Review Article

Sonographic Diagnosis of Infantile Hypertrophic Pyloric stenosis- Use of Simultaneous Grey-scale & Colour Doppler Examination

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Abstract

Objective: To evaluate the accuracy of Ultrasound in the diagnosis of Infantile Hypertrophic Pyloric stenosis, especially with simultaneous use of grey-scale & colour doppler examination of pylorus.

Methods: Fifty two infants with suspected Infantile Hypertrophic Pyloric stenosis (IHPS) were evaluated with grey-scale and colour Doppler examination. The sonographic findings were categorized as positive IHPS, negative IHPS and equivocal cases. Positive songraphic findings in 21 infants (40%) were confirmed at surgery. Negative sonographic findings in 27 infants (52%) were followed by ward chart reviews.

Results: Sensitivity, Specificity and Accuracy of grey-scale & colour doppler examination for the diagnosis of IHPS were 100%.

Conclusion: Sonography is the method of choice for the diagnosis of IHPS. Simultaneous grey-scale and colour Doppler examination of pylorus for suspected IHPS is more accurate than simple grey-scale sonography.

Key words: Grey-scale Sonography, Colour Doppler examination, Infantile Hypertrophic Pyloric stenosis, experienced radiologists.

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Introduction

Infantile Hypertrophic Pyloric Stenosis is a common problem affecting neonates and young infants [1]. Its etiology is still unclear [2]. This condition is characterized by hypertrophy of the antral wall muscle and mucosa, resulting in gastric outlet obstruction [3]. Clinically such infants present with non-bilious vomiting, often projectile [4]. Demonstration of 'olive' in the upper abdomen due to thickened pylorus is accurate for the clinical diagnosis of majority of IHPS but is not always possible [5]. Delay in diagnosis can lead to continuous vomiting, dehydration, electrolyte imbalance and death. Therefore, prompt and accurate diagnosis is mandatory for the early surgery which is curative in almost 100% cases [6].

Current imaging techniques, particularly sonography is safe, accurate and gives quick diagnosis of IHPS [7]. Therefore, radiologists play a key role in the initial care of these infants and the appropriate disposal of infants for the surgery [8].

Methods

This study was conducted between January 1999 to June 2002 at Zia-ud-din Medical University Hospital, a tertiary referral and teaching hospital. Fifty two infants between 08-90 days (mean age 49 days), 32 boys and 20 girls with history of non-bilious vomiting after feed were referred to department of Radiology and imaging for the sonographic diagnosis of clinically suspected IHPS. The infants were examined by Toshiba using high frequency linear transducer of 7 MHZ frequency. All examinations were performed by the author himself. The infants were placed in supine position. Examination was started in the epigastric region and the transducer was moved gently caudally till pylorus was identified between the distended stomach on left side and duodenum & gallbladder on right side [9]. In difficult cases, gravity dependent maneuvers by positioning the infant in oblique positions and bottle feeding were proved helpful in many cases [10].

The pylorus was sonographically examined for the pylorus muscle wall thickness, length of pyloric canal, pylorus diameter and the vascularity of the thickened pylorus muscle & the pylorus mucosa. All the measurements were taken three times and then averaged for more accuracy. The sonographic findings were categorized as Positive IHPS, Negative IHPS and equivocal IHPS. Follow up ultrasound was performed in doubtful cases within 24 hours.

Results

The sonographic findings were positive in surgically proven 21 cases (40%) 17 boys and 4 girls (4:1). The sonographic findings were negative for IHPS in 27 (52%) infants and alternative diagnoses were made clinically and by other means. Only 4 (8%) cases gave equivocal findings on initial sonographic examination however, subsequent sonographic examination within 24 hours in these 4 cases were unremarkable. All the infants with negative sonographic IHPS were improved by conservative treatment and discharged symptom free for alternative diagnosis. Tables 1 – 3 summarize the sonographic findings for positive and negative IHPS.

