SONOGRAPHIC ASSESSMENT OF INFANTILE HYPERTROPHIC PYLORIC STENOSIS WITHOUT CLINICALLY PALPABLE PYLORIC LUMP

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ABSTRACT

Objective: To evaluate the role of ultrasound in the diagnosis of patients with suspected Infantile Hypertrophic Pyloric Stenosis (IHPS) who do not have a clinically palpable 'pyloric lump' or olive by taking surgery and follow-up as gold standard.

Study design: Validation study.

Setting: Radiology department at National Institute of Child Health (NICH), Karachi from January 2008 to March 2010.

Methods: Appropriate technical and ethical approval for the study was obtained. Twenty eight consecutive patients (22 males and 6 females) with clinical suspicion of IHPS without a definite palpable 'pyloric lump' referred to radiology department of National Institute of Child Health (NICH) were included in the study. All patients underwent ultrasonography by an experienced consultant radiologist. Patients were categorized as having or not having IHPS. The results were compared with follow up at surgery for those declared as having IHPS on ultrasound and clinical follow up for those not having IHPS on ultrasound. Sensitivity, specificity, negative predictive value (NPV) and positive predictive value (PPV) of ultrasound were calculated.

Results: Twenty four patients were diagnosed with IHPS. Four were diagnosed as not having IHPS. Out of these 4 patients 1 was subjected to barium meal examination. Patients were followed up to confirm the ultrasound findings or otherwise. Ultrasonography yielded a sensitivity of 96% and specificity of 100% in diagnosing IHPS in patients without a palpable 'pyloric lump' or 'olive'. The positive predictive value of ultrasonography in these patients was 1.00 and the negative predictive value was 0.75.

Conclusion: Ultrasonography should be the initial investigation in patients with clinical suspicion of IHPS and an impalpable pyloric lump to improve early diagnosis in these babies.

Keywords: palpable olive, pyloric stenosis, Ultrasound

INRODUCTION

Infantile Hypertrophic Pyloric Stenosis (IHPS) is a common condition of unknown etiology affecting infants[1]. It is the most common surgical cause of vomiting and also the commonest indication for abdominal surgery in infants[2]. IHPS has an overall incidence of 4 per 1000 live births but its incidence varies in different parts of the world[3]. Male to female ratio is 4:1[3]. Surgery remains the only curative treatment for this condition. IHPS should be suspected in any infant with severe non bilious vomiting. On examination, palpation of the abdomen may reveal a mass in the epigastrium. This mass, which consists of the thickened and elongated pylorus, is referred to as the 'olive' or 'pyloric lump' and is sometimes evident after feeding. It is an elusive diagnostic skill requiring much patience and experience. There are often palpable (or even visible) peristaltic waves due to the stomach trying to force its contents past the narrowed pyloric outlet. In the past the pyloric olive, was said to be felt by surgeons in up to 80% of patients. Review of the more recent literature indicates that the olive currently is felt much less frequently[4,5]. In a study by Macdessi and Oates[4], palpation was successful in 87% of infants between 1974 and 1977 but in only 49% between 1988 and 1991. Although the presence of an ovoid olive shaped mass in the right upper quadrant area close to the epigastrium is a very important sign and conclusive enough to proceed with further care its absence creates a diagnostic enigma resulting in delayed diagnosis which can lead to emaciation and electrolyte imbalance, making the patient a

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suboptimal surgical candidate. Delay in diagnosis can lead to increased surgical and anesthetic complications or even death[6]. This highlights the role of radiology in rapid and accurate diagnosis of this condition.

Many imaging techniques are being employed for this purpose like ultrasound, upper gastrointestinal contrast study and radionuclide imaging. However ultrasound remains the modality of choice due to absence of radiation exposure, safety, easy availability with high sensitivity and specificity in diagnosing IHPS[7,8]. Ultrasonographic images are obtained using standard protocols and pyloric canal length pyloric canal wall thickness, Ultrasonographic 'Cervix sign' (fig.1) and the 'Target sign' (fig 2) are helpful in obtaining a diagnosis. Water contrast may be employed to improve Ultrasonographic diagnosis (fig.3).

The use of ultrasound has become increasingly popular since it was first reported in 1977[9,10] and later on standardized by pioneers in this field[11]. The ultimate criterion for ultrasound diagnosis was laid down by Grubner et al.[12].

