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Variation in the Use of Diagnostic Bronchoscopy among Intensive Care Unit Patients: Implications for Surveillance

Mechanical ventilation is a major risk factor for pneumonia among intensive care unit (ICU) patients. The diagnosis of pneumonia in these patients is challenging because of coexisting pulmonary diseases, such as fibrosis and diffuse alveolar damage.[1] The National Healthcare Safety Network (NHSN) definition for ventilator-associated pneumonia (VAP) is widely used for infection prevention surveillance. There are limitations of the NHSN definition, including its relationship to clinically defined pneumonia and interrater reliability.[2-5] Alternative definitions for VAP have been advocated.[6,7] Several of these definitions would require the use of lower respiratory tract specimens, such as bronchoalvaeolar lavage (BAL) specimens, to improve correlation between surveillance and clinical definitions of VAP.[2,8] However, bronchoscopic procedures are invasive, and the performance of bronchoscopy might vary among types of ICUs as well as among individual intensivists. Because of the current climate of mandated public reporting of healthcare-acquired infections and pay-for-performance measures, it is important that proposed changes to the VAP surveillance definition increase the consistency and accuracy of case finding.

The objective of this study was to determine physician- and ICU-specific variability in the performance of diagnostic bronchoscopic procedures for patients receiving mechanical ventilation. This would help to determine the feasibility of incorporating the results of these procedures into pneumonia surveillance definitions.

A retrospective cohort study of patients who received mechanical ventilation was performed at Barnes-Jewish Hospital, a 1,250-bed academic, tertiary care facility associated with Washington University School of Medicine in St. Louis, Missouri. All patients who received mechanical ventilation and were admitted to the hospital during June 2008–May 2010 in 6 ICUs were included. Three ICUs are predominantly medical, including 2 medical ICUs (MICUs) and a coronary care ICU (CCU), and 3 ICUs are predominantly surgical, including a surgical ICU (SICU), a cardiothoracic ICU (CTICU), and a neurological and neurosurgical ICU (NNICU). All 6 ICUs are closed units.

Patients who received mechanical ventilation were identified via documentation of ventilator settings in the electronic nursing charting system. Ventilator-days were defined by counting the number of patients who received mechanical ventilation at midnight of each calendar day. Performance of diagnostic bronchoscopy among patients who received mechanical ventilation was defined as either bronchial washings, BAL, or bronchial brushing cultures from a single date as identified from the hospital laboratory database. Diagnostic bronchoscopy rate was defined as the number of diagnostic bronchoscopic procedures performed per 1,000 ventilator-days. ICU attending schedules were obtained for June 2008–August 2009 and were used to calculate intensivist-specific bronchoscopy rates (only intensivists who staffed ICUs for >100 ventilator-days over the 15-month period were included).

χ^2 analysis and 95% confidence intervals (CIs) of rates were used to determine statistical significance. Analyses were completed using Epi Info 3.01 (Centers for Disease Control and Prevention) and Microsoft Excel 2003. Institutional review board approval was obtained from Washington University.

There were 38,845 ventilator-days among 5,824 patients during the study period (mean ventilator-days per patient, 6.67). Seven hundred twenty-three diagnostic bronchoscopy procedures were performed for 618 patients (mean bron-

TABLE 1. Comparison of Diagnostic Bronchoscopy Rates, by Intensive Care Unit (ICU), June 2008–May 2010

	Predominantly medical ICUs				Predominantly surgical ICUs				
Variable	CCU	MICU I	MICU II	All	CTICU	SICU	NNICU	All	Overall
No. of bronchoscopic procedures	33	248	126	407	110	182	24	316	723
Ventilator-days	3,984	7,933	4,485	16,402	7,974	9,480	4,989	22,443	38,845
Bronchoscopy rate[a]									
Mean value	8.28	31.26	28.09	24.81	13.79	19.20	4.81	14.08	18.61
95% CI	5.5–11.1[b]	27.4–35.2[b]	23.2–33.0[b]	22.4–27.2	11.2–16.4[b]	16.4–22.0	2.9–6.7[b]	12.5–15.6	17.3–20.0
Intensivist-specific bronchoscopy rate[a,c]									
Median value	8.7	27.1	24.0	21.8	13.2	17.6	0.0	13.4	16.7
Range	0.0–37.0	8.3–34.3	0.0–50.0	0.0–50.0	0.0–16.7	0.0–62.5	0.0–4.8	0.0–62.5	0.0–62.5

NOTE. CCU, coronary care unit; CI, confidence interval; CTICU, cardiothoracic ICU; MICU, medical ICU; NNICU, neurological and neurosurgical ICU; SICU, surgical ICU.

[a] No. of procedures per 1,000 ventilator-days.

[b] Indicates that the 95% CI does not overlap the overall rate; these units are significantly different from the mean.

[c] Based upon intensivist who attended in ICU for >100 ventilator-days during the study period.

choscopic procedures per patient, 1.2; median bronchoscopic procedures per patient, 1.0). Overall, the mean bronchoscopy rate was 18.6 procedures per 1,000 ventilator-days (95% CI, 17.3–20.1; Table 1). The confidence interval of the bronchoscopy rate for all ICUs other than the SICU did not overlap the overall bronchoscopy rate.

The overall bronchoscopy rate of the predominantly medical ICUs was higher than that of the predominantly surgical ICUs (24.8 vs 14.1 bronchoscopic procedures per 1,000 ventilator-days; incidence density ratio [IDR], 1.76; $P < .01$). The overall bronchoscopy rate in the 4 ICUs where bronchoscopy is performed primarily by intensivists (MICU I, MICU II, CTICU, and SICU) was significantly higher than the rate in the 2 ICUs where bronchoscopy is performed by pulmonary consultants (22.3 vs 6.4 bronchoscopic procedures per 1,000 ventilator-days; IDR, 3.51; $P < .001$).

