TO SURVEY ASSOCIATED FACTORS OF VENTILATOR ASSOCIATED PNEUMONIA IN BURNS PATIENTS AT THE INTENSIVE CARE UNIT (ICU), NATIONAL BURNS HOSPITAL

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SUMMARY

This study aimed to investigate factors related to the onset of ventilator-associated pneumonia (VAP) in patients with severe burns at the (ICU), National Burn Hospital. Associate factors for VAP include burns surface area (r = 0.53; p = 0.0002), deep burns area (r = 0.5; p = 0.0005), burns prognosis index (r = 0.52; p = 0.0003), inhalation injury (r = 0.5; p = 0.0006) and deep burns on the back (r = 0.41; p = 0.006). Multivariate logistic regression analysis identified only inhalation injury to be independently associated with VAP (p < 0.05), patients with inhalation injury are at risk of VAP 9.6 times higher than those without inhalation injury (p = 0.02).

Keywords: *Ventilator-associated pneumonia (VAP), inhalation injury*

1. INTRODUCTION

Ventilator-associated pneumonia hospital-acquired pneumonia that occurs after at least 48 hours of mechanical ventilation is a common complication of mechanical ventilation with a high mortality rate, from 24 to 50% and can be as high as 70% [1]. Its incidence ranges from 5% to 67% depending on case mix and the diagnostic criteria used, and the highest rates are in immunocompromised, surgical, and elderly patients [2], [3], [4].

The increased pneumonia risk in burns patients is multifactorial. First, patients with major burns injury (> 20% total burns surface area - TBSA) have a marked abrogation in T-lymphocytes and B-lymphocytes function, leading to immunosuppression. Second, inhalation injury, which increases burns mortality, impairs the physical defenses by means such as cilia damage, surfactant impairment, cast formation, and bronchiole obstruction. As a result, ventilator-associated pneumonia rates increase to almost 20% in burns patients [5], [6], [7].

This study aimed to investigate factors related to the onset of VAP in patients with severe burns at the Intensive Care Unit (ICU), National Burns Hospital.

2. SUBJECTS AND METHODS

- A prospective and descriptive study on 44 adult burns patients receiving

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invasive mechanical ventilation in the ICU of National Burns Hospital, from August 2019 to June 2020.

- Diagnosis of ventilator-associated pneumonia in burns patients according to the International Society for Burns Injuries (2018) [5].

The clinical diagnosis of pneumonia in burn patients includes two of the following:

+ (1) Chest X-ray with new and persistent infiltrate, consolidation, or cavitation.

+ (2) Sepsis (as defined in the section on Sepsis, p. xx).

+ (3) A recent change in sputum or purulence in the sputum

Microbiologic data may modify the diagnosis into one of three categories:

+ (1) Confirmed: Clinical signs and pathogen isolated;

+ (2) Probable: Clinically present without microbiologic confirmation

+ (3) Possible: Abnormal chest X-ray with uncertain cause and with low or moderate clinical suspicion, but microbiologic definite criteria met or pathogen identified.

Positive microbiology is defined as tracheal aspirate with 10^5 organisms, bronchoalveolar lavage 10^4 organisms, and protected bronchial brush 10^3 organisms. It should be remembered that the burn wound can be the source of pathogen spread.

- The collection criteria included: Age, gender, burn agent, burn area, deep burns area, inhalation injury, the severity of burns patients, the location and depth of burns injuries, some drugs related to the treatment and VAP. Data are analyzed by univariate and multivariate regression to identify independently associated with the risk of VAP.

- The data was analyzed and processed by Stata software 14.0 with $p < 0.05$ is considered as statistical significance. Pearson's correlation coefficient (r) is used to measure the relationship between two quantitative variables. The ROC curve is used to analyze the prognostic values of prognostic indicators.

3. STUDY RESULTS

Table 3.1. Patient's characteristics

Characteristic	Mean (n = 44)	Min-Max
Age (year)	41.95 ± 2.30	23 - 86
Burns surface area (%)	56.52 ± 3.61	8 - 95
Deep burns area (%)	34.14 ± 3.11	0 - 74
Time of post-burns tube insertion (day)	3.02 ± 1.13	1 - 50
Inhalation injury n (%)	30 (68.18)	
The incidence of VAP n (%)	28 (63.64)	

Comments: All patients are severe and very severe with Burns surface area of 56.52 ± 3.61, deep burns area of 34.14 ± 3.11. In 44 patients study, there were 28 patients with VAP accounting for 63.64% of patients study.

Table 3.2. Relationship between patient's parameters and VAP

Indices		Non - VAP (n = 16)	VAP (n = 28)	r	p OR
Age		39.6 ± 4.0	43.2 ± 2.8	0.12	0.22
Gender	Female	4 (40)	6 (60)	0.04	0.79
	Male	12 (35.3)	22 (64.7)		
Burns surface area(%)		40 ± 5.0	65.96 ± 4.0	0.53	0.0002
Deep burns area (%)		20.6 ± 3.7	41.9 ± 3.7	0.5	0.0005
Burns Index		40.6 ± 5.7	74.8 ± 5.3	0.54	0.0002
Prognostic burns index		80.2 ± 6.2	118.2 ± 6.4	0.52	0.0003
Inhalation injury (%)	Yes	6 (37.5)	24 (85.7)	0.5	0.0006 OR = 10
	No	10 (62.5)	4 (14.3)		
APACHE II		11.9 ± 1.2	12.5 ± 0.8	0.07	0.64

APACHE II: Acute Physiology and Chronic Health Evaluation II score

Comment: Patients with VAP have burns size, deep burns area, burns index, burns prognosis index is greater than that of the patients without VAP. Patients with inhalation injury are at risk of VAP 9.6 times higher than those without inhalation injury ($p < 0.001$).

