

DOPPLER ULTRASONOGRAPHY IN THE EVALUATION OF GASTROESOPHAGEAL REFLUX

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ABSTRACT

Gastroesophageal reflux (GERD) is the involuntary passage of gastric contents into the lumen of the esophagus. It is a common condition in infants and young children, and is often considered physiological; however, it can determine clinical manifestations and lead to gastroesophageal reflux disease. The general objective of this study was to analyze the role of ultrasonography in the diagnosis and follow-up of gastroesophageal reflux. The methodology used in this work was a literature review. The methodology used was a bibliographic review of articles published in Spanish, English and Portuguese in the last 20 years, the database was PubMed, SciElo, Bireme, Lilacs. What can be concluded is that the ultrasonography in the evaluation of gastroesophageal reflux is a non-invasive, fast, affordable and cheap exam.

KEYWORDS: GASTROESOPHAGEAL REFLUX, ULTRASONOGRAPHY, DIAGNOSTIC IMAGING

INTRODUCTION

Gastroesophageal reflux (GER) is the condition that most attacks the esophagus and one of the most common complaints in medical facilities¹.

The expression symptomatic gastroesophageal reflux disease refers to those patients who present with peptic signs (heartburn and regurgitation), with or without endoscopic evidence of esophagitis. The most complex patients to understand are those who exhibit extensive symptoms with no evidence of tissue damage to the esophagus (nonerosive gastroesophageal reflux disease)².

The number of hospitalizations associated with gastroesophageal reflux disease (GERD) in the United States increased from 710,000 to 3,100,000 from 2002 to 2004. An episode of GER occurs when the lower esophageal sphincter (LES)

opens spontaneously and gastric content affects the esophagus³.

GERD is one of the most common disorders in medical practice. North American data indicate that heartburn, the most prevalent symptom of the disorder, occurs at least once a week in 20% of the studied population. Similar data has been reported in England and Scotland. In Brazil, a population-based study showed a prevalence of at least 12% in the general population⁴.

It is one of the most common conditions affecting the gastrointestinal tract and is generally considered to be the cause of a variety of esophageal symptoms. In an individual suffering from GERD, symptoms such as heartburn or a burning sensation in the chest can be present. Untreated GERD can lead to other consequences such as Barrett's esophagus, which has been considered a precursor to esophageal cancer⁵.

GERD has a multifactorial etiology where both the tissue damage and symptoms result from the contact of the mucosa with the refluxed content. Such contact is due to the failure of the esophageal defenses. The anti-reflux barrier, considered to be the main protection against gastroesophageal reflux, is formed by the internal sphincter (or lower esophageal sphincter) and external sphincter (formed by the crural portion of the diaphragm). The main mechanism of this failure is the transitional relaxation of the lower esophageal sphincter, unrelated to swallowing, being responsible for about 70% of GERD episodes⁶.

The diagnosis of GER should start by identifying the complete clinical history of the patient. The diagnostic approach should vary depending on the clinical presentation. The clinical manifestations of GER are variable and refer not only to the digestive tract. Therefore, the differential diagnosis is wide, covering clinical and surgical causes of vomiting and regurgitation, causes of bronchospasm and atypical



symptoms, such as asthma, otitis, laryngitis and sinusitis. Another significant factor is the patient's age, as the diseases vary according to age⁷.

Gastroesophageal reflux disease can be diagnosed by its subjective clinical manifestations. Heartburn (or pyrosis), regurgitation and dysphagia represent the common symptoms of GERD. Endoscopy is indicated in patients in whom the common clinical treatment is not efficient and presents symptoms of GERD, dysphagia, odynophagia, microscopic or macroscopic gastrointestinal bleeding or in patients with detected iron deficiency anemia⁶.

Considering the non-invasive and non-oncogenic characteristic of the transabdominal ultrasonography (US), this method can eliminate the main disadvantages of upper digestive endoscopy. Several studies have suggested the utility of transabdominal US in detecting GERD in pediatric patients. However, there seems to be few studies that investigate the utility of US in detecting esophagitis induced by GERD in the adult population⁶.

Recently, Savino et al.⁸ published an article on US for the diagnosis of pediatric GERD. The authors analyzed other causes of symptoms, such as vomiting, other than GERD; and measured the length of the abdominal esophagus, the diameter of the esophagus, the thickness of the esophageal wall and the angle of Hiss to obtain anatomical and functional data. The authors also highlighted the need to define diagnostic criteria, to standardize the exams and the referred measures. The traditional analysis for the study of GERD is the seriography of esophagus, stomach and duodenum (SESD) with barium and, more recently, the intraabdominal esophagus ultrasonography (IEUS) - figure 1.

