Ultrasound Scan In The Diagnosis Of Infantile Hypertrophic Pyloric Stenosis

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Ultrasound scan (USS) was performed in 26 babies with infantile hypertrophic pyloric stenosis (IHPS). The sonographic measurements of pyloric tumor correlated precisely with the operative findings. These measurements were in accordance with the standard sonographic diagnostic parameters in 25 patients, but absent parameters were observed in a premature baby presenting at an earlier age of 10 days. This study confirms that as a sensitive and specific investigation, USS is a safe and non-invasive alternative to conventional contrast studies in situations where the diagnosis is doubtful. However, the diagnostic criteria need to be modified in premature and low birth-weight babies.

Key Words : Pyloric stenosis; infantile hypertrophic pylorus; ultrasound scan.

IHPS is a relatively common condition typically affecting otherwise healthy infants between the age of 3-6 weeks. Projectile, non-bilious vomiting is the characteristic symptom resulting from near complete gastric outlet obstruction produced by a thickened and elongated pylorus; "the pyloric tumour". Most of the patients can be diagnosed clinically by palpating the tumor. In a few patients in whom the clinical findings are inconclusive, further investigations may be required to confirm the diagnosis. We describe our experience with the use of ultrasound scan in the diagnosis of IHPS, along with a literature review.

Patients And Methods

Medical records of 49 patients with IHPS admitted to our Regional Paediatric Surgical Unit were reviewed retrospectively. Thirty four patients were referred from various peripheral Paediatric units after the diagnosis of IHPS had been made, while 11 patients were directly admitted to our hospital. The age rage was 10-120 days, with a male to female ratio of 4:1. In 22 out of 34 patients referred to us, the diagnosis had been made by ultrasonographic scan at their respective referring hospitals. This was because of inconclusive test feed performed by the treating physicians, reflecting their inexperience in palpating the pyloric tumor. It is to be noted that repeat test feed performed by our Paediatric surgical team was positive in 19 of these patients. Out of the 15 patients admitted directly to our unit, test feed was negative in one patient. In this patient ultrasound scan ratified the diagnosis. Test feed was positive in remaining 14 patients, however, USS was employed to further confirm the diagnosis in a premature baby who presented at the age of 10 days.

Results

Preoperative findings correlated significantly with the sonographic measurements in all 26 patients undergoing USS. It is noteworthy that in this series, USS helped to make a diagnosis of IHPS in 5 patients in whom the test feed was negative. In all but one patient who was a premature baby, the sonographic findings (Table 1,2) were consistent with the standard diagnostic criteria i.e. pyloric length>17mm, diameter>15mm and muscle thickness>4mm. In the premature baby with body weight of 1.8Kg, the muscle length was 14mm and thickness was 3mm, so the USS was labeled as "pylorus within normal limits" . Because of highly suggestive history and a palpable lump, he underwent a successful pyloromyotomy.

Table 1. Pyloric length on USS

In (mm)	n=
14	1*
18	9
19	5
20	6
21	2
22	3

*Ten days old premature baby

Table 2. Muscle Thickness On USS

In (mm)	n=
3	1*
5	19
6	6

*Ten days old premature baby.

Discussions

The pyloric "tumor" results predominantly from hypertrophy of the circular muscle[2]. However, presence of hyperplasia has also been described by a few investigators[3,4,5]. The hypertrophy is more marked at the distal end where the tumor projects into the duodenum. Proximally , it merges smoothly with muscle of the pyloric antrum. This results in a spindle-shaped or more appropriately, olive-shaped pylorus that is firm or hard in consistency. Usually, there is marked mucosal oedema that further obstructs the already narrowed lumen[2].

Clinical examination i.e. test feed, remains the corner-store in making the diagnosis of IHPS. In most of the cases, the tumor should be palpable if the test feed is properly and patiently performed by an experienced clinician. A confident diagnosis can be made in 85-90% of patients if the classic triad of projectile

vomiting, visible peristalsis and a palpable tumor is present[1,4]. However, in actual practice, the diagnosis remains dubious more often than expected. At times the tumor may not be palpable because of an enlarged liver or over distended stomach especially in a tense and unrelaxed baby. Occasionally, a taut rectus muscle, the liver edge, the caudate lobe of liver or the right kidney may be mistaken for a pyloric tumor. Cases have been reported where the diagnosis was suggested based on physical findings, only to find a normal pylorus at operation[5].

