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ORIGINAL ARTICLE

# Types and Outcome of Fetal Urinary Anomalies in Low Resource Setting Countries: A Retrospective Study

**Shalaby Hend · Hemida Reda · Nabil Hanan · Ibrahim Mohammad**

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## About the Author

**Hend Shalaby** is an associate professor of Obstetrics and Gynecology, Mansoura University, Egypt, having recieved her Masters degree in Obstetrics and Gynecology 1997 for the thesis titled: "Transvaginal scoring system for induction of labor" and MD degree of Obstetrics and Gynecology for the thesis titled: "Prenatal diagnosis of fetal congenital heart disease by fetal echocardiography". She is a member of the International Society of Ultrasound of Obstetrics and Gynecology (21777) and also a member of the Fetal Medicine Foundation (pursuing certificate of competence after obtaining certificate of attendance of all online courses). She is credited with a previous publication in the JOGI journal titled: ("Prenatal diagnosis in low resource setting, is it acceptable?".

## Abstract

*Background* Congenital anomalies of the kidney and urinary tract in the developing countries have a poor prognosis due to limited experience in antenatal and postnatal management.

*Patients and methods* A 3-year retrospective study was carried out from January 2011 to December 2013. The following data were collected and analyzed: maternal age, gravidity, parity, gestational age at diagnosis, and ultrasonography findings. Final diagnosis after birth, the performed surgeries, follow-up data, as well as survival at one year were also analyzed.

*Results* The mean age of the included patients was 28 years (range 20–35 years). The mean parity was 1.7 (range 0–4). The mean gestational age at diagnosis was 26 weeks (range 15–36 weeks). Consanguinity was reported in 10 cases (24.4 %). There were 25 males and 16 females. Bilateral renal agenesis was the commonest type (19.5 %). The anomalies of kidneys and urinary tract in our cases were associated with other anomalies in 8 cases (19.5 %). Oligohydramnios was detected in bilateral renal agenesis and posterior urethral valve. Surgical interference during the first 6 months was performed in 6 cases; pyeloplasty for unilateral or bilateral hydronephrosis was performed in 5 cases; and excision of solitary renal cyst performed in one case. By the end of the first year, two of the three cases with chronic renal disease, who were under peritoneal dialysis, died, and three cases who had undergone pyeloplasty were lost to follow-up.

*Conclusion* Among the 41 cases with antenatally diagnosed renal and urinary malformations; bilateral renal agenesis was the commonest anomaly (19.5 %). There were high rates of induction of abortion, IUFD, and neonatal deaths. The poor outcome may be due to lack of experience in performing invasive therapeutic fetal procedures.

Shalaby H., Associate Professor ·
Hemida R. (✉), Associate Professor ·
Nabil H., Lecturer · Ibrahim M., Lecturer
Mansoura University, Mansoura, Egypt
e-mail: redaelshouky@hotmail.com

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## Introduction

Congenital anomalies of the kidney and urinary tract (CAKUT) are the commonest cause of pediatric end-stage renal disease. They represent 20–30 % of all antenatally diagnosed fetal congenital anomalies in developed countries [1, 2]. Renal pelvis dilatation and hydronephrosis accounted for more than half of the cases [2]. One third of fetuses presented with associated extrarenal malformations, and 10 % of them had abnormal karyotypes [3].

Lower urinary tract obstruction is the main etiology of megacystis. Outcome of megacystis detected in the first trimester is poor. Moreover, Alhamzi et al. [4] concluded that prenatally detected urinary tract dilatation has a poor prognosis in both male and female fetuses. Associated malformations are observed more frequently in female than in male fetuses.

Antenatal diagnosis of CAKUT is usually done by ultrasound. Policianto et al. [2] emphasized the high degree of reliability of prenatal ultrasound in the establishment of diagnosis of urinary tract malformations and the prediction of postnatal outcomes. Behairy et al. [5] recommended the use of magnetic resonance imaging (MRI) to confirm the ultrasound findings.

Congenital anomalies of the kidney and urinary tract in the developing countries have a poor prognosis due to the limited experience in antenatal and postnatal management. Bondaji [6] reported after his study in Saudi Arabia that the perinatal mortality rate among fetuses with CAKUT is 310 per 1000, the majority of these cases (90 %) occurred in cases with renal parenchyma involvement.

To the best of our knowledge, there are few reported studies to describe the types and the outcome of urinary malformations in the developing countries. So, we conducted this retrospective study.

## Patients and Methods

A 3-year retrospective study was carried out from January 2011 to December 2013, in the Department of Obstetrics and Gynecology, Mansoura University Hospital, Egypt. It included cases of kidney and urinary tract malformations that were referred to our prenatal fetal medicine unit.

The following data were collected and analyzed: maternal age, gravidity, parity, gestational age at diagnosis, and ultrasonography findings, and the results of karyotyping whenever available. Decisions of the multidisciplinary prenatal team and the outcome of pregnancy were collected.

Final diagnosis after birth, the performed surgeries, data of pediatric and surgical follow-up, as well as survival at 6 months and one year were also analyzed.

