Value of cystography in urinary tract infections

It is customary in paediatric practice to investigate the urinary tract radiologically by means of an intravenous urogram (IVU), and a micturating cystogram when a child is first diagnosed as having a urinary tract infection (UTI) whether symptomatic (Smellie, 1969; Rolleston, Shannon, and Utley, 1970) or asymptomatic (Davies et al., 1974; McLachlan et al., 1975). However, cystography may be associated with numerous complications. 13 are listed by McAlister, Cacciarelli, and Shackelford (1974), and after one of our patients required a general anaesthetic for removal of a catheter, we decided to see whether in patients with a normal IVU, cystography added any useful information.

Patients and methods

X-rays of all the children with a bacteriologically proven UTI, who had had both an IVU and a micturating cystogram over a 2-year period, were reviewed. The diagnosis of UTI was made if a fresh specimen of urine contained a single organism with a quantitative count of 100 000 organisms/ml or more. For the IVU, after a plain film of the whole abdomen had been taken, an injection of Urovison (sodium and methylglucamine salts) 1·0 ml/kg body weight was given. No abdominal compression was used.

The first film was taken at 5 minutes (3 minutes in very young children). If the 5-minute film showed two kidneys filling well, a bottle of cold Pepsi-Cola was given through a straw with the child lying down. This distended the stomach and showed the kidneys through a gas-filled stomach. At 15 minutes a complete renal tract film was taken. This was occasionally supplemented with an oblique film to show, if necessary, a kidney partially obliterated by overlying bowel shadow, and to bring it into the area of the clear gas-filled stomach. If an adequate film of the bladder was obtained, a further renal tract film was taken after micturition to assess bladder emptying. Tomography was not used in any of these patients.

Cystourethrography was performed on another day. The patient was catheterized with a Foley's catheter (a self-retaining catheter was used as it had been found that some children would extrude a fine polyethylene catheter before adequate bladder filling was obtained). A specimen of urine was sent for culture, but the bladder was not emptied. The subsequent examination was controlled by minimal intermittent screening. The bladder was filled by a 60 ml catheter-tip syringe with half diluted Urovison and sterile water, or if the bladder was very full with an undiluted Urovison. If reflux was seen to occur no further contrast was added, otherwise the bladder was filled to tolerance. The amount of contrast introduced varied between 25 and 75 ml according to bladder volume and the age of the child. No screening films were taken unless reflux was
seen. If reflux occurred a coned anteroposterior and a
coned appropriate oblique of the lower ureter were
taken to confirm the presence of reflux, and then a localized
film of the appropriate kidney to assess the degree and
extent of the reflux. In some children visualization of
reflux was obtained with screened films, but if no
reflux was seen on the screen, and thus no films taken,
three films were then taken with an over-couch tube
with the child micturating, an anteroposterior, and
right and left oblique.

An important part of the examination is giving an
adequate explanation and obtaining the co-operation of
the child, as this helps to minimize the inevitable
anxiety.

The IVU films were examined without knowledge of
the results of the cystogram. Ureteral, with this high
dose technique, were usually seen easily and any dilata-
tion noted. Bladder emptying was assessed on the
IVU films as this was felt to be more physiological than
after catheterization. On the micturating cystogram
reflux was graded according to the criteria of Rolleston
et al. (1970).

**Results**

Fifty-one children with a bacteriologically proven
UTI had both an IVU and a micturating cystogram.
16 showed abnormalities in the IVU, the remaining
35 cases forming the basis of the study. Clinical
features of these 35 cases are given in Table I.

**TABLE I**

<table>
<thead>
<tr>
<th>No.</th>
<th>Age Mean (yr)</th>
<th>Range</th>
<th>First infection</th>
<th>Recurrent infection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Girls</td>
<td>28</td>
<td>4-3</td>
<td>16 d - 9.5 yr</td>
<td>19</td>
</tr>
<tr>
<td>Boys</td>
<td>7</td>
<td>3-5</td>
<td>10 d - 9.5 yr</td>
<td>6</td>
</tr>
</tbody>
</table>

Girls out numbered boys by 4 to 1, with a similar
age range from the neonatal period to 9½ years in
both sexes. Most children were investigated after
their first infection, the remainder had either had
infections before being referred to hospital, or had
had a further infection while under outpatient
supervision.

Cystography was normal in 29 children, and
showed ureteric reflux in 6, all girls. Clinical
details and the radiological findings in these 6
cases are given in Table II. 3 children had had
only one infection, and three recurrent infections.
3 children had grade I reflux, affecting one ureter,
and one child had grade II reflux in one ureter.

**TABLE II**

<table>
<thead>
<tr>
<th>Case no.</th>
<th>Age (yr)</th>
<th>No. of infections</th>
<th>Reflux</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6</td>
<td>Numerous</td>
<td>Grade I in L ureter</td>
</tr>
<tr>
<td>2</td>
<td>8</td>
<td>1st</td>
<td>Grade I in L</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>2nd</td>
<td>Grade I in L</td>
</tr>
<tr>
<td>4</td>
<td>6</td>
<td>6th</td>
<td>Grade II in L</td>
</tr>
<tr>
<td>5</td>
<td>3-9</td>
<td>1st</td>
<td>Grade III in L</td>
</tr>
<tr>
<td>6</td>
<td>5-5</td>
<td>1st</td>
<td>Grade II in R</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Grade III in L</td>
</tr>
</tbody>
</table>

The fifth child had grade III reflux in one ureter,
and the sixth had reflux affecting both ureters,
grades II and III. Both the children with grade
III reflux were investigated after their first infection,
while the child with numerous infections had only
mild reflux. In the whole series of 35 patients,
17% showed reflux, unsuspected on IVU, affecting
10% of the ureters at risk.

