

## ASSESSING OUTCOME OF ANTENATAL HYDRONEPHROSIS- AN INTEGRATED CLINICAL APPROACH

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### ABSTRACT

#### BACKGROUND

The widespread use of ultrasonography during pregnancy has resulted in a higher detection rate of congenital malformations. Out of these antenatally detected congenital malformations Antenatal Hydronephrosis (ANH) is the commonest one. The diagnosis of ANH causes significant distress to the parents. There always remains a probability of the neonate having complete resolution to undergoing surgery based on the degree of hydronephrosis measured primarily with AP diameter of renal pelvis.

#### MATERIALS AND METHODS

A total of 94 patients were enrolled (Excluding 16) and their complete profile with clinical, radiological imaging and renal scan details were taken as per Study Performa and were followed up and outcomes were assessed for complete resolution, partial resolution with non-obstructive drainage and cases requiring surgical intervention.

#### RESULTS

The incidence of ANH in our study was 2.14% and M:F ratio was 2.13:1. The distribution of mild, moderate and severe ANH was at 58.51, 31.92 and 9.57% respectively. The relative risk of surgery for cases with APD > 10 mm, (moderate and severe ANH) was 15.511 with Odds ratio of 21.21. The 95% Confidence interval was from 2.6 to 172.79. Hence a statistically significant association (for a 95% confidence interval  $p < .05$ ) exists between the APD >10 mm and the risk of surgery. Only one case in mild ANH underwent surgical intervention and the association was not statistically significant.

#### CONCLUSION

The result of our study show that Mild ANH runs a benign course and chances of spontaneous resolution are high. Those cases which failed to resolve need follow up and further detailed investigation (MCU & Radionuclide scan), only if there was increase in severity of hydronephrosis, urinary tract infection or thinning of renal cortex. However, cases of moderate ANH have specific postnatal pathology and may undergo surgical intervention while in cases of severe ANH all have significant postnatal pathology and majority may have to undergo surgical intervention. This study brings about the relevant data for a better and sequential counselling of worried parents and also adds to the literature to draw various centres to a consensus on management of these foetus/neonates.

#### KEYWORDS

Antenatal Hydronephrosis, Pelviureteric Junction Obstruction, VUR, VUJ Obstruction, Society of Foetal Urology (SFU), Pelvic AP Diameter, MRU, Radionuclide Studies, Parental Counselling.

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#### BACKGROUND

The widespread use of ultrasonography (USG) during pregnancy has resulted in a higher detection rate of congenital malformations. Out of these Antenatal Hydronephrosis (ANH) is the commonest one and at present the reported incidence in the literature is approximately 1-5% in all pregnancies.<sup>1</sup>

The diagnosis of antenatal hydronephrosis causes significant distress to the parents. Therefore, it would be pertinent to identify infants with significant illness that require surgery or long-term follow up, from those with transient hydronephrosis which are likely to resolve spontaneously. An integrated clinical approach would be an honest way to approach the affected family, who often have questions regarding the chances of spontaneous resolution of hydronephrosis and the chances of surgical intervention.

The prenatal diagnosis of ANH is an indication for genetic counselling. The counsellor is expected to present information regarding the diagnosis, natural history, available investigations and therapies to the family.<sup>2</sup>

The outcome of ANH has correlation with the severity of the hydronephrosis. The literature regarding the chances of spontaneous resolution and surgical intervention is quite extensive but confusing. The results vary widely in existing literature. The chances of spontaneous resolution in mild

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ANH is 74% as per Signorelli et al,<sup>3</sup> 88.1% as per Lee RS et al<sup>4</sup> and 96% as per Sidhu et al.<sup>5</sup> The risk of surgical intervention also varies in various studies because it depends on the interpretation of investigations and criteria used for surgical intervention.

At INHS Asvini, the cases of ANH are being managed as per the Society of Fetal Urology (SFU) consensus statement on the evaluation and management of ANH of 2010.<sup>1</sup> Hence present study was planned to find out the chances of spontaneous resolution and surgical intervention in various grades of antenatal hydronephrosis at our centre.

*Aims and Objectives*

To study and analyse the outcome of mild, moderate and severe antenatal hydronephrosis with respect to spontaneous resolution and surgical intervention.

