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THE RELATIONSHIP BETWEEN *REVISED TRAUMA SCORE* (RTS) AND MORTALITY RATE IN HEAD INJURY PATIENTS AT DR. SAIFUL ANWAR MALANG HOSPITAL

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ABSTRACT

A head injury is scary. Head injuries can be fatal and require medical attention. Trauma severity evaluation helps clinicians make informed judgements, create effective treatment plans, reduce time and costs, and maybe prevent brain injury impairment and death. A comprehensive physiological grading system, the Revised Trauma Score evaluates human physiological function. This study examines the relationship between the Revised Trauma Score and head injury fatalities at RSUD dr. Saiful Anwar Malang. The research uses cross-sectional and observational correlation analytic methods. The study sampled 70 people incidentally. Used secondary data from observation sheets and medical records. The majority of 46 respondents (65.7%) had RTS scores of 11-12, indicating low brain injury. Despite the high mortality rate, 57 respondents (81.43%) survived. Spearman rank test two variables for correlation. The study found a 0.000 p-value between the RTS category and head injury mortality at RSUD Dr. Saiful Anwar Malang. Lighter RTS categories have lower mortality rates, while heavier ones have higher rates. RTS's effectiveness in predicting head injury death needs further study.

Introduction

A head injury is a highly traumatic event. Every year, 1.4 million Americans suffer from brain injuries. Of the total injuries, about 50,000 of them died and more than 235,000 went to hospitals for treatment. The majority of injuries caused by falls (28%), followed by motor vehicle collisions and blunt and penetrating injuries (Naiduch, D., 2014).

The Central Statistics Agency (BPS) reported 98.4% of traffic accidents. Highway accidents have varied over the past decade (BPS, 2015). Based on the 2018 Basic Health Survey, the highest number of accidents occurred on the highway, which was 44.7%. Motorcycle accidents cause injuries in 72.4% of cases (Ministry of Health of the Republic of Indonesia, 2018).

The WHO says head injuries are the leading cause of disability and death in people under 45 (Lagarde, 2019). One brain injury occurs every 7 seconds and one brain injury every 5 minutes. Head injuries from car accidents kill 18.2 million per 100,000 worldwide (WHO, 2018; Marbun et al., 2020). According to Irawan et al. (2010) reported that head injuries account for 27% of all traffic injuries in Indonesia. Tjahjad et al. (2013) found that 6-12% of brain injuries in Indonesia are serious injuries, with a mortality rate of 25-37% (Ristano *et al.,* 2016).

RTS to measure the severity of injuries and risk of death. This helps in providing prompt and appropriate care and management during emergencies, especially in emergency rooms (Salim, 2015). According to Fedakar, Aydiner, & Ercan 2007, RTS can predict death in more than

97% of patients without therapy. Khayat, Sharifipoor, and Rezaei (2014) found that RTS is a complete tool for physiological assessment of pre-hospital trauma patients. Various research has confirmed the reliability of the trauma score in accurately predicting the consequences of an accident. This measure predicts the death of trauma patients and helps treat and manage individual trauma cases. Didik Saud and Mukamad Rajin (2020) identified the relationship between *Revised Trauma Score* (RTS) and death in trauma patients within 24 hours of hospitalization. The study revealed that a large number of deaths were associated with low RTS values. Among 62 patients, the sensitivity was 88% and the mortality rate was 90%. Ristanto et al. (2016) found that RTS can reliably predict 97% of deaths without treatment. In addition, RTS has an accuracy of 76.9% in identifying life-threatening diseases. Research conducted by Ranti et al., 2016 revealed that the RTS scores of all investigation participants varied between 5.148 to 7.8408, with a threshold value of 5.88. There were four deaths that exceeded this threshold, resulting in a mortality rate of 86%. The data presented is in line with the findings of Kondo et al. (2011), who reported a mortality rate of 81.92% in those who had an RTS score between 5 and 6. RTS is an easy and practical assessment system for assessing physiological status. This is particularly useful in pre-hospital settings and field triage, as it can be easily administered by physicians and paramedics. Based on the findings of this study, RTS has been established as an assessment benchmark in the ATLS protocol (Jennings P, 2004). Respiratory rate, systolic blood pressure, and *Glasgow Coma Scale* (GCS) may change depending on the severity and treatment of the injury. Therefore, this data can be used as a pre-hospital assessment and triage tool. RTS can also be utilized. This assessment is used during the evaluation of patients who are still undergoing therapy, although this term includes routine checkups and not single checkups. After initial testing at the dr Saiful Anwar Malang Emergency Installation (IGD) Hospital, 225 head injuries were found in three months. Patients can have mild, moderate, or severe brain damage. Some patients are admitted to intensive and non-intensive care wards. The emergency unit and inpatient room at Dr. Saiful Anwar Hospital, Malang, saw several head injury patients survive and several people died. During that period there were 10 cases of patients who died. Some individuals who died experienced head trauma of varying degrees, ranging from mild to severe, which is indicated by the RTS value when arriving at the emergency room. The researchers aimed to determine the potential correlation between RTS and mortality in head injury patients at dr. Saiful Anwar Hospital Malang.

Methods

This study uses correlation analysis techniques with *cross-sectional* and observational methodologies. In *cross-sectional* research, researchers collect data by observing or measuring variables at a certain point in time. This implies each subject is examined once and the topic variables are measured. *Cross-sectional* studies do not track measurements at follow-up (I Made Adiputra, et al., 2021). While *observational* research, research is carried out by observing and recording characteristics or phenomena. Researchers refrain from making any intervention on the research variables. The data obtained only consists of pre-existing data and advanced data generated without the involvement of researchers (Febri Endra, 2017).