Discussion

The sonographic criteria for positive IHPS were pyloric muscle wall thickness > 3 mm, pyloric canal length 14-20 mm, pylorus diameter > 12 mm and vascularity of the pylorus mucosa nd

muscles. The sonographic criteria for negative IHPS were pyloric muscle wall thickness < 3 mm, pyloric canal length <14 mm, pylorus diameter < 12 mm and absent or minimal vascularity of the pylorus mucosa nd muscles. The sonographic finding of pylorus muscle wall thickness between 2-3 mm was considered equivocal cases.

The pylorus muscle wall thickness was considered the fixed criterion for the diagnosis of IHPS. It appears as hypoechoic in all positive cases (fig.1). The pylorus diameter appears as target sign in transverse plane (fig.2) and was easily detected in the positive cases. The pyloric canal length appears more variable and appears as cervix sign (fig.3). presence of vascularity in the mucosa & muscle of pylorus was considered positive for IHPS (fig.4) and absence or minimal vascularity in the pylorus was considered negative for the IHPS. The detection of vascularity in the thickened mucosa and pyloric muscles on simultaneous Colour Doppler examination has not been studied so far and appears the new helpful sign for the diagnosis of IHPS, excluding false positive diagnosis by sonography. All the sonographic parameters may be variable according to the patient's age, calmness of infant, sonographic technique and radiologist's experience.

The sonographic parameters of muscle wall thickness, length pf pyloric canal and pylorus diameter are the same as considered in many previous study like the most popular study conducted by Hernanz-Schlman, Chen E et all, Teele RL et all, Blumhagen JD and O'Keefee FN et all [11-15]. However, simultaneous Doppler examination of the pylorus for the vascularity of mucosa and muscle of pylorus is so far not evaluated previous to this study in authors opinion and appears to be more promising sign for the diagnosis of IHPS, excluding the false positive diagnosis by only grey-scale sonography.

The sonographic parameter of pylorus muscle wall thickness of > 3 mm was considered cut off for IHPS in this study as well as by Yip WC et all [16]. However, Bulmhagen JD [14] and some other studies considered > 4 mm wall thickness for positive IHPS. The explanation for the higher value is most likely increasing age of the infant in their studies and relatively younger age of patient in this study.

The sonographic parameter of pylorus diameter of 12 mm used in this study is similar to Yip WC et all [16]. Slightly lower values of 10 mm were used in Lund Kofoed PE study [17] and slightly higher value of > 15 mm considered in Zoder G study [18]. The variability of this parameter is most likely depends upon the mucosal thickening of pylorus. However, in this study this parameter is average of lower and higher values of most studies.

The sonographic parameter of pyloric length of 14-20 mm is variable in this study as well as in study conducted by Haider N et all [19]. However, higher values of 22 mm were considered for positive IHPS by Keller H study [20]. This variability in pylorus canal length depends upon the sonographic technique and infant's position during sonography.

The most exciting parameter was vascularity of the mucosa and pyloric muscle, not studied before and seems to be more promising. Normal pylorus on doppler scanning reveal no vascular flow or minimal flow in some infants. However, presence of moderate to severe degree flow on color doppler of the pylorus was considered a significant parameter for the diagnosis of IHPS.

In addition to the above mentioned sonographic criterias, there are few other sonographic parameters like measurements of pylorus volume and pylorus muscle index. These were used by Westra SJ et all and Rohrschneider WK et all [21-22]. These criteria appear more complex to measure and aids little further for the diagnosis of IHPS. The criterias used in this study were used by many and appears most appropriate, simple and accurate for the diagnosis of IHPS.

The major limitation of this study is the use of sonographic criteria which is operator – dependent. Therefore, application of sonographic parameters is excellent in experienced radiologists and may prove worse in inexperienced sonographers.

