Evaluation of the Vitek EPS Enteric Pathogen Screen Card for Detecting *Salmonella*, *Shigella*, and *Yersinia* spp.

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We evaluated the Vitek EPS card as a screen for the enteric pathogens *Salmonella* spp., *Shigella* spp., and *Yersinia enterocolitica*. *Salmonella* spp., *Shigella* spp., and *Y. enterocolitica* (125, 54, and 5 isolates, respectively) and 81 nonenteric pathogens that might be selected for screening from primary plates (non-lactose fermenters) were tested. The EPS card correctly identified 183 of 184 pathogens tested (sensitivity, 99.5%). Of 81 nonenteric pathogens screened with the EPS card, 5 were identified as possible enteric pathogens (specificity, 90.1%). We reviewed our stool culture records over the past 1.5 years and analyzed the specificities of TSI-urea screens for 300 stool cultures that had suspicious colonies. From 55 of 300 stool cultures, either *Salmonella* spp. or *Shigella* spp. were isolated, and from 245 stool cultures, no pathogen was isolated. Of the 245 negative cultures, 166 gave false-positive screening-test results that resulted in further biochemical identification procedures (Analytab Products or Vitek identification). Thus, the specificity of the TSI-urea screen in our experience was 32.2%. The Vitek EPS card was shown to be a more cost-effective screening procedure than the TSI-urea screen.

Diagnosis of bacterial gastroenteritis relies on isolation of the etiologic agent from culture. Stool samples are the most common specimens submitted for microbiologic analysis. A variety of bacterial agents cause gastroenteritis; *Salmonella* spp., *Shigella* spp., and, to a lesser extent in some areas, *Yersinia enterocolitica* are agents that are frequently sought in routine stool cultures. After samples are plated on a variety of selective and differential media, colonies suspected of being one of these potential enteric pathogens (usually non-lactose fermenters) are selected for further study by biochemical and/or immunologic methods (3). Most laboratories use simple biochemical methods for screening suspect colonies before proceeding with complete identification and serologic analysis. Until recently, our laboratory had used TSI Agar-urease tests as the screening procedure for identification of *Salmonella* spp., *Shigella* spp., and *Y. enterocolitica*. However, these screening tests require overnight incubation and are not specific for these agents (2, 4-6). To find a rapid system (4 to 8 h) for screening of these potential stool isolates as well as to use a more specific assay, we recently evaluated the Vitek EPS screen card (Biomerieux Vitek; Hazelwood, Mo.). This product has been commercially available for a number of years and is intended to be used for rapid screening and presumptive identification of *Salmonella* spp., *Shigella* spp., and *Y. enterocolitica*. The present study was performed because the few studies of the EPS system that have been previously published (2, 4, 5) were conducted with earlier versions of Vitek software analysis programs.

(This work was presented at the 92nd General Meeting of the American Society for Microbiology, New Orleans, La., 26 to 30 May 1992 [abstr. no. C-98].) *Salmonella* spp., *Shigella* spp., and *Yersinia enterocolitica* (125, 54, and 5 isolates, respectively) and 81 nonpathogens (non-lactose fermenters) were tested in the present study (Tables 1 and 2). For *Salmonella* and *Shigella* isolates, all except five were from our stock collection of clinical isolates and had been frozen at −70°C. Each isolate was subcultured twice on Trypticase soy agar with 5% sheep blood before being tested. Two isolates of *Salmonella* sp. serovar arizonae were obtained from the Bureau of Laboratories, Pennsylvania Department of Health. Three isolates of *Y. enterocolitica* were obtained from the Clinical Microbiology Laboratory at St. Christopher’s Hospital for Children, Philadelphia, Pa.

The Vitek EPS card is composed of three sections, with 10 wells in each section. Ten biochemical reaction mixtures are contained in each section, allowing the user to test three different colonies on each card. The card is incubated for 4 to 8 h after inoculation, at which time a report indicating the likelihood that the isolate is one of three pathogens identified by the system is generated. The identification of any isolate as *Salmonella* sp., *Shigella* sp., or *Y. enterocolitica* is then confirmed by conventional techniques and serologic studies if appropriate.

Compared with conventional identification, the Vitek EPS card correctly identified 183 of 184 enteric pathogens tested (sensitivity, 99.5%). A single isolate of *Salmonella* sp. serovar arizonae was not correctly identified as a possible enteric pathogen. Of the 81 nonpathogens tested, 73 were correctly identified as nonpathogens (specificity, 90.1%). Of the 8 false-positive isolates, five were *Citrobacter freundii* and were identified by the Vitek EPS card as lac* Salmonella* spp.; two *Hafnia alvei* isolates were also identified as *Salmonella* spp., and one *Plesiomonas* sp. isolate was reported as probably negative or questionable regarding its identification as *Y. enterocolitica*.

Prior to this study, our laboratory used a TSI-urea screening test for suspect colonies selected from culture media. In a retrospective analysis of our conventional screening tests for enteric pathogens, we determined the specificity of the TSI-urea test for 300 stool cultures compared with that of the Vitek EPS screen card. Of 255 nonpathogens identified from 300 stool cultures, the TSI-urea screen exhibited positive...
434 NOTES

Salmonella spp.

serovar 3

Salmonella

Shigella

Shigella

boydii

with

subsequent

screening

of

isolate

(Analytab

Morganella

coli

Proteus penneri

Hafnia

cost

$288.00

Providencia

colonies

rial

Enterobacter

assumed

of

mirabilis

significant

time-consuming

Citrobacterffreundii

Citrobacter diversus

C1

C2

D

E

H

Salmonella serovar

arizonae

Salmonella spp.

