Table 1. Patient Hand Carriage of Aerobic Bacterial Organisms

Bacterial Species	Patients, No./Total (%)
Pathogenic bacteria	9/56 (16)
Methicillin-susceptible *Staphylococcus aureus*	3/56 (5.4)
Ciprofloxacin-sensitive gram-negative bacteria	2/56 (3.6)
Klebsiella sp.	0/56 (0)
Pseudomonas sp.	0/56 (0)
Multidrug-resistant bacteria	4/56 (7)
Methicillin-resistant *Staphylococcus aureus*	2/56 (3.6)
Vancomycin-resistant *Enterococcus sp.*	1/56 (1.8)
Ciprofloxacin-resistant gram-negative bacteria	1/56 (1.8)
Normal flora[a]	47/56 (84)

[a]*Diptheroid* spp, *Bacillus* spp, *Micrococcus* spp, and *Staphylococcus* spp.

On the other hand, our study was performed at a single tertiary-care center, and our results may not be applicable to other hospital settings. Furthermore, this study reports patient microbial colonization of hands, which does not necessarily indicate clinical infection. In addition, agar hand plates were used to assess bacterial contamination instead of the glove juice technique. The handprint method can be less effective because it solely provides information about the microbial burden from the anterior surface of the hand, whereas the glove-juice technique recovers microbes from the entire hand. Thus, the hand plate technique may yield comparatively less microbe recovery.

In conclusion, our study demonstrates that ICU patients' hands may harbor pathogenic bacteria, providing further evidence that poor patient hand hygiene may contribute to transmission of resistant HAIs. Further studies are necessary to understand barriers to adequate patient hand hygiene and to identify best practice strategies.

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Understanding reasons clinicians obtained endotracheal aspirate cultures and impact on patient management to inform diagnostic stewardship initiatives

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Endotracheal aspirate cultures (EACs) are commonly obtained in the evaluation of suspected ventilator-associated infections (VAIs),[1] an important cause of nosocomial infections.[2] Overutilization of EACs may contribute to overtreatment for VAI because EACs cannot distinguish between bacterial colonization and infection,[3,4] and positive EAC results prompt treatment with antibiotics.[1,5,6] EAC utilization and interpretation

of results are subject to site-specific variability.[1] As part of a quality improvement project, we aimed to better understand local practices as a formative step in the development of a guideline to standardize EAC utilization in the pediatric intensive care unit (PICU).

Methods

We prospectively identified a convenience sample of EACs obtained from mechanically ventilated patients (endotracheal tube or tracheostomy) from November 21, 2017, to February 4, 2018, in the Johns Hopkins Children's Center PICU. We surveyed clinicians caring for patients with EACs using a 2-part written survey comprised of 10 multiple-choice or Likert-scale questions (see Supplement 1 online). Survey part 1 was distributed within 1–2 days of EAC collection to capture clinicians' reasons for and expectations of the culture results. Survey part 2 was distributed 5 days after EACs were conducted to examine how the results contributed to patient management. We defined VAI as clinician-diagnosed ventilator-associated pneumonia or tracheitis because these entities are often treated interchangeably.[7,8] We retrospectively performed chart review. Descriptive analyses were completed using Stata version 14.0 software (StataCorp, College Station, TX). The Johns Hopkins Institutional Review Board acknowledged this evaluation as part of a quality improvement project.

Results

Description of EACs and patients

We conducted surveys and reviewed 25 EACs of 107 EACs obtained. The median patient age was 1.0 year (interquartile range, 0.92–5.0), and 52% were female. Overall, 18 patients (72%) had been ventilated for ≥4 weeks and 11 patients (44%) had had a tracheostomy. EACs were collected concurrent with blood cultures for 19 patients (76%), and "pan cultures" (ie, ETA, blood, and urine) were collected for 15 patients (60%). In 23 of 25 cases, the patients had had a previous EAC (92%), and 7 EACs were repeated within 3 days (28%), of which only 1 clinician recalled. The median time to repeat culture was 6 days. Repeated EACs often grew the same or fewer bacteria (n = 17, 72%).

Results of survey part 1: Provider perceptions at time of culture

The completion rate for the 25 two-part surveys was 100%. Surveys were primarily completed by the first-call clinician: the nurse practitioner (72%, two-thirds of first-call providers are nurse practitioners in this unit), resident (22%), or fellow (6%). The team member reported to have suggested an EAC was the nurse (4%), attending physician (15%), fellow (24%), nurse practitioner (32%), or unknown (24%). The most frequent clinical change triggering an EAC was fever (Table 1). Moreover, 11 EACs (44%) were obtained for nonspecific clinical changes (eg, fever alone), and the remainder of cases with EACs had multiple clinical changes consistent with possible VAI (eg, increased secretions, fever, and increased ventilator settings). Clinicians expected that the EAC would help with the diagnosis of VAI (n = 17, 68%) and antibiotic selection (n = 20, 80%). Clinicians reported the expected contribution of EAC to patient management as not at all (n = 1, 4%), a little (n = 9, 30%), very (n = 15, 60%), or essential (none, 0%).

