Transverse comparisons between Ultrasound and Radionuclide parameters in children with Pelvi-Ureteric Junction obstruction.

Thesis

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LIST OF ABBREVIATIONS

Abb.		Full Term
APD	:	anteroposterior diameter
BMI	:	body mass index
CD	:	Calyceal dilatation
Ct	:	computed tomography scanning
DRF	:	differential renal function
GFR	:	Glomerular filtration rate
IVP	:	intravenous pyelography
LK	:	Left kidney
LPP	:	length pole to pole
MRI	:	magnetic resonance imaging
PT	:	Parenchymal thickness
PUJ	:	Pelvi-ureteric junction
ROI	:	Region of interest
RBF	:	Renal blood flow
RK	:	Right kidney
SFU	:	Society of Fetal Urology
^{99m}Tc-DTPA	:	technetium-99m diethylenetriamine penta-acetic acid
TTP	:	Time to peak
UPJ	:	Uereteropelvic junction
US	:	Ultrasonography
UTD	:	urinary tract dilation
UTI	:	Urinary tract infection
VUR	:	vesicoureteral reflux

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ABSTRACT

Pelvi-ureteric junction (PUJ) obstruction, is one of the causes of an obstructive uropathy which may be congenital or acquired. Ureteropelvic junction (UPJ) obstruction is a blockage at the point where ureters attaches to the bladder. This blocks the flow of urine out of the kidney. Urine can build up and damage the kidney as a result, so radiologic imaging is crucial in diagnosing UPJ obstruction. It seemed therefore interesting to determine if some US parameters could predict the radionuclide parameters and which ultrasound parameter most influencing the kidney function. The initial step was to grade the severity of hydronephrosis, calyceal dilatation and cortical thinning, although it was easy for us to classify the importance of hydronephrosis in three groups according to anteroposterior diameter (APD). AP diameter of renal pelvis and differential renal function were the most effective parameters for surgical decision. These parameters can be used for appropriate management of antenatal hydronephrosis.

Keywords: UPJ: Uereteropelvic junction, US: Ultrasonography, APD: anteroposterior diameter

INTRODUCTION

Pelvi-ureteric junction (PUJ) obstruction/stenosis, is one of the causes of an obstructive uropathy which may be congenital or acquired with a congenital PUJ obstruction being one of the commonest causes of antenatal hydronephrosis **(Esteves et al.,2006)**. Several methods are used in diagnosing upper urinary tract obstruction as: ultrasonography, intravenous pyelogram, un-enhanced CT, diuretic renography,

Magnetic resonance urography and antegrade or retrograde pyelography **(Mohammad et al., 2016).**

It may present in both paediatric and adult populations although they tend to have differing aetiology, The estimated incidence in paediatric populations is ~1 per 1000-2000 new-borns. **(Esteves et al., 2006).**

PUJ obstruction is most commonly unilateral but is reported to be bilateral in ~30% (range 10-49%) of cases **(Esteves et al., 2006).**

Radiologic imaging is crucial in diagnosing UPJ obstruction .the diagnosis of UPJ obstruction signifies functionally impaired transport of urine from the renal pelvis into the ureter. Because the increased renal pelvic pressure from obstruction may lead to progressive renal injury and embarrassment, correct diagnosis is clinically important (**Montero et al., 2008).**

Current radiologic standards define hydronephrotic kidneys as those with an anteroposterior (AP) diameter at the renal pelvis of greater than 4 mm at a gestational age of less than 33 weeks and an AP diameter of greater than 7 mm at a gestational age of 33 weeks or older. An abnormal initial ultrasonogram should be followed up with another ultrasonogram after 4 weeks in severe cases or after 33-34 weeks in mild to moderate cases **(Wiener et al., 2002).**

Not uncommonly, asymptomatic UPJ obstruction is discovered in older children or adults when radiologic studies, such as ultrasonography, intravenous pyelography (IVP), computed tomography (CT) scanning, or magnetic resonance imaging (MRI), are performed for other reasons. The use of intravenous contrast material with nephrogenic and delayed excretion phases during CT scanning may provide qualitative information regarding obstruction, but in general, CT should be avoided because of the inherent high radiation dose. When hydronephrosis is seen when UPJ obstruction is suspected, diuretic renography is more accurate than CT **(Wiener et al., 2002).**

Intravenous pyelography (IVP) has historically been the primary study used to diagnose UPJ obstruction in adults, because it also provides anatomic and functional information. However, ultrasonography is preferred as the initial study in children

because of its nonionizing and non-invasive nature **(Dunnick et al., 1997)**.

