

Urine Samples from Disposable Diapers: An Accurate Method for Urine Cultures

Herman A. Cohen, MD; Baruch Woloch, MD; Nehama Linder, MD;
Amir Vardi, MD; and Asher Barzilai, MD
Petach Tikvah and Tel-Hashomer, Israel

BACKGROUND. The method of collection of the urine sample is of paramount importance in making a diagnosis of urinary tract infection in infants and children. Squeezing urine out of disposable diapers can provide a urine sample that can be used to detect chemical abnormalities as well as a specimen suitable for microscopic examination. To date there have been no reported studies on the use of this technique for urine culture as compared with samples collected by suprapubic aspiration and catheterization.

METHODS. Urine was obtained from 38 infants aged under 2 years who presented with fever with no obvious cause. All infants had urine collected either by catheterization or suprapubic aspiration and by extraction from a disposable diaper. The urine samples were cultured using standard bacteriologic techniques.

RESULTS. Five infants had a urinary tract infection, as shown by a pure growth of more than 10^5 colonies/mL of a single species of bacterium. In all the cases the same result was obtained from both the diaper urine sample and the sample obtained by suprapubic aspiration or catheter. In 31 infants the urine samples collected by both techniques (diaper and catheter or suprapubic aspiration) were negative, and in only 2 infants did the diaper specimen yield a positive result, while the urine obtained by suprapubic aspiration or catheter was sterile.

CONCLUSIONS. Urine obtained from a disposable diaper can provide a valid sample for diagnosing urinary tract infection. The technique is simple, and can be carried out readily in ambulatory settings with minimal equipment and expense.

KEY WORDS. Infant care; urinary catheterization; diapers, infants; urinary tract infection; specimen handling. (*J Fam Pract* 1997; 44:290-292)

Urinary tract infection (UTI) is a common and serious clinical problem in infants and young children. Urine cultures and microscopic urinalysis are essential steps in making the diagnosis of UTI. The diagnosis, however, must be accurate, because a positive diagnosis of UTI may suggest the need for extensive radiologic examination and follow-up evaluation that is expensive, is stressful for the patient and family, and may lead to treatment with a variety of drugs and procedures.

The method used to collect the urine specimen

has important diagnostic implications. The diagnosis of bacterial urinary tract infections is based on the presence in urine of more than 10^5 colonies/mL of a single type of bacterium. Midstream specimens are easily obtained from older children. In infants, however, urine is usually collected by using sterile adhesive bags, which in many cases do not adhere adequately, or the adhesive may cause discomfort to infants with skin disorders. Furthermore, urinalysis and culture performed on a bagged specimen of urine are seldom useful in children who have diarrhea, incontinence, or poor hygiene, or in those instances in which the bag is permitted to remain attached for a considerable length of time. On the other hand, any bacteria isolated from suprapubic aspiration or bladder catheterization are clinically significant.

Urine obtained by compressing wet diapers that do not contain highly absorbent gel beads has been shown to be reliable for estimating specific gravity

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From the Pediatric Ambulatory Center (H.A.C.) and the Department of Pediatrics (B.W.), Sackler School of Medicine, Tel Aviv University, Petach Tikvah, and the Departments of Neonatology (N.L.) and Pediatrics (A.V.), Infectious Disease Unit (A.B.), Chaim Sheba, Tel-Hashomer, Israel. Requests for reprints should be addressed to Herman Cohen, MD, 23 Histadrut Street, Petach Tikvah, Israel.

and pH, and for the qualitative determination of the presence of glucose, protein, and blood.^{1,2} This technique has also proved useful for microscopic examination and the measurement of electrolytes, creatinine, and urea.³ Moreover, an 80% complete concordance has been demonstrated between urine cultures collected from bags and those collected from disposable diapers in a study by Ahmad and associates.⁴

The present study, conducted in children under the age of 2 years, compared the microscopy and culture of urine specimens obtained from the fiber padding of disposable diapers with urine obtained by either a urinary catheter or suprapubic bladder aspiration (SPA).

METHODS

Urine samples were obtained from 38 infants aged 1 to 24 months who presented to our pediatric ambulatory community clinic with fever ranging in temperature from 37.9°C to 39.6°C; these infants were irritable and showed no signs of toxicity and had no obvious focus of infection on physical examination. They were not considered by their pediatricians to be sufficiently sick to justify hospitalization.

Urine samples were collected from each infant by either standard bladder catheterization technique or SPA and by extracting urine from disposable diapers.

The urine was extracted from the diapers as fol-

lows: First, the lining layer of the diaper was removed under aseptic conditions using sterile tweezers, and the damp fibers pushed into the barrel of a standard 20-mL disposable syringe from which the plunger had been removed. By replacing the plunger and compressing the fibers, urine was easily obtained from the diapers.

Ultra-absorbent diapers that contain a gel-like material were excluded from the study because extracting urine from them is difficult and time consuming. In addition, diapers contaminated with feces or those that had been on the infant for longer than 3 hours were excluded.