Bảng 3.3. Relationship between burns site and VAP

Burns site		Non-VAP (n = 16) n (%)	VAP (n = 28) n (%)	p	OR
Face	No	4 (25)	2 (7.1)	0.10	4.3
	Yes	12 (75)	26 (92.9)		
Deep burns on the face	No	11 (68.7)	14 (50)	0.24	2.2
	Yes	5 (31.3)	14 (50)		
Neck	No	2 (12.5)	1 (3.6)	0.27	3.9
	Yes	14 (87.5)	27 (96.4)		
Deep burns on the neck	No	7 (43.8)	10 (35.7)	0.61	1.4
	Yes	9 (56.2)	18 (64.3)		
Chest	No	3 (18.8)	1 (3.6)	0.10	6.2
	Yes	13 (81.2)	27 (96.4)		
Deep burns on the chest	No	8 (50)	10 (35.7)	0.37	1.8
	Yes	8 (50)	18 (64.3)		
Back	No	6 (37.5)	4 (14.3)	0.08	3.6
	Yes	10 (62.5)	24 (85.7)		
Deep burns on the back*	No	13 (81.2)	11 (39.3)	0.006	6.7
	Yes	3 (18.8)	17 (60.7)		

Comment: Patients with deep burns on the back are 6.7 times more likely to develop VAP ($p = 0.006$).

Table 3.4. Relationship between the use of certain drugs and VAP*

Medicines used		Non-VAP (n = 16) n (%)	VAP (n = 28) n (%)	p	OR
Muscle relaxants	No	12 (75)	15 (53.57)	0.17	2.6
	Yes	4 (25)	13 (46.43)		
Corticoid	No	16 (100)	25 (89.29)	0.18	
	Yes	0	3 (10.71)		
Vasopressors	No	13 (81.25)	20 (71.4)	0.47	1.7
	Yes	3 (18.75)	8 (28.6)		

** Used before a diagnosis of VAP*

Comments: There was no relationship between a drug used and VAP occurrence.

Table 3.5. Multivariate analysis for risk of VAP

Indices	Coef.	OR	p > |z|	95% CI
Burns surface area	0.02	1.01	0.56	-0.04 - 0.08
Deep burns area	0.02	1.02	0.67	-0.08 - 0.13
PBI	0.02	1.02	0.46	-0.04 - 0.09
Deep burns on the back	-0.34	0.71	0.76	-2.58 - 1.87
Inhalation injury	2.26	9.6	0.02	0.35 - 4.18
Cons.	-4.75	0.01	0.02	-0.7 - (-0.79)

Comments: Only inhalation injury was independently associated with the risk of VAP. Patients with inhalation injury are at risk of VAP 9.6 times higher than those without inhalation injury (p = 0.02).

4. DISCUSSION

Diagnosis of burns surface area and deep burns are the primary basis for the prognosis and treatment of burns patients [8]. The more area of burns surface area and deep burns increase, the more severe prognosis of burns is and the higher the incidence of complications becomes.

In our study (Table 3.2), there is a positive relationship between the burns area, deep burns area, burns index, burns prognosis index with VAP (p < 0.001). The mean values of burns area, deep burns area, burns index, burns prognosis index were statistically higher in the VAP group than in the non-VAP patient group.

In addition to relying on the area, agent and the circumstances of the burns, the location of the burns is one of the suggestions to help clinicians predict burns for treatment [8]. The location of burns in the head, face and neck area is one of the suggestions for inhalation injury, and the course of the disease is often worse. Burns deep in the back, chest, necrosis of chest circumference, back to prevent breathing, needing necrotic incision to release pressure, and deep burns are also the source of infection.

In this study, there was a difference

between the two groups VAP and non VAP with deep burns on the back. Patients with deep back burns were 6.7 times more likely to develop VAP than those without, there was a strong positive association between deep back burns and VAP (p = 0.006). This may be explained by the fact that deep back burns are the location that is closest to the lungs. On the one hand, it obstructs breathing, on the other hand, edema develops, and a strong local inflammatory response affects the respiratory organs directly.

Nowadays the rate of mortality in inhalation injury still high. In inhalation injury, bronchial circulatory disturbances in inhalation injury cause increased pulmonary shunts, leading to lung damage. Toxic products peroxynitrite formed from nitric oxide after inhalation injury, damage the alveolar-capillary membrane. Inhalation injuries are associated with the appearance of VAP and increase the incidence of VAP in burns [5].

In our study, the only inhalation injury was independently associated with the risk of VAP. Patients with inhalation injury at risk of VAP were 9.6 times more than the patients without inhalation injury (p = 0.02) (Table 3.5).

5. CONCLUSION

Only inhalation injury was independently associated with the risk of VAP. Patients with inhalation injury at risk of VAP were 9.6 times more than the patients without inhalation injury (p = 0.02).

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