for bacterial content was shown to compare very well with subsequent culture results. 87% of infected urines were detected, and only 6% of noninfected urines were wrongly identified. Evaluation of the uncentrifuged samples was less easy. There was poor agreement between the naked eye appearance, the presence of protein, and the pus cell count and the ultimate laboratory bacterial count. Microscopy of urinary sediments after centrifuging is recommended to assist in the rapid diagnosis of urinary tract infections particularly in young children.

We thank Sister E. Godfrey and the staff of the paediatric outpatient department, St. James’s Hospital, for assisting in the collection of the samples; Dr. S. R. Meadow for advice; and Miss A. Dick and Miss S. Whitehead for secretarial help.

References


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Bladder emptying in neonates

It has been suggested that neonates may not empty their bladders completely when micturating (Sertel and Scopes, 1973). At school age, girls have a higher incidence of urinary tract infection than boys (Mair, 1973) while in neonates the sex incidence is more equal, though some authors have found a higher incidence in males (Lincoln and Winberg, 1964). It has been suggested that incomplete bladder emptying occurs only in the male neonate, and that this explains the sex incidence in urinary infection (Johnston, 1976). In addition, residual urine in the bladder would invalidate timed urine collections.

Ultrasound scanning is a safe noninvasive investigation already widely used in obstetrics and for prenatal diagnosis. Although the fetal bladder can easily be shown using ultrasound (Campbell et al., 1973), no technique has previously been described to show the bladder in the newborn. The aim of this study is to determine the effectiveness of bladder emptying in the neonate.

Subjects

Sixteen normal newborn infants (9 males, 7 females) were studied. Their ages ranged from 2–13 days. Informed consent was obtained from the mother who was encouraged to come with her child to the ultrasound department. Babies were selected only if their mothers had had an ultrasound scan during pregnancy, and thus were familiar with the apparatus.

Methods

A Diasonograph NE 4102 with a 2–5 MHz probe was used for the ultrasound scanning. Most examinations were carried out after a scan converter had been added to the original machine, thus providing grey-scale visualization.

A ‘water bath’ method was used as follows. The baby’s skin was coated with warm olive oil. The water bath consisted of a sheet of plastic held in a metal frame which was held over the baby’s abdomen. It was noted that when the water bath was held over the baby’s abdomen it helped to calm the baby so that he was less active. Cooling was avoided by the addition of warm water to the water bath. The babies were scanned in the supine position at frequent intervals shortly after feeding until they passed urine. They were scanned again immediately after micturition. When the total quantity of urine passed was caught, its volume was measured in a volumetric measuring cylinder.

Scans were made in two planes. The initial scan was always in the sagittal plane. The second scan was made transversely in a plane at 90° to the long axis of the bladder, through its widest diameter. Further scans were made to determine the shape of the bladder. Where quantitation was possible, electronic calipers preset at 2 cm were drawn on each film and from this the scale of measurements could be determined. The volume of the bladder was calculated using the formula \( \frac{2}{3} \pi abc \) where \( a, b, \) and \( c \) are the three diameters of the bladder (Campbell et al., 1973). The amount of urine passed was estimated by subtracting the postmicturition volume from the premicturition volume.

Results

Both pre- and postmicturition scans support the view that the shape of the bladder is most accurately described as an ovoid. Of the 16 babies studied, 15 did not completely empty their bladders. In the remaining infant, who was female, the bladder could not be detected on the postmicturition scan.
In the initial 4 babies studied, the technique for volume measurements had not been perfected. 7 babies passed urine before premicturition scans could be obtained. Postmicturition residual volumes were calculated in 11 babies and ranged from 3·9 to 13·9 ml (see Table 1) with a mean of 7·7 ml. The mean postmicturition volume for the 8 boys was 7·0 ml; and for the 3 girls 9·4 ml. In 4 out of the 5 babies in whom both pre- and postmicturition bladder volumes were determined, the actual volume of urine passed at micturition is known (see Table 2).

Table 1 Comparison between the actual volume (ml) of urine passed and the volume calculated to have been passed

<table>
<thead>
<tr>
<th>Case no.</th>
<th>Calculated volume passed</th>
<th>Actual volume passed</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>16·4</td>
<td>20·4</td>
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<td>13·8</td>
</tr>
<tr>
<td>13</td>
<td>20·0</td>
<td>17·5</td>
</tr>
</tbody>
</table>

postmicturition volume for the 8 boys was 7·0 ml and for the 3 girls 9·4 ml. In 4 out of the 5 babies in whom both pre- and postmicturition bladder volumes were determined, the actual volume of urine passed at micturition is known (see Table 2).

