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Research Article

Role of fetal renal pelvic dilatation - as a predictor of neonatal urological outcome

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ABSTRACT

Background: Mild pelvic dilatation is relatively frequent in the normal fetus but once it is detected, adequate follow-up is required. An abnormal finding, can affect parental attitude towards the pregnancy and their unborn baby. Therefore, it is necessary to have specific ultrasound criteria that differentiate transient dilatation from pathological abnormality to offer an accurate counseling to the parents. To evaluate the need for postnatal treatment- surveillance and or surgery in relation to grade of renal pelvic dilatation found on third trimester ultrasound and to identify a cut-off value of APD which discriminates transient pelvic dilatation from pathological abnormality.
Methods: A Hospital based prospective study was conducted at Fernandez hospital, Fetal Medicine Unit (FMU), Hyderabad by reviewing the hospital records from January 2010 to January 2015 among 310 Antenatal cases with isolated fetal renal pelvic diameter (APD) > 7 mm in third trimester on ultrasound were included and post natal follow up was done for 1 year duration.
Results: Post natal follow up identified that out of 162 mildly dilated renal pelvic units (APD 7-9 mm) 98 cases (60.4%) resolved and none required surgery. Out of 117 moderate hydronephrosis (APD 9-15 mm) 22 cases resolved (18.8%), 11 cases (9%) required surgery and out of 18 cases with severe hydronephrosis (APD of > 15mm) none of them resolved and 6 cases needed surgery. The cases which required surgery had either moderate or severe hydronephrosis with mean renal pelvic diameter of 11.3 mm. Similarly on the basis of receiver operating characteristic curves, the renal threshold that best predicted surgery in postnatal period was anteroposterior diameter of > 11 mm in third trimester, yielding sensitivity - 74.07%, specificity -93.97%, positive likelihood ratio - 12.27, not clinically significant.
Conclusions: The need for postnatal treatment increased with the grade of antenatal RPD. Neonates with antenatal mild dilatation (renal pelvis diameter < 9 mm) were discharged early from follow-up whereas those with RPD > 11 mm required surgery.

Keywords: Urinary tract, Fetal anomalies, Hydronephrosis, Gestation

INTRODUCTION

Abnormalities of the urinary tract are reported to account for 30-50% of fetal anomalies. The presence of hydronephrosis at any stage of gestation is generally the first indicator of a potential urinary tract anomaly. There is, how-ever, no agreed definition of "significant" antenatal hydronephrosis that warrants further investigation and no consensus on appropriate management.[1]

Ultrasound screening during pregnancy has resulted in increasing recognition of fetal hydronephrosis. Depending on diagnostic criteria and gestation, the prevalence of antenatally detected hydronephrosis (ANH) ranges from 0.6-5.4%.[2]

Routine antenatal ultrasonography is being used increasingly to detect abnormalities of the fetal urinary tract, some of which are important and may benefit from early diagnosis and treatment. Antenatal scanning indicates abnormalities of the urinary tract reliably in both selected and unselected groups, although its diagnostic accuracy is not always clear. The incidence of fetal uropathy has been reported recently to vary from 0.14% to 0.39%. Ring and Zobel suggested that, although many abnormalities of the urinary tract can be diagnosed prenatally, a high proportion will not be found until after infection of the urinary tract during infancy. The value of early diagnosis of some renal abnormalities is debatable, particularly as the natural course is unknown for some types of lesions. For other lesions, however, early diagnosis and postnatal treatment undoubtedly minimizes renal damage. Fetal abnormalities of the renal tract can be screened for specifically. The optimum time for screening to achieve maximum pick up has not b en ascertained. During a screening programme for fetal malformation in Sweden only 9% of renal abnormalities were detected by 17 weeks' gestation, but 91% were detected by 33 weeks. In a group with non-lethal abnormalities the abnormalities were detected in only a few cases before 24 weeks.[3]

Mild pelvic dilatation is relatively frequent in the normal fetus but once it is detected, adequate follow-up is required. An abnormal finding, can affect parental attitude towards the pregnancy and their unborn baby. Therefore, it is necessary to have specific ultrasound criteria that differentiate transient dilatation from pathological abnormality to offer an accurate counselling to the parents. Hence present study has been undertaken to evaluate the need for postnatal treatment- surveillance and or surgery in relation to grade of renal pelvic dilatation found on third trimester ultrasound and to identify a cut-off value of APD which discriminates transient pelvic dilatation from pathological abnormality.

