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## A Comparison between the Diagnostic Value of Sonography vs. Barium Swallow In Gastroesophageal Reflux in Children

**Background:** One of the common problems in children, especially infants, is gastroesophageal reflux (GER).

**Objectives:** This study was performed to compare the diagnostic value of lower esophageal sonography with that of barium swallow.

**Patients and method:** Our trial was a triple-blind, performed on 50 patients of 1 month to 15 years of age. The patients suspicious of having GER were evaluated by sonography and barium swallow. Esophageal pH monitoring was the standard test, and both the ultrasound and barium swallow were compared to it.

**Results:** The results showed that sonography was 90% sensitive, vs. 50% for barium swallow. Both tests had the same specificity equal to 35%.

**Conclusion:** We concluded that sonography was a better test than barium swallows, for evaluation of suspected patients with GER, and screening of the infants.

**Keywords:** Sonography, barium swallow, pH monitoring, gastro-esophageal reflux

### Introduction

Most infants experience mild gastroesophageal reflux (GER) or regurgitation but 1 in 300 have moderate to severe reflux or related complications.<sup>1</sup> In general, when the lower esophageal sphincter functions improperly, reflux from stomach to esophagus occurs and therefore the following complications could ensue: apnea, stridor, cough, sinusitis, otitis media, aspiration pneumonia, asthma, malnutrition, esophagitis, and failure to thrive.<sup>2</sup> Therefore, early diagnosis and treatment of GER could reduce the possible complications due to GER. So, a diagnostic screening test is essential.

There are different diagnostic tests for GER, including barium study, scintigraphy, esophageal endoscopy, and pH monitoring (pHm).<sup>3</sup> Currently, the most accurate method for GER detection is pH monitoring, but as it is not available everywhere and is too expensive, it is not the first choice diagnostic method. Barium study (BS), the modality of choice for GER diagnosis nowadays, has many side effects; including aspiration pneumonitis and radiation exposure, and also it has 30% false positive and 14% false negative results. Considering noninvasiveness, safety, availability, and cost-effectiveness of the lower esophageal sonography (US), our goal is to introduce it as an alternative for barium study. Although, recent studies have approved the high sensitivity, and specificity of sonography<sup>4,5</sup>, none of them has compared all the three diagnostic methods at the same time.<sup>6</sup>

In other countries, there are several studies about GER, its different imaging modalities, and their respective values.<sup>5-11</sup> Most of them agree that sonography has a high sensitivity in determining GER. In Iran, however, there were no such studies before the current one.

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Moreover, all of those studies in other countries have compared just two methods, but in our study we compared barium swallow and ultrasound with pH monitoring in our patients. To our knowledge and according to the literature, there are no other reports on GER imaging modalities in a triple-blind study.

**Patients and Method:**

This study was performed in the year 2003, in Tehran Children Medical Centre on 50 patients between one month and 15 years of age. After a complete history of the problem and careful clinical examination, if the signs and symptoms were compatible with GER, the patients were included in the study and sonography, barium study, and pH monitoring were performed on them.

Our suggested method is the lower esophageal sonography with 3.5 MHz and 7.5 MHz probes. First the patients were fed with water or milk and then positioned supine or at right lateral decubitus, and probe was placed on their xiphoid. If GER was present, the passage of fluid column through this area would be seen as echogenic spots (Figure 1). So, the findings of all 3 tests were analyzed with the Chi-square and Fisher's exact test, and the level of significance was set a p value of less than 0.05.

**Results**

In our study 64% of the patients were boys and 36% were girls.

On comparing pH monitoring with sonography, in children who were shown to have GER by pH monitoring, the sonography was 90% positive and 10% negative. In negative pH metric results for GER, the sonography was 65% positive (P=0.004).(Table 1)

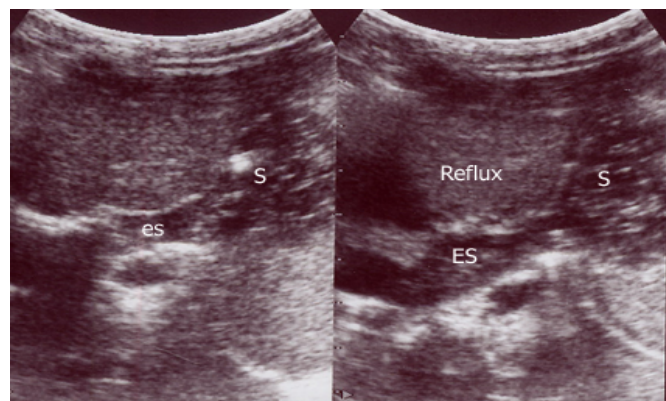


Figure 1: Reflux in sonography, ES=esophagus, S=stomach

Table 1: Sonographic results versus pH monitoring as the standard test in GER.