**MATERIALS AND METHODS**

*Study Design*

It was a 4-yr. retrospective cohort study in a Tertiary care teaching hospital.

*Place of Study*

Tertiary care teaching hospital.

*Period of Study*

Retrospective (Jan 2011 to Dec 2016).

*Inclusion Criteria*

- i. All ANH diagnosed cases during study period (Jan 2011- Dec 2016)
- ii. Diagnostic USG should have been done at INHS Asvini

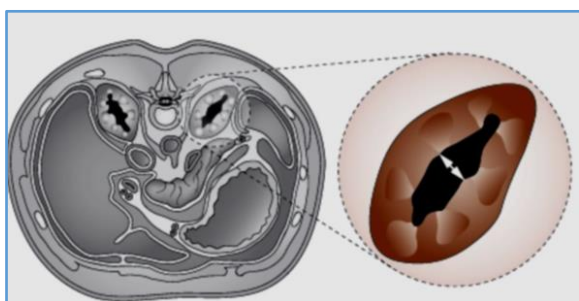
*Exclusion Criteria*

- i. Syndromic Neonates
- ii. Neonates with multiple congenital malformations
- iii. Parents who defaulted on follow up

*Methodology*

The permission to conduct study was taken from the hospital's Ethical Committee. The individual data was collected from the medical records of patients.

The antenatal USG done at around 32 weeks was used to diagnose ANH and renal pelvic anteroposterior diameter (APD)>7mm was taken as the diagnostic criteria.<sup>[6]</sup> The severity of ANH was further graded into mild, moderate and severe based on 32 week foetal pelvic APD measured by fetal ultrasound ( Fig. 1) and as given in Table I.



**Figure 1. Broad Representation for Calculating APD**

Classification	Third trimester APD of Renal Pelvis
Mild	7-9 mm
Moderate	10- 15 mm
Severe	>15 mm

**Table I. Classification of ANH based on Third Trimester Renal Pelvis APD<sup>1</sup>**

Following investigation modalities were used to evaluate new-borns with a history of ANH

- 1. USG
- 2. Voiding Cystourethrography (VCUG)
- 3. Renal Scintigraphy
- 4. Magnetic Resonance Urography (MRU)

For the usage of these investigation modalities following guidelines were used.<sup>6</sup>

*USG*

All new-borns with history of ANH underwent postnatal USG between Day 3-7 of life. Neonates with suspected posterior urethral valves, oligohydramnios or severe bilateral hydronephrosis underwent ultrasonography within 24-48 hrs of birth. Subsequent ultrasounds were done at 4 – 6 weeks, 3 month, 6 month and 6 monthly thereafter till resolution/correction. Two consecutive normal ultrasounds were considered as the criteria for resolution.

*VCUG*

VCUG was done for following cases of ANH-

- a) Moderate to Severe Hydronephrosis (Timing: 4-6 weeks of life)
- b) Worsening of Hydronephrosis
- c) ANH with ureteral dilatation (Timing: 4-6 weeks of life)
- d) Features of lower urinary tract obstruction (Timing: D 1-3 of life)
- e) Urinary Tract Infection (UTI)

*Radioisotope Studies*

Since immaturity of renal function results in reduced radiotracer uptake, renography is usually done at 6-8 weeks of life but may be performed earlier in patients with severe hydronephrosis and cortical thinning. Radioisotope studies were done for following cases of ANH-

- a) Moderate to Severe Hydronephrosis (Timing: 4-6 weeks of life)
- b) Worsening of Hydronephrosis
- c) Dilated ureter on USG (Timing: 4-6 weeks of life)

*MRU*

MRU was done, only if above modalities failed to delineate the underlying pathology. It involved prehydration with 10ml/kg of Ringers Lactate, sedation, diuresis with furosemide followed by Gadolinium-diethylenetriaminepentaacetic acid contrast.<sup>7</sup>

MRU is considered suitable to assess following information

- a. Urinary tract anatomy: The noncontrast MRU provides best information about anatomy of urinary tract.

