

# Ventilator Bundles Not Adequate in Trauma ICU

BY BRUCE JANCIN  
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COLORADO SPRINGS — Implementation of a widely advocated bundle of evidence-based practices aimed at reducing ventilator-associated pneumonia had the desired effect in a busy medical ICU but not in the same hospital's level I trauma/surgical ICU, Dr. Patrick J. Offner reported at the annual meeting of the Western Surgical Association.

"I think ventilator-associated pneumonia prevention is an important goal in our patients. However, the ventilator bundle as implemented by us was ineffective in reducing the ventilator-associated pneumonia rate in our trauma ICU," observed Dr. Offner of St. Anthony Central Hospital, Denver.

The explanation for the disparate outcomes is unclear. Compliance with all four elements of the ventilator bundle—elevation of the head of the bed to an angle of 30-45 degrees, daily interruption of sedation to assess readiness for extubation, deep vein thrombosis prophylaxis, and prophylaxis against peptic ulcer disease—was about 85% in both the medical and surgical ICUs in this prospective study, Dr. Offner said.

One thing is clear, however: If implementation of standardized ventilator bundles is going to be

incorporated in pay-for-performance, as seems highly likely, then those bundles need to be revised and made more relevant to trauma/surgical patients so hospitals and surgeons aren't unfairly penalized, Dr. Offner said.

Ventilator-associated pneumonia (VAP) is the most common ICU-acquired infection and accounts for substantial morbidity, mortality, and health care cost. Numerous medical centers have reported success in sustaining extremely low VAP rates since introducing ventilator bundles. But these reports emanate from medical ICUs, not trauma/surgical ICUs, according to Dr. Offner.

St. Anthony is a busy urban tertiary referral center with just under 3,000 trauma admissions per year. The hospital has trauma surgeons and critical care medicine physicians on site 24/7, and they do rounds together. The hospital introduced the four-pronged ventilator bundle—the same as that advocated in the 5 Million Lives Campaign of the Institute for Healthcare Improvement—as a quality improvement initiative in August 2005. Prior to implementation, ICU nurses and respiratory therapists received several months of intensive education. Compliance with the ventilator bundle was tracked daily, and VAP diagnosis was based on

the Centers for Disease Control and Prevention definition.

The VAP rate in the medical ICU fell from 7.8 cases/1,000 ventilator-days at baseline to 2.0/1,000 ventilator-days in the seventh quarter following introduction of the ventilator bundle. In contrast, the rate increased slightly in the trauma/surgical ICU from 10 to 11.9 cases.

When the study period was divided into two halves, the VAP rate dropped from 9.2 cases/1,000 ventilator-days in the first half to 1.4 in the latter months. In the trauma/surgical ICU, the VAP rate was 13.7 cases/1,000 ventilator-days in the first half and 11.6 in the second half, a nonsignificant difference. The VAP rate in the cardiac and pulmonary ICU went from 6.2 to 3.0 cases/1,000 ventilator-days.

Discussant Dr. Gregory J. Jurkovich said these results support the notion that the pneumonia commonly seen in trauma patients differs from that encountered in medical or coronary ICUs.

"Rather than calling it ventilator-associated pneumonia in these trauma patients, perhaps we should call it CTAP—chest trauma-associated pneumonia; or IAP—injury-associated pneumonia; or RAP—resuscitation-associated pneumonia," added Dr. Jurkovich, professor of



COURTESY DR. PATRICK J. OFFNER

**Ventilator bundles must be revised and made more relevant to trauma/surgical ICU patients, Dr. Patrick J. Offner said.**

surgery at the University of Washington and chief of the trauma service at Harborview Medical Center, Seattle.

"The four strategies in the ventilator bundle are advocated by the medicine-dominated critical care societies," he continued. "This type of work [by Dr. Offner] is important as we become more beholden to national norms and practice guidelines."

Asked which of the four bundle elements had the poorest compliance, Dr. Offner said it was, to his considerable surprise, elevating the head of the bed.

"I thought that would be the one that would be easiest to implement. But the nurses are con-

cerned about elevating the head of the bed. They worry about pressure ulcers, the patient sliding out of the bed, things like that," he said.

Dr. Offner noted that the four elements of the 5 Million Lives ventilator bundle are but a small portion of a lengthy list of evidence-based interventions for VAP prevention. He and his surgical colleagues are considering incorporating into the St. Anthony ventilator bundle the following measures: a rigorous hand hygiene program, routine use of a secretory tube to suction fluids, and early tracheostomy in patients likely to be on mechanical ventilation for more than a week. ■

## Chest Radiographs May Be Overused in Severe Pneumonia

BY BRUCE K. DIXON  
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CHICAGO — Routine follow-up chest radiography may not be appropriate for patients with severe community-acquired pneumonia who clinically respond to initial antibiotic therapy, according to a multicenter study presented at the Interscience Conference on Antimicrobial Agents and Chemotherapy.

