Evidence Against the Practicality and Cost-Effectiveness of a Gram-Positive Coccal Selective Plate for Routine Urine Cultures

MARTHA J. BALE and JOHN M. MATSEN

Departments of Pathology and Pediatrics, University of Utah School of Medicine, Salt Lake City, Utah 84132

Received 14 April 1981/Accepted 22 June 1981

A total of 899 urine cultures were evaluated to assess the need for and cost-effectiveness of using a gram-positive coccal selective plate in the initial plating of urine cultures. Of these cultures, 437 were examined retrospectively and 462 were examined prospectively. Urines were quantitatively plated to three media: sheep blood agar, MacConkey agar, and phenyl ethyl alcohol agar. Of all urine samples in both studies, 52% yielded no growth on any of the three media. Of all 899 urine cultures, there were only 5 cultures (less than 1%) in which a significant count of a gram-positive organism was detected only on the phenyl ethyl alcohol agar plate and not recoverable on the sheep blood agar plate. In each of these five instances, the need for the use of the selective plate occurred when a Proteus mirabilis strain swarmed over an enterococcus. The inclusion of a selective gram-positive coccal medium for initial plating of urine cultures is unnecessary and not cost-effective. When Proteus swarms on sheep blood agar, a sweep should be made with an inoculating loop from the sheep blood agar and streaked to phenyl ethyl alcohol agar or a similar gram-positive coccal medium.

Many urinary tract infections are caused by gram-positive coccal organisms, in particular enterococci and staphylococci. In addition, some urinary tract infections are polymicrobial. Most authors of urine culture procedures (1, 3-5) advocate the use of sheep blood agar (SB) and MacConkey or eosin methylene blue agar for initial plating of urine cultures, and few include a recommendation for a selective gram-positive coccal plate (2).

A recent questionnaire survey in the Clinical Microbiology Newsletter (Clin. Microbiol. News. 1:22, 1979) showed that 35% of laboratories represented in the survey routinely employ some type of selective gram-positive coccal plate for the initial plating of urine cultures, i.e., colistin-nalidixic acid agar, phenyl ethyl alcohol agar (PEA), bile esculin agar, or azide agar. The difference between what is suggested in the literature and what clinical laboratories are actually doing creates an interest as to whether the inclusion of a selective gram-positive coccal plate for routine urine cultures is either necessary or cost-effective.

Our laboratory has found that the use of a PEA plate for urine cultures from our Rehabilitation Unit is very useful and necessary since these patients often have polymicrobial infections of Proteus and enterococci. In this situation the enterococci may be only recoverable from the selective gram-positive coccal plate due to the swarming of the Proteus on SB.

This study assesses the need for and cost-effectiveness of a gram-positive coccal selective plate in the initial plating of urine cultures from non-rehabilitation patients.

MATERIALS AND METHODS

Urine specimens. All urine specimens evaluated in this study were consecutive samples submitted to the Clinical Microbiology Laboratory at the University of Utah Medical Center for culture. A routine urine culture of each was performed. Urine cultures from our Rehabilitation Unit patients were excluded because of the higher expectation of multiple strain presence due to the high proportion of spinal cord injury patients in this population.

Urine culture procedure. Each urine sample was quantitatively cultured by using a 0.001-ml calibrated loop to inoculate SB, MacConkey, and PEA culture plates. All three media were incubated aerobically at 35°C for 18 h.

Urine culture work-up. The urine specimen received a limited evaluation when isolates from non-catheter or non-aspirate specimens were cultured in quantities of less than 10,000 colony-forming units per ml, or when three or more different strains were isolated from the same culture. In these cases only a
gross identification and quantitation were reported. Strains recovered in quantities greater than 10,000 colony-forming units per ml were completely identified, and the urine was completely processed if only one or two different strains were recovered.

**Retrospective analysis.** A total of 437 urine cultures were evaluated, utilizing worksheet notation, to determine correlation of gram-positive organisms on SB and PEA. All three initial plates had been interpreted by the bench technologist responsible for the culture.

