Ventilator-associated respiratory tract infections (VARI), which include ventilator-associated pneumonia and ventilator-associated tracheal infections, account for up to 50% of nosocomial infections in pediatric intensive care units (PICUs).1,2 The diagnosis of VARI is challenging and varies between clinicians and institutions.3

Endotracheal aspirate cultures (EAC) are often obtained to help management, however these cultures cannot distinguish between colonization and infection.4-6 Despite their poor specificity to identify infection, many clinicians use positive culture results to guide antibiotic treatment.7 False positive culture results may lead to unnecessary antibiotic treatment, antibiotic-associated adverse events and antibiotic resistance.

We initiated a quality improvement project to optimize the use of EACs among ventilated patients in the PICU in the Fall of 2018.

Introduction

To better understand why clinicians obtain endotracheal aspirate cultures and how they use this information in the patients’ care as part of a quality improvement project to optimize the use of EACs among ventilated patients in the PICU.

Methods

Study Design and population: A structured two-part survey was conducted of nurse practitioners and physicians caring for children from which EACs had been obtained. Part 1 was conducted within 1-2 days after obtaining an EAC. Part 2 was conducted after EAC results were reported. This was a convenience sample of children on mechanical ventilation for at least 24 hours at the Johns Hopkins Children’s Center PICU from November 2017 to February 2018. Associated clinical data for the patients from whom a culture had been obtained were retrospectively obtained from the electronic medical record.

Results

We initiated a quality improvement project to optimize the use of EACs among ventilated patients in the PICU in the Fall of 2018.25 surveys were completed. All clinicians agreed to participate.

• Most EACs (N= 15, 60%) were obtained as part of a “pan culture” with blood and urine cultures. Of the 25 cultures, 23 patients (92%) had a previous EAC obtained. The median time to repeat EAC was 4 days (IQR 3-19).

• Of the patients with a prior EAC within 3 days, 72% recovered the same or fewer bacteria.

• Clinician thought EAC would help antibiotic selection, at time of culture?

  No 20%
  No change 52%
  Modified 28%
  Discontinued 12%

Figure 3. Clinicians’ perception of whether the culture would inform antibiotic management at the time of culture, and antibiotic therapy choices after cultures resulted.

The majority (80%) of clinicians thought cultures would help with antibiotic selection when the culture was first obtained, however, antibiotics were infrequently modified (16%) or discontinued (12%) based on ETA culture results.

Clinician thought EAC would help with diagnosis of ventilator-associated Infection, at time of culture

No 20%
Yes 80%

Figure 2. Clinicians’ perception that the culture results would inform diagnosis of ventilator-associated infection, and the subsequent proportion of patients diagnosed with a ventilator-associated infection once results were available.

A large proportion of EACs were obtained due to isolated changes in a patient’s clinical status and infections associated with ventilator settings and other signs of infection (fever, hypotension, lab work, Chest X ray results). Nearly half (44%) of EACs were obtained for isolated clinical signs, while 66% were obtained for a combination of respiratory related signs or symptoms (secretions, desaturation, increased ventilator settings) and other signs of infection (fever, hypotension, lab work, Chest X ray results).

Conclusions

A large proportion of EACs were obtained due to isolated changes in a patient’s clinical status and most EACs were obtained from patients who had prior EACs. Results were often similar to prior EAC results, and infrequently led to changes in antibiotic selection. Many clinicians did not find the EAC results helpful. These findings suggest there is opportunity to standardize and reduce the use of EACs in the PICU.

Acknowledgements

We would like to thank the faculty and staff of the Johns Hopkins Children’s Center Pediatric Intensive Care Unit. This work was supported by grant T32 AI052071 and the Baurenschmidt award from the Johns Hopkins School of Medicine Department of Pediatrics.

References