"In addition, chest radiographs obtained prior to hospital discharge, as advised by the American Thoracic Society in their 1993 guideline, seem to be unnecessary," according to the authors, whose study was published shortly after the conference (*Clin. Infect. Dis.* 2007;45:983-91).

The use of follow-up chest x-rays of patients hospitalized for severe community-acquired pneumonia (CAP) has become common clinical practice, and the absence of guidelines leaves physicians reliant on recommendations derived from grade D evidence, said lead author and presenter Dr. Anke H.W. Bruns, a research fellow in the department of internal medicine and infectious diseases at the University Medical Center Utrecht (the Netherlands).

"Furthermore, the timing of those follow-up chest x-rays is difficult, in part because we know little about time-to-resolution of findings related to infection on a

film," she said. "So, follow-up radiographs probably are ordered unnecessarily."

To address this question, the researchers studied 288 patients enrolled between July 2000 and June 2003 from a prospective randomized trial on the cost-effectiveness of an early switch from parenteral to oral therapy for severe CAP.

The mean age of the patients was 70 years, and two-thirds were men. The mean pneumonia severity index at admission was 113, half the patients had comorbidities, and virtually all patients had been placed on a  $\beta$ -lactam (82%) or  $\beta$ -lactam-macrolide combination (14%).

Of the 140 cases with proven microbiological etiology, 44% had *Streptococcus pneumoniae*. Another 20% had atypical pathogens, including *Mycoplasma pneumoniae*, *Chlamydia pneumoniae*, and *Legionella pneumophila*. The remaining 36% were infected with unidentified pathogens, Dr. Bruns explained.

Patients were observed for a maximum of 28 days, and those who were still hospitalized on day 7 underwent follow-up chest radiography. After hospital discharge, all patients were asked to return to the outpatient clinic for clinical evaluation, blood chemistry analysis, and a chest radiograph at day 28. Scores for clinical improvement on day 7 and for clinical cure on day 28 were calculated for each patient. The cu-

mulative dropout rate for radiographs was 21% at day 7 and 32% at day 28.

Radiologists reviewed the radiographs for the presence of pulmonary infiltrates, pleural fluid, atelectasis, pulmonary edema, and other findings. During follow-up, clearance of pulmonary infiltrates and resolution of chest radiograph abnormalities were established.

At 1 week, 33% of patients had clearance of pulmonary infiltrates, and only 25% demonstrated resolution of chest radiograph abnormalities. At 1 month, 62% of patients had clearance of infiltrates, and 53% had resolution of radiograph abnormalities. Resolution occurred more slowly in patients with proven *S. pneumoniae* pneumonia, the investigators reported.

Resolution of radiograph abnormalities lagged behind clinical improvement: At 1 week, clinical improvement was observed in more than half of patients, while resolution of chest radiograph abnormalities was seen in only one-quarter of patients. At 1 month, 78% of patients had clinical cures, and 53% showed resolution on radiographs.

The patients with radiographic deterioration were compared with those without radiographic deterioration for outcomes that included clinical cure at 1 month, mortality, and intervention during follow-up. "We saw no difference in any of those

three parameters, so we can state that chest radiograph deterioration during follow-up was not associated with poor outcome," Dr. Bruns said at the conference sponsored by the American Society for Microbiology.

Clinical parameters that independently predicted delayed resolution of chest radiograph findings at 1 week included dullness to percussion, multilobar disease, high respiratory rate, and high C-reactive protein (CRP) level. CRP level greater than 200 mg/L at admission also predicted delayed resolution of chest radiograph abnormalities at day 28.

The authors noted that the number of interventions in patients with deterioration of chest radiograph findings was comparable to the number of interventions in other patients, suggesting that physicians' decisions were not made solely on the basis of chest radiograph findings.

"Performing a chest x-ray to exclude a noninfectious cause of pneumonia within 4 weeks of initial diagnosis is not indicated, because at this point half of patients have radiographic findings that are a result of normal clinical course and do not necessarily indicate pathology," Dr. Bruns said.

"Chest radiograph deterioration during follow-up was not associated with poor outcome, so in our opinion, routine in-hospital follow-up radiographs in severe CAP have no additional value," she said. ■