IMAGING OF NEONATAL HYDRONEPHROSIS

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ABSTRACT

We found 4 babies of age range 46 days to 6 years suffering from hydronephrosis as confirmed by ultrasonography. The older boy and the girl also had a radionuclide renogram under computerized gamma camera using technetium 99 metastable diethylenetriamine pentaacetic acid (Tc 99mm DTPA). The younger boy had a posterior urethral valve causing bilateral hydronephrosis and was improved by uro-surgical procedure as shown by clinical and sonographic follow-up.

Key words Kidney, Ultrasound, Radionuclide renogram.

INTRODUCTION

Since most neonates are dehydrated and renal function is not optimal in the neonate, early imaging may underestimate the amount of obstruction present.[1] Instead, postnatal ultrasound should be performed at the end of the first week of life. If the renal pelvis continues to measure greater than 10 mm, we refer our patients to a pediatric surgeon or urologist. Although significant congenital hydronephrosis may result from vesico ureteral reflux, the usual cause is urinary tract obstruction. The most common site of obstruction is the ureteropelvic junction, followed by the ureterovesical junction.[2] Bladder outlet obstruction is often an obvious ultrasound diagnosis since the markedly enlarged, thick walled bladder is readily seen. A variable degree of hydronephrosis is usually also seen. Bladder outlet obstruction occurs most commonly in male fetuses who are subject to the development of posterior urethral valves, and these bladders often fill the fetal abdomen. The proximal urethra is usually dilated as well, giving the bladder a pear or keyhole shape. Renal findings vary in fetuses with posterior urethral valves. In some cases, the kidneys are markedly hydronephrotic but otherwise normal in appearance. At the opposite extreme, the kidneys are small and echogenic, secondary to obstruction-induced cystic dysplasia. Complete bilateral urinary tract obstruction occuring in utero is fatal in postnatal life, and in some cases intervention in utero is attempted. Bladder drainage with urinary electrolyte analysis (for prognostic purposes), and placement of vesico-amniotic shunts (when renal function seems reasonable) have been attempted with variable success.[3] Hydronephrosis can be caused also by congenital obstruction of the ureteropelvic junction (PUJO), by ureteric stenosis or a calculus or from external pressure on the ureters by a retroperitoneal or abdominal mass.[4]

CASE REPORTS

CASE 1

A boy of age 46 days was brought to this centre with the complaints of dribbling narrow stream of urine and swelling of lower abdomen. Ultrasonography (USG) revealed distended urinary bladder and bilateral hydronephrosis. The baby was operated for removal of posterior urethral valve and was improved

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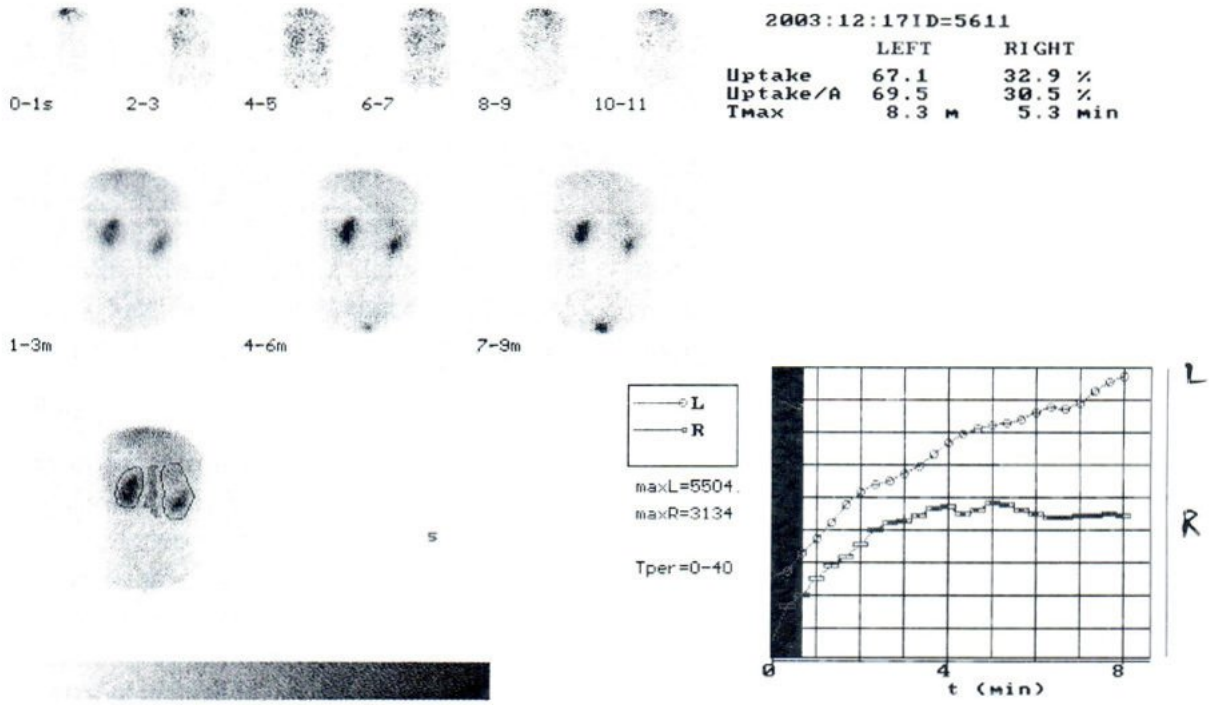
clinically as well as sonographically upto six months of age. Long-term follow-up is being done.