**Discussion**

In this study only a small proportion of children
with a normal IVU had reflux shown on cystography,
and only 2 children had grade III reflux. Other
larger series have had a higher incidence: 25% of
the 113 cases reported by Smellie et al. (1964), and
a similar proportion of the Cardiff-Oxford survey
(McLachlan et al., 1975). This difference is hard
to explain, as our cases were referred to hospital and
might be expected to have a higher incidence of
lower urinary tract abnormalities than the asympto-
matic cases from the Cardiff-Oxford study.

The importance of diagnosing ureteric reflux is
that it predisposes to recurrent infection, and so
renal damage, rather than causing renal damage in
its own right, for new renal scars 'almost invariably
develop' in association with infection (Smellie and
Normand, 1975). Therefore it could be argued that, providing the urine is kept sterile, the presence of reflux does not matter, especially as reflux does not normally get worse (Rolleston et al.,
1970).

Stansfeld (1975) found that only 50% of children
treated for a UTI had a further infection, nearly all
within a few months of stopping treatment.

If cystography were deferred until a second
infection occurred, providing the IVU was normal,
half the children with a UTI would not have this
unpleasant investigation, and only a few cases of
severe reflux would be missed. It seems unlikely
that significant renal damage would occur in a nor-
mal kidney with a second infection, at which stage
cystography would be performed, and reflux, if present, could be treated.

Bailey (1973) and MacGregor and Freeman (1975) have proposed that cystography is not necessary in children over 5 years old if the IVU is normal. We would suggest extending this policy and deferring cystography in all children with a UTI until a second infection occurs, providing the IVU is normal.

Summary

Fifty-one children with a bacteriologically proven urinary tract infection had both an intravenous urogram (IVU) and a micturating cystogram. The IVU was normal in 35. Only 6 of these children showed reflux in the cystogram, affecting 7 of the 70 ureters at risk. Since reflux on its own does not cause renal damage, which occurs only with super-added infection, detection of reflux is not important providing the urine is kept sterile. We suggest that cystography be deferred providing the IVU is normal until recurrent infections occur while under hospital care, and, with this policy this unpleasant and sometimes hazardous investigation could be avoided in many children with a single urinary tract infection.

References


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Percutaneous angiocardiography for diagnosis of persistent ductus arteriosus in the preterm infant

The diagnosis or exclusion of a haemodynamically significant persistent ductus arteriosus (PDA) in preterm infants with respiratory distress syndrome, by single film aortogram via an umbilical arterial catheter, has been described by Thibeault et al. (1975). Difficulty arises, however, where there is no umbilical arterial catheter in the aorta, as small preterm infants may not develop signs of a PDA until long after the umbilical arterial catheter has been removed after the respiratory distress syndrome (RDS). We describe a successful percutaneous angiocardiography technique used in this situation on an infant weighing 2 kg.

Case report

A male infant born at 28 weeks’ gestation, birthweight 1400 g, required intubation and intermittent positive pressure ventilation (IPPV) for birth asphyxia. Spontaneous respiratory effort was poor and he required 10 days IPPV by Drager ventilator using oxygen concentrations of up to 95%. He also was treated for metabolic acidosis, hypercapnia, and pulmonary infection. At 2 months he developed cardiac failure, and a loud systolic murmur appeared at the upper left sternal border which was thought to be due to a persistent ductus arteriosus. He responded to digoxin, diuretics, and ventilation in a Drager Negative Pressure Box ventilator.

At 4 months he rapidly deteriorated with a return of cardiac failure, and a loud systolic murmur reappeared at the upper left sternal border. His chest x-ray showed an enlarged heart and gross pulmonary parenchymal changes. Electrocardiogram showed sinus rhythm, right axis deviation, and right ventricular hypertrophy. As he was critically ill it was felt that cardiac catheterization should be carried out in order to exclude a persistent ductus arteriosus which might have been contributing to his poor lung function.

Cardiac catheterization. A modified percutaneous technique was used. A number 18 G short bevel, thin wall, disposable needle on a 5 ml syringe was inserted into the femoral artery at the right groin over the point of maximal pulsation. The needle was passed through the artery, and slowly withdrawn and adjusted until a free flow of arterial blood into the syringe was obtained. The syringe was then disconnected and an 0.032 ‘Cordis’ guide wire, soft end foremost, was passed up the femoral artery and aorta to the diaphragm in order to confirm that it was in the arterial system. The needle was then removed, and the skin incision slightly enlarged by opening the points of a pair of fine mosquito forceps inserted alongside the wire. A number 5 Gensini catheter was passed over the wire, and into the artery, being rotated constantly as it was inserted.
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