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Reliability of ultrasound in the prenatal diagnosis of urinary tract abnormalities

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Abstract

To investigate the ability of ultrasonography to detect urinary tract abnormalities prenatally, we reviewed the records of 26 pregnancies diagnosed by prenatal ultrasound to have urinary tract anomalies. We compared the prenatal diagnoses with postnatal renal and urinary tract pathology. This comparison showed different degrees of agreement for different prenatal diagnoses (2 individuals had more than one diagnosis): 4 of 8 for multicystic kidneys, 1 of 1 for polycystic kidney disease, 1 of 2 for renal agenesis, 6 of 7 for ureteropelvic junction obstruction, 1 of 3 for posterior urethral valves, 4 of 5 for no pathology noted, and 2 of 2 for other abnormalities. Prenatal diagnosis and postnatal findings were in agreement in 68% of cases. Varying levels of diagnostic reliability should be considered when managing pregnancies complicated by fetal urinary tract abnormalities and subsequent postnatal evaluation and diagnosis. Further efforts are needed to improve on the techniques and reliability of prenatal diagnosis of urinary tract abnormalities.

Keywords

Prenatal diagnosis; Postnatal findings; Ultrasonography; Urinary tract abnormalities

Introduction

High-resolution ultrasonography is a non-invasive and safe technique which helps in assessing the viability, sex, position, gestational age, and size of the fetus, and in determining the amount of amniotic fluid. It can also detect congenital abnormalities of the urinary tract as early as 16 weeks' gestation [1,2]. With the advent of fetal surgery and other prenatal methods of treating these congenital abnormalities, it becomes imperative to evaluate the reliability of these prenatal diagnostic techniques.

In this paper, we report the follow-up of congenital abnormalities of the urinary tract diagnosed prenatally by ultrasound in 26 fetuses. The purpose of this report is to evaluate the accuracy of fetal ultrasonography in the prenatal diagnosis of urinary tract abnormalities and to discuss the implications for the management of the affected fetus.

Methods

Our patient referral base consists of approximately 30,000 babies per year in Middle Tennessee, Southern Kentucky and Northern Alabama. In addition, about 2,800 pregnant women have ultrasonographic examinations performed per year with an average of 2.5 studies per patient at Vanderbilt University Medical Center. In our study, over a period of 2.5 years we identified 26 pregnant women, each with a fetus diagnosed during the mid-trimester of pregnancy, to have a congenital abnormality of the urinary tract. These fetuses were identified by routine obstetrical ultrasound examination and/or referred to Vanderbilt University Medical Center because of an abnormal ultrasonographic study of the urinary tract. The prenatal diagnosis was made by an experienced ultrasonographer after a minimum of two examinations performed over at least a 2-week period. Other factors such as the amount of amniotic fluid, intrauterine growth and associated abnormalities of other organ systems were also noted.

The 26 fetuses were available for postnatal follow-up for comparison of actual physical findings with the respective prenatal ultrasound diagnoses. Postnatal renal findings were determined by clinical examination and with the use of some or all of the following: intravenous pyelography (IVP), renal ultrasound examination, radionuclide renal studies, and voiding cystourethrography (VCUG). In 6 cases of intrauterine or postnatal death, an autopsy was performed. Because of our wide referral base, we were unable to determine the overall number of pregnancies and consequently the frequency of ultrasonographic congenital abnormalities of the urinary tract. Therefore, our study design precludes the evaluation of many abnormalities of the urinary tract by antenatal ultrasound examination and does not permit calculation of the number of such abnormalities missed at ultrasound evaluation.

Results

The urinary tract abnormalities diagnosed prenatally in this study included: cystic kidneys (9 cases), renal agenesis (2 cases), ureteropelvic junction (UPJ) obstruction (7 cases), posterior urethral valves (PUVs) (3 cases), and miscellaneous (7 cases). The prenatal diagnoses and respective postnatal findings of these patients are presented in Table 1

Discussion

Congenital abnormalities of the urinary tract occur in 3.3%–11.1% of autopsies [3–7] and account for about 50% of ultrasonographically diagnosed congenital malformations [1]. These abnormalities may lead to obstruction (which may interfere with renal development and function), infection, and renal failure. Prenatal diagnosis of urinary tract abnormalities allows early treatment to prevent urosepsis, dehydration, renal scarring, and subsequent renal

failure. When a urinary tract abnormality is discovered in a fetus, associated abnormalities of other organ systems and chromosome aberrations, which are present in 47% and 8%–23%, respectively, should be ruled out [8–12].