CT may depict ureteropelvic junction (UPJ) obstruction when it is used as a primary study for evaluating common presenting symptoms . In older children, the modality is useful for assessing causes of acquired UPJ and ureteral obstruction (e.g., stones, tumors, retroperitoneal processes). Often, hydronephrosis is found incidentally on CT scans, and further studies are needed to distinguish UPJ obstruction from nonobstructive hydronephrosis **(Weiss et al., 2015).**

Cortical thinning in a hydronephrotic kidney may be seen on CT scans and may be predictive of ipsilateral renal function. The use of intravenous contrast material with nephrogenic and delayed excretory-phase images also may be helpful in determining whether renal function and excretion are impaired **(Weiss et al., 2015).**

AIM OF THE WORK

The aim of the study is to correlate between ultrasound parameters and dynamic scintigraphic parameters in children with pelviureteric junction obstruction (PUJO), the importance of each factor, and which of the ultrasound parameters most reflecting the renal function which is determined by the level of differential renal function (DRF) and the quality of renal drainage after a furosemide challenge, and if we can predict, on the basis of ultrasound parameters, the patient in whom radionuclide renography can be avoided. Also the role of both ultrasound and radionuclide parameters in deciding on surgery.

Review of Literature

Radiological anatomy of the pelvicalyceal system

The urinary system consists of the kidneys, ureters, urinary bladder, and urethra. The kidneys filter the blood to remove wastes and produce urine. The ureters, urinary bladder, and urethra together form the urinary tract, which acts as a plumbing system to drain urine from the kidneys, store it, and then release it during urination. Besides filtering and eliminating wastes from the body, the urinary system also maintains the homeostasis of water, ions, pH, blood pressure, calcium and red blood cells **(Tim, 2012).**

The kidneys are a pair of bean-shaped retroperitoneal organs found in the paravertebral gutter along the posterior wall of the abdominal cavity at the level of the T12 to L3 vertebral bodies **(fig.2-1) (Tim, 2012).**

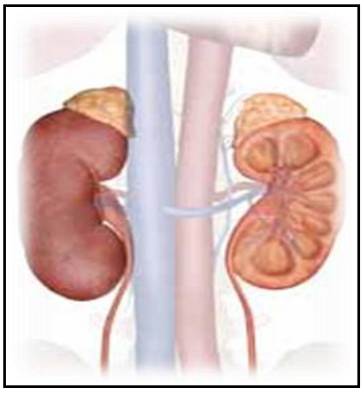

Fig.(2-1): shows the normal structure of the human kidney , and the renal hilum **(Quoted from zagoria., 2004**

The left kidney is located slightly higher than the right kidney because the right side of the liver is much larger than the left side **(Emamian et al., 1993).**

Normal kidneys size in adults varies depending on the height of the individual. Also, in general, it decreases with age and increases with body mass index (BMI).The size of the kidneys is measured mainly sonographically, although both CT and MRI scans also can be used to estimate kidney size **(Emamian et al., 1993)**

The average length pole to pole (LPP) of an adult human kidney is 10-14 cm (4 to 5 inches) long in males and 9-13 cm long in females, 3-5 cm wide, and weighs 150-260 g, with parenchymal thickness <2cm (the distance between the tip of the papilla and the edge of the kidney). In general, left kidney is slightly longer than the right, as expected, solitary kidneys are longer **(Wein et al., 2007).**

The normal size of kidneys in children will naturally depend on the age and size of the child. Based on the children's ages normal average renal length on ultrasound are as follows: **(fig.2-2) (Hodson et al,1962**).

- 0 to 2 months: 5 cm (approximately 2 inches)
- 2 months to 6 months: 5.7 cm
- 6 months to 1 year: 6.2 cm (2.5 inches)
- 1 year to 5 years: 7.3 cm (3 inches)
- 5 years to 10 years: 8.5 cm (3.5 inches)
- 10 years to 15 years: 10 cm (approximately 4 inches)
- Above 15 years: similar to adults normal kidney size.