- b. Differential Renal Function: In dynamic contrast enhanced MRU differential renal function is calculated by volume enhancement of renal parenchyma.
- c. Assessment of urinary tract obstruction: The calculation of Renal Transit Time (RTT) helps in assessment of urinary tract obstruction. Normal kidney has RTT < 245 sec. RTT of 245 – 490 sec is equivocal and RTT more than 490 sec indicates obstruction.

**Antibiotic Prophylaxis**

The postnatally confirmed ANH of moderate grade, severe grade or with dilated ureters were put on antibiotic prophylaxis with syp. Cephalixin 10 mgm/kg/ day as per our institute’s protocol till evaluation was complete.

The investigation data of postnatal USG, VCUG, Renal Scintigraphy and MRU (if done) was collected. The outcome, spontaneous resolution versus surgical intervention of each group was studied.

**Sample Size**

All patients who were diagnosed as a case of antenatal hydronephrosis at INHS Asvini and met the inclusion criteria during the study period were included in the study.

**Analysis**

The strength of association of grade of hydronephrosis and the outcome was analysed using Odd’s Ration and the statistical significance of association tested using Chi-Square test.

**RESULTS**

During this assessment period (2011-2016) 5120 babies were born at our centre. 112 patients (2.18%) were diagnosed and registered as case of ANH. Out of these 02 were excluded due to coexisting malformation and 14 were excluded due to loss to follow up leaving 94 (n = 94) in the study group. The demographic profile of cases is shown in Table II.

Sex		Weight	
Male	Female	<2.5	>2.5
64	30	14	80

**Table II. Demographic Profile**

The incidence of ANH in our study was 2.14% and M: F ratio was 2.13:1. The severity wise distribution of ANH is given in the table III

Sl. No.	Severity	Number	%
1	Mild	55	58.51
2	Moderate	30	31.92
3	Severe	9	9.57
Total		94	100

**Table III. The Severity Wise Distribution of ANH**

The incidence of significant postnatal pathology in the mild severity group was 5.46 % and only one (1.81%) had to undergo surgical intervention as shown in Table IV.

Sl. No.	Pathology	Number	%	Operated
1	Transient	52	94.54	-----
2	PUJ Obst	01	1.83	-----
3	VUJ Obst	00	-----	-----
4	VUR	02	3.63	01
5	PUV	00	-----	-----
6	Others	00	-----	-----
<b>Total</b>		<b>55</b>	<b>100</b>	<b>01</b>

**Table IV. Mild ANH – Postnatal Pathology and Postnatal Intervention**

The incidence of significant postnatal pathology in the moderate severity group was 46.66 % and the incidence of surgical intervention was 20%, shown in Table V

Sl. No.	Pathology	Number	%	Operated
1	Transient	16	53.34	-
2	PUJ Obst	06	20	02
3	VUJ Obst	04	13.33	02
4	VUR	04	13.33	02
5	PUV	-	-	-
6	Others	-	-	-
<b>Total</b>		<b>30</b>	<b>100</b>	<b>06</b>

**Table V. Moderate ANH – Postnatal Pathology and Postnatal Intervention**

The incidence of significant postnatal pathology in the severe category group was 100 % and the incidence of surgical intervention was 55.55%, shown in Table VI

Sl. No.	Pathology	Number	%	Operated
1	Transient	-	-	-
2	PUJ Obst	07	77.77	05
3	UVJ Obst	-	-	-
4	VUR	-	-	-
5	PUV	-	-	-
6	Others	02	22.23	-
<b>Total</b>		<b>09</b>	<b>100</b>	<b>05</b>

**Table VI. Severe ANH – Postnatal Pathology and Postnatal Intervention**

Sl. No.	Severity	No.	Significant Postnatal Pathology	%	Postnatal Surgical Intervention	%
1	Mild	55	03	5.46%	01	1.8%
2	Moderate	30	14	46.66 %	06	20%
3	Severe	09	09	100%	05	55.55%
<b>Total</b>		<b>94</b>	<b>24</b>		<b>09</b>	

**Table VII. Summary Postnatal Pathology and Postnatal Intervention**

Group- APD Size	Operated	Not-Operated	Total
>10 mm (Moderate +Severe)	11	28	<b>39</b>
< 10 mm	1	54	<b>55</b>
	12	82	<b>94</b>

**Table VIII. Statistical Analysis of Operated Versus Nonoperated Cases**

The statistical analysis of risk of intervention between cases of ANH with APD < 10 mm and APD >10mm was done. The relative risk of surgery for cases with APD > 10 mm was 15.511 indicating that these cases (moderate and severe ANH) are 15.511 times more likely to need an intervention. The Odds ratio was 21.21 indicating that the odds of having APD > 10 mm in patients requiring surgery were 21. The 95% Confidence interval was from 2.6 to 172.79. Hence a statistically significant association (for a 95% confidence interval  $p < .05$ ) exists between the APD > 10 mm and the risk of surgery.

