An audit of RCP guidelines on DMSA scanning after urinary tract infection

P V Deshpande, K Verrier Jones

Abstract

Aim—To assess the outcome of imaging investigations carried out in children with urinary tract infection (UTI), to compare the investigations with national guidelines, and to assess the impact on management.

Methods—Retrospective review of inpatients and outpatients, aged 0–12 years, referred to the University Hospital of Wales Healthcare Trust between February 1997 and January 1998 with UTI. All children without bacterial evidence of UTI and children previously investigated for antenatal urological anomalies, major congenital anomalies, or UTI were excluded.

Results—A total of 164 children (51 boys, 113 girls) were included. Thirteen of 56 infants (23%) and 82/108 older children (76%) were diagnosed at home over one year. The prevalence of dilatation on ultrasound was 8%, renal scarring on dimercaptosuccinic acid (DMSA) scan was 11%, and vesicoureteric reflux (VUR) was 34% when investigations were carried out following guidelines published by the Royal College of Physicians. In children aged 1–6 years, the prevalence of scarring was 1/54 (2%) in those treated at home and 6/18 (33%) in inpatients.

Conclusion—The low yield of positive results and lack of evidence of impact on management indicate that DMSA scanning, with all the implications of isotope exposure, intravenous injection, staff time, psychological trauma, and expense, could be omitted in children over 1 year with first simple UTI not sufficiently ill to be admitted to hospital. The low rate of detection of UTI in primary care in infants may represent under diagnosis.

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Keywords: urinary tract infection; inpatients; outpatients; DMSA scan; guidelines

Urinary tract infection (UTI) is one of the commonest bacterial infections of childhood, accounting for around 5% of febrile illnesses.1 Over 30 years ago imaging studies carried out on children with UTI showed that renal scarring was present in 10–25% and vesicoureteric reflux (VUR) was present in 30%.2 Renal scarring was worse in children who developed a first infection at a young age.3 had recurrent UTI, had VUR, and where there was a delay in diagnosis and treatment.4 Because of the high incidence of anomalies in these series and the risk of progression of renal damage, recommendations were made for routine imaging of children following UTI.

In 1991 a working group of the Royal College of Physicians published guidelines on the diagnosis and management of UTI in children.3 These guidelines recommend that all children should have an ultrasound scan of the urinary tract with an abdominal x-ray. In addition, the working group recommended that all children less than 7 years should have a dimercaptosuccinic acid (DMSA) scan and all children less than 1 year should have a micturating cystogram (MCUG).4 These recommendations were based on observations from a number of studies showing the high incidence of VUR and renal scarring, and the belief that renal scarring could be prevented by prophylactic antibiotic therapy or reimplantation of the ureter.5 At that time guidelines were not subjected to the same rigorous care in preparation that would be expected now, a decade later.6 In particular, the value of invasive imaging tests was not supported by evidence that knowledge of their presence altered management or prognosis. The huge cost of carrying out these tests in this common condition and the trauma and radiation to children were barely considered.

The guidelines were a valuable first step in rationalisation of the diagnosis and management of early childhood UTI and have encouraged some uniformity of practice which has brought about some rationalisation of management. However, in clinical practice since the guidelines were published there has been more emphasis on the imaging tests recommended after full recovery from the infection than on the diagnosis and treatment of infection. In early childhood, particularly in children under 2 years, the diagnostic process is fraught with difficulty and confusion because of problems with urine collection, contamination of samples, and uncertainty about laboratory criteria for diagnosis.7

The aims of the study were to assess the extent to which local practice followed the guidelines published by the Royal College of Physicians in 1991 and to evaluate the outcome.

