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THORACIC TRAUMA SEVERITY SCORE (TTSS) AS AN OUTCOME PREDICTOR OF BLUNT THORACAL INJURY PATIENTS IN ADAM MALIK MEDAN HOSPITAL

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Abstract

Introduction

Trauma is one of the biggest causes of death in the world. In thoracic trauma, 90% is blunt trauma and 10% of them require surgery. Mortality rates can be prevented by establishing a diagnosis and good measures. Thoracic Trauma Severity Score (TTSS) can be used to assess the severity of patients with thoracic trauma both anatomically and physiologically. TTSS can help predict advanced complications and provide early management of thoracic trauma patients. The purpose of this study was to determine the relationship between the assessment of TTSS trauma scores and outcomes on thoracic trauma at H. Adam Malik Medan Hospital.

Methods

This study is a correlative analytic study with a cross sectional study design conducted at H. Adam Malik Medan Hospital. The main results in the form of the relationship of TTSS scores with Karnofsky scores were analyzed using the Spearman correlation test. Other results relate to the comparison of TTSS value categories with patient characteristics and outcomes with the Chi square test.

Result

In this study, 20 study samples were obtained, with an average age of 51.15 (± 14.47) years, consisting of 14 men (70.0%) and 6 women (30.0%). The patient's condition was classified into two conditions, namely 13 patients (65.0%) good condition and 7 patients (35.0%) in poor condition. The correlation coefficient between the TTSS score with Karnofsky score is 0.794 and the p value <0.001 or shows statistically significant results.

Conclusion

Based on the results of the study, it was found that there was a significant correlation between the assessment of TTSS trauma scores with poor outcomes in the thoracic trauma (p <0.001).

Introduction

Trauma is one of the biggest causes of death in the world. In thoracic trauma, 90% is blunt trauma and 10% of them require surgery. The thoracic trauma mortality rate is the second largest after head trauma, so it requires the right action. Mortality rates can be prevented by establishing a diagnosis and good measures. (Lugo et al, 2015).

The incidence of thoracic trauma ranges from 10-15% of all trauma and represents 25% of all deaths due to trauma. Approximately 16,000 deaths per year in the United States are caused by thoracic trauma. The prevalence of death in multiple trauma patients is thoracic trauma of 20-25%. The highest trauma death rate worldwide is in Asia.

Thoracic trauma can be accompanied by involvement of bone, pleura, lung, heart or other organs that are in the thorax and mediastinal cavity. The involvement of these organs can result in an increase in mortality and morbidity. Nowadays a lot of scoring is used to assess the severity of thoracic trauma. Trauma and Injury Severity Score (TRISS) is one of the scoring that is often used. Scoring has criteria in the form of age, Injury Severity Score (ISS), and Revised Trauma Score (RTS) to predict mortality in thoracic trauma patients. However, this scoring is not specific to patients who have only had thoracic trauma. The Thoracic Trauma Severity Score (TTSS) introduced in 2000 can be used to assess the severity of patients with thoracic trauma both anatomically and physiologically (Pape et al, 2000).

This kind of research has been done before by Momssen et al. with the conclusion that TTSS is a predictor of severity and an appropriate assessment system for assessing outcomes of patients with blunt thoracic trauma. (Mommsen et al, 2012) TTSS can assess bone injury involvement, parenchymal injury and estimate physiological

disorders. The parameters used are bone fractures, pulmonary contusions, pleural involvement, PaO2 / FiO2 and age. TTSS only uses diagnostic tools that are already available in emergency departments i.e chest radiographs and blood gas analysis. Early assessment of the severity can help predict advanced complications and provide early management of thoracic trauma patients. (Subhani, Muzaffar and Khan, 2014) The purpose of this study was to determine the relationship between the assessment of TTSS trauma scores and the outcome of thoracic trauma at H. Adam Malik General Hospital Medan.

Methods

This research is a correlative analytic study with cross sectional research design. The study was conducted at the H. Adam Malik General Hospital in Medan, with the study sample being thoracic trauma patients who met the inclusion and exclusion criteria treated at the H. Adam Malik General Hospital in Medan.