The statistical significance of association was tested using Chi-square test. The p-value is 0.000158. Since the p-value is less than significance level of 0.05, we cannot accept the null hypothesis. Hence the association between the APD > 10 mm and the risk of surgery is statistically significant.

## DISCUSSION

ANH is the commonest antenatally detected congenital malformation. A hydronephrosis is not necessarily synonymous with true obstruction of the urinary tract. A true obstruction of the urinary tract as defined by Koff is any restriction to urinary outflow that if left untreated is likely to cause progressive kidney damage. Working by this definition the obstruction will always be diagnosed retrospectively at the cost of losing irreversibly valuable renal function. This limitation in definition of obstruction along with absence of effective early markers of progression of obstruction presents a major challenge in clinical management of ANH, and indications for surgery many a times becomes debatable.

To circumvent these limitations numerous management guidelines have been published.<sup>8</sup> At INHS Asvini the SFU consensus statement on evaluation and management of ANH of 2010 is being followed and the outcomes of our study are based on these guidelines.

The incidence rates reported in various studies vary from 0.6 – 5.4%.<sup>9-12</sup> In our study the incidence of ANH was 2.18% which is in line with the incidence reported in previous studies. The statistics derived from this study show severity distribution as mild ANH (58.5%), moderate ANH (31.61%) and severe ANH (9.5%). Ahmad et al reported the

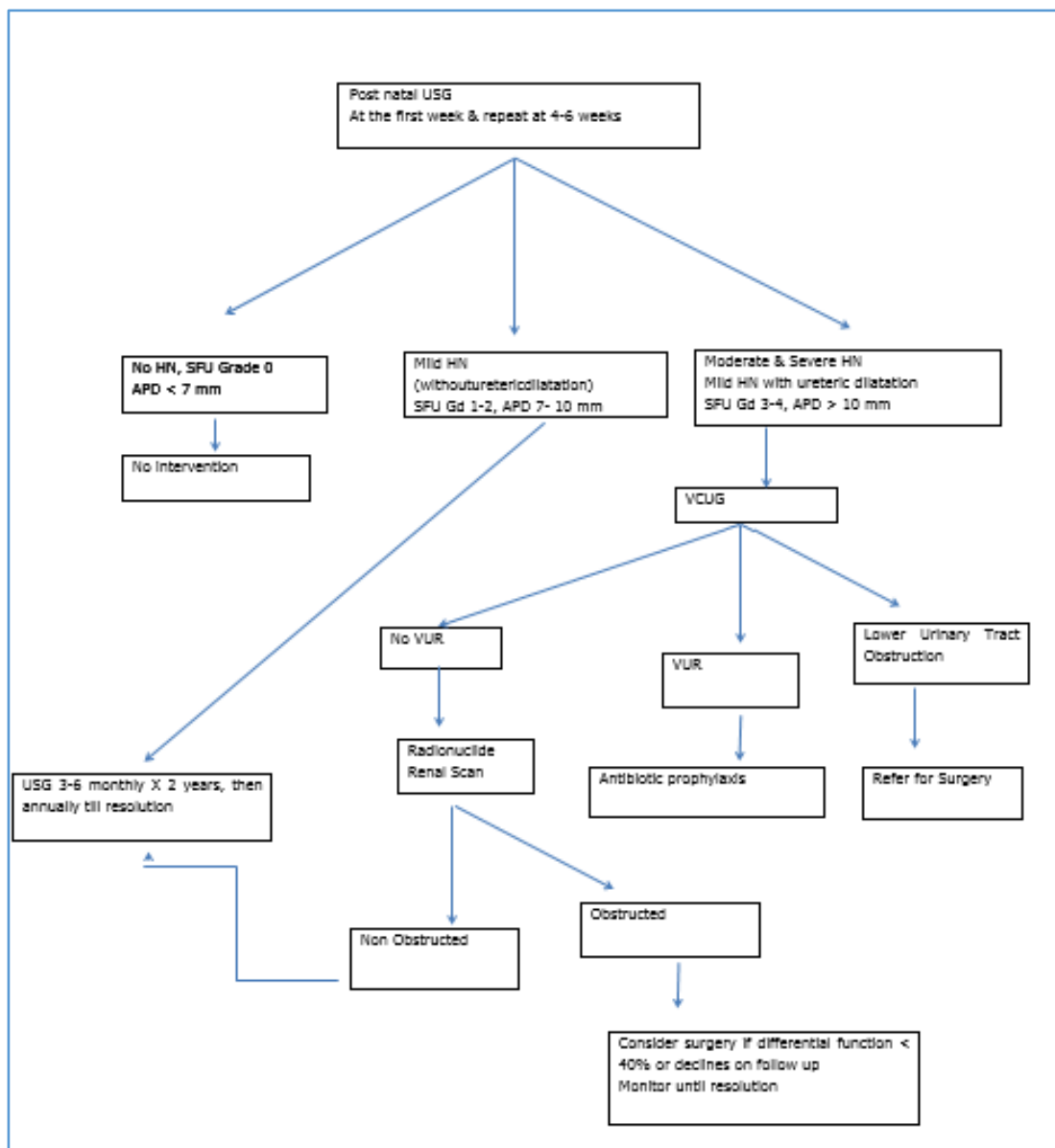
severity distribution of ANH as mild (56.7 -88%), moderate (10.2-29.8%) and severe (1.5 – 13.4%).<sup>13</sup>

