

Diagnostic validity of Thoracic trauma severity score in patient with blunt thoracic trauma for predicting mortality rate



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ABSTRACT

Introduction: The high incidence of blunt thoracic trauma is still a serious concern in emergency services. Mild to severe cases of blunt thoracic trauma that come to the emergency department are not those that can be considered simple but need to be reviewed for the possibility that can lead to the occurrence of advanced complications. This study aims to predict mortality in patient with blunt thoracic trauma with TTS (Thoracic trauma severity) score.

Patients and Methods: This is a retrospective study with 52 subjects of blunt thoracic trauma patients treated at our University Hospital from January 2016 to May 2017. Eligible data were collected from medical record analyzed by receiver operating characteristics curve and cross tabulation.

Results: The age of the subjects are 48.03 ± 15.62 , with male 42 subjects (80.8%) and female ten subjects (19.2%). The mean point of Thoracic trauma severity score (TTSS) was 8.32 ± 2.69 . The outcome was three patients dead (5.8%) and 49 patients discharged (94.2%). The sensitivity of TTSS 100 %, specificity 89.7%, positive predictive value (PPV) 37.5%, negative predictive value (NPV) 100%, and accuracy rate 90.3%. Highly sensitivity and specificity results for Thoracic Trauma Severity Score is valid for the screening of Blunt Thoracic Trauma.

Conclusion: At 11.5 cut-off point, the TTSS was an excellent tool to predict the mortality rate of patients with blunt thoracic trauma. It has a 100% sensitivity and 89.7% specificity, as well as 37.5% PPV and 100% NPV.

Keywords: blunt thoracic trauma, thoracic trauma severity score, retrospective, diagnostic test

Cite This Article: Hermawan, N.G.D., Semadi, I.N., Widiana, I.G.R., Permatasari, D., Ryalino, C. 2019. Diagnostic validity of Thoracic trauma severity score in patient with blunt thoracic trauma for predicting mortality rate. *Neurologico Spinale Medico Chirurgico* 2(1): 20-22. DOI:10.15562/nsmc.v2i1.148

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INTRODUCTION

The high incidence of blunt thoracic trauma (TT) and the lack of scale to determine the advanced treatment often results in doubts in providing the type of treatment in blunt thoracic trauma patients. TT is a significant cause of mortality and morbidity and is the third most common trauma after head injury and extremity.¹ Eligible data shows about thoracic trauma can directly account for 20 to 25% of all trauma deaths.² In our hospital, from January 2016 to May 2017, there were 148 cases of blunt thoracic trauma, with 47 cases were multi-trauma and the other 101 were localized thoracic trauma.³

The accuracy of diagnosing TT in trauma patients is essential because it directly saves lives and determines further management. The proper test in determining risk criteria for TT is needed for the treatment of patients so that it can be considered whether the TT patient requires outpatient care, or needs to be admitted, requires intensive care, mechanical ventilation, or maybe surgery so that morbidity and mortality from thoracic trauma can be prevented.

A score was developed in predicting and determining the advanced treatment of TT in the form

of a thoracic trauma severity score (TTSS). There are only a few researchers that have explored and tested the validity of this score and the relationship between this score with mortality, so it is not widely applied.⁴⁻⁹

Differences in patient characteristics may affect the mortality rate because this scoring system is more widely used abroad. This study aims to predict mortality in patient with blunt thoracic trauma with thoracic trauma severity score.

PATIENTS AND METHODS

This study is a retrospective diagnostic study that was conducted at Sanglah Hospital in Bali, Indonesia. A total subject of 52 patients aged over 18 with blunt TT from January 2016 to May 2017, was included in this study.

In this study, all subjects were diagnosed using TTSS. The calculations consist of the results of chest X-ray plain expertise, and the calculation of the PaO₂/FiO₂ ratio from the blood gas analysis (BGA) results as a base for diagnosing thoracic trauma patients. Analysis of data was divided into three stages: descriptive data analysis, analysis of receiver operating characteristics (ROC) curves to

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determine the cut-off point, and the diagnostic test analysis with 2x2 cross-table to find the sensitivity, specificity, positive predictive value, and negative predictive value. All statistic calculations were processed using the SPSS 22.0 software. A p value of <0.05 was considered significant.

