Archives of Anesthesiology and Critical Care (Summer 2025); 11(3): 353-357.

Available online at http://aacc.tums.ac.ir

Research Article

Risk Factors and Outcomes of Lower Respiratory Infections in Patients with Traumatic Brain Injury

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ARTICLE INFO

Article history:
Received 15 December 2024
Revised 06 January 2025
Accepted 20 January 2025

Keywords:
Traumatic brain injury;
Intensive care units;
Hospital-acquired pneumoniae;
Ventilator-associated tracheobronchitis;
Ventilator-associated pneumoniae

ABSTRACT

Background: Respiratory infections are a widespread and rapidly spreading disease that plays an important role in the mortality of children and adults. This study aimed to determine the prevalence, contributing factors, and outcomes of LRTI in patients with TBI.

Methods: In this study, 140 patients who were admitted to the ICU with a diagnosis of TBI were included in the study. Patients who had respiratory infections, including hospital-acquired pneumoniae (HAP), ventilator-associated tracheobronchitis (VAT), and ventilator-associated pneumoniae (VAP), were included in the group of patients with LRTI. The diagnosis of LRTI is based on laboratory indicators and the methodology of previous articles. The tool used in this study was a checklist including the data registry. This checklist was completed by the researchers and by visiting the department daily. In all stages of this study, the instructions issued by the Ethics Committee were followed. Also, data analysis was performed with the help of SPSS 18 software.

Results: In this study, out of 140 patients admitted to the ICU, 47 (33.6%) patients had LRTI and 93 (66.4%) patients had no symptoms of LRTI. The result showed that most patients were male (73.6%), had no history of pregnancy (99.3%), had no bedsores (81.4%), were admitted from the Emergency Department (52.9%), and had blunt trauma (79.3%). Also, the M(SD) age of the patients was 45.05 (11.1), the M(SD) length of hospital stay was 6.25 (1.8), and the mean (SD) consciousness score was 7.82 (2.22). Regarding the relationship between the status of the variables studied and the rate of LRTI, it was shown that there was a significant relationship between ICU LOS and age with LRTI status. So that the M(SD) of ICU LOS in patients with LRTI was 5.38 (2.21) and in patients without LRTI was 3.55 (1.45), (95% CI: 2.11 (1.98-2.23)). Also, the M(Sd) age of patients in the LRTI group was 46.76 (13.47), and in the No LRTI group was 44.19 (9.65) (95% CI: 1.87 (1.51-2.22)). Also, the mortality rate in patients with LRTI was 36.2%, which was higher than the mortality rate of non-LRTI patients with a mortality rate of 8.6%.

Conclusion: Given the high incidence of LRTI, preventive measures are recommended in this regard. Also, patient age and ICU LOS were identified as two important variables in the incidence of LRTI, which requires these patients to be prioritized for preventive care in order to reduce the incidence of LRTI.

The authors declare no conflicts of interest.
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DOI: 10.18502/aacc.v11i3.18496

Introduction

Traumatic injuries cause many physical and psychological harms in patients, and the complications of these injuries include amputation, inability to function, PTSD, decreased mental health and quality of life, loss of employment, and even death [1-3]. Traumatic brain injury (TBI) is one of the leading causes of death and disability at all ages, occurring as a result of trauma, falls, traffic accidents, fights, and sports incidents. Hospitalization of patients with TBI may lead to infection in these patients [4-5].

Infectious diseases have emerged as a major health problem in the world, with a high prevalence rate in developing countries. In fact, one of the most common problems in hospitals is infectious diseases, including lower respiratory tract infections, sepsis, and urinary tract infections, which can have adverse consequences for the patient [6-8].

Respiratory infections are a widespread and rapidly spreading disease that plays an important role in the mortality of children and adults. Pathogens that cause respiratory infections can include viruses, bacteria, fungi, or parasites, which are treated with antibiotics. However, in recent years, due to the increase in microbial resistance, the prescription of antibiotics has been limited [9-10]. The tool used in this study was a checklist, which included the following questions: days on MV, hospital LOS, ICU LOS, age, GCS score, LRTI status, gender, pregnancy status, pressure injury, admission source, injury type, and mortality [11-12]. Every year, in the group of children, various people die due to acute respiratory infections; a significant number of these people are in developing countries [13].