Data regarding our part of world and Pakistan in particular is limited. The purpose of this study was to evaluate the validity of ultrasound in the assessment of infantile pyloric stenosis without clinically palpable lump in our population and comparison with surgery and clinical follow-up.

PATIENTS AND METHODS

This validation study of patients with clinical features suggestive of Infantile Hypertrophic Pyloric Stenosis (IHPS) was carried out from January 2008 to March 2010 simultaneously at three major hospitals in Karachi namely National Institute of Child Health (NICH), Jinnah Postgraduate Medical Centre (JPMC) and PNS Shifa hospital. Approval of technical and ethics review committees of all involved institutes was obtained. Patients with clinical suspicion of IHPS without a definite palpable 'pyloric lump' were referred from surgical and pediatric OPDs and casualty departments of NICH, JPMC and PNS Shifa hospital Karachi to the Department of Radiology at National Institute of Child Health.

Ultrasound examination was carried out by a single experienced consultant radiologist. The infants were imaged in the supine position supported with pillows and consoled with a pacifier dipped in honey, but feeding generally was not employed as part of the examination. Images oriented along the long axis of the gastric outlet and carefully aligned through the center of the lumen were obtained with a 7.5 MHz transducer as sector, linear or curvilinear probes. In one instance patient was subjected to barium meal examination to further evaluate the condition. The ultrasonographic criteria for diagnosis were pyloric canal length of 14 mm or more and pyloric canal muscle wall thickness of 4 mm or more.

The clinical and ultrasonographic findings were discussed with the attending surgeon or physician. All the babies who underwent surgical exploration based on ultrasonographic diagnosis were followed up at surgery to confirm the ultrasonographic findings. The rest of the patients were also followed up till resolution of symptoms or confirmation of an alternate diagnosis to confirm these as true negative cases. Data was analyzed using SPSS version 15. Descriptive statistics were used to describe the data. Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) and accuracy were calculated for ultrasound in diagnosing IHP by keeping surgery and clinical follow-up as gold standard.

RESULTS

A total of 28 patients were included. They were 22 (78.6%) male and 6 (21.4%) female babies (Male to Female ratio 3.6:1). The age ranged from 25-90 days with mean of 48.5 days (table 1). Clinical presentation included non bilious vomiting (100%), constipation (100%) and varying degrees of dehydration (100%).

Twenty four patients were diagnosed with IHPS based on ultrasonographic examination criteria mentioned above. One patient was subjected to barium meal examination because

of equivocal ultrasonographic findings and strong clinical suspicion. This patient met one criterion for diagnosis i.e. the pyloric muscle wall thickness of greater than 4mm but did not meet the other criteria of pyloric canal length of 14 mm or more. Barium meal examination confirmed this patient as having IHPS. Three patients were diagnosed as not having IHPS and were referred back to the attending surgeon or physician to work up an alternate diagnosis.

In all the cases diagnosed with IHPS the pyloric muscle thickness was more than normal with a mean of 5.1mm (range 4-7 mm). The mean pyloric canal length was 17.4 mm (range 14-30 mm) (table 2). The patient which was equivocal (and classified as false negative) had a pyloric muscle thickness of 4mm and pyloric canal length of 11mm.

Patients diagnosed as having IHPS were subjected to surgery and the diagnosis was confirmed per operatively. One patient who was diagnosed on barium meal was also confirmed to have IHPS at surgery. The three patients diagnosed as not having IHPS were followed up at respective hospitals and all three were managed successfully with alternate diagnoses.

Table-1: Age and Gender distribution (n=28).

Age(days)	No. of patients (%age)	Male	Female
25-30	05(17.9)	5	0
31-60	21(75)	15	6
61-90	02(7.1)	02	0

Table-2: Ultrasound findings in IHPS patients (n=24).

Parameter	mm	No of patients (%age)
Pyloric Muscle Thickness	4.0-5.0	13 (54.2)
	5.1-6.0	9 (37.5)
	6.1-7.0	2 (8.3)
Pyloric Canal Length	14.0-16.0	2 (8.3)
	16.1-18.0	5 (20.8)
	18.1-20.0	7 (29.2)
	20.1-22.0	6 (25)
	22.1-24.0	1 (4.2)
	24.1-26.0	1 (4.2)
	26.1-28.0	1 (4.2)
	28.1-30.0	1 (4.2)

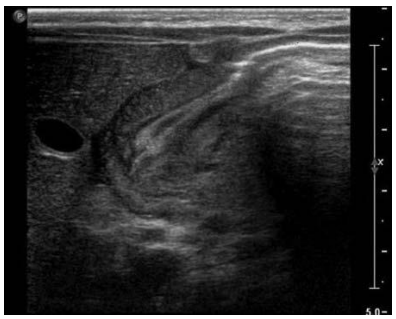

Fig 1: Long-axis view of the pylorus demonstrating the 'Cervix sign'.

