

Role of Antenatal Ultrasonography in Early Detection of Fetal Urinary System Anomalies

Essay

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Abstract

Congenital abnormalities of the urinary tract are the most common sonographically identified malformations approximately 20-30% of all ultrasound detected anomalies.

In this study US has been successfully used for the evaluation of urinary tract congenital anomalies, although congenital urinary tract malformations comprise a broad range of structural and functional anomalies at the level of the kidney parenchyma, collecting system, bladder and urethra.

Our study concludes that US especially 3D US offers a new promising imaging modality for detection and diagnosis of many congenital anomalies such as renal agenesis, polycystic kidney, hydroureter and posterior urethral valve.

List of abbreviation

3D US	3 Dimensional Ultrasound
4D US	4 Dimensional Ultrasound
ADPKD	Autosomal dominant polycystic kidney disease.
AFI	Amniotic fluid index.
AFV	Amniotic fluid volume.
ARPKD	Autosomal recessive polycystic kidney disease.
BD	Bladder diverticulum.
BRA	Bilateral renal agenesis.
DCS	Duplex collecting system.
EXIT	EX-utero intrapartum treatment.
GCKD	Glomerulocystic kidney disease.
LUTO	Lower urinary tract obstruction.
MCDK	Multicystic dysplastic kidney.
MMIHS	Megacystitis microcolon intestinal hypoperistalsis.
PUV	Posterior urethral valve.
ROH	Renal oligohydramnios.
ROI	Region of interest.
SDP	Single deepest pocket.
UPJ	Ureteropelvic junction.
UPJO	Ureteropelvic junction obstruction.
US	Ultrasound.
UVJ	Ureterovesical junction.
VUR	Vesicoureteral reflux.

LIST OF FIGURES

No.	Figure	Page
1.	<i>The three sets of excretory systems in an embryo during the fifth week. A. Lateral view. B. Ventral view</i>	5
2.	<i>A. Lateral view of a five-week embryo showing the extent of the mesonephros and the primordium of the metanephros or permanent kidney. B. Transverse section of the embryo showing the nephrogenic cords from which the mesonephric tubules develop. C-F. Transverse sections showing successive stages in the development of a mesonephric tubule between the fifth and eleventh weeks</i>	7
3.	<i>Development of permanent kidney (A) lateral view of 5-week embryo, showing the ureteric bud, the primordium of the metanephros. (b) to (e) successive stages in the development of the ureteric bud (fifth to eighth weeks)</i>	8
4.	<i>Derivatives of the ureteric bud (Collecting tubules and ducts)</i>	10
5.	<i>A-D. Ventral views of the abdominopelvic region of embryos and fetuses (sixth to ninth weeks), showing medial rotation and 'ascent' of the kidneys from the pelvis to the abdomen</i>	12
6.	<i>Development of the urinary bladder and urethra</i>	14
7.	<i>Incorporation of mesonephric duct and formation of trigone of bladder</i>	15
8.	<i>Structures related to the anterior surface of each kidney</i>	17
9.	<i>Structures related to the posterior surface of each kidney</i>	18
10.	<i>Internal structure of the kidney (coronal section)</i>	21
11.	<i>Renal vasculature</i>	23
12.	<i>Internal renal vasculature</i>	24

13.	<i>Ureters</i>	25
14.	<i>Urinary bladder. The trigone.</i>	28
15.	<i>Urethra</i>	32
16.	<i>Normal appearance of the fetal urinary tract at 20 weeks' gestation</i>	34
17.	<i>(A) Normal 25-week premature kidney. Longitudinal US scan shows increased echogenicity of the renal cortex relative to the liver with prominent, triangular, hypoechoic medullary pyramids. (B and C) Normal 28-week premature kidney. Longitudinal (B) and transverse(C) US scans of the right kidney (between calipers) show increased renal cortical echogenicity relative to the liver parenchyma, although not as increased as on (A). The hypoechoic medullary pyramids (P) are triangular, relatively prominent, and regularly arranged</i>	35
18.	<i>(A) Focused longitudinal US image of the kidney obtained with a linear-array transducer shows a normal corticomedullary differentiation. Normal renal perfusion is observed on color Doppler (B) and power Doppler (C) interrogation. Note the normal cortical vessels and the physiological hypovascular medulla</i>	36
19.	<i>Severe oligohydramnios in a fetus with renal agenesis at 14 weeks gestation</i>	37
20.	<i>Longitudinal US scan(A)of the right renal fossa shows an elongated appearance to the right adrenal and no renal tissue..Longitudinal US scan (B),color Doppler image (C), of the pelvis show renal tissue abutting the posterior wall of the bladder. B, bladder</i>	40
21.	<i>Transverse US scan shows a band of renal tissue overlying the spine (S)</i>	41
22.	<i>Crossed fused renal ectopia</i>	43
23.	<i>Unilateral renal agenesis in fetus at midgestation; while the left kidney is well demonstrated, the right renal fossa</i>	47