Table 1 Ages of children treated for urinary tract infection at home (outpatients) and in hospital (inpatients)

<table>
<thead>
<tr>
<th>Age (y)</th>
<th>Outpatients</th>
<th>Inpatients</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>%</td>
<td>No.</td>
</tr>
<tr>
<td>0 to &lt; 1</td>
<td>13</td>
<td>8</td>
<td>43</td>
</tr>
<tr>
<td>1 to &lt; 7</td>
<td>69</td>
<td>42</td>
<td>20</td>
</tr>
<tr>
<td>7 to 12</td>
<td>13</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td>Total</td>
<td>95</td>
<td>58</td>
<td>69</td>
</tr>
</tbody>
</table>

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Table 2 Imaging investigations carried out as a result of local guidelines according to age in children treated for urinary tract infection at home (outpatients) and in hospital (inpatients)

<table>
<thead>
<tr>
<th>Age (y)</th>
<th>Investigation</th>
<th>Outpatients</th>
<th></th>
<th>Inpatients</th>
<th></th>
<th>Total</th>
<th></th>
<th>TF</th>
<th>NR</th>
<th>DNA</th>
<th>PD</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to &lt;1</td>
<td>Ultrasound</td>
<td>13/13</td>
<td>100</td>
<td>43/43</td>
<td>100</td>
<td>56/56</td>
<td>100</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>DMSA</td>
<td>10/13</td>
<td>77</td>
<td>42/43</td>
<td>98</td>
<td>52/56</td>
<td>93</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>MCUG</td>
<td>11/13</td>
<td>85</td>
<td>39/43</td>
<td>91</td>
<td>50/56</td>
<td>89</td>
<td>1</td>
<td>0</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>1 to &lt;7</td>
<td>Ultrasound</td>
<td>69/69</td>
<td>100</td>
<td>19/20</td>
<td>95</td>
<td>88/89</td>
<td>99</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>DMSA</td>
<td>54/69</td>
<td>78</td>
<td>18/20</td>
<td>90</td>
<td>72/89</td>
<td>81</td>
<td>3</td>
<td>11</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>7–12</td>
<td>Ultrasound</td>
<td>13/13</td>
<td>100</td>
<td>6/6</td>
<td>100</td>
<td>19/19</td>
<td>100</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>Ultrasound</td>
<td>95/95</td>
<td>100</td>
<td>68/69</td>
<td>99</td>
<td>163/164</td>
<td>99</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>DMSA</td>
<td>64/82</td>
<td>78</td>
<td>50/53</td>
<td>95</td>
<td>124/145</td>
<td>86</td>
<td>4</td>
<td>12</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>MCUG</td>
<td>11/13</td>
<td>85</td>
<td>39/43</td>
<td>91</td>
<td>50/56</td>
<td>89</td>
<td>1</td>
<td>0</td>
<td>4</td>
<td>1</td>
</tr>
</tbody>
</table>

TF, technical failure; NR, not requested; DNA, did not attend; PD, parents declined.

Table 3 Prevalence of abnormalities detected by ultrasound, Tc99m DMSA scanning, and MCUG in children treated for UTI at home (outpatients) and in hospital (inpatients)

| Age (y) | Investigation | Outpatients | | Inpatients | | Total | | No. | % | No. | % | No. | % |
|--------|---------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| 0 to <1 | Ultrasound    | 0/13        | 0           | 7/43        | 16          | 7/56        | 13          | 0           | 0           | 0           | 0           |
|        | DMSA          | 0/10        | 0           | 7/42        | 17          | 7/52        | 14          | 0           | 0           | 0           | 0           |
|        | MCUG          | 3/11        | 27          | 14/39       | 36          | 17/50       | 34          | 0           | 0           | 0           | 0           |
| 1 to <7 | Ultrasound    | 2/69        | 3           | 5/19        | 26          | 7/88        | 8           | 0           | 0           | 0           | 0           |
|        | DMSA          | 1/54        | 2           | 6/18        | 33          | 7/72        | 10          | 0           | 0           | 0           | 0           |
| 7–12   | Ultrasound    | 1/13        | 8           | 1/6         | 17          | 2/19        | 11          | 0           | 0           | 0           | 0           |
| Total  | Ultrasound    | 3/95        | 3           | 13/68       | 19          | 16/163      | 10          | 0           | 0           | 0           | 0           |
|        | DMSA          | 1/64        | 1           | 13/60       | 22          | 14/127      | 11          | 0           | 0           | 0           | 0           |
|        | MCUG          | 3/11        | 27          | 14/39       | 36          | 17/50       | 34          | 0           | 0           | 0           | 0           |

