Paediatric urology

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Abstract

Paediatric urology is a subject that covers the urological aspects of care in children some of which are seen also in adults, but may have specific diagnostic methods and treatments that are quite different. Additionally, it covers a range of congenital anomalies either on their own or in combination with a spectrum of disorders that need more complex management available at only specialized centres. For the purposes of a broad and basic understanding of the subject, this article will cover relevant topics and up to date guidelines.

Keywords Antenatal hydronephrosis; disorders of sex development; foreskin; hypospadias; paediatric urology; posterior urethral valves; undescended testis; urinary tract infection; vesico-ureteric reflux

Introduction

Urological problems of childhood may present themselves either as a result of antenatal scanning or following birth. Children may present much later with symptoms of urinary dysfunction or infections or indeed the identification may be incidental during the course of investigations for other childhood problems. The important priorities are the preservation of renal function, relief of symptoms and all that which facilitates achievement of normal milestones in development.

Antenatal hydronephrosis (ANH)

This is one of the most commonly detected abnormalities on antenatal scanning and is identified in 1% of babies. The findings of an abnormality provides the opportunity for follow up and the offer of appropriate counselling during pregnancy and in the perinatal period. Most are transient with no long term consequences. The anterior–posterior diameter (APD) of the renal pelvis at the level of the renal hilum, in the transverse plane of a renal ultrasound is what is recorded. An APD of greater than or equal to 4 mm at less than 33 weeks' gestation and 7 mm at greater than 33 weeks' gestation most commonly define antenatal hydronephrosis.[1] Ultrasound findings would give further indications regarding the level of obstruction or possible diagnoses. Dilatation limited to the renal pelvis might indicate a pelvi-ureteric junction obstruction (PUJO) whereas if associated with a dilated ureter, could reflect either a vesico-ureteric junction obstruction (VUJO) or vesico-ureteric reflux (VUR). Bilateral dilatation might indicate a bladder outflow obstruction, at the level of the bladder neck or urethra. A very important consideration especially in males is to exclude posterior urethral valves (PUV). Other anomalies that may be picked up on antenatal scanning include duplication and multi-cystic dysplastic kidneys. Absent or reduced maternal liquor may be due to poor urine output, urinary obstruction or renal insufficiency. Severe cases of antenatally detected defects may be counselled for termination of pregnancy or in severe cases for in-utero interventions.

In most cases of antenatally detected isolated unilateral hydronephrosis, the child is evaluated at birth and further investigations organized. Soon after birth prophylactic antibiotics are commenced, usually trimethoprim at the dose of 2 mg/kg weight each night. The dose is increased as the child grows. An ultrasound scan of the kidney and bladder is repeated in the first week (but not in the first 48 hours), ensuring that the baby is adequately hydrated. In the case of any ureteric dilatation, duplex kidneys or bilateral hydronephrosis, a micturating cystogram (MCUG) is also performed to document VUR and to look for bladder outlet obstruction or evidence of PUV. Serum creatinine is also measured. An ultrasound is repeated after 6 weeks in all cases, and again at 3 months if abnormal. Functional imaging is deferred until 3 months of age to allow for renal maturation. A dynamic renal scan such as 99Tc-mercaptoacetyltriglycine (MAG3) is preferred for children with obstruction whilst a static renal scan such as a 99Tc-dimercaptosuccinic acid (DMSA) is more useful to look for scarring. Both scans provide split or differential renal function as well.

Pelvi-ureteric junction obstruction (PUJO)

This is by far the most common cause of dilatation and accounts for half of all those with hydronephrosis (Figure 1) *It occurs in 1:1500 and has a male preponderance of 2:1*. The causes may be intrinsic due to an abnormal fibromuscular and neural configuration at the PUJ which affects the normal peristalsis and urine flow or the obstruction may also be due to extrinsic compression from crossing lower pole vessels.

Most cases will resolve spontaneously without need for any intervention. In a prospective randomized trial of surgery versus observation for patients with unilateral hydronephrosis (APD >15 mm) and a differential function of greater than 40%,[2] 33% of infants remained stable on follow-up and 47% resolved or improved to mild dilatation.[2] Indications for surgery included worsening renal function, an increase in hydronephrosis (especially calyceal dilation) and a differential function of less than 40% on a MAG 3 scan. Hydronephrosis which in the UK is measured as AP diameter in the transverse plane on an ultrasound scan can guide treatment as follows. Less than 15 mm AP diameter rarely deteriorates or needs intervention and after initial scans can be discharged. When greater than 30 mm the likelihood of surgical intervention is high. The intermediate group of 15–30 mm pose the biggest challenge as they need regular follow up. Deterioration after the age of 4 is rare. Older children may present with intermittent loin pain and a diagnosis is made on US scanning. In this age group the usual cause is lower pole crossing vessels, although an intrinsic defect may occur as well.