METHODS

A hospital based prospective study was conducted at Fernandez hospital, Fetal Medicine Unit (FMU), Hyderabad by reviewing the hospital records during January 2010 to January 2015 with 310 antenatal cases.

Antenatal cases with isolated fetal renal pelvic diameter (APD) ≥7 mm in third trimester on ultrasound were included and post natal follow up was done for 1 year duration.

During the study period, all antenatal women in third trimester were screened using ultrasonography with their prior consent. Those antenatal cases with isolated fetal renal pelvic diameter ≥7 mm were included in the study. Brief clinical history from these women including gestational age was noted. They were followed. After delivery, birth weight of the baby and the sex of the baby were noted down. Afterwards all women included in the study along with their baby were followed for one year. During follow up period, the babies were regularly screened using ultrasound to measure the renal pelvic diameter. Those babies having severe hydronephrosis and not resolving were referred for surgery.

We used the revised guidelines for classification of fetal renal pelvic diameter.[2]

The collected data was entered in the Microsoft Excel sheet and analysed using proportions and suitable statistical test.

RESULTS

Table 1: Distribution of study subjects according to sex of the baby.

Sex of the baby	Number	Percentage
Male	236	76.1
Female	074	23.9
Total	310	100

Table 1 shows the distribution of the study subjects according to the sex of the baby. Majority i.e. 76.1% were male compared to only 23.9% of females.

Table 2: Distribution of study subjects according to birth weight of the baby.

Birth weight of the baby	Number	Percentage
Low birth weight (< 2.5 kg)	014	04.5
Normal birth weight (> 2.5 kg)	296	95.5
Total	310	100

Table 2 shows the distribution of the study subjects according to the birth weight of the baby. Majority i.e. 95.5% were having normal birth weight compared to only 4.5% with low birth weight babies.

Table 3: Distribution of study subjects according to side of renal pelvis dilatation.

Side of renal pelvis dilatation	Number	Percentage
Unilateral	228	73.5
Bilateral	082	26.5
Total	310	100

Among 310 antenatal cases, 228 cases had unilateral dilatation and 82 cases had bilateral renal pelvic dilatation.

Post natal follow up identified that out of 162 mildly dilated renal pelvic units (APD 7-9 mm) 98 cases (60.4%) resolved and none required surgery. Out of 117 moderate hydronephrosis (APD 9-15 mm) 22 cases

resolved (18.8%), 11 cases(9%) required surgery and out of 18 cases with severe hydronephrosis (APD of ≥ 15mm) none of them resolved and 6 cases needed surgery. The cases which required surgery had either moderate or severe hydronephrosis with mean renal pelvic diameter of 11.3mm.

Similarly on the basis of receiver operating characteristic curves, the renal threshold that best predicted surgery in postnatal period was anteroposterior diameter of ≥ 11 mm in third trimester, yielding sensitivity- 74.07%, specificity -93.97%, positive likelihood ratio - 12.27, not clinically significant.

Table 4: Neonatal urological outcome.

classification of fetal renal pelvic diameter (APD)	Outcome			Total
	Resolved	Required surgery	Under surveillance	
Mild (7-9 mm)	98	00	64	162
Moderate (9-14 mm)	22	11	74	117
Severe (≥ 15 mm)	00	06	12	018
Total	120	17	150	297*

*13 cases were lost to follow up

Table 5: Sensitivity and specificity of APD cut off of > 11mm.