The severity of a respiratory infection is determined by various factors, including the causative pathogen and the host immune response [14]. Acute respiratory infections refer to a wide range of diseases, such as colds, pharyngitis, tonsillitis, influenza, and respiratory tract diseases. Lower respiratory tract infection (LRTI) includes two major diseases: bronchiolitis and pneumonia. ALRTI is the most common infectious disease that leads to hospitalization and mortality in patients, especially the elderly. Also, more than half of the hospitalized patients with ALRTI have a history of some type of cardiovascular disease, and their hospitalization leads to worsening of the patients' condition [15-18].

In some cases, LRTI is not the main reason for hospitalization, and the patient develops ALRTI during hospitalization [19-20]. Therefore, it is a priority to identify the prevalence, contributing factors, and consequences of complications from the disease, especially in patients hospitalized in the intensive care unit with a diagnosis of TBI [21-22].

Given the importance of respiratory diseases, this study aimed to determine the prevalence, contributing factors, and outcomes of LRTI in patients with TBI.

Methods

This study is part of the Iran ICU Registry (IICUR), a Persian ICU-based registry that was launched in 2018 through a collaboration with the Australian and New Zealand ICU (ANZICS). IICUR was approved by the Ethics Committee of Shiraz University of Medical Sciences (Ethic Number IR.SUMS.REC.1397.559) and recognized by the Iran Ministry of Health as the first and single registry of adult ICU in Iran.

In this study, which was conducted in Ilam City, 140 patients who were admitted to the ICU with a diagnosis of TBI and were over 18 years of age were included. Patients who had respiratory infections, including hospital-acquired pneumoniae (HAP), ventilator-associated tracheobronchitis (VAT), and ventilator-associated pneumoniae (VAP), were included in the group of patients with LRTI. The diagnosis of LRTI is based on laboratory indicators and the methodology of previous articles [23-26].

The tool used in this study was a checklist, which included the following questions: days on MV, hospital LOS, ICU LOS, age, GCS score, LRTI status, gender, pregnancy status, pressure injury, admission source, injury type, and mortality. This checklist was completed by the researchers and by visiting the department daily. In all stages of this study, the instructions issued by the Ethics Committee were followed. Also, data analysis was performed with the help of SPSS 18 software.

Results

In this study, out of 140 patients admitted to the ICU, 47 (33.6%) patients had LRTI and 93 (66.4%) patients had no symptoms of LRTI. The result showed that most patients were male (73.6%), had no history of pregnancy (99.3%), had no bedsores (81.4%), were admitted from the Emergency Department (52.9%), and had blunt trauma (79.3%) (Table 1). Also, the mean (SD) age of the patients was 45.05 (11.1), the mean (SD) length of hospital stay was 6.25 (1.8), and the mean (SD) consciousness score was 7.82 (2.22) (Table 2). According to the findings, a significant relationship was observed between injury type and mortality status with LRTI status (P value < 0.05). So the mortality rate in patients with LRTI was 36.2%, which was higher than the mortality rate of non-LRTI patients with a mortality rate of 8.6%.

The findings (Table 2) showed that there was a significant relationship between ICU LOS and age with LRTI status. So that the M(SD) of ICU LOS in patients with LRTI was 5.38 (2.21) and in patients without LRTI was 3.55 (1.45), (95% CI: 2.11 (1.98-2.23)). Also, the

M(Sd) age of patients in the LRTI group was 46.76 (13.47), and in the No LRTI group was 44.19 (9.65) (95% CI: 1.87 (1.51-2.22)).

