RESEARCH ARTICLE

Observational Study of Fetal Outcome of Pregnancies Antenatally Diagnosed on Ultrasound to Have Isolated Fetal Urological Congenital Anomalies

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Abstract

Background: Most common severe congenital anomalies are birth defects, neural tube defects, and Down syndrome. Congenital anomalies of the kidney and urinary tract anatomy (CAKUT) are common in children and represent approximately 30% of all prenatally diagnosed malformations. The spectrum includes more common anomalies such as vesicoureteral reflux and, rarely, more severe malformations such as bilateral renal agenesis.

Materials and methods: The present study was an observational prospective study, conducted in tertiary maternity hospital affiliated to a medical college in a metropolitan city. The study subjects were recruited in the study at the time of delivery or at the time of termination of pregnancy through universal sampling of all patients who register at Maternity Hospital. Study period was of 18 months, i.e., from February 2017 to August 2018.

Results: The antenatal diagnosis of urological anomalies was made in second trimester in 50%. 57.4% were male fetuses and 42.6% were female. Six fetuses underwent medical termination of pregnancy. Of the 54 cases born, 3 babies were stillborn, 3 babies died, and 84% survived till the 28th day of life. Most common anomaly diagnosed was hydronephrosis (51%), followed by renal agenesis (12.7%) and polycystic kidney (12.7%).

Conclusion: It can be said that antenatal and postnatal USG are good diagnostic tools when it comes to diagnosing congenital urological anomalies. Any suspected case of congenital urological anomaly should be referred to a tertiary care setup where NICU facilities are available.

Keywords: Congenital anomalies, Hydronephrosis, Ultrasound, Urological anomalies.

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Background

Of the 2.68 million deaths worldwide in 2015, 303,000 newborns died due to congenital anomalies. India has 6.7% prevalence of birth defects, which is translated to around 1.7 million birth defects annually. Some birth defects are clinically apparent at birth and other may get diagnosed later in life.[1]

Congenital anomalies of the kidney and urinary tract anatomy are common in children and represent approximately 30% of all prenatally diagnosed malformations. The spectrum starts from common anomalies such as vesicoureteral reflux till more severe malformations such as bilateral renal agenesis. In young children, congenital anomalies are the leading cause of kidney failure, kidney transplantation, or dialysis.[2]

This study was based upon identification of such high-risk pregnancies, their close follow-up, delivery of those mothers at tertiary care unit with pediatric urology units. This study summarizes the fetal outcome of these pregnancies to reflect the impact of antenatal care on fetal outcome. Fetal renal anomalies may be discovered coincidentally during antenatal and postnatal USG. Even when prenatal diagnosis of urinary tract anomalies is relatively easy (detection rate of 89%) based on USG finding, providing prognostic counselling to the parents and predicting the probable outcome is a difficult task. The postnatal follow-up of the study is to reveal the prognosis of such fetuses in terms of normalization.[3]

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Materials and Methods

The present study was an observational prospective study, conducted in tertiary maternity hospital affiliated to a medical college. The maternity hospital specializes in offering affordable obstetric and gynecological services to women across all sections of society. The study population included all pregnant females

with antenatal USG suggesting isolated fetal urological congenital anomalies.

Sampling Method

The study subjects were recruited in the study at the time of delivery or at the time of termination of pregnancy through universal sampling of all patients who register at the maternity hospital.

After taking the informed consent, convenient sampling method was used for sampling, consecutive persons got enrolled during the study period till the desired sample size was reached.

Sample Size

Sample size was calculated using formula

$$n = 4pq/d^2$$

where
p = prevalence
$q = (100 - p)$
d = precision (5% of p)
p = expected proportion in population based on previous studies (study of apparent congenital urological anomalies in North Indian newborns)[3] ($p = 3.91\%$)
$q = 100 - p = 100 - 3.91 = 96.09$

Using the formula, n is calculated as 60 (the above sample size is calculated assuming error of 5% at 95% of confidence interval).

Inclusion Criteria

- All the pregnant females registered at maternity hospital and who are antenatally diagnosed on USG to have fetal urological congenital anomalies.

Exclusion Criteria

- Women with fetuses having multiple system congenital anomalies.
- Women with severe medical disorders in pregnancy who themselves have impact on irrespective of fetal outcome irrespective of the presence or absence of fetal urological anomalies.

Study Period

The study period was of 18 months, i.e., from February 2017 to August 2018. This included planning up the study, setting up protocol, getting the necessary approvals, data collection, analysis of data, data interpretation, and dissertation writing.

Study Procedure

A semi-structured questionnaire was designed comprising three parts. Part A included socio-demographic characteristics; part B was for birth history and immunization status; part C includes disability profile and health-seeking behavior; part D includes questions related to quality of life on basis of WHO QOL-BREF scale.

