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ScienceDirect

Journal of the Chinese Medical Association xx (2018) 1−6

www.jcma-online.com

Original Article

Contributing factors to mortality rates of pulmonary tuberculosis in intensive care units

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Received September 3, 2016; accepted February 23, 2017

Abstract

Background: Tuberculosis (TB) remains an important health problem worldwide. TB patients sometimes require intensive care unit (ICU) treatment. The aim of this study is to establish special features and mortality rates of pulmonary TB patients in ICUs and identify the factors contributing to ICU mortality.
Methods: Medical records of adult patients (>18 years) with a diagnosis of TB who were admitted to the ICU of a referral hospital for chest diseases between 2004 and 2010 were reviewed retrospectively. Demographic characteristics, comorbidities, APACHE II scores, symptoms, radiologic appearance of the disease, bacteriological and laboratory investigations, need and type of mechanical ventilation support (invasive, non-invasive), characteristics related to ICU stay, length of ICU stay, mortality and factors affecting mortality were recorded and analysed.
Results: Forty patients (33 male) with active pulmonary TB with a median age of 55 years (43−63 years) and a median APACHE II score of 22 (17−26) were followed up in the ICU. Patients who needed invasive mechanical ventilation had significantly longer ICU stays than patients who were treated with non-invasive ventilation or medical therapy (Log rank p = 0.014). Mortality was 72.5%. The only independent risk factor for mortality was having an APACHE II score ≥18.
Conclusion: The mortality of TB patients who needed ICU support remains high. This higher mortality rate seems related to multi-organ failure, requiring invasive mechanical ventilation and high APACHE II scores.

Keywords: Intensive care; Mechanical ventilation; Mortality; Tuberculosis

1. Introduction

Tuberculosis (TB) remains an important health problem, especially in developing countries, with high incidence and mortality rates worldwide. There were an estimated 9.6 million incident cases of TB globally in 2015, 1.4 million deaths among HIV-negative cases of TB and an additional 0.35 million deaths among people who were HIV-positive.[1]

Incidence and mortality rates of TB in Turkey were 15.8 cases/100.000 population per year and 5%, respectively.[2]

Despite the improvement in strategies such as directly observed therapy during recent years, some smear-positive TB patients still require hospitalisation. Mortality of these patients still exists, particularly among those who are admitted to the intensive care unit (ICU). The most common causes of ICU admission of TB patients are acute respiratory failure and other severe organ failures such as renal and hepatic failure.[3−6] Some studies performed in small patient groups also suggest that patients with miliary TB, HIV infection or both

Conflicts of interest: The authors declare that they have no conflicts of interest related to the subject matter or materials discussed in this article.

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https://doi.org/10.1016/j.jcma.2018.02.003

commonly need ICU support.[7–9] Mortality, rates of TB patients requiring mechanical ventilation vary from 25% to 81% whereas this is around only 25% in patients with severe pneumonia.[10–14] According to our knowledge, there are no data regarding the outcomes of TB patients followed up in the ICU in Turkey.

The aim of this study was to establish mortality rates of TB patients who need ICU treatment and identify the factors contributing to ICU mortality in Izmir, which is one of the biggest cities of a developing country with intermediate TB endemicity.

2. Methods

2.1. Setting

Our institution is a regional referral and training hospital for chest diseases and chest surgery with 420 general and 29 ICU beds in Izmir, Turkey. Hospital also has a special 60 bed ward for TB patients. Annually, approximately 500 TB patients are hospitalised.

2.2. Study design

Medical records of adult patients (>18 years) hospitalised between 2004 and 2010 with a diagnosis of TB who were admitted to the ICU of the hospital were reviewed retrospectively. The study was approved by the local institutional review board.

2.3. Study population and criteria

The diagnosis of TB was based on the following: (1) positive cultures of sputum, bronchial aspirates or bronchoalveolar lavage fluid; and/or (2) positive, acid-fast bacilli smears; and/or (3) clinical and radiological findings with a histopathologic diagnosis on lung biopsy. Demographic characteristics, comorbidities, smoking history, alcoholism, reasons for ICU admission, acute physiology and chronic health evaluation (APACHE II) score (a severity-of-disease classification system applied within 24 h of admission of a patient to an ICU: an integer score from 0 to 71 is computed based on several measurements; higher scores correspond to more severe disease and a higher risk of death), symptoms, radiologic appearance of the disease, bacteriological and laboratory investigations (white cell count, haemoglobin, platelets, arterial blood gases), need and type of mechanical ventilation support (invasive, non-invasive), drug regimen used for anti-TB treatment, complications such as hepatotoxicity, acute renal failure, cardiovascular failure, central nervous system failure and other organ failures, length of stay (LOS) in the ICU and 28- day -mortality were recorded and analysed.

