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DIAGNOSTIC ACCURACY OF ANTENATAL ULTRASOUND IN POSTERIOR URETHRAL VALVES

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Abstract

Posterior urethral valves is the most common pediatric urological diagnosis in male children with worldwide estimated incidence of 1:5000 in alive male births, leading to end stage renal failure in the next 10 years of life in half of these affected children. The aim of this study is to assess the diagnostic accuracy of Antenatal Ultrasound in posterior urethral valves, keeping postnatal Cystourethrography as gold standard. Record of 90 male newborns was revived retrospectively presenting with bilateral fetal hydronephrosis during this period. All these cases underwent at least one to four times detailed antenatal sonological examination by a trained sonologist of our center. Different antenatal sonological parameters were assessed in these patients to assess diagnostic accuracy of ultrasound in diagnosing posterior urethral valves. A total of 90 patients presenting with bilateral fetal hydronephrosis were included in the study. Average gestational age was 33 weeks±3.49.The diagnoses of ultrasound were subjected to Keyhole sign, Urinary Bladder dilatation, Thickened Urinary bladder wall and Oligohydramnios. The patients were labeled ashaving posterior urethral valves when at least two of the parameters were observed on ultrasound. Our study concluded and acknowledged that antenatal ultrasound is a reliable radiological tool in diagnosis of posterior urethral valves. The sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy of antenatal ultrasound was established as 92.59%, 41.67%, 70.42%, 78.95%, and 72.22.% respectively. Among all sonologicalparameters , presence of distended and thick walled urinary bladder was the most frequently found finding.

Keywords: *Antenatal ultrasound, Cystourethrography, Diagnostic accuracy, Posterior urethral valves*

INTRODUCTION

Hydronephrosis in male fetuses on antenatal ultrasound alarms us about a wide spectrum of diagnosis including posterior urethral valves, vesicoureteral reflux, urethral stenosis, Prune Belly syndrome and primary megaureter (1). As all these pathologies have their own appropriate treatment and prognosis, so it emphasizes the significance of prompt and specific diagnosis in this condition for both parental counseling and antenatal decision about treatment (2).

A posterior urethral valve is the most common pediatric urological diagnosis in male children with worldwide estimated incidence of 1:5000 in alive male births, leading to end stage renal failure in the next 10 years of life in half of these affected children (3). Posterior urethral valves is a congenital malformation, still there origin is an area of further research. Posterior urethral valves can be diagnosed on antenatal ultrasound. Diagnostic criteria favoring posterior urethral valves include bilateral hydronephrosis, dilated posterior urethra giving keyhole sign, distended and thick-walled urinary bladder showing poor emptying for more than 30min and wall thickness more than 3mm, and oligohydramnios. Persistently distended urinary bladder should be evaluated on follow up scans to exclude posterior urethral valves (4). Undiagnosed posterior urethral valves can present in a number of ways ranging from delayed and weak stream, lethargy, failure to thrive or in severe cases respiratory distress due to pulmonary hypoplasia (5).

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The management of PUV is dependent on many factors which include the age of the patient and the severity of the condition at the time of presentation (6). There are very few cases of PUV which reach term and are delivered live. The prognosis is much better if the condition is diagnosed and treated on time (7). In a study done by Shilpa Sharma found that the sensitivity and specificity of PUV at antenatal stage have been found to be 94% and 43% (8). Antenatal ultrasound can detect serious fetal structural abnormalities in around 1% of pregnancies which would otherwise be diagnosed in until later life when symptoms such as abdominal pain, colic etc. develop. It is pertinent to mention that the detection of such abnormalities antenatally depends upon experience and skill of sonographer and age of gestation (9).

Institute of kidney diseases is a vast center of urological pathologies in Khyber Pakhtunkhwa, Pakistan. Hundreds of patients are referred here on a daily basis from far away areas presenting with renal diseases, Posterior urethral valves is one of them.

The aim of this study was to assess the diagnostic accuracy of Antenatal Ultrasound in posterior urethral valves, keeping postnatal Cystourethrography as gold standard.