Conclusion

Sonography is safe, non-invasive and fast for the diagnosis of IHPS. It is almost 100% sensitive and accurate for the diagnosis of IHPS in safe hands. Simultaneous grey-scale and colour Doppler examination of the pylorus gives more accuracy for the diagnosis of IHPS. Therefore, use of colour doppler examination with grey-scale sonography is recommended for the more accurate diagnosis of IHPS.

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Table-1: Infants for sonography

Total infants examined by sonography	Positive IHPS on sonography	Negative IHPS on sonography	Equivocal IHPS on sonography
52	21 (40%)	27 (52%)	4 (8%)

Table-2: Sonographic Positive IHPS

Pylorus muscle wall thickness	Pylorus diameter (target sign)	Pyloric canal length (Cervix sign)	Color Doppler of Pylorus
> 3 mm	> 12 mm	14-20 mm (mean = 17 mm)	Positive Flow in the Mucosa & Muscle of pylorus

Table-3: Sonographic Negative IHPS

Pylorus muscle wall thickness	Pylorus diameter (target sign)	Colour Doppler examination
< 3 mm	< 12 mm	Absent or Minimal Vascular flow

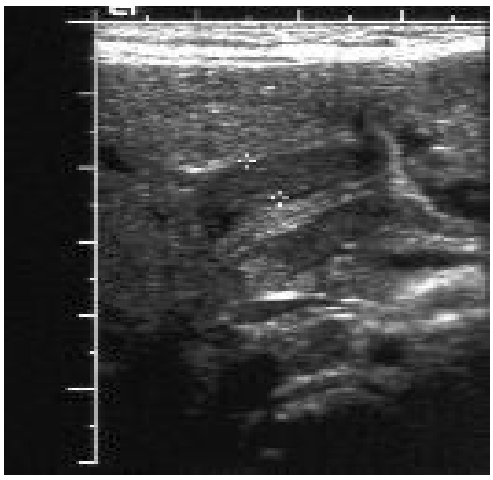

Fig. 1. Sonographic measurement of pylorus muscle wall thickness.

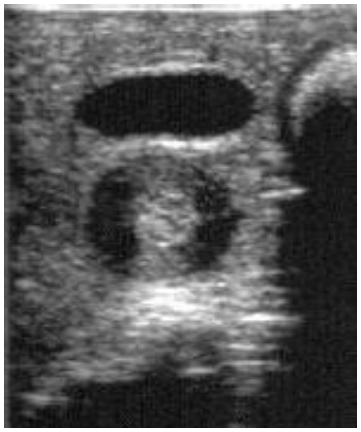

Fig. 2. Pylorus in transverse pIane in IHPS, giving target sign appearance.

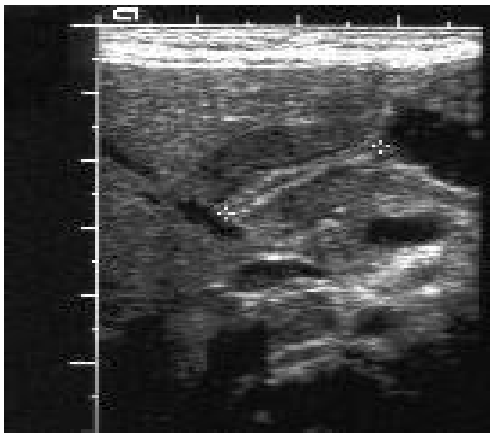

Fig. 3. Sonographic measurement of pylorus canal length (Cervix sign in IHPS).

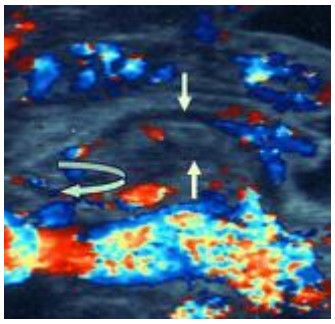

Fig. 4. Colour Doppler Examination of the pylorus showing vascularity in the mucosa s& pyloric muscle.