The operation of choice with time tested results and a success rate of greater than 95% is the dismembered Anderson-Hynes pyeloplasty. The stenotic segment is excised and a wide water-

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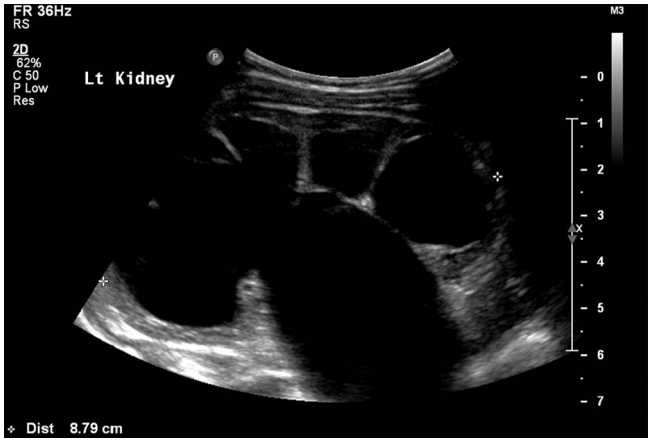

Figure 1 Ultrasound image showing hydronephrosis and calyceal dilatation due to PUJO.

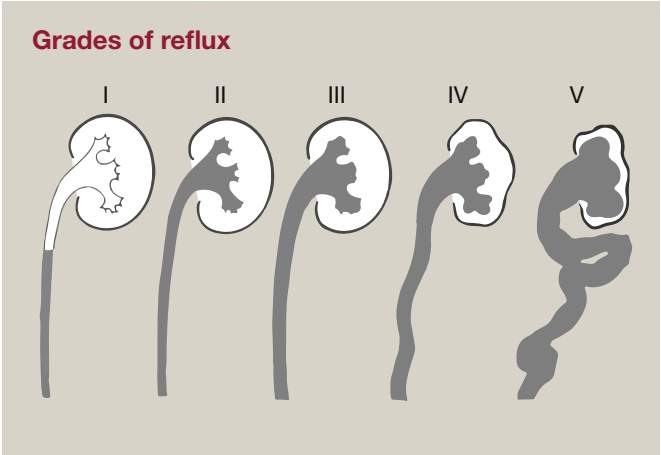

Figure 2

tight, dependant anastomosis made after spatulating the ureteric end. Pyeloplasty may be undertaken laparoscopically or even robot assisted in specialized centres. Other surgical options such as V–Y plasty, vascular hitch and endoscopic incision of the PUJ have been used with variable results.

Vesico-ureteric reflux (VUR)

A deficient valvular mechanism at the vesico-ureteric junction (VUJ) permits retrograde flow of urine to the kidney. The incidence of VUR in antenatally detected hydronephrosis is approximately 15%. VUR is graded as per the International Reflux Study in children into grades I–V (Table 1 and Figure 2).[3]

VUR is usually treated conservatively. Most babies are put on prophylactic antibiotics as described above. Maturation of the VUJ gives a high rate of spontaneous resolution during the first five years of life in the lower grades of reflux. For any boy with unilateral or bilateral reflux, PUV must be ruled out by visualizing the entire urethra on MCUG. A refluxing VUJ can be associated with abnormal kidney development and reduced function on imaging, even without a history of urinary tract infection. Patients with reflux, especially the higher grades, are at risk of secondary renal damage through ascending infection and intra-renal reflux of infected urine. This produces a characteristic pattern of renal scarring at the poles, occurring maximally during the first infective episode but mitigated by prompt antibiotic treatment. Prophylactic antibiotics are continued until the child is fully potty trained. Surgical intervention is indicated for breakthrough infection, patient non-compliance, deterioration in dilatation or function on follow up imaging and non-resolution of the reflux.

The incidence of UTI in VUR detected after presentation with ANH is 52%. Reflux nephropathy and bladder dysfunction were risk factors for developing a UTI and circumcision appeared to significantly reduce the risk of infection.[4] A recent trial called the Randomized Intervention for Children with Vesicoureteral Reflux (RIVUR) also showed that there was a 50% reduction in infections but no reduction in renal outcomes for children on prophylactic antibiotics.[5]

In the majority of the cases that require intervention, the first-line surgery is an endoscopic injection of a bulking agent just below (STING) or within the ureteric orifice (HIT). The success rates for endoscopic treatment are approximately 78.5% in grades I and II, 72% for grade III, 63% for grade IV and 51% for grade V. Injections may be repeated with an overall success of 85%.[6]

Open surgery such as re-implantation of the ureter, most commonly the Cohen cross trigonal re-implant, is reserved for more severe cases, where injection is not possible, or following failed injection treatment. The distress of MCUG and catheterization is avoided in children over the age of 1 year. Older children who are already potty trained can be imaged using MAG3 indirect cystography instead. VUR and its renal consequences remain a major cause of end stage renal failure in children.

The grades of vesicoureteric reflux VUR as described by the International Reflux Study in children

Grade I	Ureteric reflux only; does not reach the renal pelvis
Grade II	Reflux reaches the renal pelvis without dilatation of the collecting system; normal fornices
Grade III	Mild or moderate dilatation of the ureter, with or without kinking; moderate dilatation of the collecting system; normal or minimally deformed fornices
Grade IV	Moderate dilatation of the ureter with or without kinking; moderate dilatation of the collecting system; blunt fornices, but impressions of the papillae still visible
Grade V	Gross dilatation and kinking of the ureter, marked dilatation of the collecting system; papillary impressions no longer visible; intraparenchymal reflux

Table 1

Posterior urethral valves

This is the most common cause of bladder outflow obstruction and occurs in 1:4000 live births. It is caused by a valve like membrane in the posterior urethra below the level of the veru

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