The inclusion criteria of this study were: thoracic blunt trauma sufferers at H. Adam Malik General Hospital Medan, who were admitted through Emergency Installation (ED). While the exclusion criteria of this study are: trauma in children, patients with multiple trauma and decreased consciousness, patients with a history of chronic illness and patients with other metabolic disorders.

The research flow starts from recording thoracic trauma patients, adjusting them for inclusion and exclusion criteria and calculating TTSS based on data from medical records. Then the data is classified into High TTSS and Low TTSS based on grading. Patient outcomes were assessed using the Karnofsky score. The data were then analyzed statistically with SPSS to see the relationship of TTSS to the outcome of thoracic trauma. The main results is the correlation of TTSS scores with Karnofsky scores were analyzed using the Spearman correlation test. Other results related to the comparison of TTSS value categories with patient characteristics and outcomes are analyzed with the Chi square test. The significance value is obtained at p value <0.05.

Results

In this study, 20 study samples were obtained, with an average age of 51.15 (± 14.47) years, consisting of 14 men (70.0%) and 6 women (30.0%). Patients treated had several treatment outcomes consisting of 5 patients (25.0%) can be ambulatory, 8 patients (40.0%) inpatient care, 4 patients (20.0%) were treated with chest tube insertion, and 3 patients (15.0%) were treated with chest tube insertion and ICU care. The patient's condition was classified into two conditions, namely 13 patients (65.0%) in good condition and 7 patients (35.0%) in poor condition. Patient characteristics in this study are shown in table 1.

Table 1. Patients' Characteristics

Variable	Mean (±SD) / N (%)
Age (y.o)	51,15 (±14,47)
Sex	
Male	14 (70,0%)
Female	6 (30,0%)
Outcomes	
Ambulatory	5 (25,0%)
Inpatient department	8 (40,0%)
Chest tube insertion	4 (20,0%)
Chest tube insertion and ICU care	3 (15,0%)
End condition	
Good (Ambulatory, Inpatient department)	13 (65,0%)
Poor (ICU care, Surgery, Death)	7 (35,0%)

Scoring on the Thoracic Trauma Severity Score (TTSS) consists of the components of age, PaO2 / FiO2, rib fracture, pulmonary contusions, and pleural involvement. The characteristics of these components can be seen in table 2.

Table 2. Characteristics of Thoracic Trauma Severity Score

Scoring Category	N	(%)	Point	p-value
Age				0,628
<30	3	15,0	0	
30-41	2	10,0	1	
42-54	2	10,0	2	
55-70	13	65,0	3	
>70	0	0	4	
PaO_2/FiO_2				0,01
>400	2	10,0	0	
300-400	11	55,0	1	
200-300	7	35,0	2	
150-200	0	0	3	
<150	0	0	4	
Rib Fracture				0,08
0	9	45,0	0	
1 s.d 3	3	15,0	1	
3 s.d 6	5	25,0	2	
>3 and Bilateral	3	15,0	3	
	0	0	4	
Flail Chest				
Contussion				0,01
None	7	35,0	0	
1 Lobe, Unilateral	7	35,0	1	
1 Lobe Bilateral	5	25,0	2	
< 2 Lobe Bilateral	1	5,0	3	
	0	0	4	0.01
< 2 Lobe Bilateral				
Pleural Involvement				
None	12	60,0	0	
	5	25,0	1	
Pneumothorax				
HT HPT unilateral	3	15,0	2	
HT HPT bilateral	0	0	3	
	0	0	4	
TPT	16	80,0		
Total Score				
Low TTS (0-10)				
High TTS (11-25)	4	20,0		

Each TTSS assessment component is given a score of 0-4. Based on table 2, found the majority of patients aged 55-70 years (65.0%), with 300-400 PaO2 / FiO2 levels (55.0%), and the majority of patients did not experience rib fractures (45.0%). Pulmonary contusions commonly occur in 1 lobe and unilateral lung (35.0%) and 60.0% of patients have no pleural disorders. Based on the results of the analysis per component, it was found that there was a significant relationship between PaO2 / FiO2, rib fracture, lung contusion, and pleural involvement with adverse conditions in patients with thoracic trauma ($p < 0.05$).