Shigella sonnei

Shigella flexneri

Shigella boydii

Yersinia enterocolitica

3

36

17

1

5

TABLE 1. Salmonella, Shigella, and Yersinia isolates used for this study

<table>
<thead>
<tr>
<th>Serogroup or species</th>
<th>No. tested</th>
<th>Serovar(s) (no.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salmonella spp.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>31</td>
<td>breedeney (1), typhimurium (17), heidelberg (9), agona (1), chester (1), brandenburg (1), saintpaul (1)</td>
</tr>
<tr>
<td>C1</td>
<td>15</td>
<td>montevideo (1), infantis (3), oranienburg (1), tennessee (1), cholera suis (1), livingstone (1), mbandaka (4), thompson (2), braenderup (1)</td>
</tr>
<tr>
<td>C2</td>
<td>10</td>
<td>hadar (5), newport (3), blockley (1), litchfield (1)</td>
</tr>
<tr>
<td>D</td>
<td>60</td>
<td>enteritidis (55), berta (2), typhi (3)</td>
</tr>
<tr>
<td>E</td>
<td>2</td>
<td>anutum (1), senftenberg (1)</td>
</tr>
<tr>
<td>H</td>
<td>1</td>
<td>carrau (1)</td>
</tr>
<tr>
<td>Salmonella serovar</td>
<td></td>
<td></td>
</tr>
<tr>
<td>arizonae</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Morganella morganii</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Proteus</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

TABLE 2. Common nonpathogens tested*

<table>
<thead>
<tr>
<th>Organism</th>
<th>No. tested</th>
</tr>
</thead>
<tbody>
<tr>
<td>Escherichia coli</td>
<td>13</td>
</tr>
<tr>
<td>Citrobacter freundii</td>
<td>13</td>
</tr>
<tr>
<td>Citrobacter diversus</td>
<td>17</td>
</tr>
<tr>
<td>Hafnia alvi</td>
<td>3</td>
</tr>
<tr>
<td>Pleisomonas shigelloides</td>
<td>5</td>
</tr>
<tr>
<td>Proteus vulgaris</td>
<td>1</td>
</tr>
<tr>
<td>Morganella morganii</td>
<td>5</td>
</tr>
<tr>
<td>Proteus mirabilis</td>
<td>19</td>
</tr>
<tr>
<td>Proteus penneri</td>
<td>1</td>
</tr>
<tr>
<td>Providencia stuartii</td>
<td>2</td>
</tr>
<tr>
<td>Enterobacter taylorae</td>
<td>1</td>
</tr>
</tbody>
</table>

* Non-lactose-fermenting colonies observed on culture media.

We also compared the cost of using the TSI-urea screen with subsequent complete biochemical identification of the isolate (Analytab Products or Vitek GNI card) with the cost of using the Vitek EPS card with subsequent biochemical identification (Analytab Products or Vitek GNI card). We assumed that for each stool sample, at least three colonies were tested by either screening procedure. In an analysis of the cost per 100 cultures with a positive screen, the EPS card cost $288.00 versus $452.00 for the TSI-urea test and subsequent biochemical identification in our laboratory.

Conventional biochemical tests used for screening bacterial colonies from stool cultures, such as the TSI-urea test, are time-consuming and often delay the identification of significant enteric pathogens. In our experience, the specificity of the TSI-urea screen is unacceptable and results in a significant number of nonpathogens being subjected to more complete biochemical identification. Other studies have also shown that biochemical screens, such as the ones used in the present study, have a high rate of false-positive results (3-6).

We found that the Vitek EPS screen card was both sensitive in detecting the spectrum of organisms isolated in our patient population and much more specific than our conventional TSI-urea screen. The EPS card is not recommended for the screening of oxidase-positive organisms such as *Pleisomonas* spp. We included these organisms in our evaluation since they might inadvertently be set up during routine screening. However, one isolate gave a positive screening result. In addition, the EPS card is not intended as a definitive identification system, and isolates identified as positive by the screen test must be confirmed by a conventional biochemical-serologic test. Our studies showed that although the specificity of the EPS screen test was much higher than that of our TSI-urea tube screen, a significant number of false-positive results were obtained and would preclude one from considering the EPS results definitive.

Cost analysis of the EPS screen card versus the TSI-urea screen revealed that there was no significant difference in the cost of materials per unit. When the rate of false-positive results of each test was factored into the analysis, the TSI-urea screen resulted in a cost increase of $144.00 per 100 positive cultures compared with the EPS screen card.

Few studies on the performance of the Vitek EPS screening system have been reported in the literature (3-5). Sensitivity and specificity have ranged from 87 to 99% and from 86 to 96%, respectively. These studies were reported between 1987 and 1989. The Vitek system has undergone several modifications since then; with the current version (version 5.02 or higher), our results suggest very good screening-test performance. In conclusion, the Vitek EPS screen card appears to be as sensitive as and more specific than conventional tubed biochemical screening tests such as the TSI-urea screen. On the basis of our cost analysis for tests performed in our laboratory, the EPS screen card is also more cost-effective. The actual cost savings of using the EPS screen card may vary depending on the existing screening tests used. At the very least, the EPS screen card provides very good performance characteristics for a screening test and provides results in a more timely fashion than many conventional biochemical screening procedures.

REFERENCES