**Prospective analysis.** A total of 462 urine cultures were analyzed prospectively. Each urine was inoculated to the media described above. The SB and MacConkey plates were read and interpreted by the routine bench technologists. The PEA plate was read by one of the investigators (M.J.B.), who correlated the results the same day so that further work could be performed, if necessary, from the PEA. When an isolate was present on the selective plate as isolated colonies not present on SB, the SB plate was examined to assess whether the gram-positive strain could be detected. Whenever swarming Proteus was present on SB plates, a “sweep” subculture was made to a fresh PEA plate to ascertain the ability to subsequently isolate a gram-positive coccal strain.

**RESULTS**

A total of 899 urine cultures were analyzed in this study, 437 retrospectively and 462 prospectively. Fifty-two percent of all urine samples did not yield growth on any of the three media (less than 1,000 colony-forming units per ml of urine).

Retrospectively, a significant count of a gram-positive coccal strain was detected only on the selective gram-positive coccal plate (PEA) in three cases (<1%). However, with 13 cultures a gram-positive strain was detected on both SB and PEA. The colonies on PEA were used to inoculate the biochemical identification tests.

Prospectively, the PEA plate was necessary in two cases (less than 1%). In both of these cases, as well as in the three cases from the retrospective analysis, a Proteus sp. had swarmed on the SB and an enterococcus was recovered from the PEA. In each of these two instances a subculture to a PEA plate from an SB plate with Proteus swarm allowed recovery of the enterococcal strain.

All other urine cultures in this study showed correlation between the SB and PEA. A summary of our findings is shown in Table 1.

**DISCUSSION**

A selective gram-positive coccal medium was necessary for the isolation of a significant organism in only 5 of 899 urine cultures. This selective medium was necessary only when a Proteus sp. had swarmed on the SB. Prospectively, we attempted taking a subculture to PEA of all urine SB cultures that had a Proteus swarm. This technique permitted the recovery of the gram-positive organism in both cases, but accurate quantitation could not be obtained from this subculture.

The use of a selective gram-positive coccal plate in the routine plating of urine cultures is not necessary, nor is it cost-effective. The addition of this third plate increases medium cost by one-third, as well as increasing technologist time by the amount required to inoculate, handle, and interpret the additional plate. However, a subculture to such a medium should be performed if a Proteus sp. swarms over the SB.

There is one special situation in which the routine use of a medium such as PEA may be advisable. The rehabilitation patients at our hospital have a high incidence of neurogenic bladder disease or indwelling urinary catheters or both, and as such are frequently vulnerable to mixed Proteus and enterococcal urinary tract infections. We therefore do not treat this patient population routinely; we include a selective gram-positive coccal plate, which avoids the necessity for subculturing the plates on which Proteus has swarmed and thus precludes the 1- or 2-day delay. The incidence of swarming Proteus in these patients is 20 to 30%. We also process these urine samples in a manner that takes into account the frequency of polymicrobial infections.

---

**Table 1. Summary of findings**

<table>
<thead>
<tr>
<th>Phase</th>
<th>No. of urine cultures analyzed</th>
<th>No growth on any plate</th>
<th>Probable contaminated urines* (PEA-SB correlated)</th>
<th>Positive urine (PEA-SB correlated)</th>
<th>Significant organism isolated only on PEA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retrospective phase I</td>
<td>437</td>
<td>226 (52)</td>
<td>84 (19)</td>
<td>127 (29)</td>
<td>3 (&lt;1)</td>
</tr>
<tr>
<td>Retrospective phase II</td>
<td>462</td>
<td>241 (52)</td>
<td>105 (23)</td>
<td>118 (26)</td>
<td>2 (&lt;1)</td>
</tr>
<tr>
<td>Total</td>
<td>899</td>
<td>467 (52)</td>
<td>189 (21)</td>
<td>245 (27)</td>
<td>5 (&lt;1)</td>
</tr>
</tbody>
</table>

* Less than 10,000 colony-forming units, or ≥3 organisms.
ACKNOWLEDGMENTS

The technical assistance of Peggy Ahlin and Rebecca Boshard, the cooperation of the staff of the Clinical Microbiology Laboratory, University of Utah Medical Center, and the editorial and secretarial help of Constance Staples are gratefully acknowledged.

LITERATURE CITED