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Table 3. Analysis of the Thoracic Trauma Severity Score category with patient outcome categories

		Patient Outcome		p-value
		Poor	Good	
TTSS	High	4	0	0,007
	Low	3	13	

Based on table 3, it appears that there are 4 patients with a high TTSS score category and experiencing poor clinical outcomes. Whereas there were 13 patients with a low TTSS score category and experienced good clinical outcomes. In this study, an analysis test was performed using the Fischer's exact test to obtain a p value of 0.007 or clinically significant.

Table 4. Analysis of Thoracic Trauma Severity Score with Outcome

Outcome	Mean *Thoracic Trauma Severity Score*	p-value
Good	4,46 (±2,57)	0,001[1]
Poor	9,43 (±2,37)	

[1] Data analysis using independent T tests with p <0.05 indicates significance

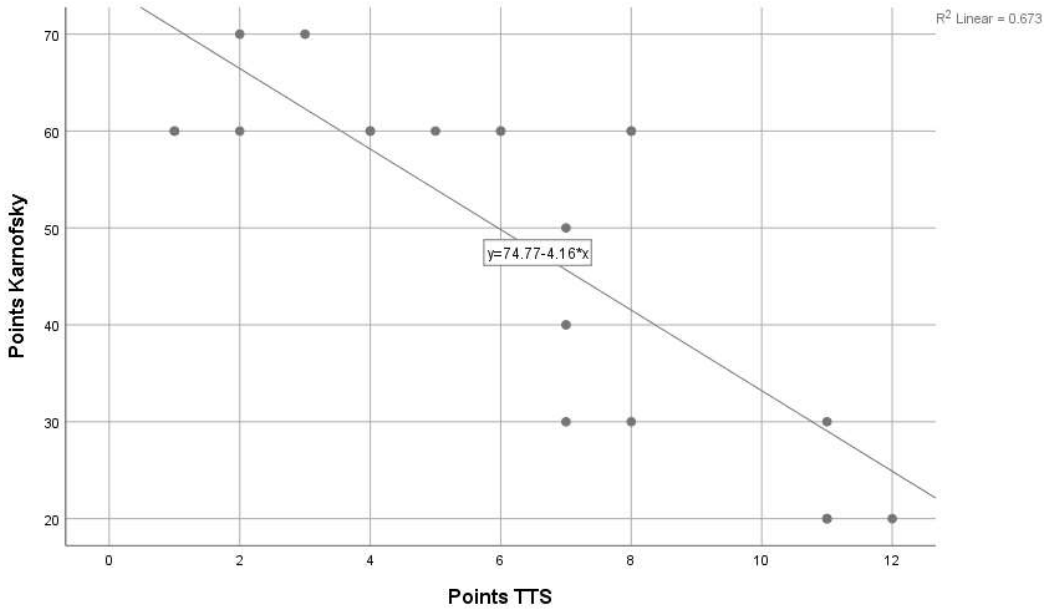
Seen in table 4. the mean thoracic trauma severity score (TTSS) obtained in patients with good outcomes is 4.46 (± 2.57) compared with poor outcomes which is 9.43 (± 2.37). Data analysis was performed and a p-value of 0.001 was obtained or showed statistically significant results.

Table 5 Thoracic Trauma Severity Score Analysis with Karnofsky score

		TTSS Score	**Karnofsky Score**
TTSS Score	Correlation coefficient	1.00	-0.794
	Sig. (2 tailed)	.	<0.001
Karnofsky Score	Correlation coefficient	-0.794	1.000
	Sig. (2 tailed)	<0.001	.

[1]Data analysis using the Spearman test with p <0.05 indicates significance

It can be seen in Table 5 that the correlation coefficient between the TTSS score with Karnofsky score is 0.794 and the value of p <0.001 or shows statistically significant results.



Discussion

Thoracic trauma is a wound or injury that affects the thoracic or thoracic cavity that can cause damage to the thoracic wall or the contents of the thoracic cavity (chest cavity). Thoracic trauma is a significant cause of morbidity and mortality in adults and children, which is usually the main cause of death in about 25% of patients with multiple trauma and when accompanied by injury to other body parts can cause an additional death of 50% of patients with multiple trauma due to hypoxia and hypovolemia.