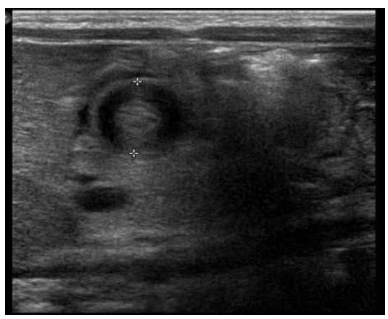

Fig2. Short-axis view of the pylorus demonstrating the 'Target sign'.

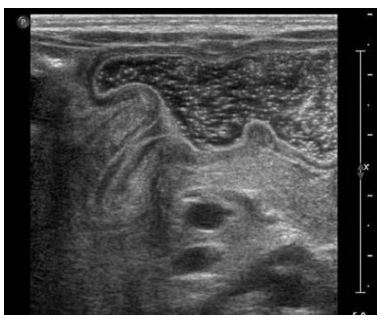

Fig 3.Long-axis view demonstrating a fluid-filled stomach with no fluid passing through the pylorus.

Based on these results ultrasonography yielded a sensitivity of 96% and specificity of 100% in diagnosing IHPS in patients without a palpable 'pyloric lump' or 'olive'. The positive predictive value of ultrasonography in these patients was 100% and the negative predictive value was 75%. Accuracy was 96.4%.

DISCUSSION

The preferred diagnostic approach for suspected Infantile Hypertrophic Pyloric Stenosis (IHPS) is a debatable topic, with different investigators discussing the cost-effectiveness and merits of available radiological investigations[14].

The first and most important step in patient workup of suspected IHPS is a detailed history and a thorough physical examination. When the triad of visible peristalsis, palpable pyloric lump and projectile vomiting is observed the diagnosis can be made beyond all doubts and the clinician can proceed with the definitive surgical management of the baby. However, many surgeons are uncomfortable with this protocol because a false positive physical examination then leads to a negative laparotomy[14]. Ultrasound is therefore recommended because of its high sensitivity and specificity as has also been shown in our study. More importantly as has been highlighted in this particular study ultrasonography should always be the initial investigations in babies with high clinical suspicion and lack of classical clinical signs.

If the vomiting infant is outside the usual age range for IHPS or if the clinical suspicion is low, an upper gastrointestinal (UGI) study is recommended because it effectively rules out other problems such as gastrointestinal malrotation and gastroesophageal reflux.

Certain investigators[9] support the use of a UGI study as the initial investigation in these patients based on the logic that it is a cost-effective study (compared to ultrasound) and also because a negative US invariably leads to a UGI study to rule out other diagnoses that a focused US evaluation does not detect. A second test, such as US, rarely follows a negative UGI study for IHPS.

This study however supports the view that in experienced hands, ultrasound is the preferred modality in the workup of suspected IHPS. The study is easier to conduct and less time consuming than an UGI study, involves no radiation exposure to the baby and most importantly can be repeated at short intervals if required.

The use of ultrasonographic criteria in diagnosing IHPS is also a point of contention among radiologists. Investigators vary in opinion regarding the most sensitive criteria among pyloric canal length, pyloric canal wall thickness and length of the pyloric muscle[13,15]. This study supports the view that pyloric muscle mass thickness is the most sensitive criteria as the one false negative patient in this study would have been diagnosed correctly if this criterion alone had been followed. This study has few limitations beside small sample size and short clinical follow-up. No intra or inter observer agreement for ultrasound operator was calculated. Imaging diagnosis was biased towards only patients referred to radiology for ultrasound assessment.

CONCLUSION

Ultrasonography should be the initial investigation in patients with clinical suspicion of IHPS and an impalpable pyloric lump to improve early diagnosis in these babies. Ultrasound is rapidly and easily performed in the neonate, avoids radiation exposure and has a specificity of 100% and a positive predictive value of 100% in these patients. However the ultrasonographic confirmation of the diagnosis of IHPS should always follow clinical evaluation by surgeon in order to avoid the gradual atrophy of the clinical skills.

Conflict of Interests:

The authors do not have any conflict of interests to declare.

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