The semi-structured questionnaire was drafted and validated with the help of field experts.

Those who are willing to participate in the study, informed consent was taken from them.

Data Analysis

All responses were tabulated by using Microsoft-Excel 2013 Software.

Data were analyzed by using SPSS software version 22.0.

Data were summarized using proportions, percentages, and contingency tables.

Results

Majority of women in the study were between the age-group of 26–35 years (53.3%). Twenty percent of the babies born with urological anomalies were born of consanguineous marriage. There were mothers with history of endocrine disorders like thyroid disorders and gestational diabetes (10.16% each). The maternal characteristics and medical history are depicted in Table 1.

As shown in Table 2, a total of 4 fetuses had breech presentation at term, 6 pregnancies were medically terminated, 6 were preterm deliveries, and 48 term deliveries (20 emergency cesarean deliveries, 7 elective cesarean deliveries, 20 full-term vaginal deliveries, 1 vacuum-assisted delivery).

The antenatal diagnosis of urological anomalies was made in the second trimester in 50% cases (30 mothers) and third trimester in 45% cases (27 mothers). Only 5% were identified in the first trimester (three cases). As shown in Table 3, 57.4% were male fetuses and 42.6% were female.

The survival of neonates at the end of 28 days was evaluated. Six fetuses had already underwent medical termination of pregnancy. Of the 54 cases born, 3 babies were stillborn, 3 babies died, and

Table 1: Maternal characteristics and medical history in cases with fetal urological congenital anomalies

Maternal characteristics	*No. of cases*	*Percentage*
Maternal age		
• 18–25 years	18	30
• 26–35 years	32	53.33
• Above 35 years	10	16.67
Consanguinity	12	20
• Second degree	4	6.66
• Third degree	8	13.33
Primigravida	32	53.33
Multigravida	28	46.67
H/o MTP	5	8.33
H/o adverse pregnancy outcome	19	31.66
Spontaneous conception	45	75
Periconceptional folic acid given	38	63.33
X-ray exposure	4	6.66
Significant medical history	2	3.33
Significant surgical history	11	18.33
Significant family history	2	3.33
History of oligohydramnios	9	15
History of gestational diabetes mellitus	6	10.16
History of thyroid disorder	6	10.16
Breech presentation	4	6.66
History of anemia	2	3.33
Intrauterine growth restriction	2	3.33
History of anhydramnios	1	1.66

Table 2: Mode of delivery

Mode of delivery	*No. of cases*	*Percentage*
Emergency LSCS	20	33.33
FTND	20	33.33
Preterm vaginal delivery	6	10
Medically terminated pregnancies	6	10
Elective LSCS	7	11.67
FT vacuum-assisted delivery	1	1.67
Total	60	100.0

Table 3: Fetal characteristics and fetal outcome in cases with fetal urological congenital anomalies

Fetal characteristics	*No. of cases*	*Percentage*
Sex		
• Male	31	57.4%
• Female	23	42.6%
Birth weight		
• Below 1 kg	3	
• 1–1.7 kg	4	
• 1.7–2.5 kg	17	
• Above 2.5 kg	36	
Maturity at birth		
Preterm	12	
Term	30	
Postterm	18	
Birth weight		
• Less than 1.7 kg	7	
• 1.7–2.5 kg	24	
• Above 2.5 kg	29	
Respiratory distress at birth	13	21.66
Total live births	51	85%
Stillbirths	3	5%
Neonatal deaths	3	5%
Babies who required surgical intervention	4	6.6%

84%, i.e., 48 babies survived till the 28th day of life. Thirty-five cases (58.34% cases) were given antibiotic prophylaxis.

The surviving 51 babies were advised urine microscopy, renal function tests, serum electrolytes, and renal ultrasound postnatally. Ten babies were advised DMSA scan, seven were advised micturating cystourethrography, and karyotyping was done for six cases. Based on this, antenatally diagnosed anomalies were correctly correlated postnatally in 70% cases. Among all the lesions 37.2% were unilateral and 62.7% were bilaterally located.

As shown in Table 4, most common anomaly diagnosed was hydronephrosis (51%), followed by renal agenesis (12.7%) and polycystic kidney (12.7%).

Hydronephrosis was the major anomaly detected. Fourteen cases had grade I hydronephrosis (58.3%), four had grade II hydronephrosis, two had grade III hydronephrosis, and four had grade IV hydronephrosis. Of these 24 cases, 7 cases had resolved spontaneously after birth (Table 5).