CASE 2

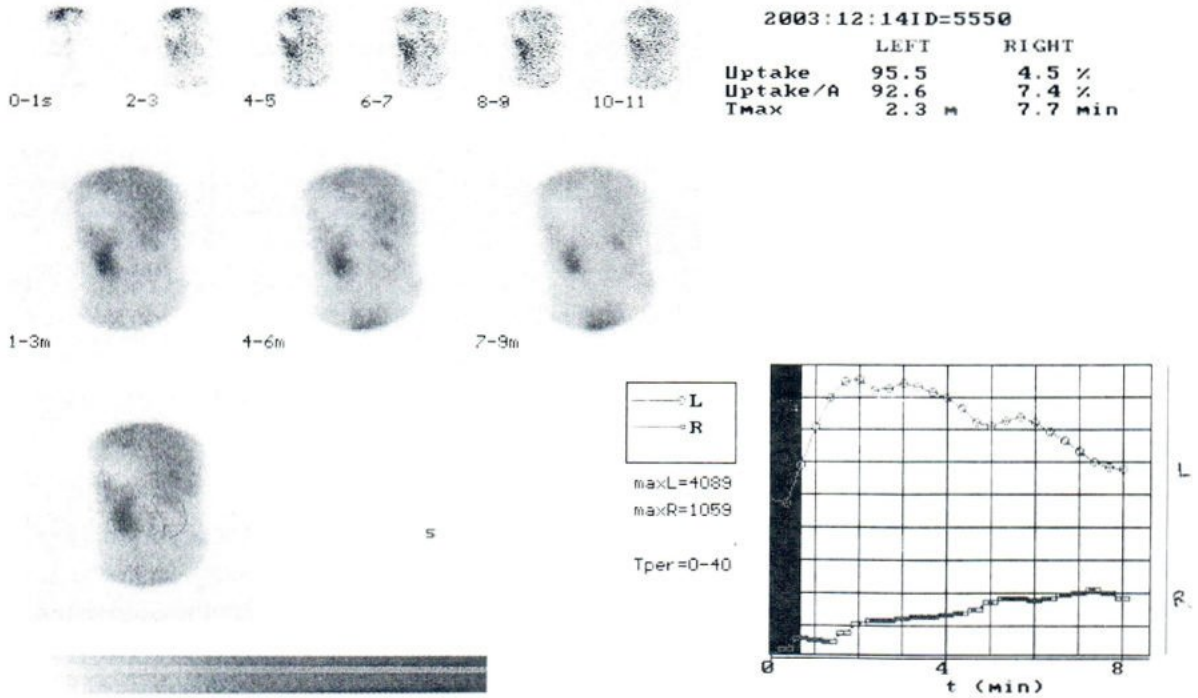
A boy of age 5 months was sent to this centre with a palpable lump in left loin. The referring physicians asked for sonogram. Findings show normal right kidney and hydronephrotic left kidney. A radionuclide renogram was requested by the uro-surgeon, which revealed normally functioning right kidney and obstructive features in left arterial and secretory phases are depressed, and clearance is very slow (Figure 1).