MATERIALS AND METHODS

Approval of the study was taken from the ethical committee of the Institute of Kidney Diseases. The study design was a cross- sectional retrospective carried out in the Radiology Department, Institute of Kidney Diseases, Hayatabad Medical Complex Peshawar from May 2019 to June 2020. Record of 90 male newborns was revived retrospectively presenting bilateral fetal hydronephrosis during this period. Female fetus, lack of follow up and intrauterine death were excluded from study. All these cases underwent at least one to four times detailed antenatal sonological examination by a trained sonologist of our center. Detailed antenatal ultrasound was performed using Aplio 300 color Doppler ultrasound machine with 1.9 to 6 MHZ transducer. Different antenatal sonological parameters were assessed in these patients to assess diagnostic accuracy of ultrasound in diagnosing posterior urethral valves. These parameters include bilateral fetal hydronephrosis, dilated prostatic urethra giving keyhole sign, distended thick-walled urinary bladder (more than 3mm) and oligohydramnios. All these parameters were subjectively assessed by our sonologist and a persistently distended urinary bladder was followed several times to exclude the possibility of posterior urethral valves.

Postnatally all these patients underwent physical examination by a pediatric urologist of our center followed by cystourethrography for confirmation of posterior urethral valves. Data was entered in SPSS 20 for analysis.

RESULTS

A total of 90 patients presenting with bilateral fetal hydronephrosis were included in the study. Average gestational age was 33 weeks±3.49.

All the patients have gone through ultrasound to diagnose posterior urethral valves and these results were confirmed through cystourethrography which have been carried out by an expert pediatric urologist. The diagnoses of ultrasound were subjected to Keyhole sign, Urinary Bladder dilatation, Thickened Urinary bladder wall and Oligohydramnios. The patients were labeled ashaving posterior urethral valves when at least two of the parameters were observed on ultrasound.

The parameters on ultrasound shows that the majority of the patients have Urinary bladder dilation which was observed in 94.4% of patients followed by thickened Urinary bladder wall while keyhole sign was observed only in 53.3% of patients (Fig. 1).

Diagnostic Accuracy of ultrasound in detecting posterior urethral valves using Cystourethrography was observed as72.22 % (CI 62.2,80.42). While the sensitivity and specificity was recorded as 92.59% (82.45,97.08) and 41.67%(27.14, 57.8) . Which shows that the correctly disease patients were 92% although the correctly non disease patients were low as 41.67% (Table I).

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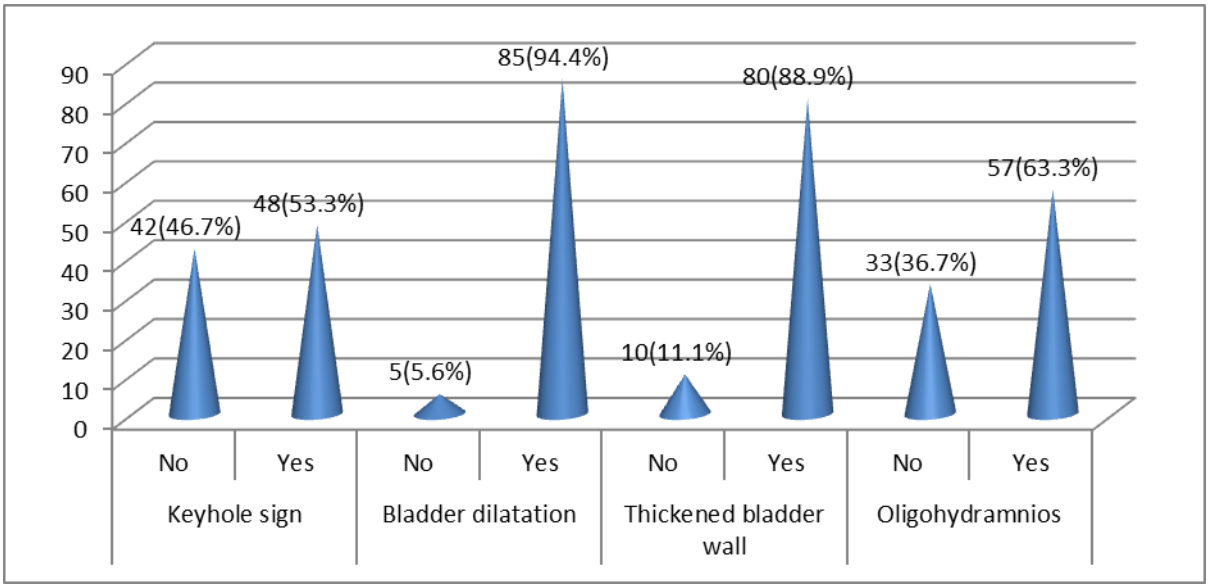

