Efficacy of Ultrasound Diagnostic Criteria using Scoring System for Infantile Hypertrophic Pyloric Stenosis (IHPS)

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An analytic cross sectional study in the Department of Paediatric Surgery, Mayo Hospital, Lahore conducted. Twenty patients of non-bilious projectile vomiting with a control group of 20 patients were evaluated from June 2001 to May 2002. An attempt was made to prepare a diagnostic criteria with a scoring system using ultrasonography as a primary tool. Pyloric diameter was 9.1±0.51 in control and 15.25±1.75 patients. Muscular thickness in control group was 1.72±0.51 in comparison with 4.64±1.09 in patients. Similarly pyloric length was 11.37±1.47 in control group and 19.84±1.50 patients. Using probit analysis of ultrasonographic findings a composit scoring was developed and results evaluated. Evaluating 40 cases which included the normal infants (n=20) and infants with IHPS (n=20) both groups could be identified 100% with overall score of 2 or less as normal and those with overall score of 3 or more as having IHPS. All cases of IHPS can be correctly discriminated and diagnosed using these criteria.

Key words: Infantile hypertrophic, pyloric stenosis, ultrasound, scoring system

The aetiology of (IHPS) is still far from being clear. A polygenic mode of inheritance is incriminated IHPS affects an otherwise healthy first born male. Without effective treatment the child rapidly becomes wasted. The diagnosis is mainly clinical and based on palpation of pyloric tumour or its demonstration by the ultrasonic examination. While the worldwide prognosis of the babies with IHPS is improving, our children continue to suffer due to the delay in the diagnosis. Consequently the treatment is delayed and child suffers nutritionally. Thus there is need for early diagnosis of IHPS for the better management of the patients. It was against this background that the topic of efficacy of ultrasonic diagnostic criteria using scoring system for IHPS was selected for this study. The study is aimed at improving the accuracy of diagnosis of IHPS by combining a plurality of condition rather than a so called singular condition.

Material and methods:

This analytic cross sectional study was conducted in the Department of Paediatric Surgery, Mayo Hospital, Lahore for the period of one year from June 2001 to May 2002. This study was carried out on 20 patients with non bilous, projectile vomiting. A control group of 20 neonates admitted to the hospital who weighed 3-3.5kg and were free of vomiting were also evaluated. Ultrasound was performed for normal infants before giving feed. For affected patients a nasogastric tube was inserted to suck and discharge air and liquid inside the stomach and pyloric portion was observed in supine position. The diameter of pyloric portion, thickness of muscular coat and length of the pyloric canal were measured and these measurements were compared with those of normal infants. Evaluation by scoring was performed.

For statistical analysis 2 sample t-test, probit analysis and discrimination function test were performed.

Results:

Measurement of normal infants:

The pyloric portions of 20 normal infants studied as control were seen by ultrasound with the following results.

1. Pyloric diameter (9.10±1.29) range 8.5-11.5mm.
2. Muscular thickness (1.72±0.51) range 1-3mm
3. Pyloric length (11.87±1.47) range 11-13.5mm

Measurement of Infants with IHPS

The results of ultrasonographic findings in patients of IHPS were as follows

1. Pyloric diameter (15.25±7.75) range 12 to 22mm
2. Muscular thickness (4.64±1.09) range 4.5 to 7.8mm
3. Pyloric length (19.85±1.50) range 18 to 21mm

Both those measurements were divided into these for normal groups and IHPS group (Table 1).

Status	Mean	SD	Valid N (list wise)	
			Under weight	Weighted
Patients				
Ultrasonographic pyloric diameter/mm	15.25	1.29	20	20.00
Muscular thickness/mm	4.64	0.51	20	20.00
Pyloric length/mm	19.85	1.47	20	20.00
Control				
Ultrasonographic pyloric diameter/mm	9.10	1.75	20	20.00
Muscular thickness/mm	1.72	1.09	20	20.00
Pyloric length/mm	11.87	1.50	20	20.00

For 15mm or greater pyloric diameter, all the patients had IHPS whereas for 10mm or less all the patients were normal. For muscular thick all the patients with 4mm or thickness muscular coat had IHPs and all with 2mm or less

were normal. For 18mm or greater pyloric length all the patients had IHPS, whereas all shorter than 14mm were normal. An attempt was made to prepare a diagnostic criteria with a scoring system. The 2-sample t test was performed and scoring points were given to relevant measurements in a conformity with the probit analysis as shown in Table 3.

