Outpatient Urine Culture

Does Collection Technique Matter?

Edward Lifshitz, MD; Liane Kramer, RNC, BSN

**Background:** Dysuria is one of the most common presenting complaints of young women, and urinalysis is one of the most common laboratory tests performed. Despite the fact that the midstream clean-catch technique is commonly used for urine collection, contaminated urine cultures occur with distressing regularity. The midstream clean-catch technique is time-consuming to explain, frequently not performed correctly by patients, costly for supplies, often embarrassing for patients and staff, and of unproven benefit. Therefore, we designed a study to compare various methods of obtaining specimens for culture from acutely dysuric young women.

**Methods:** A total of 242 consecutive female patients who presented with symptoms suggestive of a urinary tract infection were randomized into 3 groups. The first group (n=77) was instructed to urinate into a clean container. No cleansing was done, and the specimen was not obtained midstream. The second group (n=84) was instructed to collect a midstream urine sample with perineal cleansing and spreading of the labia. In an attempt to decrease contamination from the vagina, the third group (n=81) was given the same instructions as group 2, with the addition of using a vaginal tampon. Contamination rates were calculated for all 3 groups.

**Results:** Contamination rates for the 3 groups were nearly identical (29%, 32%, and 31%, respectively). Comparing the no-cleansing group with the combined cleaning, midstream groups also showed no difference in contamination rates (28.6% and 31.5%, respectively, with $P=.65$).

**Conclusions:** In young, outpatient women with symptoms suggestive of a urinary tract infection, the midstream clean-catch technique does not decrease contamination rates.

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SUBJECTS AND METHODS

A total of 242 consecutive female patients (mean age, 21.2 years; median age, 20 years; and age range, 17-50 years) who presented to our university clinic and had symptoms suggestive of cystitis were randomized into 1 of 3 groups. Rutgers University is the largest state university in New Jersey, and all full-time students are eligible to be seen at the health centers without charge. While specific socioeconomic data were not collected for our subjects, patients at the health centers are representative of the general university population: a highly educated, economically diverse group. While the majority of our subjects were undergraduates, a significant minority were graduate students.

Seventy-seven patients (mean age, 21.4 years; age range, 17-50 years) randomized to the first of our groups (“nothing”) were told to urinate into a clean, nonsterile container without any preparation (no cleansing, no midstream collection). The second group of patients (n=84; mean age, 21.3 years; age range, 17-41 years) (“midstream”) were told to cleanse the perineum with a bactericidal wipe of witch hazel, benzalkonium chloride, solubilized lanolin, and methyl p-hydroxybenzoate (Rantex; Clinipad Corp, Guilford, Conn) by wiping from front to rear, to spread the labia, to discard the first urine output, and to collect the midstream specimen in a clean, nonsterile container. The third group (“everything”) was identical to the second, except that the patients, who ranged in age from 17 to 37 years (mean age, 21.0 years), were instructed to insert a vaginal tampon prior to collection. If the patients in this group were unable or unwilling to use a tampon, they were automatically relegated to the midstream group. There were only a few patients who needed to be reassigned this way.

The only exclusion criterion was antibiotic usage or urethral instrumentation in the previous 7 days, or known urologic abnormality or nephrolithiasis. According to the current standard of care, the patients were treated based on their symptoms and on the results of a “dipstick” analysis (including tests to detect the presence of nitrites, leukocyte esterase, hemoglobin, and protein).

Within 5 minutes of collection, all specimens were injected into a receptacle containing boric acid and sodium formate (Vacutainer Urine Transport Kit; Becton Dickinson & Co, Franklin Lanes, NJ) and transported to the laboratory. Microbiologists at the laboratory were blinded as to grouping. The specimens were plated within 24 hours using a 1-µm loop, streaked on both blood and MacConkey agar, and incubated for 24 hours at 37°C. At this time, a preliminary reading was done and the specimen was re-incubated for another 24 hours, when a final reading was done. Final culture reports were classified as no growth, mixed, or pure. Mixed was defined as at least 2 organisms, and in most cases, specific identification of those organisms was not made. Those that were pure were further categorized according to species and colony-forming units per milliliter using a standard technique.