The present study shows different degrees of agreement between pre- and postnatal findings for the different prenatal diagnoses of urinary tract abnormalities. Cystic kidney disease and UPJ obstruction showed high agreement. However the small number of cases of renal agenesis and PUVs did not allow specific conclusions to be drawn for these abnormalities. The overall agreement was 68%. Similar studies on 33 fetuses reported by Helin and Persson in 1986 [1] revealed a similar agreement of 65%.

The reasons for the incorrect prenatal diagnosis in approximately one-third of fetuses with urinary tract abnormalities in our study and that of Helin and Persson [1] are not clear. The limitation of available ultrasonographic techniques, reports by different ultrasonographers (although our studies were performed by one ultrasonographer) or inaccurately reported gestational ages may have played a role in the incorrect diagnoses. The lack of normative data on the development of the urinary tract of the fetus may have also contributed to these errors.

The accuracy of prenatal diagnostic techniques and specifically ultrasonography is of utmost importance in view of the decisions that have to be made once the prenatal diagnosis is achieved. The reliability of prenatal diagnosis of various urinary tract abnormalities should be taken into consideration in interpreting findings and making decisions regarding the management of fetuses.

Until more accurate prenatal diagnosis of urinary tract abnormalities is available, the management of these abnormalities should be conservative. Our approach is similar to that of Helin and Persson [1]. Fetuses with unilateral renal malformations and bilateral abnormalities without impairment of renal function may be investigated in the neonatal period with renal ultrasound, renal function studies and, when indicated, VCUG and a renal scintigram. IVP, CT scan, or magnetic resonance imaging of the kidney generally add little information to the above studies [13]. Fetuses with bilateral lesions and progressively decreasing renal function should be considered for a planned preterm delivery in a tertiary care center where modern diagnostic techniques are available. A definitive plan for management should await accurate postnatal evaluation. If early elective delivery is precluded in these fetuses by immature lungs or other problems, fetal surgery could be considered. The efficacy and safety of fetal surgery, which consists mainly of decompression of the urinary tract, have not yet been established [10]. Premature labor or abortion are the main complications of fetal surgery [14, 15] and procedure-related death occurs in about 5% of cases [10]. Fetuses with oligohydramnios and bilateral renal agenesis or cystic malformations have a very poor prognosis and their parents may choose to terminate the pregnancy if diagnosed early in gestation.

Further efforts are needed to improve the techniques and reliability of prenatal diagnosis of urinary tract abnormalities.

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Table 1

Prenatal ultrasonographic diagnoses and respective postnatal findings in the 26 infants

Prenatal diagnosis (no. of fetuses)	Postnatal finding (no. of fetuses)
<i>Renal abnormality</i>	
Multicystic kidney (6)	
Unilateral (2)	Multicystic kidney with an extrarenal pelvis (1) Polycystic kidney disease (1)
Bilateral (4)	Same (2) Unilateral multicystic kidney (1) Polycystic kidney disease (1)
Polycystic kidney disease (1)	Same
Unilateral renal agenesis with contralateral multicystic kidney (1)	Normal
Renal agenesis, bilateral (1)	Same
<i>Urinary tract obstruction</i>	
PUV with unilateral multicystic kidney and bilateral hydroureter (1)	Polycystic kidney disease with bilateral hydroureter
UPJ obstruction	
Unilateral (5)	Same (4) Normal (1)
Bilateral (2)	Unilateral dilated renal pelvis (2)
PUV (2)	PUV(1) UPJ obstruction (1)
<i>Other</i>	
Defects not identified on follow-up ultrasonographic studies (5)	Normal (4) Prune belly syndrome with vesicoureteral reflux (1)
Hydronephrosis with distended bladder (1)	Hydronephrosis, glycogen storage disease
Chorioangioma (1)	Placental mass

PUV, Posterior urethral valves; UPJ ureteropelvic junction