	<i>appears empty; the diagnosis is supported by the observation of a vertical direction of the adrenal gland and by the failure to demonstrate the right renal artery with color Doppler ultrasound</i>	
24.	<i>Sagittal scan of multicystic dysplastic left kidney</i>	51
25.	<i>Unilateral multicystic dysplastic kidney at 20-week scan</i>	51
26.	<i>Dysplastic modifications of the kidneys (coronal view). Note echogenic kidneys with collecting system dilatation</i>	56
27.	<i>Glomerulocystic disease. (A) Longitudinal US scan and (B) focused US image obtained with a linear-array transducer show diffuse increase in echogenicity of the renal parenchyma, with multiple, predominantly peripheral, tiny cortical cysts</i>	59
28.	<i>Duplex collecting system (obstructed upper pole moiety)</i>	61
29.	<i>Left (lt) pyelectasis (5.1mm) at 18 weeks gestation</i>	64
30.	<i>Mild hydronephrosis at 27 weeks. Three orthogonal view (left) and 3D reconstructed inverted image of the renal pelvis (right)</i>	65
31.	<i>Ectopic ureter (inserts into the urethra)</i>	67
32.	<i>Duplication of Ureters</i>	68
33.	<i>Renal duplication anomalies obstruction of the upper pole moiety</i>	69
34.	<i>A parasagittal US scan through the bladder show ureterectasis (between calipers)</i>	71
35.	<i>Rounded calyces (arrow) with UPJ obstruction</i>	73
36.	<i>Loss of calyceal shape (arrow) with severe UPJ obstruction</i>	73
37.	<i>Hyperechogenic bands in the renal pyramids associated with obstruction. (A) A longitudinal US scan of the right kidney and (B) focused view of the middle upper pole show moderate to severe pelvicaliectasis. There is a hyperechoic band in the renal pyramids, associated with obstructive</i>	74

	<i>hydronephrosis. This band is believed to represent the result of slight distention of the collecting ducts owing to the obstruction</i>	
38.	<i>Ureterocele in the bladder</i>	77
39.	<i>Pelvic (Bladder) ultrasound shows a large outpouching (D) of the bladder wall and mucosa projecting from the lumen of the bladder(B)</i>	80
40.	<i>Longitudinal scan of the lower abdomen. The cord insertion is visualized above the protruding mass that contains bladder and bowel loops</i>	81
41.	<i>Fetal megacystis demonstrated by antenatal Sonography</i>	83
42.	<i>Fetal megacystitis</i>	84
43.	<i>A) Coronal prenatal US image of the bladder shows a dilated posterior urethra with keyhole appearance to the bladder in keeping with posterior urethral valves</i>	86
44.	<i>Thickened bladder wall (between graticules) due to posterior urethral valves</i>	86
45.	<i>Prenatal diagnosis of prune-belly syndrome at 13 weeks of gestation</i>	90

CONTENTS

	Page
• Introduction	1
• Aim of the work	3
• Review of literature	4-103
- Embryology and Development Of the Urinary System	4
- Anatomy of the Urinary System	16
- Normal Sonographic Appearance Of Urinary Tract	33
- Role of Ultrasound in Diagnosis of Urological Anomalies	39
- Role of 3D/4D Ultrasonography	91
- Intrauterine therapeutic interventions	101
• Summary and conclusion	104-105
• References	106-119
• Arabic summary	---

Introduction

Congenital anomalies of the urinary tract are the most common sonographically identified malformations, with an incidence of 1 to 4 in 1000 pregnancies. As just they represent 15-20 % of all prenatally diagnosed congenital anomalies (*Grandjean et al., 1999*).

Prenatal diagnosis improves the outcome of the affected child because of early recognition and treatment of critical obstruction and UTI, preventing further renal damage and renal function impairment; it also allows fetal intervention in case of obstructive uropathy (*Adiego et al., 2011*).

Urinary tract anomalies may be isolated but can also be associated with other congenital anomalies, therefore, a through examination of other systems is mandatory to exclude possible genetic disorders (*Dias et al., 2014*).

Antenatal Ultrasonography plays an important role in diagnosing urinary tract malformations, the sensitivity of ultrasonography in detection of urinary tract malformations prenatally increased gradually, thus approximately half of the cases of the postnatally diagnosed abnormalities coincided with the prenatally discovered fetal urinary tract malformations , but they don't always allow detection of all malformations (*Artur et al., 2014*).