Table 1- Demographic characteristics of patients

Variable		N (%)	LRTI	No LRTI	P value
Gender	Male	103(73.6)	35(74.5)	68(73.1)	0.73
	Female	37(26.4)	12(25.5)	25(26.9)	
Pregnancy Status	Yes	1(0.7)	0(0)	1(1.1)	0.15
	No	139(99.3)	47(100)	92(98.9)	
Pressure Ulcer	Yes	26(18.6)	7(14.9)	19(20.4)	0.10
	No	114(81.4)	40(85.1)	74(79.6)	
Admission Source	Operating Room/Recovery	38(27.1)	11(23.4)	27(29)	0.76
	Emergency Department	74(52.9)	23(48.9)	51(54.8)	
	Other hospital	28(20)	13(27.7)	15(16.1)	
Injury type	Penetrating	29(20.7)	5(10.6)	24(25.8)	0.000
	Blunt	111(79.3)	42(89.4)	69(74.2)	
Mortality	Yes	25(17.9)	17(36.2)	8(8.6)	0.000
	No	115(82.1)	30(63.8)	85(91.4)	

Table 2– Regression analysis for LRTI in TBI

Variable	Total	LRTI	No LRTI	OR (95% CI)	P value
Days on MV	3.07(1.86)	4.19(1.75)	2.5(1.65)	2(1.89-2.09)	0.52
Hospital LOS	6.25(1.8)	8.08(1.44)	5.33(1.14)	2.85(2.69-3.01)	0.51
ICU LOS	4.17(1.94)	5.38(2.21)	3.55(1.45)	2.11(1.98-2.23)	0.000
Age	45.05(11.1)	46.76(13.47)	44.19(9.65)	1.87(1.51-2.22)	0.000
GCS score	7.82(2.22)	5.53(1.12)	8.97(1.68)	0.44(0.24-0.64)	0.06

Discussion

The aim of this study was to determine the prevalence and factors affecting LRTI in patients with TBI. In this study, 0.7% of patients admitted to the ICU were pregnant, and 99.3% of patients were not pregnant. In a meta-analysis by Al Fauzi et al., which analyzed the results of 22 articles, it was shown that TBI during pregnancy is a rare condition and occurs very rarely [27]. Also, in a study by Vaajala et al., the incidence of TBI in pregnant women in 1998 was 103 per 100,000, and in 2018 it was 257 per 100,000. Also, a history of TBI was known to be an influence on the health of the newborn and delivery [28].

According to the findings, 18.6% of patients had pressure ulcers (PU). In the study by Osis et al., the PU status of patients was examined within 30 days after hospitalization in 240 patients with TBI. In this study, the incidence of PU was 18.8%, with 2.7% in mild TBI, 23.2% in moderate TBI, and 42.6% in severe TBI. PU was also reported more frequently during the first 10 days of hospitalization and was associated with the mortality rate of patients in the first 30 days of hospitalization [29]. In the study by Yoon et al., in 237 patients hospitalized in the ICU with a diagnosis of TBI, the incidence of pressure injuries was 13.9%, and PU was associated with the period of enteral feeding, mechanical ventilation, and fever [30]. PU is one of the complications of hospitalization of patients in the ICU, and the results of the aforementioned studies are consistent with the results of this study.

According to the findings, the incidence of LRTI was reported as 33.6%. In the study of Caceres et al., which studied 291 patients with TBI, the incidence of TBI was reported as 37.45% [31]. In the study of Black et al., it was shown that penetrating trauma was reported as an effective factor in causing pneumonitis/pneumonia and respiratory failure in patients with TBI. In fact, penetrating injuries were known as an effective factor in causing pulmonary problems [32]. In the study of Hui et al., with a sample size of 24,525 patients, the incidence of pneumonia due to various causes was reported as 6.5%. In people with pneumonia, 35.0% had AP, 12.6% had VAP, and 60.9% had IP [33]. Also, in the study of Hansen et al., the incidence of pneumonia in the brain injury unit was reported as 27% and during rehabilitation as 12% [34]. Due to the prevalence of viral and infectious diseases, it is necessary to implement therapeutic interventions to reduce these diseases [35]. The results of the aforementioned studies confirm the presence of pneumonia in patients with TBI, which is consistent with the results of this study.

Conclusion

Given the high incidence of LRTI, preventive measures are recommended in this regard. Also, patient age and

ICU LOS were identified as two important variables in the incidence of LRTI, which requires these patients to be prioritized for preventive care to reduce the incidence of LRTI.

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