The incidence of thoracic trauma ranges from 10-15% of all trauma and represents 25% of all deaths due to trauma. Approximately 16,000 deaths per year in the United States are caused by thoracic trauma. The prevalence of death in multiple trauma patients is thoracic trauma of 20-25%. The highest trauma death rate worldwide is in Asia.

Thoracic trauma can be accompanied by involvement of bones, pleura, lungs, heart or other organs that are in the thoracic and mediastinal cavities. The involvement of these organs can result in an increase in mortality and morbidity. Nowadays a lot of scoring is used to assess the severity of thoracic trauma. Thoracic trauma is ranked as the most important injury in severely injured patients, and about 50% of those with multiple trauma also suffer from thoracic injuries. Injury to the thorax can affect the thoracic wall (for example, ribs, sternum fractures) as well as thoracic organs (eg lungs, heart, blood vessels). Only a small proportion of patients with thoracic trauma tend to experience respiratory failure that requires intubation and ventilator support to improve hypoxia and hypercapnia. (Bayer et al., 2017)

On the other hand, 35 - 58% of patients with severe injuries require prehospital intubation, depending on the severity of the thoracic injury that occurs together. While patients who are seriously injured usually require intensive care regardless of thoracic injury. Organ dysfunction and multiple organ failure (MOF) are known to develop more frequently in patients with severe thoracic trauma. In severely injured patients, including those with severe traumatic brain injury (TBI), at least one organ fails in about 52%, with lung failure occurring in 26% of cases. While the lung failure rate ranges from 50-65% in MOF patients, only 7% of patients without MOF suffer from respiratory failure. Overall, MOF patients require prolonged ventilation and prolonged care in the intensive care unit (ICU), thus consuming a considerable amount of health care resources as well. (Bayer et al., 2017)

Severe multiple trauma is often associated with traumatic lung injury and presents with a broad spectrum of severity; reported thoracic trauma mortality can be as high as 60%, and 20-25% of deaths in severely injured patients are associated with thoracic injuries. (Bayer et al., 2017)

In this study, 20 study samples were obtained, with an average age of 51.15 (± 14.47) years, consisting of 14 men (70.0%) and 6 women (30.0%). Different from previous studies conducted at Prof. RSUP Dr. R. D. Kandou Manado, in this study, did not assess the most age range of thoracic trauma and did not specify thoracic trauma that occurred only due to traffic accidents, so that all patients with thoracic trauma were included regardless of the cause. In a study conducted in China by Zhu, et al found that the number of male patients was greater than female with male age range of 45.1 ± 17.4 and female age range of 46.2 ± 15.9 with the largest age range was 13 ≤ age <45 (Zhu, et al 2017). Likewise, a study conducted by Rubenson Wahlin et al found that more male patients than female (72.8% and 27.2%) with an average age of 15-39 years. The trauma studied is blunt or penetrating type, with different trauma mechanisms such as traffic accidents, falls, etc. (Rubenson Wahlin, et al 2016).

There are several conditions that can threaten the lives of patients with thoracic trauma, such as, cardiac tamponade, massive pneumothorax, massive hematothorax, and flail chest. In these conditions requires immediate treatment after the initial assessment of the airway, breathing, circulation, for example in massive pneumothorax requires needle thoracostomy immediately which then requires the insertion of a chest tube. Likewise with hematothorax which requires the insertion of a chest tube. Cardiac tamponade, requires immediate pericardiosynthesis. Flail chest requires immediate pain relief that needs to be done next operation.

Current standards for assessing thoracic trauma vary greatly. Existing scores that include several anatomic, radiographic, and physiological criteria are needed to improve diagnostic accuracy in cases of thoracic trauma. Early identification and aggressive management of thoracic trauma is very important to reduce morbidity and

mortality rates significantly. This is important because the level of thoracic trauma has a significant impact on the requirements of resuscitation and intensive care unit support. Timely assessment of the adequacy of treatment strategies will help reduce various complications. (Subhani, Muzaffar and Khan, 2014)