Fetal urinary tract can be visualized ultrasonically from 11 weeks onwards, allowing recognition of mega cystitis , a mid trimester anomaly scan enable detection of most renal anomalies with higher sensitivity ,as bilateral renal agenesis ,dysplastic kidneys , also Sonographically it is possible to differentiate between infantile type and adult type of polycystic kidney disease (*Dias et al., 2014*).

Obstructive uropathies account for majority of cases, the prenatal sonographic identification of urinary tract dilatation reflects a spectrum of potential etiologies and uropathies (*Nguyen et al., 2014*).

Invent of 3D and 4D ultrasound has made a dramatic improvement in fetal imaging and diagnosis of urinary system malformations. Various viewing directions, multiplanar and rendering modes help better demonstration of pathologies suspected on 2D US (*Donald school journal of ultrasound in obstetrics and gynecology, 2010*).

Aim of the work

Evaluate the role of antenatal ultrasonography in early detection of fetal urinary system anomalies.

Embryology and Development Of the Urinary System

Development of the urinary system in humans is a complex process; consequently, renal anomalies are among the most common congenital anomalies (*Moore et al., 2015*).

The urinary system consists of:

- Kidneys, which produce and excrete urine.
- Ureters, which convey urine from the kidneys to the urinary bladder.
- Urinary bladder, which stores urine temporarily.
- Urethra, which discharges urine from the bladder externally.

Development of kidneys and ureters:

Three sets of successive kidneys develop in the embryos. The first set, the pronephroi, is the rudimentary. The second set, the mesonephroi, functions briefly during the early fetal period. The third set, the metanephroi, forms the permanent kidneys (fig 1) (*Moore et al., 2015*).

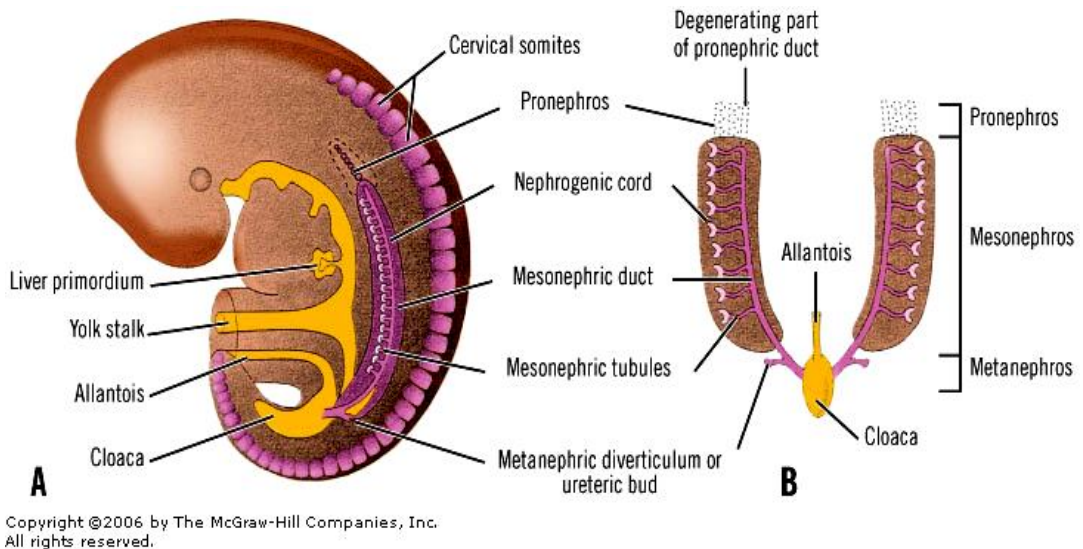


Fig (1): The three sets of excretory systems in an embryo during the fifth week. **A.** Lateral view. **B.** Ventral view (*Moore et al., 2015*).

Pronephroi

Pronephroi are bilateral transitory structures that appear early in the fourth week. They are represented by a few cell clusters and tubular structures in the developing neck region. The pronephric ducts run caudally and open into the cloaca, the chamber into which the hindgut and allantois emptied. The pronephric soon degenerate; however, most parts of the ducts persist and are used by the second set of kidneys (*Moore et al., 2015*).

Mesonephroi

Mesonephroi, which are large, elongated excretory organs, appear late in the fourth week, caudal to the pronephroi. The mesonephroi function as interim kidneys for

approximately 4 weeks, until the permanent kidneys develop and function. The mesonephric kidneys consist of glomeruli (10-50 per kidney) and mesonephric tubules. The tubules open into bilateral mesonephric ducts, which were originally the pronephric ducts. The mesonephric ducts open into the cloaca. The mesonephroi degenerate toward the end of week 12 (fig 2) (***Moore et al., 2015***).