Renal scintigraphy in infants with antenatally diagnosed renal pelvis dilatation

Scintigrafija bubrega kod odojčadi sa antenatalno dijagnostikovanom hidronefrozom

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Abstract

Background/Aim. Ureteropelvic junction obstruction and vesicoureteral reflux are the most frequent entities identified on the basis of antenatal hydroureter. The aim of this study was to determine the incidence and pattern of abnormal renal scintigraphy findings in postnatal investigation of children with antenatal hydroureterosis. Methods. Twenty four infants (19 boys and five girls) presented with antenatal hydroureterosis and mild to moderate hydroureterosis on ultrasound in newborn period were referred for renal scintigraphy. Ten patients with vesicoureteral reflux documented on micturating cystoureterography underwent 99mTc-DMSA renal scintigraphy and 14 patients were subjected to 99mTc-DTPA scintigraphy. Results. Anteroposterior pelvic diameter on ultrasound ranged from 11 to 24 mm. Renal DMSA scans identified congenital scars in two boys with bilateral reflux of grade V and unilateral reflux of grade III. Relative kidney uptake (RKU) less than 40% was found in three, and poor kidney function (RKU less than 10%) in two patients. Significant obstruction was shown on DTPA diuretic renal scintigraphy in 6/14 patients. Some slowing in drainage (T1/2 greater than 10 minutes) with no reduction in differential renal function was identified in three patients. Differential renal function less than 10% was obtained in one case. Conclusion. A high percent of abnormal renal scintigraphy findings was obtained. Renal scintigraphy was useful in determination of underlying cause of antenatally detected hydroureterosis.

Key words: radionuclide imaging; kidney, pelvis; hydroureterosis; infant; diagnosis; kidney diseases.

Introduction

Anomalies are reported in around 2–3% of routine antenatal ultrasound scans 1. About a third of these are due to abnormalities of the renal tract. Hydroureterosis detected antenatally was first reported in the early 1980s 2. Hydroureterosis is the most common congenital anomaly observed with antenatal ultrasonography 3. Multiple systems of classification have been used for fetal hydroureterosis. Fetal hydroureterosis is identified if pelvic diameter is > 4 mm on...
Antenatal ultrasound. The Society of Fetal Urology utilizes five grades of classification based on renal pelvic dilatation, number of calluses visualized and the degree of parenchymal atrophy. Other systems of classification have utilized the antero-posterior pelvic diameter associated with callus morphology.

The most important aspect of management of antenatal hydrenephrosis is the determination of an underlying cause of the hydrenephrosis. The causative factors of antenatally hydrenephrosis can be categorized into those leading to obstruction, those leading to reflux and the group comprising of non-obstructive and non-refluxing “idiopathic” hydrenephrosis. Many studies described postnatal diagnosis associated with antenatally detected renal pelvis dilatation. In these studies there has been a preponderance of cases of pelves-ureteric junction (PUJ) obstruction, posterior urethral valves and multicystic kidneys. An association between antenatal renal pelvis dilatation (ARPD) and vesicoureteral reflux (VUR) is particularly important in view of the association between VUR and the subsequent development of renal scarring.

The aim of this study was to determine the incidence and pattern of abnormal renal scintigraphy findings in a postnatal investigation of children with antenatally diagnosed renal pelvis dilatation.

**Methods**

Twenty four infants (19 boys, 5 girls, 40 days to 12 months old, average age 6.4 months), presented with antenatal hydrenephrosis and mild to moderate hydrenephrosis on ultrasound in newborn period (antero-posterior pelvic diameter on ultrasound ranged from 11 mm to 24 mm), were referred for renal scintigraphy.

Ten patients with VUR detected on micturating cystoureterography (MCU) underwent static renal scintigraphy, and the remaining 14 patients in whom VUR excluded on MCU, received diuretic renal scintigraphy. Static renal scintigraphy was performed 2 to 3 hours after intravenous (iv) injection of 99mTc-Technetium labeled dimercaptosuccinic acid (DMSA) using a dose of 50 μCi (1.85 MBq/kg; minimal dose 300 μCi) in posterior projection. Single-head “Philips-Tomo” gamma camera filtered with low energy all purpose collimator and with Pegasys computer was used. To assess renal drainage 15 min after starting the study, 0.50 mg/kg furosemide iv was injected. Differential renal function (DRF) was calculated using an integral method, and T/2 as a time during which maximal count number decrease to a half of that maximal number. Significant obstruction was defined as DRF < 40% in association with T/2 greater than 20 minutes, and slowing of drainage as T/2 > 10 minutes without reduction in renal function.

