CHEST

Diagnosis of Ventilator-Associated Pneumonia

A Pilot, Exploratory Analysis of a New Score Based on Procalcitonin and Chest Echography

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BACKGROUND: To facilitate the clinical diagnosis of ventilator-associated pneumonia (VAP) in the ICU, the Clinical Pulmonary Infection Score (CPIS) has been proposed but has shown a low diagnostic performance in subsequent studies. We propose a new score based on procalcitonin level and chest echography with the aim of improving VAP diagnosis: the Chest Echography and Procalcitonin Pulmonary Infection Score (CEPPIS).

METHODS: This retrospective pilot study recruited patients admitted to the Intensive Care Unit of the Emergency Department, Careggi University Hospital (Florence, Italy), from January 2009 to December 2011. Patients were retrospectively divided into a microbiologically confirmed VAP group or a control group based on diagnosis of VAP and positive tracheal aspirate culture.

RESULTS: A total of 221 patients were included, with 113 in the microbiologically confirmed VAP group and 108 in the control group. A CEPPIS $>$ 5 retrospectively fixed was significantly better in predicting VAP (OR, 23.78; sensitivity, 80.5%; specificity, 85.2%) than a CPIS $>$ 6 (OR, 3.309; sensitivity, 39.8%; specificity, 83.3%). The receiver operating characteristic area under the curve analysis also showed a significantly higher diagnostic value for CEPPIS $>$ 5 than CPIS $>$ 6 (0.829 vs 0.616, respectively; $P < .0001$).

CONCLUSIONS: In this pilot, exploratory analysis, CEPPIS is effective in predicting VAP. Prospective validation is needed to confirm the potential value of this score to facilitate VAP diagnosis.

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ABBREVIATIONS: CEPPIS = Chest Echography and Procalcitonin Pulmonary Infection Score; CPIS = Clinical Pulmonary Infection Score; LOS = length of stay; VAP = ventilator-associated pneumonia

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Ventilator-associated pneumonia (VAP) is a nosocomial complication affecting up to 27% of patients in the ICU receiving mechanical ventilation.[1] VAP is associated with a longer duration of mechanical ventilation; an increase in total hospital length of stay (LOS) and, consequently, health-care costs; and a high mortality rate (up to 70%).[2-4]

Various criteria have been proposed for diagnosing VAP, including clinical signs, imaging techniques, microbiologic sampling, and biomarkers of host response. The clinical diagnosis of VAP was traditionally made based on the criteria proposed in 1972 by Johanson and colleagues[5] associating a new or progressive consolidation on chest radiograph with at least two of the following variables: fever, leukocytosis or leukopenia, and purulent tracheal secretions. To facilitate the clinical diagnosis of VAP, Pugin and colleagues[6] proposed the Clinical Pulmonary Infection Score (CPIS) based on six variables: fever, leukocytosis, tracheal aspirates, oxygenation, radiographic infiltrates, and semiquantitative cultures of tracheal aspirates. Despite its wide use, the CPIS has shown relatively low accuracy in various studies.[7] Furthermore, despite its original high sensitivity and specificity, a multicenter randomized trial testing the discriminative effectiveness of CPIS to detect VAP in 739 patients did not find a significant score threshold to predict VAP, indicating the limited clinical utility of this score.[8] The aim of the present study was to test the diagnostic utility of a new clinical score, including clinical infection signs, chest echography information, and procalcitonin levels, in the diagnosis of VAP in critically ill patients.

Materials and Methods

Patient Selection and Study Design

This retrospective, controlled study considered for enrollment all consecutive patients admitted from First Aid to the Intensive Care Unit of the Emergency Department, Careggi University Hospital (Florence, Italy), from January 2009 to December 2011. The ethical committee of Careggi University Hospital approved the study. Informed consent for anonymous data publication was obtained from all patients or their relatives.

Patients were considered for the study if the duration of mechanical ventilation was > 48 h. Only patients with chest echography performed within 12 h before chest radiography at the time of VAP suspicion were considered. Patients admitted for pulmonary infection, COPD exacerbation, or other potential sources of sepsis at the time of VAP suspicion

TABLE 1] The Proposed CEPPIS Compared With the Original CPIS

Parameter	Points		
	0	1	2
CEPPIS			
Tracheal secretion	Nonpurulent	…	Purulent
Procalcitonin, ng/mL	< 0.5	≥ 0.5 and < 1	≥ 1
Culture of tracheal aspirate	Negative	…	Positive
Temperature, °C	≥ 36 and < 38.4	≥ 38.5 and < 38.9	< 36 or ≥ 39
Infiltrates on chest echograph	Negative	…	Positive
Oxygenation: Pao_2/Fio_2	> 240 or ARDS	…	≤ 240 and no evidence of ARDS
CPIS			
Temperature, °C	≥ 36 and < 38.4	≥ 38.5 and < 38.9	< 36 or ≥ 39
Blood leukocytes, WBC/mm^3	≥ 4,000 and ≤ 11,000	< 4,000 or > 11,000	< 4,000 or > 11,000 and band forms ≥ 500
Oxygenation: Pao_2/Fio_2	> 240 or ARDS	…	≤ 240 and no evidence of ARDS
Tracheal secretions	Absent	Nonpurulent	Purulent
Pulmonary radiography	No infiltrate	Diffuse (or patchy) infiltrate	Localized infiltrate
Culture of tracheal aspirate	Pathogenic bacteria cultured in rare or light quantity or no growth	Pathogenic bacteria cultured in moderate or heavy quantity	Same pathogenic bacteria seen on Gram stain

ARDS is defined as a $Pao_2/Fio_2 \leq 200$, pulmonary artery wedge pressure < 18 mm Hg, and acute bilateral infiltrates. CEPPIS = Chest Echography and Procalcitonin Pulmonary Infection Score; CPIS = Clinical Pulmonary Infection Score.