Cut off point of APD	Sensitivity	Specificity	Correctly classified	LR+	LR-
≥ 7.8	100%	0.00%	17.14%	1.0000	-
≥ 8	100%	0.86%	17.86%	1.0087	0.0000
≥ 8.7	100%	55.17%	62.86%	2.2308	0.0000
≥ 9	100%	56.03%	63.57%	2.2745	0.0000
≥ 10	87.50%	85.34%	85.71%	5.9706	0.1465
≥ 11	79.17%	93.97%	91.43%	13.1190	0.2217
≥ 12	75.00%	96.55%	92.86%	21.7500	0.2589
≥ 14	70.83%	99.14%	94.29%	82.1667	0.2942
≥ 15	70.83%	100%	95.00%	-	0.2917
≥ 16	41.67%	100%	90%	-	0.5833
≥ 20	20.83%	100%	86.43%	-	0.7917
≥ 24	8.33%	100%	84.29%	-	0.9167
> 26	0.00%	100%	82.86%	-	1.0000

DISCUSSION

A Hospital based prospective study was conducted at Fernandez hospital, Fetal Medicine Unit (FMU), Hyderabad by reviewing the hospital records from January 2010 to January 2015 among 310 Antenatal cases with isolated fetal renal pelvic diameter (APD) ≥ 7 mm in third trimester on ultrasound were included and post natal follow up was done for 1 year duration.

Post natal follow up identified that out of 162 mildly dilated renal pelvic units (APD 7-9mm) 98 cases (60.4%) resolved and none required surgery. Out of 117 moderate hydronephrosis (APD 9-15mm) 22 cases resolved (18.8%), 11 cases (9%) required surgery and out of 18 cases with severe hydronephrosis (APD of ≥15mm) none of them resolved and 6 cases needed surgery. The cases which required surgery had either moderate or severe hydronephrosis with mean renal pelvic diameter of 11.3mm.

Sairam S et al reported that Fetal hydronephrosis was identified in 2.3% (268/11 465) of women. Mild hydronephrosis was present in 80.6% (216/268) and moderate/severe hydronephrosis in 19.4% (52/268). The hydronephrosis resolved in the antenatal or early neonatal period in 88% of fetuses. None of the fetuses with mild hydronephrosis and approximately one in three fetuses with persistent moderate/severe hydronephrosis required postnatal surgery. Overall, only one in every 1000 total births in the study population required postnatal urological surgery.[4]

DeKort EH et al found that UTIs developed in 4 of 106 infants from group I and 5 of 19 infants from group II. Surgical interventions were performed on 1 of 106 patients of group I and 7 of 19 patients of group II. These differences were statistically significant (p-values 0.004 and <0.001, respectively). In group I, 6 of 106 patients had VUR; none of them required surgical intervention and only two developed a UTI (one of whom also had contra lateral ureteropelvic junction obstruction). Five of 19 infants in group II had underlying VUR, four of them

with associated anomalies, 1 infant required surgical correction and 4 developed UTIs.[5]

Maayan-Metzger A et al reported that of 119 infants with prenatal diagnosis of mild hydronephrosis (renal pelvic diameter <10 mm), 116 (97.5%) had postnatal ultrasound results showing normal or mild hydronephrosis. Prenatal diagnosis of severe hydronephrosis (renal pelvic diameter >20 mm; 10 infants) was correlated with high incidence (90%) of moderate and severe postnatal hydronephrosis. Prenatal diagnosis of moderate hydronephrosis (renal pelvic diameter 10 to 20 mm) resulted in moderate postnatal hydronephrosis in 20% and improvement in 80% of the new-born infants.[6]

Wollenberg A et al observed that none of the 20 children with mild dilatation experienced a urinary tract infection (UTI) or underwent surgery; two had associated renal or urinary tract abnormalities.[7] In contrast, five out of 22 (23%) children with moderate hydronephrosis and 23 out of 36 (64%) with severe hydronephrosis had either a UTI or required surgery ($P < 0.001$); associated abnormalities were also more common (6 out of 22 and 15 out of 36, respectively).