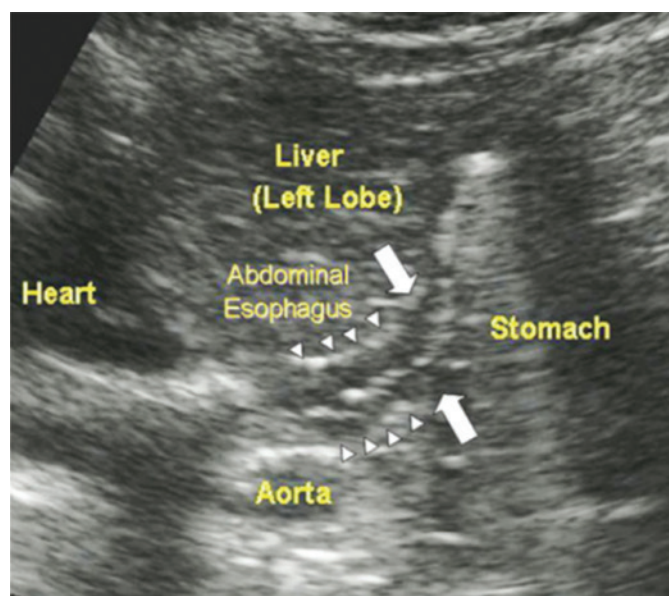


Figure 1. Transverse oblique ultrasound of the gastroesophageal junction (arrows). The esophagus seen as a tubular structure (arrowheads) with a hypoechoic wall (muscular layer) and a hyperechoic center (mucosa and lumen)⁸.

Nowadays, there are several methods that allow the analysis of esophageal disorders, such as X-rays contrasted with fluoroscopy, scintigraphy, manometry, upper digestive endoscopy and prolonged esophageal pH monitoring (24 hours). However, simple, quick, inexpensive and non-invasive tests that do not use ionizing radiation are essential. The transabdominal US used to analyze the intra-abdominal esophagus, within this context, represents a good resource and incorporates immediate advantages, such as distinguishing itself as an initial study, better directing complementary tests, and permitting appreciation of the effect of treatment in individuals with dysphagia⁹.

IEUS provides, in a similar way to SESD, the possibility to classify structural anatomical details, and can verify several pathological methods, even GER, in real time. It is a non-invasive safe method and does not use ionizing radiation¹⁰.

With this in mind, this article aimed to describe the role of the ultrasound in the diagnosis and monitoring of gastroesophageal reflux.

METHODOLOGY

This is a literature review study. After defining the theme, a search for scientific articles was carried out in the following scientific databases: Pubmed, Scielo, Lilacs and Bireme.

The search was carried out using the following keywords: gastroesophageal reflux / gastroesophagealreflux, ultrasonography / ultrasonography, gastroesophageal reflux / diagnostic imaging / gastroesophagealreflux / diagnosticimaging.

This research included: articles published in Spanish, English and Portuguese in the last 20 years. Review articles, systematic or not, and those that used animal models were excluded from this research.

RESULTS

Gastroesophageal reflux concept - GER The term symptomatic gastroesophageal reflux disease refers to those patients who present peptic symptoms (pyrosis and regurgitation), with or without endoscopic evidence of esophagitis. The most difficult patients to understand are those with great symptomatology, but with no evidence of esophageal tissue damage (non-erosive gastroesophageal reflux disease) and also those with symptoms considered extradigestive manifestations with minimal changes in esophageal motility¹¹. Gastroesophageal reflux (GER) refers to the involuntary passage of gastric contents into the esophagus.

In children, it often represents a physiological phenomenon, especially in children with innocent regurgitation. On the other hand, GER disease (GERD) occurs when reflux of gastric contents causes uncomfortable symptoms and/or complications. It is one of the most common causes of bowel symptoms in all pediatric patients age groups¹².

Although the pathophysiology and symptoms of pediatric GERD, especially in older children, are similar to those in adults, children may present with a difference between gastroesophageal and extra esophageal symptoms and pos-

sible complications¹³.

Gastroesophageal reflux disease (GERD) is the most common esophageal disorder in infants and children, causing intermittent regurgitation or vomiting. Although it is a physiological event in most adults and children, it becomes pathological when the intensity and/or frequency increases¹⁴.