Forty-five intensivists attended for more than 100 ventilator-days. The median physician-specific bronchoscopy rate was 15.2 bronchoscopic procedures per 1,000 ventilator-days (range, 0–62.5). In the predominantly medical ICUs, the mean intensivist-specific bronchoscopy rate was 20.0 bronchoscopic procedures per 1,000 ventilator-days, whereas in the predominantly surgical ICUs, the mean bronchoscopy rate was 12.1 bronchoscopic procedures per 1,000 ventilator-days.

Considerable variation was seen in the use of diagnostic bronchoscopy in this academic medical center. Higher bronchoscopy rates were seen in predominantly medical ICUs and in units where the attending intensivist routinely performs bronchoscopy than in those units where a pulmonary consultant performs bronchoscopy. One possible explanation for these observations may be that they are attributable to differences in patient populations. Patients with underlying parenchymal lung disease (eg, alveolar hemorrhage) would be more likely to be admitted to a medical ICU. In addition, relying on non-ICU staff to perform a bronchoscopic procedure may lead to fewer procedures being completed, because this requires the additional steps of obtaining a consultation and having the consultant agree to do the procedure. As hypothesized, intensivist-specific bronchoscopy rates varied considerably within each type of ICU. This might be attributable to intensivists having differing thresholds for performing bronchoscopy to diagnose VAP. More study is needed to understand physician characteristics associated with this variation in practice.

Data were collected retrospectively, which may include bias, because the data were not collected specifically for research purposes. In particular, the accuracy of ICU attending schedules cannot be confirmed. We did not know which VAP cases identified by hospital infection prevention staff met the NHSN definition primarily on the basis of lower respiratory tract cultures. Therefore, we cannot say for certain that differing bronchoscopy rates affected VAP rates. This study was performed in an academic, tertiary care medical center and may not be generalizable to other settings.

In conclusion, we found variability in the frequency of specimens obtained through bronchoscopic procedures. This needs to be considered when evaluating the use of lower respiratory tract specimens in VAP surveillance definitions.

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Preventing Catheter-Associated Urinary Tract Infections: Hospital Location of Catheter Insertion

Urinary tract infections are the most common type of healthcare-associated infection, accounting for more than 30% of healthcare-associated infections reported by acute care hospitals.[1] These infections have been associated with increased patient morbidity, mortality, hospital cost, and length of stay.[1] Approximately 70% of healthcare-associated urinary tract infections are associated with the presence of an indwelling urinary catheter.[2] The rate of symptomatic catheter-associated urinary tract infection (CAUTI) ranges from 0.4 to 4.7 infections per 1,000 days catheterized, with the higher rates being reported from intensive care units and rehabilitation wards.[3] Catheter-associated infection is associated with excess mortality, even after controlling for underlying factors, such as severity of illness and comorbidities.[4]

Recent guidelines have been published that provide recommendations for the prevention of CAUTI.[5-8] Prevention efforts are focused on four general areas: insertion of a urinary catheter only for appropriate indications, strict adherence to aseptic techniques for catheter insertion, proper techniques for catheter maintenance, and prompt removal of the catheter when no longer indicated. Current surveillance for CAUTI is focused on the hospital location where the patient resides at the time their urinary tract infection is diagnosed.[3] However, only limited data are available on the hospital location where the catheter is inserted. This information is critical to focus the recommended quality improvement programs and education that involve appropriate indications for insertion of a urinary catheter and proper aseptic techniques for insertion. For this reason, we undertook the following study to determine the hospital location for insertion of urinary catheters.

This study was conducted at the University of North Carolina Hospitals, an 806-bed academic medical facility. Data were collected from October 14 to December 8, 2011. On randomly selected days each week, the nursing daily patient acuity report (QuadraMed Acuity Plus) was reviewed to determine all patients with a urinary catheter. From a list of patients with a urinary catheter hospitalized for fewer than 5 days, patient records were selected for further review using a computer-generated list of random numbers. Data recorded on each patient included date of catheter insertion, date of catheter removal, hospital location of catheter insertion, age, and gender. The electronic medical records were reviewed to determine the duration of urinary catheterization. This study was approved by the University of North Carolina Institutional Review Board.

Overall, 1,778 patients had a urinary catheter inserted during the study period. The electronic medical records of 280 randomly chosen patients were reviewed. Four patients were excluded due to chronic use of a urinary catheter. Forty-two patients were excluded due to insufficient information to determine the hospital site of insertion. For 231 patients (82.5%), sufficient data were available to be included in our analysis.

The most common hospital location for catheter insertion was the operating room, with approximately two-thirds (62.3%) of all catheters inserted at this location (Table 1). The second most common location was the emergency department, accounting for 11.3% of all insertions. Of interest, approximately 5% of catheters were inserted in an outside hospital or extended care facility before patient admission. Among the 54 catheters not inserted in the emergency department or in an operating room, 26 (48.1%) were inserted in an intensive care unit, 14 (25.9%) were inserted in an inpatient ward, 12 (22.2%) were inserted in a step-down unit, and 2 (3.7%) were inserted elsewhere. The mean and median durations for all catheters were 3.8 and 3 days (range, 0–32), respectively. The mean and median durations for catheters placed in the emergency department were 5.5 and 4 days (range, 1–15), respectively. The mean and median durations for catheters placed in an operating room were 2.7 and 2