Discussion

The average age at which the diagnosis of urological congenital anomalies was made was found to be 24.17 weeks, and that majority were diagnosed in the second trimester (50%) followed by third trimester (45%).

Sanghvi et al. found that the mean gestational age at the time of diagnosis was 28.4 weeks.[4] Shalaby found that the mean gestational age at diagnosis was 26 weeks.[5] Boondagji et al. found that mean gestational age at the time of antenatal diagnosis was 26 weeks.[6] Thus, it is seen that most congenital anomalies of the urinary tract are diagnosed in the second or third trimester of pregnancy.

It is observed in the current study that the prevalence of dilated renal system (hydronephrosis) was found in 51.1% cases followed by renal agenesis and polycystic kidney disease in six cases; VUR and PUV was found in four and two cases, respectively, and dysplastic and ectopic kidneys were seen in two cases each. Sanghvi found that a dilated renal system was diagnosed in 39

Table 4: Distribution of various antenatally diagnosed fetal urological congenital disorders

Disorder	*Frequency*	*Percentage*
Renal agenesis	6	12.7
Ectopic kidney	2	4.2
Dysplastic kidney	2	4.2
Hydronephrosis	24	51.1
Polycystic kidney	6	12.7
Adrenal mass	1	2.1
VUR	4	8.5
PUV	2	4.2
Total	47	99.7

Table 5: Significant correlations

Variable	*Compared to*	*Rho*	*p value*	*Interpretation*
Survival at 28 days	APGAR score	0.674	0.001	Survival at 28 days is significantly associated with good APGAR score, longer NICU stay, early registration and diagnosis
	Days of NICU Stay	0.537	0.001	
	Early registration of pregnancy	0.340	0.001	
	Early antenatal diagnosis	0.323	0.001	
	Fetal distress during labor	–0.280	0.03	Presence of fetal distress at birth significantly reduces chances of survival
Days of NICU stay	Survival	0.537	0.001	NICU admission, antibiotic prophylaxis and surgical intervention are associated with good fetal outcome
	Antibiotic prophylaxis	0.530	0.001	
	Surgical intervention	0.362	0.05	

fetuses, cystic renal disease in 15, renal agenesis hypoplasia in six, combined lesions in four, and a horseshoe kidney in one.[4] The findings are similar to the present study where maximum prevalence is found for hydronephrosis. Boondagji et al. found that most common abnormalities detected were hydronephrosis, polycystic kidney disease, metacystic dysplastic kidney, and renal agenesis, in descending order of frequency.[6] Shalaby et al. found bilateral renal agenesis to be the commonest type of anomaly found among fetal urinary tract anomalies.[5] Unilateral hydronephrosis was found in 12.2% and bilateral hydronephrosis was found in 8.8% of cases. In a study by Renda et al. it was found that hydronephrosis was the most common among congenital anomalies of kidney and urinary tract.[7] Karambelkar et al. found that hydronephrosis was the most common congenital renal anomaly.[8]

Therefore, it can be said that hydronephrosis is the commonest congenital renal anomaly to be encountered on antenatal USG in cases of congenital urinary anomalies.

It is found in the present study that among cases of hydronephrosis, grade I (mild) hydronephrosis was found in 58.3% cases.

Sairam et al. found that among those with fetal hydronephrosis, mild hydronephrosis was present in 80.6% of cases.[9]

Boondagji et al. found that 27.8% of the fetuses had mild hydronephrosis and 48.6% had moderate hydronephrosis.[6]

In a study done by Feldman et al. it was found that 88% of the fetuses had mild hydronephrosis.[10]

Thus, it is observed from the present study and other relevant studies that among the various grades of hydronephrosis, the mild version is most commonly seen.

A chromosomal abnormality was detected in 1.6% (1/60) in our study. In total karyotyping was done in nine cases according to the risk factors associated.

Damen-Elias found that among the 408 cases of urinary tract anomaly, chromosomal abnormality was detected in seven (7/81), i.e., 8.6% of fetuses.[11]

Boondagji et al. found that chromosomal anomalies were detected in three cases antenatally and two cases postnatally.[6]

Dillon et al. found that chromosome anomaly was present in 2.4% of the fetuses.[12]

Study by Nicolaides et al. shows overall incidence of chromosomal abnormalities to be 12%.[13]

Thus, it can be concluded that chromosomal anomalies are present in cases of congenital urinary disorders and prevalence varies from study to study.

In our study consanguinity was observed among 20% of the cases.

Shalaby et al. observed that consanguinity was present in 24.4% of cases.[5]

Boondagji et al. found that 57 (40.4%) of the affected fetuses were due to consanguineous marriages, while 84 (59.6%) were due to nonconsanguineous marriages, and in five cases, the consanguinity status was not reported.[6]

Thus, it can be said that prevalence of consanguinity varies from study to study.