The result of our study show that mild ANH runs a benign course and chances of spontaneous resolution are high. Out of 55 cases of mild ANH only 5.5 % had specific postnatal pathology and one (1.81%) had to undergo any surgical intervention. The remaining 94.5% resolved spontaneously on follow up. Those cases which failed to resolve needed follow up. They need detailed investigation (MCU & Radionuclide scan) only if there was increase in severity of hydronephrosis, UTI or thinning of renal cortex. This data can be used in counselling of parents of such babies favourably. Sidhu et al in their meta-analysis has reported that 98% of mild ANH are likely to resolve, stabilize or improve on follow up.<sup>5</sup> Lee et al have reported risk of postnatal pathology in their meta-analysis as 11.9%<sup>4</sup> and the risk of surgical intervention as 10%.<sup>14</sup>

On the other hand, in cases of moderate ANH 46.66% had specific postnatal pathology and 20% had to undergo surgical intervention while in cases of severe ANH all had significant postnatal pathology and 55.55% had to undergo surgical intervention. Lee et al have reported risk of postnatal pathology in moderate ANH in their meta-analysis as 45.1% and risk of surgical intervention as 25%.<sup>4,14</sup> Lee et al have reported risk of postnatal pathology in severe ANH as 88.3% and risk of surgical intervention as 68%.<sup>4,14</sup> This data can be used to counsel parents of child with moderate to severe ANH about the need of detailed investigation and prolonged follow up. An algorithm for approach to a case of ANH is depicted as Fig 2.

## CONCLUSION

The results of our study show that, Mild ANH runs a benign course and chances of spontaneous resolution are high. The presence of two normal postnatal renal ultrasounds excludes presence of significant renal disease including dilating VUR. However, severity of ANH does not correlate with the grade of reflux and patients with VUR may have normal postnatal ultrasound. Hence, those cases which failed to resolve need follow up and further detailed investigation (MCU & Radionuclide scan), only if there was increase in severity of hydronephrosis, urinary tract infection or thinning of renal cortex. However, cases of moderate ANH have specific postnatal pathology and may undergo surgical intervention while in cases of severe ANH all have significant postnatal pathology and majority may have to undergo surgical intervention. This study brings about the relevant data for a better and sequential counselling of worried parents and also adds to the literature to draw various centres to a consensus on management of these fetus/neonates.



**Figure 2. ANH: An Integrated Clinical Approach**

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