of these procedures in another way indicating that esophageal pH is the most specific study (91%), whereas endoscopy was the most sensitive (92%) and had the best positive predictive value (95%).

Discussion. It is well recognized that gastroesophageal reflux is a normal phenomenon occurring in many children and also adults. The difference between this physiologic phenomenon and GERD is a matter of quantity and severity. Therefore, diagnostic studies that do not provide quantitative estimation such as barium studies may have high false positive results. Furthermore, it is well known that reflux of gastric content in the esophagus is an intermittent phenomenon in both normal subjects and those affected with GERD. Therefore, tests of short duration such as barium studies and scintigraphy will be expected to miss reflux episodes resulting in higher false negative results than tests of longer duration such as prolonged esophageal pH monitoring. Finally, there is a poor correlation between some of the tests. Comparing pH-metry and scintigraphy, Vandenplas reported that of 123 reflux episodes recorded by both techniques, only 6 occurred simultaneously and concluded that the 2 tests explore the reflux phenomenon differently.[14]

Barium meal. In this study, barium meal was positive in 80% of the children with GERD but also had a high rate of false positive results in controls (29%). These results are not much different from the 86% and 31% rates reported by others.[15] Other reports indicated much lower rates (50%) of positive results of barium meal in their patients.[16] Despite the variability in these results, barium meal is a very useful study in the evaluation of children for GERD. Its advantages include availability in virtually all hospitals, superiority to other tests in the detection of anatomic abnormalities such as hiatus hernias, ability to detect both early postprandial and alkaline reflux episodes. The disadvantages of both high false negative and false positive rates preclude its usefulness alone as a diagnostic test for GERD. Accordingly, we recommend barium meal in the initial evaluation of children not so much to diagnose reflux but more importantly to look for structural anomalies such as gastric volvulus, duodenal obstruction, or hiatus hernia which has a major implication for the determination of the position of the pH probe for the esophageal pH monitoring.

Esophageal pH studies. All of these studies consisted of continuous pH monitoring for 24 hours. The finding of positive pH studies in 35 (78%) out of 45 is consistent with the 20-30 false negative results reported by Cucchiara et al.[17] However, the 22% of false negative results in our patients with GERD are higher than the 12% rate reported by others.[15] The 24 hour pH monitoring is considered the gold standard study to confirm GERD in children partly due to it being the only procedure that quantifies reflux and is able to correlate reflux episodes with symptoms.[12] However, pH studies even of long duration have major limitations. At the present time, only acid refluxate can be detected which means that the study is unable to detect alkaline reflux and immediate postprandial episodes in infants due to the acid neutralizing effects of milk. In addition, the technique is difficult to perform and to interpret by nonspecialized persons.[18,19] Furthermore, even when performed properly, the study is still not well standardized nor reproducible.[20,21] These limitations justify the fact that some authors still think that some patients can be managed without this study.[22,23]

Gastrointestinal scintigraphy. This study was performed in a relatively small number of patients. It was positive in 9 (70%) and negative in 4 (30%) of the 13 patients with GERD, whereas none of the 2 children without the disease had reflux. Such a result is difficult to interpret due to the small number of cases, but it is better than the 57% positive studies reported in patients with GERD.[14] This good result contrasts with our higher false negative rate (30%) than the 0% reported by others.[14] The advantage of scintigraphy includes the ability to detect alkaline and immediate postprandial reflux, pulmonary aspiration and evaluation of gastric emptying which is an important factor in the mechanism of reflux and may have therapeutic implication. However, the main disadvantages are the relatively short duration and the need for sophisticated equipment and expertise that is rarely available particularly in developing countries.

Endoscopy. The finding of only 8% of false negative is better than the 54% figure, but the19% rate of false positive results in our study is higher than 0% reported in the literature.[13,14] It is worth remembering that endoscopy is a diagnostic procedure for peptic esophagitis and not for uncomplicated disease. Therefore, it is indicated only in patients presenting with symptoms of esophagitis such as irritability in infants, heartburn in older

children, hematemesis, or dysphagia. In these children, the demonstration of clear cut esophagitis on endoscopy is virtually diagnostic of GERD in the absence of any history of acid or alkali ingestion. This statement is supported by the high positive predictive value (95%) found in this study.

In conclusion, the accuracy of tests used in the diagnosis of GERD in our setting is similar to that reported by most other authors. All tests have some degree of false positive and false negative results and therefore clinical correlation is always needed for accurate diagnosis.

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