

Neonatal urological ultrasound: diagnostic inaccuracies and pitfalls

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SUMMARY Ninety one patients with urinary tract abnormalities diagnosed before birth were reviewed. Diagnoses based on prenatal and postnatal ultrasound scans alone were compared with the final diagnoses after full urological investigations, with operative or necropsy confirmation in 79 cases. The results confirmed that ultrasound examination before birth usually detects non-specific abnormalities and although scanning after birth is more accurate it is not absolutely reliable. A diagnosis of 'multicystic kidney' made on ultrasound scan alone is especially prone to error. Such mistakes can be avoided if full urological investigation is undertaken in every case.

Patients and methods

Ninety one patients were reviewed, all of whom had antenatally diagnosed urinary tract abnormalities for which they had been referred for treatment. In order to assess the accuracy of ultrasonography both antenatal and postnatal ultrasonographic diagnoses were compared with the diagnoses made after full urological investigations had been carried out. Confirmation of the diagnoses was made at operation in 73 cases and at necropsy in six.

Antenatal ultrasound investigations undertaken at the referring hospital were carried out by experienced medical staff using different types of ultrasound scanners at various times during the pregnancy. Most of the abnormalities were detected in the late second or third trimesters of pregnancy. Referral to a paediatric urologist for treatment usually took place immediately after birth. Further scanning was undertaken after referral by experienced consultant radiologists.

All patients underwent renography and cystography, with anatomical localisation by intravenous urography and sometimes antegrade pyelography. Dimercaptosuccinic acid (DMSA) scanning was used when non-functioning systems were encountered or when localisation of functioning renal tissue was difficult. Babies with suspected lower tract problems were cystoscoped.

On full scanning the criteria for diagnosis were strictly followed. Patients with renal pelvic dilatation, functioning parenchymal tissue, and an obstructive curve on diuresis renography,¹ were diagnosed as

having obstruction of the pelviureteric junction. Those with hydronephrosis, hydroureter, and an obstructed renographic appearance, were diagnosed as having obstruction of the vesicoureteric junction. Multicystic dysplasia was diagnosed if there was cystic renal dilatation in the absence of functioning parenchymal tissue on intravenous pyelography or DMSA scan, or both. Vesicoureteric reflux was diagnosed when reflux in to a dilated ureter was seen on the cystogram. Patients with urinary tract changes consistent with bladder outflow obstruction in the presence of a posterior urethral valve were diagnosed as having a posterior urethral valve, and patients were diagnosed as having a ureterocoele when one was seen on intravenous pyelography or at cystoscopy. All other cases were deemed to have non-specific upper tract dilatation with the exception of those grouped under the heading miscellaneous in table 1.

Results

Ninety one patients were studied, all of whom had abnormalities of their urinary tracts. The results are shown in table 1.

The commonest abnormality was obstruction of the pelviureteric junction (n=35, 38%). Of these four were bilateral, two had associated vesicoureteric reflux, two had contralateral multicystic kidneys and one had contralateral renal agenesis.

There were also 17 patients with unilateral multicystic kidneys, nine with posterior urethral valves, eight with obstruction of the vesicoureteric junction,

Table 1 Final diagnosis, and number correctly diagnosed by ultrasound scanning and full radiological screening

Diagnosis	Total No of patients	No correctly diagnosed by ultrasound scanning		No correctly diagnosed by full radiological screening
		Before birth	After birth	
Obstruction of the pelviureteric junction	35	5	14	35
Multicystic kidney	17	9	14	17
Posterior urethral valves	9	6	7	9
Obstruction of the vesicoureteric junction	8	0	0	8
Ureteroceles	7	0	3	7
Vesicoureteric reflux	5	0	0	5
Non-specific dilatation	4	4	4	4
Miscellaneous	6	4	4	6

seven with ureteroceles, five with vesicoureteric reflux, and four with non-specific ureteric dilatation. There were six patients in the group labelled miscellaneous; these comprised two patients with unilateral renal agenesis, one with infantile polycystic disease, one with a persistent cloaca, one with an abdominal neuroblastoma, and one with bilateral ureteric stenosis.

Table 1 shows the number of correct diagnoses made within each subgroup when each of the three different investigations was used. The antenatal ultrasound scan was insufficiently specific or accurate to make a firm diagnosis in any of the babies with vesicoureteric reflux, vesicoureteric obstruction, or ureteroceles. Accuracy improved for multicystic kidneys and posterior urethral valves (nine of 17 and six of nine babies, respectively, being correctly diagnosed), but was still poor in obstruction of the pelviureteric junction (five in 35 cases). In the miscellaneous group the patients with abdominal neuroblastoma, infantile polycystic kidney, and unilateral renal agenesis had definitive diagnoses made on the antenatal scan.