One major decision concerned what constituted a “contaminated specimen. While there are several studies that suggest that mixed cultures in hospitalized patients may not be contaminated,16-19 there is a paucity of data on outpatients. For example, while Stamm et al20 showed that approximately 13% of cultures obtained from symptomatic female outpatients by catheterization or suprapubic aspiration were mixed, they also found an unusually high rate of mixed cultures obtained by the MSSC technique (64%). In general, the prevailing view among clinicians is that since Escherichia coli is the causative agent in the overwhelming majority of cystitis cases, and since without manipulation or anatomical defect the chance of a second infection decreases, a mixed culture in an uncomplicated outpatient population likely indicates contamination. Because our population was exclusively outpatient, had not undergone urethral instrumentation, and had no history of renal disease or nephrolithiasis, and because we did not invasively obtain urine specimens for comparison, we classified all mixed cultures as contaminated.

A decision needed to be made as to what other results should be considered contaminated. While it is not possible to know with absolute certainty, given the abovementioned characteristics of our population, low levels (<10⁴/mL) of organisms commonly found on the skin and external and internal genitalia were considered to be contaminants. This group included all our cultures that yielded Enterococcus and S epidermidis (a total of 6 specimens). Other organisms commonly found on the skin were also deemed to be contaminants. This group included S viridans (2 specimens) and S aureus (1 specimen). In keeping with the current literature on dysuric women,20 coliform organisms of 10⁵ colony-forming units per milliliter or more were considered significant.

This study was presented to the institutional review board, which concluded that informed consent was not necessary, as treatment was determined by standard clinical history, physical examination, and urinary dipstick results.

as is usually thought was found in a study of hospitalized patients that showed a 92.3% correlation between catheterized specimens and those collected in disposable diapers.15 Attempts to decrease contamination rates via an educational campaign aimed at teaching male patients how to provide a MSCC specimen backfired when contamination rates actually increased.13

There is some literature to support performing at least some components of the MSCC technique, although in each of 3 studies it was a different component (spreading of the labia, cleansing of the perineum, and midstream catch in men).15 The MSCC technique is difficult and time-consuming to teach. Explaining the concept to patients often involves embarrassment for both patient and staff. The added costs of sterile containers and bactericidal wipes are significant. If the MSCC technique were shown not to improve contamination rates, then there would be a substantial benefit from abandoning the practice.

The opposite argument can also be made. The normal vaginal flora may include Staphylococcus aureus, Staphylococcus epidermidis, Streptococcus viridans, enterococci, peptostreptococci, group B streptococci, low-temperature–tolerant neisseriae, corynebacteria, some actinomyces, members of the family Enterobacteriaceae, acinetobacters, chlamydiae, Gardnerella vaginalis, occasionally clostridia and other anaerobic rods, mycoplasma, Candida albicans, other...
yeasts, and *Trichomonas vaginalis*. Since vaginal secretions may potentially contaminate a urine specimen, it is reasonable to postulate that adding a vaginal tampon to the MSCC technique would decrease urine sample contamination rates.

We devised a study to compare 3 methods of collection: standard midstream collection with bactericidal wipe, midstream collection with bactericidal wipe and the insertion of a vaginal tampon, and no precautions (no-wipe, nonmidstream). All specimens were collected in clean, nonsterile containers. Unlike most previous studies,7-11 which involved asymptomatic women, our study comprised symptomatic, premenopausal women, a population for which urine cultures are frequently ordered in clinical practice.

**RESULTS**

Table 1 contains a summary of our results. As expected in young, outpatient women, *E coli* was overwhelmingly the most common pathogen, accounting for 90% of documented infections. The other 10% were almost evenly divided among *Staphylococcus saprophyticus*, *Klebsiella*, *Proteus*, and *Enterobacter*.

The contamination rates in each of our 3 groups (29%, 32%, and 31%, respectively) were essentially identical. The null hypothesis of equality between our 3 groups could not be rejected, as a $\chi^2$ analysis of the last 3 rows of Table 1 revealed a $P$ value of .82. Also, if we state that no-growth urine cultures are not contaminated, then we can further categorize results as either contaminated or uncontaminated. And since groups 2 and 3 used both midstream collection techniques with cleansing, and since we could see that these groups were nearly identical (Table 1), we were able to combine them into 1 larger group, which allowed us to simplify our results (Table 2).