**Results**

In 10/24 patients VUR was diagnosed on MCU (42%). In 7/10 patients in whom on MCU VUR was detected, DMSA renal scans was abnormal (70%). Congenital scars were found in two boys with bilateral VUR grade V, and unilateral VUR grade III. Split renal uptake < 40% was found in three children, and poor kidney function (RKU < 10%) in two patients (Figures 1 and 2).

![Fig. 1 – Dimercaptosuccinic acid (DMSA) static study in a 7-month-old boy with antenatally detected hydrenephrosis.](image-url)
Fig. 2 – Dimerceptosuccinic acid (DMSA) study in a patient with perinatally detected mild dilatation of pelvis and vesi-courteral reflux of grade V on the left. Small scarred kidney with reduced and inhomogenous uptake of tracer (relative kidney uptake 20%).

Significant obstruction was shown on diuretic renal scintigraphy in 6/14 children and DRF of less than 10% in one child, which means that 50% of findings of diuretic renal scintigraphy were abnormal. Some slowing in drainage (T/2 > 10 min) with no reduction in differential renal function was detected in three patients (Figure 3).

Discussion

Renal tract abnormalities detected on antenatal ultrasound are relatively common. In our study VUR was the most common postnatal diagnosis occurring in 42% of the cases.

Our study confirmed the findings of Dudley et al. that VUR is the most common finding in the milder spectrum of ARPD. A high portion of these cases in our series is probably due to the limited number of patients and has to be proven on larger series. Arena et al. found VUR in 17% infants with antenatal hydronephrosis. Low-grade VUR (I–III) may be missed on antenatal evaluation as there may not be dilatation of the renal pelvis. MCU is the only certain way to determine the absence of VUR in infants and is recommended even in those infants in whom postnatal ultrasound indicates the resolution of hydronephrosis. The male preponderance in our series with VUR (8 males, 2 females) contrasts with the female bias in postnatally detected VUR and might support the hypothesis that VUR detected on the basis ARPD is a different entity. Anderson and Rick-wood have suggested that VUR detected on the basis of ARPD may be a marker of more generalized poor renal tract function.

Fig. 3 – Diuretic diethylenetriamine pentaacetic acid (DTPA) dynamic renal study showing almost no drainage of hydronephrotic left kidney after furosemide administration.
development. They found renal impairment, detected by DMSA scintigraphy, in 75% of ARPD and VUR commented that this represented dysplastic kidneys due to a prenatal vascular accident affecting renal tract development. In our study abnormal DMSA findings were found in 70% of children. In our small series in a 1/10 of children with ARPD in whom VUR and VUR renal function impairment expressed as RKU < 40% was found (in two of whom RKU was < 10%, which meant poor renal function).

Obstruction of the UPJ is second of the most frequent causes for hydronephrosis detected on prenatal evaluation. In our study in 43% of the patients with ARPD in whom VUR were excluded on MCU, diuretic renal scintigraphy detected significant obstruction. In one child poor renal function was detected (differential renal function was < 10%). On the basis of these results we can suggested that patients who are noted to have hydronephrosis at birth should have diuretic renal scintigraphy to determine if significant obstruction is present. Although initial renal scan may indicate lack of obstruction, serial ultrasound follow-up is indicated as some patients may present later with obstruction. Aksu et al. have suggested that if antenatal pelvic diameter is > 5 mm postnatal follow-up should be recommended. The grade of hydronephrosis has been correlated with the need for later surgical intervention and the potential for development of urinary tract infections. Higher grades of hydronephrosis appear to correlate with greater potential for the need for both surgery and urinary tract infections.

**Conclusion**

Routine use of antenatal ultrasonography lead to early diagnosis of urological conditions that may have postnatal consequences. On static DMSA renal scintigraphy and diuretic DTCPA renal scintigraphy 70% and 50% abnormal findings were obtained, respectively. Renal scintigraphy is very useful in determination of underlying cause of antenatally detected hydronephrosis.

**REFERENCES**