Feldman DM et al found that 88% fetuses were with mild hydronephrosis.[8] Most of these had complete resolution during the pregnancy. Forty patients had fetuses classified as having moderate hydronephrosis, and 6 patients had fetuses with severe hydronephrosis. Of those classified as moderate hydronephrosis, 15% resolved, 25% improved, 48% remained unchanged, and 12% worsened during the pregnancy. There were no cases of in utero resolution in the severe group; however, 4 of 6 cases improved to moderate or mild, and 2 cases remained unchanged.

Longpre M et al in their study found that hydronephrosis in 62 units resolved spontaneously and pyeloplasty was done in 29.[9] The remaining 27 units had persistent uncomplicated hydronephrosis at last follow up. Multivariate analysis showed larger APD (hazard ratio 0.54; 95%CI 0.36-0.80) and SFU grade 4 (HR 0.34; 95%CI 0.13-0.90) to be associated with a significantly lower likelihood of resolution. The mean initial APD in resolved cases was 9.4mm as opposed to 29.0mm in cases requiring surgery.

Babu R et al found that among those with unilateral hydronephrosis, none (0/55) with APD <15 mm required surgery, while all patients (4/4) with fetal APD> 30 mm required surgery.[10] In those with APD between 15-30 mm, 3/19 required surgery and prolonged follow-up was required to arrive at the decision

Oktar T et al reported that the risk of postnatal surgical treatment increased threefold in patients with an APD of 7-20 mm and a diagnosis of caliectasis (relative risk 3.0, 95% confidence interval 1.07-8.40).[11]

Signorelli M et al One case from the first group, three cases from the second, and seven cases from the third and 11 cases from the fourth needed surgical treatment.[12] 1.9, 7.2, 18.6, 23.9% of cases respectively worsened after birth in the four groups (trend: P=0.001).

In the present study on the basis of receiver operating characteristic curves, the renal threshold that best predicted surgery in postnatal period was anteroposterior diameter of $\geq$11 mm in third trimester, yielding sensitivity- 74.07%, specificity -93.97%, positive likelihood ratio - 12.27, not clinically significant.

Ouzounian JG et al found, from a receiver-operating characteristic curve, that fetal pyelectasis of 8 mm was 91% sensitive and 72% specific in predicting subsequent hydronephrosis.[13] Use of a threshold of 5 mm yielded a sensitivity of 100% and a specificity of 24%.

Kim HJ et al reported that the area under the receiver operating characteristic curve was 0.770, 0.828, and 0.812 at the second, early third, and late third trimesters, respectively.[14] A 100% sensitivity for predicting postnatal surgery could be achieved at a cut-off APD of 5 mm during the second trimester, 8 mm during the early third trimester, and 10 mm during the late third trimester if scheduled antenatal ultrasound scans were performed. A cut-off APD of 11 mm during the second trimester was of diagnostic value in selecting children at risk of postnatal surgery with an odds ratio of 5.13 (95% confidence interval 1.62-16.25), with relatively high sensitivity and specificity. With a cut-off of 15 mm during the early third and late third trimesters, the odds ratio was 11.51 (95% confidence interval 5.05-26.23) and 6.94 (95% confidence interval 3.30-14.57), respectively.

Coplen DE et al Receiver operating characteristic analysis revealed that when 15 mm renal pelvic dilatation is used as a threshold it correctly discriminates obstruction in at least 80% of fetuses with a sensitivity of 73% and a specificity of 82%.[15]

CONCLUSION

The need for postnatal treatment increased with the grade of antenatal RPD. Neonates with antenatal mild dilatation (renal pelvis diameter <9 mm) were discharged early from follow-up whereas those with RPD >11 mm required surgery.

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