Case 2: Fig. 1 Renogram showing left renal obstruction.

CASE 3

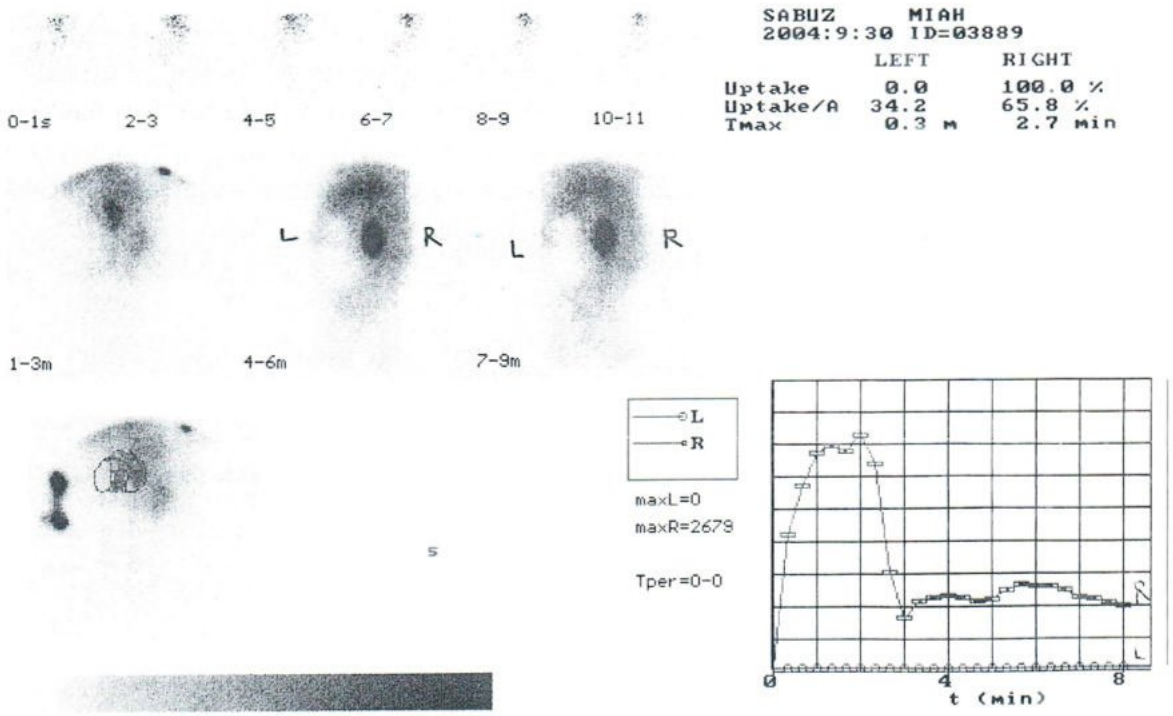
A girl of age 6 years was sent to us by a pediatric surgeon for renogram. According to her father's statement she had a lump on right side of abdomen since birth and it was growing gradually. Ultrasonography revealed grossly obstructed right renal tract (hydronephrosis and hydroureter) without any calculus and normal-looking left kidney. Tc 99m DTPA renogram revealed a normally functioning left kidney and non-functioning right kidney (Fig. 2) all phases of renal functions are grossly depressed in the right side.



Case 3: Fig. 2 Renogram showing non functioning rt. kidney.

CASE 4

A boy of age 2 years 6 months was sent to us by a pediatric surgeon for renogram. His father had nephrectomy for hydronephrosis 3 years previously. The boy's mother noticed a lump in his abdomen since birth, and USG on 29 Oct. '03 showed congenital hydronephrosis on the left side. Tc 99m DTPA renogram showed normally functioning right kidney and a swollen faint ring in the region of left kidney suggestive of poor functioning (Figure 3). The baby could not have pyeloplasty, however, he had left-sided nephrectomy in Oct. 2004.