As the data in Table 2 show, there was actually a slightly lower contamination rate among our nothing group than among our midstream plus everything group (28.6% vs 31.5%), but this trend did not reach significance ($P = .65$).

Finally, we found that the use of a bactericidal wipe did not decrease colony counts (Table 3). More than $10^5$ colony-forming units per milliliter were seen in 77.3% of the pure specimens obtained without cleansing and in 79.8% of those obtained with cleansing.

**COMMENT**

Our 3 groups—no precautions, midstream, midstream plus vaginal tampon—had essentially identical contamination rates of 29%, 32%, and 31%, respectively (Table 1). These data suggest that the method of urine collection does not affect the results of the urine culture and that, at least in our study population, collecting a specimen in a nonsterile container, with no special instructions, may save time, money, and embarrassment.

We also found virtually identical colony counts independent of the use of bactericidal wipes (Table 3). This finding suggests that, at least for symptomatic young

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**Table 1. Culture Results for Each Group**

<table>
<thead>
<tr>
<th>Pathogen</th>
<th>Nothing (n = 77)</th>
<th>Midstream (n = 84)</th>
<th>Everything (n = 81)</th>
<th>Total (N = 242), No. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Escherichia coli</em></td>
<td>37 (48)</td>
<td>41 (49)</td>
<td>41 (51)</td>
<td>119 (49)</td>
</tr>
<tr>
<td><em>Staphylococcus saprophyticus</em></td>
<td>1 (1)</td>
<td>0 (0)</td>
<td>3 (4)</td>
<td>4 (2)</td>
</tr>
<tr>
<td><em>Enterobacter</em></td>
<td>3 (4)</td>
<td>0 (0)</td>
<td>1 (1)</td>
<td>4 (2)</td>
</tr>
<tr>
<td><em>Klebsiella</em></td>
<td>1 (1)</td>
<td>0 (0)</td>
<td>1 (1)</td>
<td>2 (1)</td>
</tr>
<tr>
<td><em>Proteus</em></td>
<td>2 (3)</td>
<td>1 (1)</td>
<td>0 (0)</td>
<td>3 (1)</td>
</tr>
<tr>
<td><em>Enterococcus</em>†</td>
<td>1 (1)</td>
<td>2 (2)</td>
<td>1 (1)</td>
<td>4 (2)</td>
</tr>
<tr>
<td><em>Streptococcus viridans</em>†</td>
<td>0 (0)</td>
<td>1 (1)</td>
<td>1 (1)</td>
<td>2 (1)</td>
</tr>
<tr>
<td><em>Staphylococcus aureus</em>†</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>1 (1)</td>
<td>1 (0)</td>
</tr>
<tr>
<td><em>Staphylococcus epidermidis</em>†</td>
<td>1 (1)</td>
<td>1 (1)</td>
<td>0 (0)</td>
<td>2 (1)</td>
</tr>
<tr>
<td>No growth</td>
<td>11 (14)</td>
<td>15 (18)</td>
<td>10 (12)</td>
<td>36 (15)</td>
</tr>
<tr>
<td>Mixed</td>
<td>20 (26)</td>
<td>23 (27)</td>
<td>22 (27)</td>
<td>65 (27)</td>
</tr>
<tr>
<td>Total contaminated†</td>
<td>22 (29)</td>
<td>27 (32)</td>
<td>25 (31)</td>
<td>74 (31)</td>
</tr>
</tbody>
</table>

*See “Subjects and Methods” section for definitions of groups.
†These organisms were labeled contaminants; thus, Total contaminated = Mixed + (Enterococcus + S viridans + S aureus + S epidermis).

**Table 2. Culture Results for 2 Groups**

<table>
<thead>
<tr>
<th></th>
<th>Nothing (77%)</th>
<th>Midstream + Everything (165)</th>
<th>Total (242)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uncontaminated</td>
<td>55 (71.4)</td>
<td>113 (68.5)</td>
<td>168 (69.4)</td>
</tr>
<tr>
<td>Contaminated</td>
<td>22 (28.6)</td>
<td>52 (31.5)</td>
<td>74 (30.6)</td>
</tr>
</tbody>
</table>

*See “Subjects and Methods” section for definitions of groups.

