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 99mTc 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 a 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 99mTc 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
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
and Merrick et al that there is good overall
agreement between micturating cystography and
radionuclide cystography in the detection of vesico-
ureteric reflux. In our study there was very good
agreement when minor degrees of reflux, of doubt-
ful 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 mictur-
ating 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 intermit-
tent phenomenon.

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

<table>
<thead>
<tr>
<th>Reflux shown by:</th>
<th>All grades of reflux</th>
<th>Severe reflux only</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N (%)</td>
<td>N (%)</td>
</tr>
<tr>
<td>Both studies</td>
<td>30 (35)</td>
<td>21 (25)</td>
</tr>
<tr>
<td>Indirect radionuclide</td>
<td>17 (20)</td>
<td>9 (11)</td>
</tr>
<tr>
<td>cystography only</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Radiological micturating</td>
<td>16 (19)</td>
<td>1 (1)</td>
</tr>
<tr>
<td>cystography only</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neither study</td>
<td>22 (26)</td>
<td>54 (63)</td>
</tr>
<tr>
<td>Overall agreement</td>
<td>52 (61)</td>
<td>75 (88)</td>
</tr>
</tbody>
</table>

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 vesico-
ureteric 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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