All urine specimens were divided into their respective groups (samples from diapers, from SPA, and from catheterization) and sent within 1 hour for routine cultures on blood agar plates and MacConkey plates (HY-LAB, Rehovot, Israel) and for routine chemical urinalysis. Urinalysis was carried out by a standard technique and was analyzed for red and white blood cells, epithelial cells, crystals, debris, and bacteria. The laboratory technicians interpreting the urinalysis and urine cultures were blind to the patient's clinical information and to other laboratory information.

RESULTS

Urine samples were obtained from 38 infants (24 female and 14 male) ranging in age from 1 to 24 months. Urinary tract infection was demonstrated

TABLE 1

Methods of Specimen Collection for Detection of UTI in Infants, by Presence of Bacteria and Type of Organism

| Sex and No. of Patients | >10 ⁵ colonies/mL Sampled Urine from | | | <10 ⁵ colonies/mL Sampled Urine from | | |
|-------------------------|--|----------------------------------|------------------------------------|--|----------------------------------|------------------------------------|
| | Disposable Diapers No./Total No. | SPA or Catheter No./Total No. | Organism Isolated No./Total No. | Disposable Diapers No./Total No. | SPA or Catheter No./Total No. | Organism Isolated No./Total No. |
| Female, n=24 | 4/24 | 4/24 | <i>E coli</i> 4/5 | 1/20 | 0/20 | <i>E coli</i> 1/1 |
| Male, n=14 | 1/14 | 1/14 | <i>P mirabilis</i> 1/1 | 1/13 | 0/13 | <i>E coli</i> 1/1 |
| Total, N=38 | 5/38 | 5/38 | | 2/33 | 0/33 | |

SPA denotes suprapubic aspiration.

by SPA or catheterized specimen in 5 (13.2%) infants (4 female and one male). In all 5 children urine cultures showed more than 10^5 colonies/mL of the same single organism from urine that was collected both from the diapers and by SPA or catheterization; *Escherichia coli* was isolated from 4 infants and *Proteus mirabilis* from one.

Cultures from urine samples collected by the two techniques were negative in 31 infants. Only in 2 infants (6%) did the urine cultures collected from the diapers yield *E coli* with colony counts of 10^5 /mL, yet cultures were negative for specimens collected by SPA in one case and from a catheter in the other. Repeated cultures in both those infants were negative, and those infants were not considered to have had a urinary tract infection. Radiographic examination of the urinary tract in the 5 infants with UTI showed vesicoureteric reflux in 3 infants (2 female and one male), a renal scar in one male, and no disease in one female infant. White cell counts were lower by 40% to 70% in the urine collected from the diapers compared with that collected by SPA or catheter.

The data in the table show a sensitivity of 100% (5/5) and a specificity of 94% (31/33). A statistical analysis, however, revealed a wide confidence interval and estimated the low end to be 55% for sensitivity and 82% for specificity. These results were derived using the binomial distribution. The small sample size, particularly for infants with positive results, explains why the confidence limits are much lower than the estimated values.

DISCUSSION

Extracting urine from diapers that do not contain highly absorbent gel beads has been shown to be a reliable technique for collecting specimens for culture, microscopy, and biochemical analysis. In a study by Ahmad and colleagues,⁴ complete concordance was demonstrated between urine cultures collected from bags and those collected from disposable diapers in 82% of cases (37 of 45), resulting in 22 sterile urines, 9 with mixed growth, and 6 with more than 10^5 colony-forming units [CFU]/mL of the same single organism. In 7 infants a mixed growth was obtained from the bag specimen, while specimens

collected from the disposable diaper were sterile; on no occasion did the diaper sample show a mixed growth when the bag sample was sterile. Contaminated samples that yielded a mixed growth of organisms, or less than 10^5 CFU/mL of one species, were seen with both types of urine collection, but were almost twice as common from bag collections compared with diaper samples (17/45 vs 10/45, respectively).

In our study we compared cultures collected from disposable diapers with those collected by SPA or catheter. To our knowledge, this comparison has not been made before. Our results show that all the infants in whom cultures collected by SPA or catheter were negative also had negative cultures from urine collected from diapers. Only 6% (2/33) of the urine cultures collected from diapers were positive for *E coli* with colony counts of 10^5 /mL. Those two infants, however, had negative cultures from SPA and catheter specimens. Repeated urine cultures were negative, and the infants were not considered to have had UTI.

Our results show that samples collected from disposable diapers were in complete agreement with those obtained by SPA or catheter in 36 of 38 cases, or 95% of the time. SPA or catheterization sampling techniques are useful for isolating clinically significant bacteria when urinary tract infection is suspected. Many physicians do not routinely use these techniques because they often cause great concern to the parents and pain and discomfort to the infant, even though SPA rarely causes complications.

This method of urine collection from disposable diapers can be used by physicians as a simple, accurate, and efficient alternative for sampling urine for culture. Given the small number of patients, and the even smaller number of patients testing positive, however, we regard this finding as preliminary.

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