US \ pHm	Positive pHm		Negative pHm		Total	
	No. cases	%	No. cases	%	No. cases	%
Positive	27	90	13	65	40	80
Negative	3	10	7	35	10	20
Total	30	100	20	100	50	100

US = Ultrasonography pHm=pH monitoring

Table 2 : Barium swallow results versus pH monitoring as standard exam in GER.

BS \ pHm	Positive pHm		Negative pHm		Total	
	No. cases	%	No. cases	%	No. cases	%
Positive	15	50	13	70	28	56
Negative	15	50	7	30	22	44
Total	30	100	20	100	50	100

BS = .Barium swallow

On comparing barium study with pH monitoring, the barium study was positive only in 50% of positive pH metric results and 70% negative in all the negative results by pH monitoring. (P=0.020).(Table2)

On comparing all the 3 methods, the sonography and barium study were 100% positive in children with positive pH metric results. Also, in 80% of cases the sonography was positive but barium study was negative, and only in 20% of cases both were negative (P=0.023). (Table 3a)

In negative pH metric results, 61.5% of cases showed positive on both the sonography and barium study. The remaining 38.5% of cases, were negative on sonography but positive on barium study. 71.5% of cases were positive with sonography but negative with barium study. And finally 28.6% of cases were negative in both.(Table 3b)

False positive results for sonography and barium study were 26%, and false negative results for barium study were 30% versus 6% for sonography. Also true positive cases for sonography were 54% while for barium study they were 30%. True negatives for both tests were 14%.

The sensitivity of sonography estimated to be 90%, and its specificity was 35%, versus 50% and 35%, respectively for sensitivity and specificity of barium study. Also, the positive predictive value (PPV) of sonography was 67% and its negative predictive value (NPV) was 70%. These values for barium study were 53% PPV and 31% NPV.(Table 4)

**Table 3a:** Barium swallow results versus sonography in cases with positive pHm

US \ BS	Positive BS		Negative BS		Total	
	No. cases	%	No. cases	%	No. cases	%
Positive	15	100	12	80	27	90
Negative	0	0	3	20	3	10
Total	15	100	15	100	30	100

US = Ultrasonography pHm=pH monitoring

**Table 3b:** Barium swallow results versus sonography in cases with negative pHm.

US \ BS	Positive BS		Negative BS		Total	
	No. cases	%	No. cases	%	No. cases	%
Positive	8	61.5	5	71.4	13	65
Negative	5	38.5	2	28.6	7	35
Total	13	100	7	100	20	100

BS = .Barium swallow

**Table 4:** Comparison of Sonography and Barium Swallow

	US	BS
<b>Sensitivity</b>	<b>90%</b>	<b>50%</b>
<b>Specificity</b>	<b>35%</b>	<b>35%</b>
<b>Positive predictive value</b>	<b>67%</b>	<b>53%</b>
<b>Negative predictive value</b>	<b>70%</b>	<b>31%</b>

## Discussion

In this study we found that the sensitivity of sonography was higher than that of barium study in the diagnosis of GER. Also, in under-15 population (with a 0.33% prevalence of GER) PPV and NPV of sonography were higher. These findings were compatible with those of the previous studies.

False positive cases in both tests were equal, which we believe was due to the similarity of maneuvers in both tests. In addition, both sonography and barium study are incapable of distinguishing pathologic from physiologic GER. The structural esophageal anomalies can be better seen in barium swallow study. Of course after confirmation of the diagnosis and a therapeutic course for GER, the final decision making about the case will be possible.

Because ultrasound is a non-invasive, cost-effective, and safe method of diagnosis for GER in comparison with barium study; and as it has a higher sensitivity and is convenient for patients' follow-up, from now on we recommend the sonography as the first line modality for diagnosis, screening, and follow up of the GER patients under 15 years of age instead of barium study.

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