Clinical respiratory specimens were decontaminated and homogenized by the N-acetyl-l-cysteine-sodium hydroxide (NALC-NAOH) method. The MGIT 960 automated culture system (BD, Sparks, Maryland, USA) and Lowenstein-Jensen (LJ) medium were used for isolation of mycobacteria. Strains were identified by stain characterisation and the ProbeTech System (BD, Sparks, Maryland, USA). The susceptibility patterns of all isolates were studied with regard to first-line antituberculosis drugs (isoniazid, rifampin, streptomycin, and ethambutol and pyrazinamide) by MGIT 960 AST system (BD, Sparks, Maryland, USA) according to manufacturer instructions. Drug resistance patterns of the isolates are given in Table 1. Standard identification and susceptibility testing was applied according to Clinical and Laboratory Standards Institute (CLSI) standards.[10]

Chest radiographic patterns were classified according to the National TB and Respiratory Disease Association (NTRDA), with category 1 defined as minimal infiltration without cavities; category 2 as moderate expansion of infiltrates, category 2a as occasional infiltrates, unilateral or bilateral without cavities, category 2b as compact infiltrates with expansion to not more than one lung lobe, and cavities with a diameter < 4 cm,; category 3 as advanced with any expansion (with or without cavities) and category 4 as miliary forms.[15] Miliary TB was defined as the presence of micronodules on chest radiographs or high-resolution computed tomography (CT).

2.4. Statistics

Categorical data were presented as number of cases and percentages. Continuous data were presented as medians with

Table 1
Baseline demographic characteristics of TB patients requiring intensive care.

Patient characteristics	All	Survivors	Deceased	*p*
n (%)	40	11 (27.5)	29 (72.5)	
Age (years), mean ± SD	54 ± 15	55 ± 13	54 ± 16	0.84
Male gender, n (%)	33 (83)	9 (81)	24 (83)	0.94
Smoking history	22 (55)	7 (63)	15 (52)	0.72
APACHE II score	22 (15–26)	17 (15–22)	23 (20–26)	0.016
Symptoms				
Dyspnea	32 (80)	6 (54)	26 (89)	0.025
Cough	25 (63)	6 (54)	19 (65)	0.72
Sputum	16 (40)	5 (45)	11 (38)	0.73
Fever	7 (17)	3 (27)	4 (14)	0.36
Presence of comorbidity	25 (63)	6 (55)	19 (65)	0.71
Laboratory parameters				
WBC ($x10^3$/L)	12.5 (9.8–22.1)	11.1 (11.3–18.4)	12.8 (9.8–22.6)	0.80
Hb, g/dl	11 (9.4–13)	9.5 (9.2–9.5)	11 (9.6–13)	0.34
Htc, %	32.5 (28.3–35)	28.2 (28–28.3)	33 (29.3–36.3)	0.21
Plt ($x10^3$/L)	266 (148–426)	443 (181–550)	249 (114–403)	0.12
Arterial blood gases				
pH	7.29 (7.16–7.36)	7.30 (7.21–7.34)	7.27 (7.13–7.38)	0.83
$PaCO_2$, mmHg	58 (39–87)	58 (39–91)	59 (37–84)	0.98
PaO_2/FiO_2	166 (128–243)	161 (135–285)	171 (126–225)	0.83

Data are presented as median (IQR) or n (%) unless specified. WBC = white blood cell, Hb = haemoglobin, Htc = haematocrit, Plt = platelets, $PaCO_2$ = arterial carbon dioxide tension, PaO_2 = arterial oxygen tension, FiO_2 = inspiratory oxygen fraction.

Please cite this article in press as: Tatar D, et al., Contributing factors to mortality rates of pulmonary tuberculosis in intensive care units, Journal of the Chinese Medical Association (2018), https://doi.org/10.1016/j.jcma.2018.02.003