RESULTS

The characteristics of the subjects are shown in Table 1. Most cases were found in a person of

>30 years of age. TT was found more in men (80.8%) rather than in women (19.2%). By area under curve characteristic, we obtained the cut-off point of the TTSS was 11.5.

Using the mentioned cut-off point, we went on to the diagnostic test analysis in the 2x2 cross-tabulation shown in Table 2. We obtained that the TTSS has a 100% sensitivity and 89.7% specificity. The positive prediction value (PPV) was 37.5%, and the negative predictive value (NPV) was 100%.

DISCUSSION

In this study, there were more men with blunt thoracic trauma (80.8% vs. 19.2%). This is similar to the previous study that reported men experienced more blunt TT than women (76.7%).¹ This is related to the level of activity and productivity of men who tend to be more dominant in outdoor activities. However, previous studies showed that under 30 years of age experienced more thoracic injuries while this study showed that blunt TT occurred more in >42 years old. This may be due to the differences in physical age, the level of productivity in using motorized vehicles, and the conditions of public transportation in each country that tend to be different.^{1,10-12}

In 2000, a study reported that a blunt thoracic trauma mortality rate was 35.3%. In 2011, another study stated that complications in blunt TT patients were about 27% with a mortality rate of 20-43%.^{1,4,13,14} In this study, the blunt TT mortality rate was 5.8%, differed from the figures indicated by previous studies. Direct injury from the lung such as pulmonary contusion is often associated with major blunt thoracic trauma and results in impaired ventilatory function, so that perfusion and pulmonary oxygenation are impaired.^{1,4,13-15}

Previous studies have suggested that patients with TT were worsening because of the effects of respiratory function which affect cardiovascular function so that the goal of treatment from thoracic trauma is to restore normal cardiorespiratory function, control bleeding, and prevent sepsis. One risk factor for death in blunt TT patients is the result of complications from a pulmonary contusion. In 2014 a study stated that patients with high TTSS had fatal outcomes of pulmonary contusions and pleural involvement from one side or both sides.^{3,16-18}

The results of the diagnostic test of TTSS validity in predicting the occurrence of death in blunt thoracic trauma patients, as seen from the ROC curve analysis, found the area under the curve of 0.918 (91.8%). In the ROC curve table, the ability of TTSS to predict mortality in blunt thoracic trauma patients has a TTSS 11.5 cut-off point. Overall TTSS

Table 1 Subjects' characteristics

Variables	N (%)
Age, years old	
< 30	6 (11.5)
30-41	12 (23.1)
42-54	16 (30.8)
55-70	15 (28.8)
Sex	
Male	42 (80.8)
Female	10 (19.2)
PaO₂ to FiO₂ ratio	
301-400	9 (17.3)
201-300	19 (36.5)
150-200	11 (21.2)
<150	13 (25)
Pulmonary contusion	
None	29 (55.8)
1 unilateral lobe	19 (36.5)
1 bilateral lobe	3 (5.8)
2 unilateral lobes	1 (1.9)
Pleural involvement	
None	22 (42.3)
Pneumothorax	9 (17.3)
Unilateral hemothorax or hemopneumothorax	19 (36.5)
Bilateral hemothorax or hemopneumothorax	2 (3.8)
Rib fracture	
None	1 (1.9)
1 to 3	10 (19.2)
3 to 6, unilateral	33 (63.5)
> 3, bilateral	6 (11.5)
Flail chest	2 (3.8)
Patient outcome	
Deceased	3 (5.8)
Survivors	49 (94.2)
TTS Score	8.32 ± 2.69

PaO₂: partial pressure of oxygen in the artery, FiO₂: given oxygen fraction, TTS: thoracic trauma severity

Table 2 Cross-table calculation of thoracic trauma severity score in predicting the mortality of blunt thoracic trauma

Effect score	Deceased	Survivors	Total
≥ 11.5	3	5	8
<11.5	0	44	44
Total	3	49	52

with a cut-off point of 11.5 can be recommended to predict the occurrence of death in blunt thoracic trauma patients because it has an excellent diagnostic test validity and can be done quickly and easily.

CONCLUSION

At 11.5 cut-off points, the TTSS was an excellent tool to predict the mortality rate of patients with blunt TT. It has a 100% sensitivity and 89.7% specificity, as well as 37.5% PPC and 100% NPV.

ACKNOWLEDGMENT

The authors report no conflict of interests.

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