Discussion
The guidelines on management of childhood UTI were published in 1991 as a consensus statement following a one day meeting of clinicians interested in UTI in childhood.1 There was general agreement that children with UTI benefited from imaging investigations, although evidence that these tests alter the immediate or long term outcome is weak.10 The
Although much is known about the natural history of UTI, VUR, and renal scarring, little evidence exists that the natural history can be altered. Scars remain static or progress in a proportion of children, even when given excellent care and supervision.13 14 This may be in part because UTI is easily overlooked in infants at the age when there is the greatest risk of renal scarring.13 14 Much of the preventable damage may have occurred prior to entry into the two largest controlled studies.13 14

Only 23% of infants with UTI included in our study were diagnosed in primary care, compared with 77% managed in hospital; in older children the ratio was reversed. In a pilot study, van der Voort et al showed that children with UTI had visited their general practitioners twice as often as controls prior to diagnosis of the first UTI.15 This suggests that UTI may have been overlooked, thus predisposing to renal scar formation.

We have used a simple process, hospital admission, to identify children who were likely to have had severe or systemic illness and to distinguish them from those who were treated at home and who were more likely to have had a trivial illness. Of the children under 1 year, 13/56 (23%) were diagnosed in primary care compared with 77% diagnosed in hospital. This may reflect a higher rate of upper tract infection in this subgroup or the difficulty general practitioners have in establishing the diagnosis of UTI in infancy.13 The incidence of UTI is highest and the risk of renal damage is greatest in the first year of life.13 14 The recommendations in the guidelines that infants should have ultrasound, DMSA, and MCUG were generally accepted by members of the working group. In our study renal scarring was shown in 14% of infants, and 17% of those infants treated in hospital. Although no scars were shown in infants diagnosed at home, the numbers are too small for statistical significance or comment. There is a possibility that there may have been some false positive diagnoses of UTI.17

In children aged 1–6 years, only one child (2%) of the 54 treated at home showed any sign of renal scarring compared with 6/18 (33%) of those admitted to hospital. This difference is both statistically and clinically significant. The time from UTI to DMSA scan was slightly shorter in children managed in hospital. This difference could bias the results in favour of scars in the group managed in hospital but would not affect the conclusions of this study that children over 12 months insufficiently ill to require admission do not benefit from DMSA scans.

DMSA scans are invasive tests that involve an intravenous injection, several hours in hospital, radiation to the child and the gonads, and in some cases, sedation or restraint. There is a risk of psychological trauma to the child and the investigation is also stressful to parents.13 Parents may lose time from work and there are financial costs of travelling with young children. In our study the DMSA was abandoned in four children because of technical failure and in two cases the parents did not
wish their children to undergo the investigation. In 12 cases it was not requested by the medical staff, perhaps because they did not feel that it was indicated. The test costs around £120, with additional costs in smaller children who are often admitted as day cases for sedation. Stark has questioned the economic value of routine imaging of the urinary tract in children and Chambers has questioned the process from the child’s perspective. On the basis of £120 per DMSA scan, the cost of detecting one scar in this series was £1100 pounds. If selected at risk groups had been targeted and fewer scans had been carried out, the cost could have been reduced. The cost of detecting each scar in infants admitted to hospital with UTI was £720; in children over 7 years with clinical evidence of acute pyelonephritis in this series, the cost was £360 per scar. In contrast, the cost of detecting one scar in children managed as outpatients was £7680. Perhaps this money would be better spent on resources in primary care to improve the diagnosis and treatment of UTI in infants and toddlers.

This small study indicates that there are reasonable grounds to question the benefit of carrying out a DMSA scan on every child under 7 years with a proven UTI based on risks and benefits to the patient and on the cost to the NHS. The clinician should be free to recommend a DMSA scan in a child with a history suggestive of acute pyelonephritis, or in cases where there is a history of delay in treatment or frequent recurrences of UTI. The conclusion from this study is that routine use of DMSA scans in children over 1 year with a straightforward simple infection is unhelpful and unnecessary.


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