It was found that 29.1% of those who were found to have hydronephrosis during the antenatal scan resolved spontaneously postnatally.

Boondagji et al. found that out of the 72 cases of hydronephrosis, 45 of the mild and moderate degree hydronephrosis resolved spontaneously and were not seen at the 6-week follow-up scan.[6]

Feldman et al. found that (88%) fetuses had mild hydronephrosis. Most of these had complete resolution. Of those classified with 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.[10]

In a study done by Lam et al. it was found that babies who had mild dilation of the renal pelvis of 6–10 mm during fetal life revealed either normal renal findings in the postnatal period or complete resolution of the abnormalities within the first year.[14]

Nef et al. found that children with prenatal isolated hydronephrosis, ultrasound normalized at median age of 1.2 years (range 0.1–9).[15]

Thus, it can be concluded that most cases of mild hydronephrosis resolve spontaneously in cases of congenital hydronephrosis.

It was observed that among all the lesions 37.2% were unilateral and 62.7% were bilaterally located.

Damen-Elias et al. found that the anomaly was bilateral in 51.2% of fetuses and unilateral in 43.1% of foetuses.[11]

It was found that oligohydramnios was present in 15% of cases and gestational diabetes in 10.16%. Advanced maternal age was present in 3.3% cases; 1.6 % mothers had thalassemia.

Tain et al. found that the associated risk factors with CAKUT were maternal age, parity, gestational diabetes, maternal thalassemia/hemochromatosis, polyhydramnios, oligohydramnios, gestational age <37 weeks, and male babies.[16]

The presence of oligohydramnios and gestational diabetes tends to complicate the outcome of the pregnancy. Both of these complications were seen in the current study and could be affected the outcome in them.

51.6% of the fetuses were low birth weight.

Karambelkar et al. found that low birth weight was present in 64% of the babies born with congenital renal anomalies.[8]

Thus, low birth weight can be one of the outcomes in fetuses with congenital renal anomalies.

It is found that 57.4% of those affected with congenital urological abnormalities were male and 42.6% were female, i.e., male-to-female ratio of 1.3:1.

Scott et al. found that there was a 2:1 male-to-female ratio among those affected with urogenital abnormalities.[17]

Shalaby et al. found that 60.9% and 39.02% were male and female children among those affected with congenital urinary anomalies.[5]

Boondagji et al. found that among those infants who were affected with congenital renal anomalies 66.7% were male and 31.2% were females.[6]

Damen-Elias found that the overall male-to-female ratio was 7:3.[11]

Thus, it can be said that congenital renal anomalies are more common among male fetuses as compared to female ones.

Termination of pregnancy was performed in 10% of the cases and 10% did not survive till 28 days post delivery.

Damen-Elias found that among the 408 cases of urinary tract anomaly termination of pregnancy was performed in 13.7% cases.[11] Shalaby et al. found that induction of abortion was done in 26.8%.[5]

Thus, earlier diagnosis of congenital urinary anomalies can help couples and treating doctors to decide on termination of pregnancy depending on the severity of the anomaly.

It is observed that 5.5% of the children had neonatal deaths 5.5% were still born, 66.6 % required NICU admission, and surgical intervention was done in 7.4% of the cases.

Boondagji et al. found that 3.5% of the cases had intrauterine deaths, 18.4% had neonatal deaths, 20.7% required NICU admission, and surgical intervention was done in 7.1% of cases.[6]

Damen-Elias found that 3% of the fetuses with congenital urinary anomalies were still births.[11]

Thus, still births are seen in cases of severe cases of congenital urinary anomaly and those associated with other system anomalies. The prevalence of which varies from study to study.

Conclusion

Antenatal USG is an important tool to diagnose congenital anomalies of the renal system and those in whom anomalies are detected are advised to have repeat USG postnatally to correlate the antenatal findings. Mild hydronephrosis was found to be the most common renal congenital anomaly and most cases resolved simultaneously. Thus, the treating obstetrician should keep this in mind and counsel the parents accordingly to prevent unnecessary anxiety. Fetuses with complex congenital anomalies and severe hydronephrosis along with other system anomalies generally tend to have poor outcome. Therefore, termination of pregnancy should be offered to parents whenever such diagnosis is made. Any suspected case of congenital urological anomaly should be referred to a tertiary care setup where NICU facilities are available. The treating obstetrician should keep in mind the possibility of congenital renal anomalies when treating such complicated pregnancies. Urological congenital anomalies often occur in association with anomalies of other systems, many of these anomalies have genetic etiology. Hence complete genetic surveillance of such cases is recommended.

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