As a general rule, one should never operate on a baby in whom the pyloric tumor has not been palpated, but in doubtful cases refusal to avail the imaging facilities may lead to unnecessary delay. However, these studies are not justified unless serious attempts at clinical diagnosis have failed. Imaging studies are indicated when the history is suggestive but the tumor is not palpable, there is a disparity in clinical findings amongst the treating clinicians, or, the history is atypical[4,5]. In the past, barium meal was often used by recently, it has fallen into disrepute because it is less safe and more invasive as it involves significant dose of radiation[4]. There is always a risk of inhalation of barium in a vomiting baby at the time of the study or induction of anaesthesia[6]. The contrast studies may at times be impractical in an unwell baby and occasionally they may give misleading information[7]. In addition, the contrast materials, particularly the hypertonic ones, may prove hazardous in a dehydrated baby.

Ultrasound scan has several advantages. It is a painless, non-invasive procedure that avoids ionizing radiation and the use of contrast materials with there inherent morbidity. The diagnostic sonography does not lead to any significant biological damage[8]. The scanning can be done in multiple planes with the patient in any position. A further advantage is that portable scanning can be performed at bedside in the neonatal unit, eliminating the need of transferring the baby to the radiology department[9].

Sonographic diagnosis of IHPS was first described in 1977[6]. Several reports have since been published indicating successful use of this modality[10,11,12,13]. Initial doubts about the accuracy of USS have proven unfounded. The USS findings have been found to correlate precisely with the operative findings[6,14]. Almost 100% sensitivity and specificity has been documented in several studies[15,16,17]. A real-time sonography utilizing high frequency probes (e.g.7.5mHz) is generally used in infants to provide high resolution[18]. Various USS findings suggestive of IHPS include a pyloric canal longer than 17mm, pyloric muscle thickness greater than 4mm (Fig1), pyloric diameter greater than 15mm, significantly elevated muscle-to-lumen ratio exceeding 2:1, characteristic "target" or "bulls-eye" sign on the transverse scan (Fig 2) and no passage of stomach contents into the duodenum on real time sonography[15,19,20,21]. In our patients, the sonographic measurements correlated accurately with the operative findings in all patients. The USS proved diagnostic in 5 babies in whom careful test feed was negative on more than one occasions. In a premature patient, however, absence of the ultrasonic criteria were observed.

This study indicates that USS is a safe, sensitive and specific investigation for the diagnosis of IHPS. However, the standard criteria described above may not apply at the premature or low birth-weight babies, leading to false-negative results. Perhaps this element of error could be eliminated by modifying the diagnostic criteria by taking the body weight into account. It is proposed that an index derived from the ratio of pyloric tumor volume to body weight may be even more predictive of the diagnosis particularly in low birth-weight and premature babies.

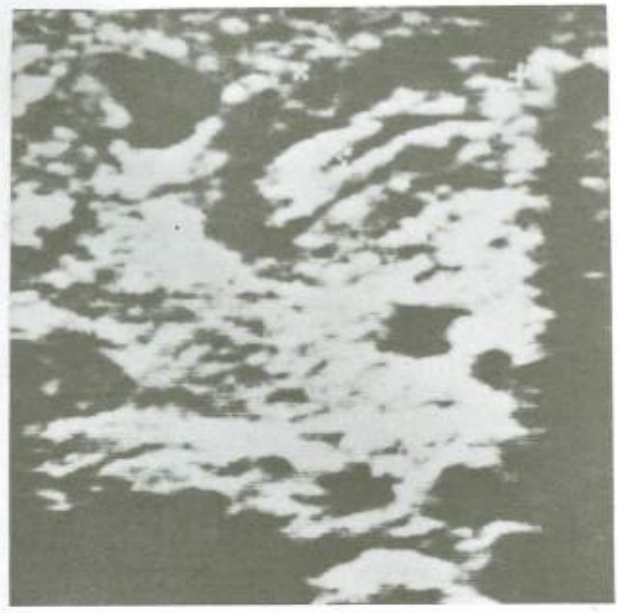

Fig 1: Longitudinal ultrasound scan of IHPS . Note the markers measuring the length and thickness of the pylorus.

Fig 2: Transverse ultrasound scan of IHPS ,demonstrating the characteristic "target" or "bull's eye" sign. Note the markers measuring the diameter of pylorus.

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