The retrograde movement of gastric contents into the esophagus is called gastroesophageal reflux (GER). This clinical condition, resulting from the immaturity of the natural anti-reflux defense mechanisms, is common in infants, being self-limited and free of complications. When accompanied by clinical repercussions such as anemia, gastrointestinal bleeding, difficulty in gaining weight or weight loss, respiratory and otorhinolaryngological manifestations, developmental delay, among others, it is characterized as gastroesophageal reflux disease (GERD)¹⁵.

Reflux of gastric content can occur to a greater or lesser degree and with variable frequency. In most cases it is transitory, in small volume and with no particular consequences. However, if it is persistent, pathological reflux is configured¹⁶.

EPIDEMIOLOGY

GER is certainly one of the main gastroenterological conditions among children. Despite being common in males, the difference between the sexes has no statistical significance. A recent study involving a sample of 1,447 mothers in the United States, using the criteria defined by the Roma III Consensus, showed a prevalence of regurgitation among infants of 26%. It is also estimated that regurgitations occur more than once a day in 41 to 67% of healthy infants aged four months. Fortunately, only the minority of these regurgitating children will need some clinical investigation and/or therapeutic intervention¹⁷.

Another alarming association was proposed by a recent epidemiological study that suggests that the occurrence of GERD, in preterm newborns or small for gestational age, may be the responsible factor for the higher frequency of esophageal adenocarcinoma in adults that were born prematurely¹⁸.

The prevalence rates of GERD, characterized by the presence of symptoms of pyrosis and acid regurgitation, are quite variable, but, especially in western countries, they are almost always high. In Spain, a cross-sectional study published in 2004, identified a prevalence of 31.6% of GERD per year. In Belgium, it is also high, having been 28% in 2002. In a study conducted in Australia in 1996, 56% of individuals reported having had GERD symptoms at least once in their lifetimes, with 37% having them at least once every four months. In Denmark, in 1994, the prevalence was 38% among men and 30% among women. In Brazil, in 2001 it was 48.2%. In a review study published in 1997, the variation in prevalence ranges from 10% to 48% for pyrosis, 9% to 45% for acid regurgitation and 21% to 59% for both symptoms¹⁹.

The prevalence of gastroesophageal reflux disease (GERD) is increasing in Japan, as well as in Western countries, which may be related to westernization and diet, increased age, decreased prevalence of *Helicobacter pylori* infection, and so on. GERD affects the activities of daily living and reduces the patient's quality of life, so that the diagnosis and management of this condition are clinically crucial²⁰.

Diagnostic tests: Doppler ultrasonography. The diagnosis of GER needs to start with the elaboration of the complete clinical history. The diagnostic focus of GERD should change according to the clinical presentation. Diagnostic tests are useful to document pathological reflux or its difficulties, to constitute a causal relationship between reflux and symptoms, to analyze therapy and to exclude other pathological species. As no test ponders all these questions, they must be carefully chosen according to the history obtained and their limitations must be recognized⁷.

Gastroesophageal reflux (GER) is a common condition in early childhood, characterized by the retrograde flow of gastric content into the esophagus. Due to potentially serious sequelae, early diagnosis and treatment in these patients is extremely important. Although continuous pH monitoring, scintigraphy and contrast tests of the upper gastrointestinal tract have been the primary methods for assessing GER, ultrasound has also been used to diagnose this condition, especially in children and term babies. The sensitivity and specificity of ultrasound in the diagnosis of reflux in children are around 95 and 60%, respectively, and it has recently been shown that sensitivity can be increased by the use of color Doppler imaging. Several studies have compared pH monitoring with ultrasound exams in the diagnosis of GERD in children, giving different results²¹.

A study by Manabe et al.²² speculated that impaired salivary flow contributes to abnormal acid clearance in patients with erosive esophagitis (EE). For an easy and objective assessment of salivary function, we have developed a technique for measuring blood flow in the salivary glands using continuous wave Doppler sonography. In the present study, we assessed salivary secretory function in patients with EE and those with non-erosive reflux disease (NERD) using this method. An analysis of the Doppler waveform was performed in the facial artery to assess blood flow to the submandibular gland of 30 healthy subjects (HS). Blood flow was compared before and after secretory stimulation with 1 ml of lemon juice. Saliva was simultaneously collected and weighed before and after stimulation. Continuous wave Doppler sonography was also performed in patients with EE and NERD. The size of the submandibular gland was compared in 26 patients with EE, 41 patients with NERD and 86 in the control group. The blood flow of the submandibular gland increased after stimulation in all HS. Both the reproducibility in the day as in the day to day was good. There was a significant correlation between the percentage increase in maximum speed and the percentage increase in salivary secretion. Although the size of the sub-

mandibular gland was not significantly different between the three groups, the percentage increase in maximum speed in patients with EE was significantly less than in HS. What this study revealed is that a decrease in salivary secretory function is involved in the pathology of EE. Manabe et al.²², developed a new method to measure the blood flow of the submandibular gland by cephalometric Doppler sonography to assess salivary secretion. Using this method, we demonstrated that patients with EE had significantly less reactivity to salivary secretion after stimulation than HS.