Fig. 1. Parameters observed on ultrasound

Table I. Accuracy of ultrasound using Cystourethrography as gold standard

		Cystourethrography		Total
		PUV	No PUV	
Antenatal Ultrasound	PUV	50	21	71
		55.6%	23.3%	78.9%
	No PUV	4	15	19
		4.4%	16.7%	21.1%
Total		54	36	90
		60.0%	40.0%	100.0%

Parameters	Value	Confidence Interval
Sensitivity	92.59%	(82.45, 97.08)
Specificity	41.67%	(27.14, 57.80)
Positive Predictive Value	70.42%	(58.98, 79.77)
Negative Predictive Value	78.95%	(56.67, 91.49)
Diagnostic Accuracy	72.22%	(62.21, 80.42)

DISCUSSION

Our results confirm that antenatal ultrasound has a prime role in timely diagnosis of posterior urethral valves, carrying a major role in management plan of the disease and preventing end stage renal failure. The diagnostic accuracy of antenatal ultrasound for posterior urethral valves is confirmed to be 72.22% revealing that all antenatal patients should be included in surveillance of the disease to avoid undesirable delayed diagnosis.

A posterior urethral valve is a very common abnormality in male infants which results in lower urinary tract obstruction with an incidence of 1:5,000 male infants and 1:25,000 live births (10). Persistent and unrelieved obstruction can result in back pressure which affects the urinary bladder and kidneys which then lead to end stage renal disease (ESRD).In most developed countries prenatal ultrasound screening of PUV has significantly increased the early diagnosis and management of PUV (11).

In our study we included 90 male patients; we intended to assess the diagnostic accuracy of antenatal ultrasound in the diagnosis of posterior urethral valves. The sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy turned out to be 92.59%, 41.67%, 70.42%, 78.95%, and 72.22% respectively. In a study done by AdemolaOlusegun in Nigeria all the participants had abdomino-pelvic ultrasound with 31 (83.7%) patients having varying degrees of hydronephrosis, hydroureters, and thick wall urinary bladder which agrees with our study (12).In another study by LS

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bernades they took 54 fetuses out of which 42(77.8%) were suspected to have PUV but 29(69%) were diagnosed to have PUV postnatally and 13(31%) had some other pathologies on postnatal investigation, they found the sensitivity and specificity of antenatal ultrasound examination for the postnatal diagnosis of PUV 94% (95% CI, 87–99%) and 43% (95% CI, 30–57%) which is similar to our result (13).

There are different views of researchers according to the ultrasound findings specificity for PUV. Montemarano *et al.,* found that urinary bladder dilatation and wall thickness is only found in fetuses that are diagnosed as having PUV postnatally which is similar with our study which also found the same signs (14). Max Maizel conducted a study in which he found that presence of dilated and thick walled urinary bladder can be indicative of different diagnosis such as megaureter, VUR and PUR which is contrast with this study (15).

There were few weaknesses of our study i.e. small sample size, use of a single color Doppler Aplio 300 ultrasound machine and lack of inter and intra observer variation in opinions. Our study is implicated on radiologists and pediatric urologists who can benefit from the fact that timely and prompt diagnosis of posterior urethral valves by antenatal ultrasound plays a major role in management plan and prevention of end stage renal failure.

CONCLUSION

Our study concluded and acknowledged that antenatal ultrasound is a reliable radiological tool in diagnosis of posterior urethral valves. The sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy of antenatal ultrasound was established as 92.59%, 41.67%, 70.42%, 78.95%, and 72.22.% respectively. Among all sonological parameters, presence of distended and thick walled urinary bladder was the most frequently found finding.

Conflict of Interest:

The authors declare no conflict of interest.

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