Table 2 Clinical details of subjects, and results

<table>
<thead>
<tr>
<th>Case no.</th>
<th>Sex</th>
<th>Age (d)</th>
<th>Calculated volumes (ml)</th>
<th>Residual detected?</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Before micturition</td>
<td>After micturition</td>
</tr>
<tr>
<td>1</td>
<td>M</td>
<td>10</td>
<td>3·9</td>
<td>4·1</td>
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<td>2</td>
<td>F</td>
<td>6</td>
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<td>F</td>
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<td>4</td>
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<td>3·9</td>
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<tr>
<td>5</td>
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<td>16</td>
<td>F</td>
<td>3</td>
<td>3·9</td>
<td>4·1</td>
</tr>
</tbody>
</table>

Discussion

Initially direct contact scanning of the bladder was attempted but this proved unsatisfactory due to continual movement of the baby. Scanning was also attempted with the lower half of the baby immersed in warm water but this did not overcome the difficulty. The method described here was easy and gave good technical results. Bladders containing as little as 4 ml of urine were visualized. In the girl in whom the bladder could not be detected after micturition we assumed that it had emptied completely.

Evidence in support of the validity of the method was obtained by comparing the actual amount of urine passed with the calculated volume passed. From Table 2 it can be seen that a reasonable estimate of the volume of urine passed was obtained.

We have shown that the incidence of incomplete bladder emptying in the newborn is high. In particular, 6 out of 7 girls did not empty their bladders completely. Our results are at variance with those of O'Donnell and O'Connor (1971) who concluded that girls did empty their bladders completely while boys did not. However, not only was their technique invasive but their subjects were being investigated because of urinary tract abnormality and they were older.

Thus in contrast to the view of Johnston (1976), we feel that the sex incidence of urinary infection in the newborn is more closely related to the male prevalence to generalized infection and bacteraemia than to the capacity to empty the bladder. In older children, ascending infection explains the higher incidence in girls. Timed voided collections of urine in the neonate will not necessarily reflect the rate of urine production since we have found that as much as 14 ml of urine may remain in the bladder after micturition. The error will be greatest in single void collections.

Summary

Ultrasound scanning was used to determine whether bladder emptying is complete when a newborn baby micturates. Residual urine was detected in 6 females and 9 males while one female emptied her bladder completely. The residual volume was estimated in 11 subjects and ranged from 3·9 to 13·9 ml. Incomplete bladder emptying cannot be the main factor in explaining the sex incidence of urinary tract infection in neonates.

J. O. and G. du M. are grateful to the St. Thomas's Hospital Research Endowments Fund and the Sir William Coxen Trust Fund, respectively, for financial support without which this work could not have been carried out. We also thank Professor J. Scopes for advice.

References


**898 Short reports**


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**Total intestinal aganglionosis**

An autosomal recessive condition?

The risk of long-segment Hirschsprung's disease recurring in further sibs of a patient is well known. Ehrenpreis (1970) estimated the incidence to be 12±%. The extreme variety of this condition in which the entire large and small bowel is aganglionic seems to constitute a separate group. This is a fatal condition and fortunately is rare. The patient described here is a further affected sib in the family reported by Ahmed et al. in 1971. The second child born in the family was a normal healthy female.

**Case report**

The male third child of healthy unrelated white British parents was born at 38 weeks' gestation by normal delivery at home. When feeding was begun he vomited bile-stained fluid. He was admitted as an emergency to hospital late on the third day of life, by which time he had not passed meconium; he was not dehydrated and weighed 3·02 kg. The abdomen was distended but soft. Rectal examination suggested the presence of a microcolon. The full details of the family history were not then available and the possibility of total intestinal aganglionosis was not considered. It was only later that the case notes of the eldest sib were made available, showing that she had died at the age of 20 days from total intestinal aganglionosis.

Hb was 16·6 g/dl, WBC 5·7 x 10⁹/l. Serum electrolytes were normal. X-ray of abdomen showed several distended intestinal loops with fluid levels, while in the right lower quadrant there was the characteristic stippled appearance of meconium. A diagnosis was made of small bowel obstruction possibly due to a complicated meconium ileus. At laparotomy the proximal third of the small bowel was grossly distended with a serosal tear already present. The terminal ileum was full of putty-like meconium and was of narrow calibre, as was the colon. The contents of the proximal small bowel were more fluid than commonly found in meconium ileus. The jejunum was deflated by aspiration and the serosal tear repaired, and a caecostomy was established through which the distal ileum was emptied.

The following day, after reviewing the case notes of the eldest sib, the diagnosis of total intestinal aganglionosis was considered. This was confirmed firstly by rectal biopsy, then at a further laparotomy the extent of the aganglionic segment was shown to include the entire small bowel. The child died 14 days after admission and post-mortem studies showed that there were ganglion cells present only as far as the pylorus.

**Discussion**

The aganglionic segment of Hirschsprung's disease is limited to the rectosigmoid colon in 70% of cases. More extensive involvement is described as 'long-segment disease', but total colonic aganglionosis and

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**Fig. Family trees in total intestinal aganglionosis.**
Bladder emptying in neonates.

J Osborne, G Du Mont, M Beecroft and A B Ayres

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Notes

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