Case 4: Fig. 3 DTPA Renogram

DISCUSSIONS

Ultrasound is popular and safe imaging modality in the neonates, as it is non-invasive and non-ionizing in nature. Radionuclide renogram is much less risky than intravenous urography (IVU),however, its interpretation is sometimes difficult,--failure to visualize a kidney by Tc 99m DTPA does not preclude recoverable renal function.[5] A case of calcification of the arteries and obliterative endarteritis associated with hydronephrosis in a child aged six months was reported by Bryant and White in 1901.[6] Complications of idiopathic arterial calcification of infancy include hematuria, hypertension, congestive cardiac failure and nonimmune hydrops.[7] This condition is usually fatal,[8] although spontaneous resolution of the calcification has been reported in one survivor.[9] A good news is that sonographic mild pyelectasis is seen in 3% of normal fetuses.[10] Although anatomic severity of hydronephrosis can be detected in utero by USG, relative functional renal impairment, important for surgical planning, cannot be determined without postnatal renal radionuclide scans.[11] Serial assessment of renal function forms an important aspect of pediatric urology, particularly in children with hydronephrosis, vesicoureteral reflux and chronic pyelonephritis who may require repeated evaluation both pre and post-operative.[12] In a child under 2 years of age the injection is via a pedal vein so that we may evaluate the possibility of inferior vena cava (IVC) occlusion. The child must not perform the Valsalva during the injection or the IVC will be occluded due to increased physiological intra-abdominal pressure.[13] Homsy et al showed that diuresis renograms performed in early infancy correlated poorly with follow up examination at 3 at 6 months and suggested that the wash-out response on the initial examination should not be used to determine the need for

surgery.[14] Therapeutically Koff and Campbell concluded that most infants whose hydronephrosis was discovered by prenatal ultrasound could be managed non-operatively.[15] Gordon et al questioned the role of surgery because many neonatal hydronephrotic kidneys improved spontaneously and those that did have surgery did not show significant functional improvement.[16]

Since 85% to 90% of affected neonates may appear entirely normal on physical examination, prenatal detection of ureteropelvic junction obstruction permits early therapy of a correctable lesion that may otherwise remain unrecognized for years.[17] Obstruction frequently occurs at the ureteropelvic junction, the site of the first bifurcation of the ureteral bud. This represents the most common cause of neonatal hydronephrosis.[18] Dilatation of the fetal urinary tract is increasingly being recognized with the wide-spread uses of fetal scanning, sophistication of ultrasound equipment and greater expertises. The pediatrician is often faced with managing infants with asymptomatic hydronephrosis, which was detected in utero. In most instances, mild to moderate dilatation of renal pelvis resolves after birth. However, all such babies should be carefully investigated to exclude urinary tract obstruction and vesico-ureteric reflux. There is considerable debate regarding optimal management of patients with antenatally diagnosed hydronephrosis.

Antenatal hydronephrosis is the dilatation of the collecting system of the fetal kidney. Dilatation of the ureter may be associated. It is estimated that fetal urinary tract dilatation is identified in 1% of all pregnancies. In more than 50% cases, the antenatally detected dilatation is transient and resolves spontaneously. Antenatally detected dilatation, which persists after birth is labeled as neo-natal hydronephrosis. Pelviureteric junction (PUJ) obstruction accounts for 50-60% patients with neonatal hydronephrosis. Vesicoureteric reflux (VUR) is detected in 20-30% of such cases. It sometimes may be difficult to differentiate multicystic dysplastic kidney from hydronephrosis.

Fetal hydronephrosis of moderate degree can be detected as early as 15-18 weeks' gestation by ultrasonography. A maximum anteroposterior diameter of renal pelvis of more than 10 mm or the ratio of antero-posterior diameter of renal pelvis to kidney of more than 0.5 after 30 weeks gestation requires postnatal evaluation. Oligohydramnios indicates severe urinary flow obstruction that may be seen in fetuses with severe bilateral hydronephrosis and posterior urethral valves. A pediatric nephrologist or urologist should be consulted for such cases.

The indications for performing bio-chemical investigations on fetal urine are limited. Similarly, the criteria for fetal intervention are very few.[19]

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