When patients were investigated by postnatal ultrasound scanning there was a considerable increase in diagnostic accuracy in multicystic kidney (14 of 17) and a moderate improvement in posterior urethral valves, obstruction of the pelviureteric junction and ureteroceles (seven of nine, 14 of 35, and three of seven, respectively). Obstruction of the vesicoureteric junction and vesicoureteric reflux were not diagnosed in any case, confirming that ultrasound scanning was as imprecise postnatally as it was antenatally for these conditions. In the miscellaneous group the diagnostic accuracy was the same for both prenatal and postnatal ultrasonography.

The diagnosis was completely accurate in all the subgroups after full screening. Further confirmation of the diagnosis was made in 73 patients who underwent surgical correction, and in a further six who came to necropsy. These patients died either

Table 2 Number of patients misdiagnosed as having multicystic kidney by ultrasound scanning

Correct diagnosis	No misdiagnosed before birth	No misdiagnosed after birth
Obstruction of the pelviureteric junction	8	6
Ureteroceles	3	2
Obstruction of the vesicoureteric junction	2	1

from irreversible renal failure secondary to urinary tract obstruction, or from associated cardiopulmonary abnormalities. In all patients the diagnosis made after full screening corresponded with that made at operation or necropsy.

Among the patients a number of anomalies were misdiagnosed on ultrasonography as multicystic kidney. There were 13 antenatally and nine postnatally. The actual diagnosis was only determined after full urological screening. The results are shown in table 2. The differentiation between obstruction at the pelviureteric junction and multicystic kidney presented the greatest difficulty, but there was also difficulty in diagnosing ureteroceles and obstruction at the vesicoureteric junction.

Discussion

The accuracy of antenatal ultrasound scanning in diagnosing abnormalities of the urinary tract has been discussed by several authors. Avni *et al* claimed to have correctly diagnosed 43 out of 63 fetal uropathies.² Grignon *et al*³ found an 'accuracy' of 77% when considering obstruction at the pelviureteric junction and Turnock and Shawis⁴ made accurate diagnoses in 19 out of 32 children with various urological abnormalities. The definition of the word accurate, however, must be carefully

considered as the ultrasound findings (particularly in the latter two groups) were mainly non-specific, and in Turnock and Shawis' series 12 of 24 diagnoses of pelviureteric obstruction were incorrect. Two further series confirm these findings: Hutson *et al* claimed an accuracy of 89%.⁵ When their results are analysed, however, only three of the cases had been given a specific diagnosis; the actual abnormality was defined in only 17% of their total cases. Pocock *et al* claim 26 out of 30 patients had correctly diagnosed abnormalities, but their results show that over half their cases had the non-specific finding of 'hydronephrosis'.⁶ Among these cases there was a broad range of disease including obstruction of the pelviureteric and vesicoureteric junctions, multicystic dysplasia, and ureteroceles, all abnormalities with different treatments and varying prognoses. Their all encompassing statement that antenatal ultrasound 'accurately diagnoses fetal abnormalities' is not strictly true; although a finding of hydronephrosis or cystic enlargement may be a sign of underlying obstruction, dysplasia, or reflux it is not sufficiently accurate a diagnosis for initiating treatment or commenting on prognosis.

Once an abnormality is detected the first priority is to confirm the diagnosis.⁷ Postnatal ultrasound scanning has an important part to play, but as our results show it must not be used alone. Although the detection of intrarenal dilatation using ultrasound has a high degree of accuracy,⁸ dilatation does not equal diagnosis, merely being an indication for further investigation. We feel that full investigation should be mandatory, but we have found series in which ultrasound scanning has been the only imaging technique used. Although we accept that accuracy will vary according to the operator and the type of machine, we believe that to make a diagnosis from the ultrasound scan alone will necessarily mean that there is an unacceptable degree of speculation in many cases.

The difficulty in differentiating multicystic dysplasia from obstruction of the pelviureteric junction has been emphasised before.^{9 10} Avni failed to distinguish between these two diagnoses in four of nine cases in his series (45%).² We found this a problem in 15% of our cases with obstruction at the pelviureteric junction, but we also encountered difficulty with other abnormalities such as ureteroceles. Errors of this type were present in 9% of our series. As the current vogue in some hospitals is to establish the diagnosis by ultrasound alone there is a

serious danger that a number of cases will be misdiagnosed with the attendant possibilities of increased kidney damage and morbidity.

We have recently had a patient who was diagnosed as having multicystic dysplasia, and who was managed conservatively on the basis of the ultrasonographic diagnosis alone. He subsequently presented to us with posterior urethral valves at the age of 6 months. Examples such as this, though they are the exception rather than the rule, are bound to occur with greater frequency if too much reliance is placed on postnatal ultrasound scanning without full investigation. In the words of one investigator¹¹: 'The inability of ultrasound to delineate the exact anatomy of all lesions is to be anticipated but is often not considered'. We feel that full investigation should take place, not only in patients with multicystic dysplasia on ultrasound scan, but in patients in whom an anatomical abnormality of the urinary tract has been detected antenatally.

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Accepted 9 August 1988