Sakuno²³, in a dissertation presented to the Federal University of Santa Catarina, 76 compared US with SESD. They examined 102 children with clinical suspicion of GERD using SESD, US and US with Doppler. US proved to be more sensitive than SESD in detecting GERD (83.3% of US against 62.7% of SESD), with a high negative predictive value, close to 100% and the addition of Doppler to US did not having increased its sensitivity. Riccabona et al.²⁴ comparing US with pH metry found 100% sensitivity of 87.5% specificity, however its population was exclusively newborns and infants. Jang et al.²⁵ using US with Doppler also found a sensitivity of 95.5%, but a low specificity of 11.0% when compared to pH metry (figure 2).

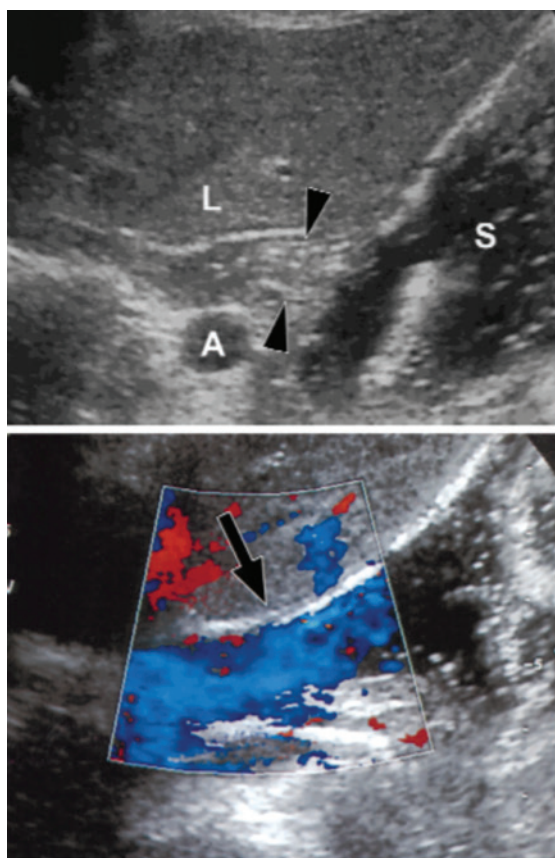


Figure 2. A - Longitudinal oblique ultrasound of the epigastrum shows the gastroesophageal joint (arrowheads). B - The blue color in the Doppler study illustrates a reflux episode (arrow) in the gastroesophageal junction. A = aorta, S = stomach, L = liver²⁵.

A comparison analysis of some articles that talk about sensitivity and specificity was carried out, as shown in the table below:

Autor	Sensibilidade	Especificidade
Pezzati et al., 2005	38%	100%
Sakuno T, 2002	87,5%	97,4%
Riccabona et al., 1992	100%	87,5% p <0,001.

A study by Pezzati et al.²¹ (2005), showed that ultrasonography has low sensitivity in the detection of GER in premature infants and should not replace the 24-hour esophageal pH test as a definitive diagnostic tool. However, ultrasonography has a very high specificity and a 100% positive predictive value. In a study by Sakuno²³ ultrasonography was able to diagnose gastroesophageal reflux, its number and duration, adequately assessing the anatomy of the esophagogastric junction and accurately determining the length of the intra-abdominal esophagus and the angle of His. When compared to duodenal esophagogastric seriography, it has greater sensitivity and a high negative predictive value. Another study by Riccabona et al.²⁴ (1992), compared the ultrasound to pH metry and/or esophageal manometry to assess ultrasound accuracy in the early diagnosis of gastroesophageal reflux. Thirty children with an average age of 72 days (21-252 days) were studied. The results showed that the specificity of the ultrasound diagnosis was 87.5% and the sensitivity was 100% (with P <0.001). Ultrasonography has proven to be useful in providing both functional and morphological data, in addition to metric pH results.

CONSIDERATIONS

Doppler ultrasonography can be used as the procedure of choice in the investigation and control of GERD.

It is able to diagnose gastroesophageal reflux, its number and duration, adequately assess the anatomy of the esophagogastric junction and accurately determine the length of the intra-abdominal esophagus and the angle of Hiss.

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