**Table 3. Colony Counts Greater Than 10^5 Colony-Forming Units per Milliliter for Uncontaminated Specimens**

<table>
<thead>
<tr>
<th>Pathogen</th>
<th>No Cleansing</th>
<th>Bactericidal Wipe</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Escherichia coli</em></td>
<td>27 (73)</td>
<td>64 (78)</td>
</tr>
<tr>
<td><em>Staphylococcus saprophyticus</em></td>
<td>1 (100)</td>
<td>3 (100)</td>
</tr>
<tr>
<td><em>Enterobacter</em></td>
<td>3 (100)</td>
<td>1 (100)</td>
</tr>
<tr>
<td><em>Klebsiella</em></td>
<td>1 (100)</td>
<td>1 (100)</td>
</tr>
<tr>
<td><em>Proteus</em></td>
<td>2 (100)</td>
<td>2 (100)</td>
</tr>
<tr>
<td>Total</td>
<td>34 (77.3)</td>
<td>71 (79.8)</td>
</tr>
</tbody>
</table>

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women, the concern that bactericidal wipes may lower pathogenic colony counts is not warranted.

Why did midstream collection with cleansing (with or without a vaginal tampon) not decrease contamination rates? Several possibilities come to mind. Despite careful instruction, patients may not have been able to perform the somewhat complicated procedures correctly, and thus not gain their benefits. If there were not a sufficient quantity of contaminating organisms in the urethra, vagina, or peri-neal region to grow in culture, then the bactericidal wipes and midstream collections would not decrease the number of mixed cultures. Finally, despite all precautions, some areas of the perineum may not have come in adequate contact with the bactericidal wipe, thus allowing contaminating bacteria to reach our clean container.

One criticism that could be considered is that we used clean, but not sterile, containers to collect the urine. Despite the fact that others found no difference in colony counts or contamination rates when clean containers were used, the argument may be made that the number of contaminated specimens in all 3 of our groups may have been elevated. If the contamination rate was elevated enough, it may have obscured small differences between our groups.

In an attempt to gauge the effect of culturing from a “clean” container, we poured sterile saline into a clean cup, and from there into a clean test tube, and finally into our transport container to be cultured. This simulated the process by which the urine samples were collected from our subjects. For 10 specimens, we were careful not to touch the inside of the container (simulating the ideal urine collection technique), and for 10 specimens, we purposely touched the inside of the cup with our fingers to “contaminate” the container (simulating the effect of a patient inadvertently doing the same). None of these 20 cultures showed any growth.

Also, our contamination rate was actually lower than that reported in other studies. We also compared our culture results with those of 440 urine cultures performed in the same laboratory but from a different health center, which were collected using a sterile container and the MSSC technique. This “control” group was predominately composed of symptomatic women, but as the symptoms were not always recorded on the requisition slip, an exact percentage was not attainable. We found similar results, with 26.9% of our patients and 24% of those in the control group having mixed cultures. We obtained 54.5% pure cultures; the control group had 41%. We did have a lower percentage of no-growth samples (14.9% vs 35%), but this difference could largely be attributed to the fact that all our patients had signs and symptoms suggestive of cystitis.

Our study population included women, mostly young, with symptoms of lower urinary tract infection (cystitis). They were all premenopausal and without other significant medical illnesses. None had a history of nephrolithiasis or renal disease, and several had had negative results on renal ultrasonography and/or intravenous pyelography. However, while this population represents a sizable percentage of all persons with urinary tract infections, it is also one in which current thinking suggests that cultures need not always be obtained. Overall, our results suggest that it may not be necessary for urine cultures to be collected by means of the MSSC technique in young women with symptoms suggestive of cystitis. Abandoning the use of the MSSC technique in this population may be warranted, thereby resulting in considerable savings in money, time, and embarrassment. We believe that further studies should be performed to see whether the same result would be obtained in male patients, patients with more complicated urologic histories, and patients with signs and symptoms suggestive of upper or complicated urinary tract infections.

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REFERENCES


