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.

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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).***

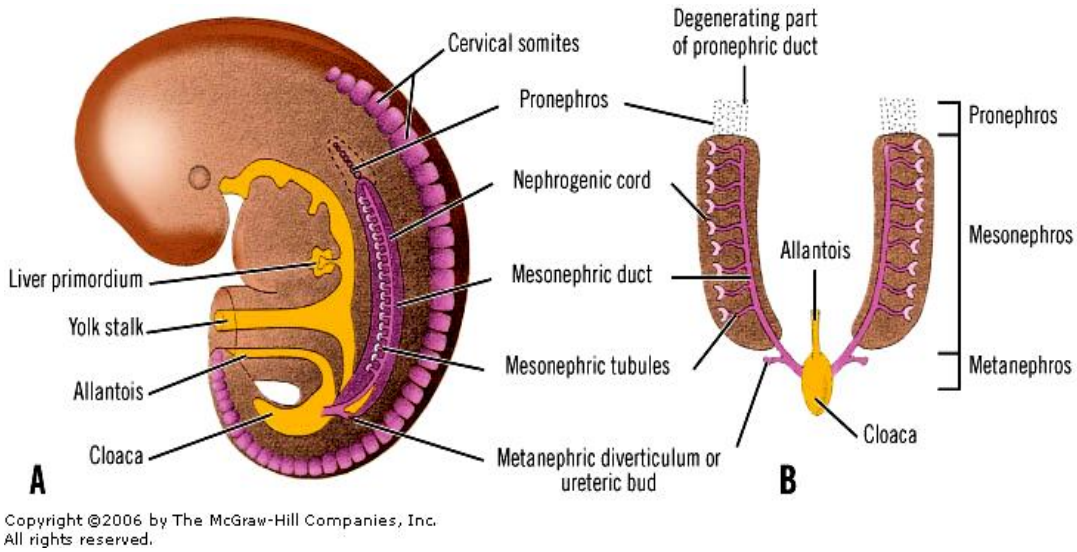

Fig (1): The three sets of excretory systems in an embryo during the fifth week. **A.** Lateral view. **B.** Ventral view ***(Moore et al., 2015).***

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).***