LUNG ULTRASOUND COMBINED WITH PROCALCITONIN AS AN EARLY PREDICTOR OF VENTILATOR ASSOCIATED PNEUMONIA AND EFFECT ON ICU STAY

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INTRODUCTION

Ventilator-associated pneumonia or VAP is referred to as pneumonia developing within 48–72 h of the initiation of mechanical ventilation which is featured by the presence of a new or progressive infiltrate, systemic infection symptoms (e.g., fever, altered count of white blood cell), alterations in sputum characteristics, and causative agent identification.

Worldwide, VAP poses grave implications in the adult endotracheally intubated patients within the intensive care unit (ICU). It usually leads to increased adverse outcomes and healthcare expenses. It is the most prevalent nosocomial infection in ICUs and the most prevalent among patients on mechanical ventilation.

Quantitative respiratory culture, often performed using bronchoalveolar lavage (BAL) fluid culture over 104 CFU, is a gold standard.

PCT levels have become an important component in VAP diagnosis. People with VAP have higher PCT levels, especially when the illness is bacterial, according to research. Elevated PCT levels are critical for diagnosis since they allow for the early detection of VAP, resulting in rapid and successful treatment.

Ultrasound imaging has a 90% accuracy rate in diagnosing pneumonia, with excellent specificity in consolidation and dynamic air bronchograms. Studies using chest CT as the gold standard have found ultrasonography superior.

AIM OF THE WORK

This study objective was evaluating the diagnostic performance of a lung ultrasound (LUS) with procalcitonin (PCT) combination as an early predictor in mechanically ventilated patients with late positive outcomes of pneumonia and its impact on ICU stay duration.

SUBJECTS AND METHODS

This was an observational study that recruited 40 consecutive patients, who were mechanically ventilated and were admitted to the Critical Care Medicine Department in Alexandria University Hospitals according to sample size calculation.
The following data were collected from every patient after enrollment into the study:
Demographic data including age (years) and sex, Complete medical history including past medical, surgical and drug history, Routine laboratory investigations

(Complete blood count (CBC), Sodium (Na), Potassium (K), Urea, Creatinine), The clinical and laboratory data will include the following: body temperature, white blood cell count, plasma concentration of C-reactive protein, PaO2 /FIO2, quality of bronchial secretions, and the results of lower respiratory tract specimen culture. Also, Acute physiologic and chronic health evaluation (APACHE) II score was also used. Once appearance of clinical criteria of VAP, LRT sampling, lung ultrasound and procalcitonin were done.

Duration of mechanical ventilation, ICU length of stay, ICU mortality, and results of the lung ultrasound examination were recorded. The relation between variables with mortality rate and hospital stay were also discussed.

RESULTS

Table 1: Comparison between the two studied groups according to PCT

	No-VAP (n = 14)	VAP (n = 26)	U	P
PCT				
Min. – Max.	0.02 – 5.0	0.32 – 4.24	105.50*	0.029*
Mean ± SD.	0.93 ± 1.33	1.26 ± 0.90		
Median (IQR)	0.36 (0.16 – 1.27)	1.18 (0.49 – 1.74)		

Table showed a statistically significant increase in the mean PCT among patients in the VAP group compared with the non-VAP group.
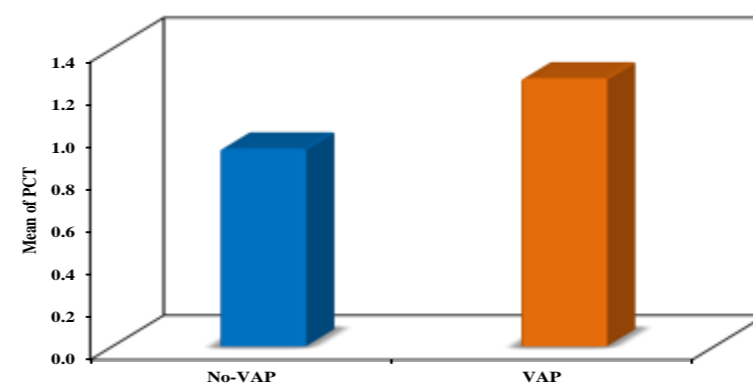

Figure 1: Comparison between the two studied groups according to LUS, CXR and CT

Table showed that LUS diagnosed 24 positive cases with VAP; CT diagnosed 24 positive cases with VAP, while CXR diagnosed only 12 positive cases with VAP. There was a statistically significant increase in the positive VAP cases diagnosed by LUS and CT.
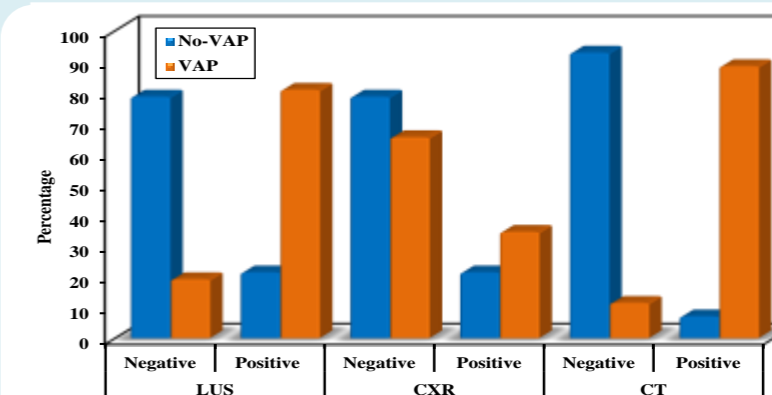

Figure 2: Comparison between the two studied groups according to LUS, CXR and CT

Table 2: Comparison between the two studied groups according to LUS, CXR and CT

	No-VAP (n = 14)		VAP (n = 26)		χ^2	P
	No.	%	No.	%		
LUS						
Negative	11	78.6	5	19.2	13.352*	<0.001*
Positive	3	21.4	21	80.8		
CXR						
Negative	11	78.6	17	65.4	0.754	0.484
Positive	3	21.4	9	34.6		
CT						
Negative	13	92.9	3	11.5	25.073*	<0.001*
Positive	1	7.1	23	88.5		

CONCLUSION

Combining of lung ultrasound (LUS) or CT along with procalcitonin (PCT) is important for predicting and diagnosing the Ventilator-associated pneumonia (VAP) prognosis within the ICU settings.

Additionally, for early detection of VAP, it is useful to monitor the serum PCT. Its therapeutic application value is significant since early intervention with anti-infection therapy aid to minimize hospitalization durations, the VAP incidences, and the associated mortality rate with it.