## Statistical Analysis

Data were analyzed using SPSS (Statistical Package for Social Sciences) version 15. Qualitative data were presented as number and percent. Comparison between groups was done by Chi Square test. Quantitative data were presented as mean ± SD. *F* test (One-way Anova) was used to compare between more than two groups. $P < 0.05$ was considered to be statistically significant.

## Results

The mean age of the included patients was 28 years (range 20–35 years). The mean parity was 1.7 (range 0–4). The mean gestational age at diagnosis was 26 weeks (range 15–36 weeks). Consanguinity was reported in 10 cases (24.4 %). Regarding fetal gender, there were 25 males and 16 females (60.98 and 39.02 %, respectively).

Types of renal anomalies among the studied cases are presented in Table 1; bilateral renal agenesis was the commonest type (19.5 %). The anomalies of kidneys and urinary tract in our cases were associated with other anomalies in 8 cases (19.5 %) which were 3 cases of micrognathia, 2 cases of ventricular septal defect (VSD), 2 cases of Down syndrome (confirmed by postnatal karyotyping), and 1 case of hydrocephalus. Furthermore, in 14 cases (34.1 %), renal anomalies were associated with features of Potter I, Potter II, and Potter III syndromes.

Amniotic fluid index (AFI) was measured in the studied cases; oligohydramnios was detected in bilateral renal agenesis and posterior urethral valve (mean AFI = 2.9 & 4.0, respectively). The mean AFI values in different renal anomalies are presented in Table 2.

Induction of abortion was done in 11 cases (26.8 %) after discussion with the neonatologist and the pediatric

**Table 1** Type of prenatally detected renal anomalies

| Type of anomaly | Number of cases | Percentage |
|---|---|---|
| Bilateral renal agenesis | 8 | 19.5 |
| Unilateral renal agenesis | 2 | 4.9 |
| Autosomal recessive polycystic kidney (ARPCK) | 7 | 17.1 |
| Multicystic dysplastic kidney (MCDK) | 4 | 9.8 |
| Autosomal dominant polycystic kidney (ADPCK) | 3 | 7.3 |
| Posterior urethral valve | 5 | 12.2 |
| Unilateral hydronephrosis | 5 | 12.2 |
| Bilateral hydronephrosis | 4 | 8.8 |
| Solitary renal cyst | 3 | 7.3 |
| Total | 41 | 100 |

**Table 2** Correlation between amniotic fluid index (AFI) and type of renal anomaly

| Type of anomaly | AFI (mean) | *P* value |
|---|---|---|
| Bilateral renal agenesis | 2.88 | <0.0001 |
| Unilateral renal agenesis | 8.00 | |
| Autosomal recessive polycystic kidney | 5.43 | |
| Multicystic dysplastic kidney | 7.50 | |
| Autosomal dominant polycystic kidney | 7.33 | |
| Posterior urethral valve | 4.00 | |
| Unilateral hydronephrosis | 9.20 | |
| Bilateral hydronephrosis | 7.00 | |
| Solitary renal cyst | 10.33 | |

**Table 3** Outcome of prenatally diagnosed renal anomalies by end of first year

| Outcome | Number of cases | Percentage |
|---|---|---|
| Induction of abortion | 11 | 26.8 |
| Intrauterine fetal death | 2 | 4.9 |
| Neonatal death | 8 | 19.5 |
| Alive with chronic renal disease[a] | 3 | 7.3 |
| Alive with normal renal function | 11 | 26.8 |
| Alive after performing operation | 6 | 14.6 |
| Total | 41 | 100 |

[a] Under peritoneal dialysis

nephrologist. The decision of pregnancy termination was taken after counseling with the mother and her husband. The outcomes of pregnancy in the studied cases were concluded as shown in Table 3.

Surgical interference during the first year was performed in six cases; pyeloplasty for unilateral or bilateral hydronephrosis was done in five cases; and excision of solitary renal cyst done in one case.

The fetal outcome and survival at 6 months in relation to different types of anomalies of kidneys and urinary tract are demonstrated in Table 4. The difference in outcomes in different types was statistically significant ($P < 0.0001$). However, by the end of the first year; two of the three cases with chronic renal disease who were under peritoneal dialysis died, and three cases who had undergone pyeloplasty were lost to follow-up.

## Discussion

Congenital anomalies of kidney and urinary tract represent a significant proportion of antenatally diagnosed fetal anomalies in the developing countries. Policianto et al. [2] reported that CAKUT constituted 21 % of antenatally diagnosed fetal anomalies. The role of the prenatal ultrasound has evolved in its specificity (93–99 %) and sensitivity (14–85 %) for identification of fetal