0 points were given to the cases with no probability of IHPS. 1 point to those with less than 25% probability. 2 points to those with 25% or more but less than 50% probability. 3 points to cases with 50% or more probability

Table 2: Ulstraonographic scoring with probit analysis

Parameters	Measurement	Scoring
Pyloric deiameters	Less than10mm	0
	10.1 to 15mm	1
	15.1 to 17mm	2
	More than 17.1mm	3
Muscular thickness	Less than 2.5mm	0
	2.51 to 3.51mm	1
	3.51 to 4.5mm	2
	More than 4.5mm	3
Pyloric length	Less than 13mm	0
	13.1 to 19mm	1
	19.1 to 22mm	2
	More than 22mm	3

Points were totaled and analysis was performed as shown in table 2. Based on scoring, the adequacy of the present diagnostic criteria was investigated statistically. The composit score was evaluated by probit analysis and following results were obtained.

Total score of 2 or less were all included in the normal group. Those with a composit score of 3 or more were all in the IHPS group. The discriminant function and multivariate analysis were performed to examine the relation between IHPS and the scoring system. These are shown in the following tables.

Table 3: Summary of conomical discriminant function

Function	Eigen Values			
	Eigen value	% of variance	Cumulativ e %	Concomical correlation
1	15.063[a]	100.0	100.0	.968

First 7 conomical discrimant functions were used in the analysis.

Classification statistics classification function coefficient.

	Status	
	Patient	Control
Ultrasonographic pyloric diameter	3.957	1.940
Muscular thickness/mm	3.503–02	1.676–02
Pyloric length/mm	12.175–157.738	7.316-52.990
(constant)		

Fisher linear discriminant functions:

Evaluating 40 cases which included the normal infant (n=20) and infants with IHPS (n=20) both groups could therefore be 100% identified. Thus the score of 3 or more was 100% for IHPS and that of 2 or less was 100% for normal group.

Discussion:

For the clinical diagnosis of IHPS palpation of pyloric tumour is essential but palpation ratio varies with the experience and technique of the physician performing the palpation.

In one large series 85% of the patients were confidently diagnosed clinically[1]. In reality this figure is significantly lower and thus if there was any doubt about the diagnosis, upper gastrointestinal series (UGI) and ultrasonography (U/S) are generally carried out. Comparing these two methods the advantages of ultrasonography include:

1. Free of radiation exposure
2. Free of danger of aspiration.
3. Easily performed at bed side.
4. Pyloric tumour in drawn three dimensionally

However the disadvantages of ultrasonography include:

1. Entire stomach cannot be visualized
2. Unable to distinguish other disease of intestine below duodenum.
3. Difficult to judge images under presence of air.
4. Difficult to obtain clear images if the infant cries[2].

Halka et al reported that from the view point of cost UGI is superior because secondary inspection is less frequently required. But US provides a high application value as a clinical instrument and has advantages because it is free of exposure invasion and can be performed easily at bed side.

The accuracy of ultrasonography diagnosis was remarkable in our study. This contrasts with misdiagnosis ratio of 4.5 to 11.1% with UGIS. The pyloric diameter of 15mm or more and muscular thickness of4mm or more are generally accepted as the diagnostic criterion of IHPS[3,4].

However, the size of pyloric tumour in IHPS varies among cases. Conversely there are reports in which muscle thickness of 3mm or thickener was noted in 9% of even normal cases[5]. Therefore the grey zone between normal cases and IHPS is a muscular coat 2-3mm thick. In addition it has been proposed that the age in days should be taken into accout[6]. But in view of the individual differences between neonates and infant age in days seems to have little significance. Similarly role of weight and height has also been emphasized.

To overcome all these difficulties Kitimura et al prepared criterion using so called degree of stenosis by stenotic index in which neither height nor weight was taken into accout[7]. A pyloric index using pyloric diameter and pyloric length muscular thickness of the pyloric portion and weight also seems to be an excellent criterion[8].

In our study a diagnostic criterion was prepared using probit analysis based on measurement of pyloric diameter, muscular thickness and pyloric length of a normal group and an affected group to improve the accuracy of diagnosis of IHPS by combining a plurality of condition rather than a so called singular condition.

These three parameters are independent and a diagnostic criterion based on these was established. The adequacy of the criterion was statistically investigated based on the to the setting and the results. By probit analysis cases with a composite score of 2 or less were all included in the normal group, whereas, those with score of 3 or more were all included in the group with IHPS. Moreover, both groups could be 100% identified and discriminated.

Conclusion:

In our study ultrasonography was able to diagnose cases with overall score of 2 or less as normal and those with overall score of 3 or more as having IHPS. All cases of IHPS can be correctly discriminated and diagnosed using these criteria.

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