Short reports

Radionuclide cystography in vesicoureteric reflux

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SUMMARY We investigated 47 children in whom vesicoureteric reflux was clinically suspected by both conventional radiological and indirect radionuclide cystography. Comparison of the two methods showed no significant difference in their accuracy in detecting vesicoureteric reflux. The advantages and disadvantages of, and indications for, indirect radionuclide cystography are discussed.

The optimal investigation of children with urinary tract infections is controversial and is periodically reviewed.^{1,2} The dilemma, to ensure adequate investigation while avoiding undue trauma or radiation exposure, is familiar to paediatricians and radiologists. The most unpleasant investigation used is undoubtedly the radiological micturating cystogram, which requires urethral catheterisation. This study was performed to determine whether a selected group of children can be spared this cystogram with its associated hazards of infection, radiation exposure and, rarely, urethral stricture formation.

Indirect radionuclide cystography, using an intravenously injected radioactive marker excreted by the kidney, was pioneered by Dodge in 1963.³ The availability of radiopharmaceuticals more suitable than the original ¹³¹I hippuran, in particular ^{99m}Tc DTPA (diethylene triamine penta-acetic acid), and improved imaging with the gamma camera, has now made the technique suitable for routine clinical use.

Patients and methods

Forty seven children aged between 5 and 15 years were studied. All had had urinary tract infections and needed a radiological micturating cystogram because of renal scarring or ureteric dilatation on intravenous urography, recurrent infections, or they were being followed up for medically managed vesicoureteric reflux. Informed parental consent was obtained for each child to have an indirect

radionuclide cystography performed in addition to a micturating cystogram. The study was approved by the ethical committee of Guy's Hospital and Medical School.

The procedure for indirect radionuclide cystography was explained to the child, who emptied his or her bladder and was then given ^{99m}Tc DTPA intravenously in a dose of 9 mCi/m² body surface area. Divided renal function measurements were made at this stage. The child was then encouraged to drink freely (a variety of palatable drinks was made available) until he or she felt able to void, usually after about one hour. Boys were positioned standing in front of the gamma camera with a bottle; girls used a specially adapted, well screened commode. When preliminary screening confirmed activity in the bladder rather than the kidneys, the areas over the kidneys, ureters, and bladder were screened for one minute before, during, and 1½ minutes after voiding.

Vesicoureteric reflux was diagnosed radiologically if contrast was seen to enter the ureter, and was classified as severe if the pelvicalyceal system was outlined and distended, or if intrarenal reflux was observed. Reflux was diagnosed on indirect radionuclide cystography only if tracer was observed in the pelvis, and was described as severe if it was gross, unequivocal, and immediately obvious on inspecting the images. The results were analysed statistically using McNemar's test.

Results

Three studies using indirect radionuclide cystography were unsuccessful: two children were unable to cooperate and the other failed for technical reasons. The table shows the results for the remaining 44 children, expressed in terms of potentially refluxing kidney-ureter 'units.' Two children had only one kidney each and in one child results of both investigations were equivocal for one kidney, so results from 85 units are available for analysis. The two methods were concordant for the detection

Table Results of indirect radionuclide cystography and radiological micturating cystography in 85 potentially refluxing units

	All grades of reflux No (%)	Severe reflux only No (%)
Reflux shown by:		
Both studies	30 (35)	21 (25)
Indirect radionuclide cystography only	17 (20)	9 (11)
Radiological micturating cystography only	16 (19)	1 (1)
Neither study	22 (26)	54 (63)
Overall agreement	52 (61)	75 (88)

of reflux in 61% of units, and in 88% for the detection or exclusion of severe reflux (table). There was no significant difference between the methods for detecting reflux if all grades were considered together, but the study using indirect radionuclide cystography detected severe reflux more reliably than the micturating cystogram ($p < 0.05$).

Discussion

Our results confirm the findings of Hedman *et al*⁴ and Merrick *et al*⁵ that there is good overall agreement between micturating cystography and radionuclide cystography in the detection of vesicoureteric reflux. In our study there was very good agreement when minor degrees of reflux, of doubtful clinical importance, were excluded. All three studies have shown that reflux may be shown by indirect radionuclide cystography in some patients in whom it was not detected by radiological micturating cystography; some of these cases could be false positives caused by retrograde ureteric peristalsis but an alternative and more likely explanation is that reflux, even when severe, can be an intermittent phenomenon.

In children over 5 years of age we had few difficulties in getting cooperation with voiding for the radionuclide cystography. This is considerably less traumatic than conventional micturating cystography in that the risks of bladder catheterisation are avoided, and radiation exposure is reduced to 10% or less of that entailed in conventional micturating cystography. The success of indirect radionuclide cystography, however, depends on patient cooperation and we have not found it suitable for routine use in children under 5 years; it is practicable in selected 3 and 4 year olds. Another disadvantage of indirect radionuclide cystography compared with micturating cystography is that the penile urethra is not visualised.

In conclusion, we recommend the use of indirect radionuclide cystography in the following groups of children needing investigation for suspected vesicoureteric reflux: (a) all girls over 5 years of age; (b) girls aged 3–5 years thought likely to be able to cooperate; and (c) boys over 5 years who have already had micturating cystography, thus excluding posterior urethral valves, and who need a repeat investigation during follow up of medically managed vesicoureteric reflux.

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