**Short Communication**

**Appropriate Sampling Sites for the Surveillance of Multidrug-Resistant *Pseudomonas aeruginosa* Colonization**

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**SUMMARY**: This study aimed at evaluating the effectiveness of testing multiple samples (urine, stool, and pharyngeal swabs) for accurate screening of multidrug-resistant (MDR) *Pseudomonas aeruginosa*. Of a total of 641 patients, 16 (2.5%) were confirmed for MDR *P. aeruginosa* carriage at any site (urine and/or stool and/or pharyngeal swab). Notably, of the 3 sample sites, urine culture had the highest rate of positive surveillance for MDR *P. aeruginosa*. Seven (43.8%) of the 16 cases of MDR *P. aeruginosa* were detected by urine culture alone. Eleven (91.7%) of the 12 MDR *P. aeruginosa* carriers detected by urine culture had an indwelling urinary catheter. Our data suggest that urine culture was the most effective in detecting MDR *P. aeruginosa* carriage, particularly for patients with an indwelling urinary catheter. However, sample cultures from all 3 sites increased the detection rate of MDR *P. aeruginosa* carriage. Therefore, we recommend the use of a urine culture in combination with either a stool and/or a pharyngeal swab culture to increase the accuracy of MDR *P. aeruginosa* carriage detection.

Multidrug-resistant (MDR) *Pseudomonas aeruginosa* is an important agent of nosocomial infections. Therefore, screening for MDR *P. aeruginosa* carriage is essential to prevent cross-transmission in a hospital setting. However, the effectiveness of screening is unknown and, at present, there is no consensus on optimal sampling sites for active screening of MDR *P. aeruginosa*. Therefore, this study aimed at evaluating the effectiveness of active screening of MDR *P. aeruginosa* from 3 sampling sites.

From May 2008 through May 2013, urine, stool, and pharyngeal swabs were collected from a total of 641 patients (419 men and 222 women; median age, 64 years; age range, 20–101 years), who were admitted to Toranomon Hospital, a 890-bed facility in Tokyo, Japan, and screened for the presence of MDR *P. aeruginosa* colonization. The patients were enrolled in this study only if all 3 sampling sites could be screened simultaneously. Each patient was included in the study only once, even if the patient was screened more than once.

If an MDR *P. aeruginosa* carrier was found, all patients in the same ward were screened for *P. aeruginosa* colonization. MDR *P. aeruginosa* was defined as *P. aeruginosa* resistant to aminoglycosides (minimum inhibitory concentration [MIC] of amikacin ≥ 32 µg/mL), carbapenems (MIC of imipenem ≥ 16 µg/mL), and fluoroquinolones (MIC of ciprofloxacin ≥ 4 µg/mL). Specimens were plated on trypticase soy agar supplemented with 5% sheep blood and Drigalski agar media. The inoculated plates were aerobically incubated for 2 days at 35°C. Each colony typical of *P. aeruginosa* was selected and identified by routine antibiotic susceptibility testing using the MicroScan WalkAway 96 SI system (Siemens Healthcare, Deerfield, Ill., USA).

Statistical analysis was performed using the Fisher’s exact test with the SPSS statistical software package (version 20.0 for Windows; SPSS Inc., Chicago, Ill., USA). A P value < 0.05 was considered statistically significant.

The departments where the 641 subjects were housed were as follows: hematology, 48% (n = 308); respiratory, 29% (n = 189); cardiology, 11% (n = 73); neurology, 4% (n = 24); gastroenterology, 3% (n = 18); orthopedics, 1% (n = 8); and others, 3% (n = 21). Overall, 116 (18.1%) of 641 patients were confirmed with *P. aeruginosa* carriage for at least 1 of the 3 sampling sites. Furthermore, 3.9% (25/641) of urine samples, 10.3% (66/641) of stool samples, and 11.1% (71/641) of pharyngeal swabs were positive for *P. aeruginosa* (Table 1). There were significantly more positive stool and pharyngeal swab cultures (P < 0.0001 and 0.0001, respectively) than urine cultures.

Of the 641 patients, 16 (2.5%) had confirmed MDR *P. aeruginosa* carriage at any site (urine and/or stool and/or pharyngeal swab). Urine cultures (48.0%, 12/25) had a higher MDR *P. aeruginosa*-positive rate than stool (12.1%, 8/66) or pharyngeal swab cultures (4.2%, 3/71). The rate of positive surveillance cultures for MDR *P. aeruginosa* was 1.9% (12/641) for urine samples, 1.2% (8/641) for stool samples, and 0.5% (3/641) for pharyngeal swabs (Table 1). A significantly greater number of urine cultures was positive for MDR *P. aeruginosa* than pharyngeal swab cultures (P = 0.034). Furthermore, 11 (92%) of the 12 MDR *P. aeruginosa* carriers detected using urine samples had an indwelling urinary catheter.
When different combinations of samples from the screening sites were compared, the highest rate (2.5%) of MDR *P. aeruginosa* carriers were detected from the combination of all 3 sites, whereas the lowest rate (0.2%) resulted from the use of the pharyngeal swabs only (Table 2). Of the 16 cases of MDR *P. aeruginosa* carriage, 7 (43.8%) were detected using only urine culture, 3 (18.8%) were detected using stool culture, and 1 (6.3%) was detected using pharyngeal swab culture.

To the best of our best knowledge, this is the first report to describe the importance of urine cultures for the screening of MDR *P. aeruginosa*. Previous reports have described the use of several different methods for the detection of MDR gram-negative bacilli, including perirectal or rectal swabs alone or in combination with oropharyngeal, endotracheal, inguinal, or wound cultures (1–6). However, the optimal sampling sites for the active screening of MDR gram-negative bacilli, including those for MDR *P. aeruginosa*, remain unclear.

In the present study, we confirmed that stool and pharyngeal swab cultures were better than urine cultures for *P. aeruginosa* surveillance. Therefore, it can be assumed that these 2 sampling sites may also increase the likelihood of MDR *P. aeruginosa* detection. However, only a few MDR *P. aeruginosa* cases were detected using stool or pharyngeal swab cultures alone. Instead, urine cultures resulted in the highest detection rates from the *P. aeruginosa*-positive cases (48%) and the total number of MDR *P. aeruginosa* cases (44%). Thus, the use of urine cultures may be particularly useful for the detection of MDR *P. aeruginosa* in patients with indwelling catheters.

The present study had some limitations. First, the sample size was relatively small and few patients were identified as MDR *P. aeruginosa* carriers. Second, the patients were enrolled from a limited number of hospital departments, and there was little variation in the underlying disease. Sites colonized by MDR *P. aeruginosa* may vary depending on the nature of the underlying disease. Three relatively accessible sampling sites were selected by considering the cost-effectiveness and complexity of the procedure; however, this approach may have omitted other important test sites. Therefore, further investigations are warranted.

In conclusion, our data suggest that urine culture was the most effective in detecting MDR *P. aeruginosa* carriage among the 3 different sampling sites, and sample cultures from all 3 sites increased the detection rate of MDR *P. aeruginosa* carriage. Therefore, we recommend the use of a urine culture in combination with a stool culture and/or a pharyngeal swab culture to increase accuracy of MDR *P. aeruginosa* carriage detection.

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**REFERENCES**