Eighty percent to 90% of patients with severe thoracic trauma have several additional injuries. The incidence of systemic inflammatory response syndrome (SIRS), infectious complications (eg, pneumonia), acute respiratory distress syndrome (ARDS), and multiple organ dysfunction syndrome (MODS), is substantially higher in patients with multiple trauma with severe thoracic trauma. (Stevenson, 2001) The things mentioned above also caused a significant increase in ventilation time and length of stay in the intensive care unit (ICU) in thoracic trauma patients. In addition, thoracic injuries are associated with 30% -40% mortality and trauma-related mortality of 20% -25%. About 50% -75% of polytraumative patients who die suffer thoracic injuries. (Mommsen et al., 2012)

Current standards for assessing thoracic trauma vary greatly. Several trauma assessment systems exist, including The Trauma and Injury Severity Score (TRISS), most often used to predict mortality. However, in its implementation TRISS has many limitations, so that in 2000 Pape et al made a new assessment system, namely the Severe Traumatic Thoracic Score (TTSS) which combines the patient's age, resuscitation parameters and chest radiological assessment.

After the publication of TTSS in 2000, several studies reported an association between TTSS and thoracic trauma outcomes. TTSS evaluates five parameters, namely different PaO2 / FiO2, rib fracture, pulmonary contusions, pleural involvement and age. TTSS is a better predictor of trauma related complications when entering in an emergency department by using parameters that are already available, namely chest x-ray and arterial blood gas analysis (Subhani, Muzaffar and Khan, 2014). Patient outcomes worsen with increasing scores using the Chi Square test, the results show a statistically significant relationship between patient outcomes and TTSS. Patients with TTSS > 9 have a 4-fold higher risk of death (Elbaih et al, 2016). Using the gray zone approach the high specificity limit of the TTSS for ARDS prediction is > 13, while the high sensitivity threshold is > 8. In patients included in the inconclusive gray zone (ie score 8-12), the risk of delayed ARDS cannot be excluded. The cut-off point level in TTSS can be used to classify patients for careful observation (Martinez Casas et al, 2016)

This study divides the output of thoracic trauma into two, namely good and poor outcomes. Outcomes are good, ie patients who can be ambulatory and patients treated in a non-ICU room, while poor outcomes are patients who need ICU care, performed surgery, and experienced mortality.

In this study the patients treated had several treatment outcomes, which consisted of 5 patients (25.0%) was ambulatory, 8 patients (40.0%) was observed in hospital, 4 patients (20.0%) was performed chest tube insertion, and chest tubes insertion along with ICU care in 3 patients (15.0%). The condition of the patient at the time of discharge was found in good condition as many as 11 patients (55.0%) and in poor condition as many as 7 patients (35.0%). For this reason, it is important to assess thoracic trauma using a good scoring system to be able to assess the severity of trauma experienced by the patient so that we can handle it properly.

This study showed the mean TTSS in patients with good outcomes was 4.46 (± 2.57) while the poor outcomes were 9.43 (± 2.37). Data analysis was performed and a p-value of 0.001 was obtained or showed statistically meaningful results. This shows that TTSS can be used as a predictor of outcome for patients with thoracic trauma, as has been done in previous studies.

Another outcome examined in this study is the correlation between TTSS and karnofsky score. The correlation between the two was assessed by the Spearman test and showed a strong inverse correlation (kk = -0.794). Karnofsky score is considered to be able to predict the clinical condition of patients that describe the level of morbidity and mortality incidence. Until this study was written, no research has been found linking TTSS to Karnofsky scores. However in 2016, a study by Martinez et al concluded that TTSS is an appropriate and feasible tool for predicting the development of complications or mortality in patients with thoracic trauma (Martinez Casas et al, 2016).

This research is not perfect because there are still shortcomings, including this study does not take into patient's condition before trauma. In addition, this study goes through measurements at once observation. Conditions for the patients in the following months were not included in the monitoring in this study. The Karnofsky score is not yet ideal to describe the patient's outcome because the Karnofsky score can change rapidly and the varied initial Karnofsky score influences the response of a therapy.

Conclusion

Based on the results of the study, it was found that there was a significant correlation between the assessment of TTSS with poor outcomes in the thoracic trauma ($p < 0.001$). There is a significant correlation between each TTSS component such as PaO2 / FiO2 ($p = 0.01$), lung contusion ($p = 0.01$), and pleural involvement ($p = 0.01$) with poor post-thoracic trauma outcomes.

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