**Table 4** Correlation between fetal outcome& survival at one year and type of renal anomalies

| | IOA | IUFD | ND | Alive with CRD | Alive with normal renal function | Alive with operation | |
|---|---|---|---|---|---|---|---|
| Bilateral renal agensis | 7 | 0 | 1 | 0 | 0 | 0 | Pearson Chi-Square 81.062 |
| | 63.6 % | 0 % | 12.5 % | 0 % | 0 % | 0 % | *P* value <0.0001 |
| Unilateral renal agenesis | 0 | 0 | 1 | 0 | 1 | 0 | |
| | 0 % | 0 % | 12.5 % | 0 % | 9.1 % | 0 % | |
| ARPCK | 0 | 1 | 4 | 2 | 0 | 0 | |
| | 0 % | 50.0 % | 50.0 % | 66.7 % | 0 % | 0 % | |
| MCDK | 0 | 0 | 1 | 1 | 2 | 0 | |
| | 0 % | 0 % | 12.5 % | 33.3 % | 18.2 % | 0 % | |
| ADPCK | 0 | 0 | 0 | 0 | 3 | 0 | |
| | 0 % | 0 % | 0 % | 0 % | 27.3 % | 0 % | |
| Posterior valve | 4 | 1 | 0 | 0 | 0 | 0 | |
| | 36.4 % | 50.0 % | 0 % | 0 % | 0 % | 0 % | |
| Unilateral hydronephrosis | 0 | 0 | 0 | 0 | 3 | 2 | |
| | 0 % | 0 % | 0 % | 0 % | 27.3 % | 33.3 % | |
| Bilateral hydronephrosis | 0 | 0 | 1 | 0 | 0 | 3 | |
| | 0 % | 0 % | 12.5 % | 0 % | 0 % | 50.0 % | |
| Solitary renal | 0 | 0 | 0 | 0 | 2 | 1 | |
| | 0 % | 0 % | 0 % | 0 % | 18.2 % | 16.7 % | |

The given percentage in the previous table represent % within the outcome

*IOA* induction of abortion, *IUFD* intrauterine fetal death, *ND* neonatal death, *CRD* chronic renal disease

malformations and has partly contributed to the lowering of fetal mortality rates [7, 8]. More abnormalities are seen by the third trimester, and a single early scan may miss some fetal anomalies [9].

We performed a retrospective analysis of 41 cases of kidney and urinary tract anomalies diagnosed by antenatal ultrasound during the last 3 years in the Department of Obstetrics and Gynecology, Mansoura University Hospital, Egypt.

The commonest detected anomaly was the bilateral renal agenesis. However, this finding was not in agreement with those of Bondagji et al. [6] and Policianto et al. [2], who reported that the commonest anomaly in their studies was the bilateral hydronephrosis. This means that types of renal anomalies varied with different geographic distributions.

Associated congenital anomalies were diagnosed in 8 cases (19.5 %). This finding was reported by Bornes et al. [10] who reported that an associated congenital abnormality in 32/84 (38.1 %) of their cases.

The outcomes of the reported cases were worse in cases of bilateral renal agenesis and posterior urethral valve which may be the associated severe oligohydramnios and subsequent pulmonary hypoplasia. Spaggiari et al. [11] reported that 30 of 34 cases (88.2 %) with hypoplastic kidneys complicated by oligohydramnios or anhydramnios were associated with poor outcomes. Bienstock et al. [12] reported a case of bilateral renal agenesis treated with serial amnioinfusion in which the newborn survived the newborn period and was able to undergo peritoneal dialysis followed by a planned renal transplantation.

Potter syndrome was first described in 1946 in a published article describing facial characteristics with bilateral renal agenesis by Potter [13]. It is characterized by bilateral renal agenesis in the fetus, which leads to severe oligohydramnios, and as a result, the fetus is compressed between the walls of uterus, leading to characteristic facial abnormalities, skeletal defects, and pulmonary hypoplasia [14]. We reported 14 cases of Potter syndrome; the outcome was worse in Potter I and was better in Potter III cases.

There were five cases of megacystis due to posterior urethral valve; induction of abortion was done for four cases after multidisciplinary team discussion and family counseling. One case developed intrauterine fetal death. The poor outcomes in these cases in our unit may be due to lack of experience in performing vesicocentesis and vesicoamniotic shunts (VAS). Ethun et al. [15] reported their experience in the management of 14 fetuses with megacystis, of whom 11 underwent intervention. One patient received vesicocentesis alone, while 10 had VAS. Two fetuses suffered in utero demise, and two had unknown outcomes. Lower urinary tract obstruction was confirmed in six of the eight live-born fetuses. One patient died in the neonatal period, while seven survived. All six available at follow-up (median 3.7 years) had significant genitourinary morbidity.

In our fetal-maternal unit and many units of similar low resource setting countries, we do not have the experience of performing invasive therapeutic fetal procedures such as vesicocentesis and VAS. This explains the higher rate of induction of abortion and fetal demises in cases of kidney and urinary malformations than results of the fetal–maternal centers of the developed countries.

## Conclusion

Among the 41 cases with antenatally diagnosed renal and urinary malformations, bilateral renal agenesis was the commonest anomaly (19.5 %). There were high rates of induction of abortion, IUFD, and neonatal deaths. The poor outcomes may be due to lack of experience in performing invasive therapeutic fetal procedures.

**Compliance with ethical requirements and Conflict of interest** The research was accepted by the Ethical Committee of Department of Obstetrics and Gynecology, Mansoura University Hospital, Egypt. The authors declare no conflict of interest to the contents of this manuscript.

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