Table 1. Clinician Reported Reasons Prompting Endotracheal Aspirate Cultures[a]

Reasons	Frequency[b]	Proportion
Fever	17	0.68
Decreased O_2 saturation	11	0.44
More frequent desaturations	10	0.40
Increased FIO_2	10	0.40
Change in secretions	10	0.40
Rising WBC	8	0.32
Increased end tidal CO_2	6	0.24
New opacity	5	0.20
Rising CRP	4	0.16
Increased ventilator pressure	3	0.12
Reintubated	2	0.08
Unknown	2	0.08
Bandemia	2	0.08

Note. O_2, oxygen; FIO_2, fraction of inspired oxygen; WBC, white blood cell count; CO_2, carbon dioxide; CRP, C-reactive protein.
[a]Clinicians were surveyed after 25 endotracheal aspirate cultures were obtained regarding clinical changes that prompted obtaining the culture.
[b]The survey allowed selecting all possible options, therefore the sum is >25. Overall, 11 EACs (44%) had isolated or nonspecific clinic changes reported: fever alone (n = 4), hypotension alone (n = 2), increase in ventilator settings alone (n = 2), or fever with rising WBC or rising CRP without other clinic changes (n = 3). The other 14 EACs had multiple clinical changes.

Results of survey part 2: Impact of EACs on clinical management

Clinicians reported subsequent value of the EAC data to patient management as not at all (n = 4, 16%), a little (n = 10, 40%), very (n = 7, 28%), or essential (n = 4, 16%). Overall, 10 case patients (40%) were diagnosed with a VAI. In 9 of these cases, the EAC reportedly helped inform the diagnosis, and in 7 of these cases, the bacterial culture result was the most informative component. Following the EAC result, the empiric antibiotic treatment was discontinued in 3 patients (12%), was modified in 4 patients (16%) based on the EAC result, was changed in 5 patients (20%) based on a non-EAC result (eg, urine studies), or was not changed in 13 patients (52%; 2 patients never received antibiotics).

Discussion

The results of part 1 of the survey demonstrate a relatively low threshold to obtain EACs in response to nonspecific clinical changes (eg, fever alone), fever was the primary indication, and EACs were often obtained concurrent with other cultures. The results of part 2 of the survey indicate that most patients were not diagnosed with VAI, that antibiotics were infrequently changed in response to the EAC result, and that more than half of clinicians surveyed subsequently felt the EACs were of little to no help in overall patient management. Notably, the EAC led to antibiotic modifications and was considered essential in a few cases. Our findings are congruent with a multicenter survey with hypothetical scenarios revealing that PICU physicians commonly obtain EACs as part of "rule out sepsis or infection evaluation" and that the culture data supporting "bacterial pathogenicity" was most important.[6] Longitudinal studies are needed to better understand the clinical value of repeated EACs, particularly among chronically ventilated patients.

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This study has several limitations. We primarily surveyed first-call clinicians from a single center with a modest sample size. Variability between clinicians and institutions is likely; therefore, these findings may not be generalizable to other units. However, these findings could be used to develop local assessments. Surveys were conducted as soon as feasible after EACs, but responses may have been subject to recall bias. Lastly, participation in the first survey could have influenced responses in the second survey.

Opportunities may exist to improve EAC utilization. Judicious use of EACs has the potential to reduce antibiotic use and aligns with the national "Choosing Wisely" campaign to reduce medical overuse.[9] Additional studies are needed to clarify the indications and role of EACs in the management of mechanically ventilated patients.

Supplementary material. To view supplementary material for this article, please visit https://doi.org/10.1017/ice.2019.347

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Microbial contamination of heater cooler units used in extracorporeal membrane oxygenation is not aerosolized into the environment: A single-center experience

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Heater-cooler units (HCUs) used in cardiopulmonary bypass and extracorporeal membrane oxygenation (ECMO) can generate infectious aerosols containing *Mycobacterium chimaera*, a slow-growing nontuberculous mycobacterium (NTM) associated with disseminated infection. Since the identification of *M. chimaera* infective endocarditis in 2013, many more cases of deep-seated infections with *M. chimaera* have been identified and linked to the use of contaminated Stöckert 3TLivaNova (London, United Kingdom) HCUs.[1] Few studies have analyzed the water contamination of HCUs used in ECMO.[2] In this study, we aimed to ascertain whether HICO-Variotherm units (Chalice Medical, Worksop, UK) used in ECMO were colonized with *Mycobacterium*

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