Sensitivity of Different Anatomic Sites for Detection and Duration of Colonization with Carbapenemase-producing Enterobacteriaceae (CPE)

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Abstract

Background: CPE are a growing threat worldwide. Screening to identify colonization is critical to control transmission in hospitals, but the utility of screening at different anatomic sites to detect colonization remains unclear. We describe the results of CPE screening at different anatomic sites in a study of duration of colonization in Toronto, Canada.

Methods: This was a prospective cohort study of patients population-based surveillance of CPE in Toronto Peel Region. Consecutively enrolled participants were included in the intervention (duration of colonization study) at screening enrolment, then q3mo until clearance of colonization was obtained. Swabs are incubated in broth to which they are cultured in broth then plated on MacConkey agar with cefpodoxime, as well as cultures of previously positive sites (in Peel Region). Colony count and CPE testing is done by the laboratory.

Results: Of 185 eligible patients, 139 consented to follow up. Participants colonized with CPE were screened at enrolment, then q3mo until clearance of colonization was obtained. Swabs are incubated in broth then plated on MacConkey agar with cefpodoxime, as well as cultures of previously positive sites (in Peel Region). Colony count and CPE testing is done by the laboratory.

Discussion: Differences in pathogen detection, prevalence, and species suggest multi species colonization. Consistency in the site of detection suggests testing of previously positive sites should not be ignored when a suspected patient is identified. Duration study overview is shown in Figure 2. The median time to clear carriage was 8 months (IQR: 4-13).

Conclusions: There were 33 patients who tested positive in follow-up more than once. Among their first two sets of positive tests, both rectal and groin swabs were positive in 35/51 (71%), one rectal swab was positive in 41/35 (11%), and 6/35 (17%) did not identify CPE rectally (Figure 8).

Proportion of follow-up specimens yielding CPE:

- Rectal and groin swabs were obtained from all follow-up participants, urine from 35 participants who had a previously positive urine specimen, and wound swabs from 25 with a previously positive wound culture.
- Among the 169 pairs of rectal and groin swabs with at least one positive result, 114 (67%) had a positive rectal swab, 88 (50%) had a positive groin swab (Figure 4).
- Among the 44 sets of urine, rectal and groin swabs with 21 positive results, both urine/groin/rectal swab sets with at least one positive result, 20 (57%) yielded CPE from the rectal swab (p<0.05). Using rectal swabs only in follow up would have detected 17/21 (81%) patients followed with both groin/rectal swabs being detected in 25 (42%) rectal and 34 (58%) groin swabs, and a positive urine culture (Figure 5).
- Among 22 sets of wound, rectal and groin swabs with at least one positive result, 9 (41%) had a positive rectal swab, 16 (73%) had a positive groin swab and 5 had a positive wound culture (Figure 6).
- Participants colonized with CP-K. pneumoniae and CP-E. coli were about as likely to test positive in both gastrointestinal and genitourinary sites (P=0.003) (Figure 7).

Results:

- Of 185 eligible patients, 139 consented to follow up. Median participant age was 65 yrs (range 1-99), 37% were female.
- At the time of this analysis, 66 participants remain in follow up; 43 had a consecutive negative result, and 34 were lost to follow up (16 died, 13 withdrew consent, 4 could not be contacted).

Duration study overview:

- While it makes logical sense that testing of previously positive sites may increase sensitivity; testing the originally colonized site may increase sensitivity; positivity rates are higher in patients with a previously positive wound culture (Figure 6).

Results (cont’d):

- Of 185 eligible patients, 139 consented to follow up. Median participant age was 65 yrs (range 1-99), 37% were female.
- At the time of this analysis, 66 participants remain in follow up; 43 had a consecutive negative result, and 34 were lost to follow up (16 died, 13 withdrew consent, 4 could not be contacted).
- Distribution of genes and species of clinical isolates is shown in Figure 1.

Results:

- Among the 44 sets of urine, rectal and groin swabs with 21 positive results, both urine/groin/rectal swab sets with at least one positive result, 20 (57%) yielded CPE from the rectal swab (p<0.05). Using rectal swabs only in follow up would have detected 17/21 (81%) patients followed with both groin/rectal swabs being detected in 25 (42%) rectal and 34 (58%) groin swabs, and a positive urine culture (Figure 5).
- Among 22 sets of wound, rectal and groin swabs with at least one positive result, 9 (41%) had a positive rectal swab, 16 (73%) had a positive groin swab and 5 had a positive wound culture (Figure 6).
- Participants colonized with CP-K. pneumoniae and CP-E. coli were about as likely to test positive in both gastrointestinal and genitourinary sites (P=0.003) (Figure 7).

Conclusions:

1) In our sample, biased towards patients identified originally by rectal swab, follow-up on 2 CPE swabs would identify ~80% of persistently colonized patients. This may or may not be sufficient for successful outbreak or routine control programs.
2) In patients colonized in urine, re-testing the originally colonized site may increase sensitivity; however rectal swabs should also be performed.