This study was conducted with the aim of determining whether there is a correlation between *the Revised Trauma Score* (RTS) and the mortality rate among patients who suffer from head injuries at Dr. Saiful Anwar Hospital Malang. A *cross-sectional study* was conducted to collect data on RTS and mortality status of patients in the Emergency Department. Meanwhile, observational research was carried out in collecting mortality status data in the inpatient room.

The researcher uses secondary data as his research instrument. The researchers used observation sheets and medical records of the emergency unit from the dr. Saiful Anwar Malang Hospital to collect data secondary. Medical record number, date, age, gender, etiology, diagnosis, severity of injury assessed using GCS, SBP, RR, and death status are used. In collecting data on the status of death, researchers take from observation sheets or medical records or daily censuses in inpatient rooms and emergency departments. This research was conducted at dr. Saiful Anwar Malang Emergency Unit or treatment room. The research was conducted between June 1 and September 5, 2023.

Data analysis used in this study are: Univariate Analysis (Descriptive) and Bivariate Analysis. Univariate analysis aims to explain or describe the characteristics of each research variable, usually this analysis only produces a frequency distribution and percentage of each variable (Lapau, 2015:116). In this study, the univariate analysis was carried out, namely data on age, gender, etiology, type of injury, RTS score and mortality rate. All data on age, gender, etiology, type of head injury, mortality rate and RTS score are presented using a frequency distribution.

Bivariate analysis in this study is to determine the effect of two variables including independent variables and dependent variables, in this study bivariate analysis is used to determine the relationship between Revised Trauma Score (RTS) and mortality rates in head injury patients. The researcher first conducted a normality test whether the data was normally distributed or not normally distributed with the Kolmogorov Smirnov test. Because the data distribution was not normal, the statistical test used by the researcher was the Spearman's Rank test. The test criteria used are as follows. If p-value <0.05, then H0 is rejected If p-value> 0.05, then H0 is accepted.

Revised *Trauma Score* (RTS) data and mortality status will be obtained from the patient's observation sheet or medical record and/or daily census. This study included 225 patients in the head injury emergency room at dr. Saiful Anwar Hospital Malang. This study examines the DR. Saiful Anwar Emergency Hospital for Head Injury Patients. This study used the Slovin formula to determine the sample size of the population:

$$n = \frac{N}{1 + N.e2}$$

$$n = \frac{225}{1 + 225.(0,1)^2}$$

$$n = 69.23$$

$$n = 70$$

Information:
n = Number of samples
N = Total Population
e = the desired critical value (error limit) is 10%

Researchers will collect a total of 70 samples from head injury patients.

This study will use *incidental sampling* or *convenience sampling*. This technique involves selecting individuals who happen to meet researchers by chance and are considered suitable as data sources (Sugiyono, 2001 quoted from I Made Adiputra, et al., 2021). The researcher collected data by modifying the criteria for including or excluding patients, which had been established based on the observation and medical records of head injury patients in the Emergency Department.

Inclusion and Exclusion Criteria

1. Inclusion Criteria
   a. Patients with head injury problems were treated at the emergency room of dr. Saiful Anwar Malang Hospital.
   b. Head injury patients who were assessed by RTS.
2. Exclusion Criteria

a. Head injury patients who died before arriving at the Emergency Department (*Death On Arrival*/DOA).
b. A head injury patient who comes with *a fast track groove.*
c. Head injury patients who go home on their own request (PAPS).

RESEARCH RESULTS AND DATA ANALYSIS

The results of the research are presented in three parts, namely general data, special data, and analysis test results.

General Data

The general data collected in this study included age, gender, etiology, and type of injury in individuals with head injuries.

Table 1 Distribution of Respondent Frequency by Age, Gender, Etiology, Type of Injury in Head Injury Patients

Respondent Characteristics	**Frequency**	**Percentage**
Age		
6-16 year	10	14,3%
17-27 year	27	38,6%
28-38 year	6	8,6%
39-49 year	13	18,6%
50-60 year	8	11,4%
61-71 year	4	5,7%
72-82 year	2	2,9%
Gender		
Man	60	85,7%
Woman	10	14,3%
Etiology of Head Injury		
Traffic accident	63	90%
Non-traffic accidents	7	10%
Types of Head Injuries		
Mild Head Injury	33	47,15%
Moderate Head Injury	18	25,71%
Severe Head Injury	19	27,14%

From the data in table 1 based on age, almost half of the 27 respondents (38.6%) were aged 17-27 years. Based on gender, the majority of respondents (85.7%) were male. Most respondents (90%) have suffered head injuries due to car accidents. Almost half (47.15%) have a minor head injury (CKR).

Special Data

The specific data analyzed in this study consisted of *Revised Trauma Score* (RTS) and the death rate of head injury patients in the Emergency Department of dr. Saiful Anwar Hospital.

Table 2 Distribution of Respondent Frequency Based on Revised Trauma Score (RTS) Category

RTS Category	Frequency	Percentage
Light (11 – 12)	46	65,7%
Medium (8 – 10)	13	18,6%
Heavy (6 – 7)	1	1,4%
Serious (<6)	10	14,3%

Table 2 shows that most of the 46 respondents (65.7%) who suffered a head injury with a mild RTS category (11 – 12).

Table 3 Distribution of Respondent Frequency Based on Mortality Rate

Types of Head Injuries	Mortality Rate			Total
	Live	Died (>24-72 Hours)	Died (<24 Hours)	
Mild Head Injury	33	0	0	33
Moderate Head Injury	18	0	0	18
Severe Head Injury	6	5	8	19
Total	57	5	8	70
Percentage	81,43 %	7,14%	11,43 %	

From table 3, it can be seen that mortality in head injury patients was obtained almost entirely 57 respondents (81.43%) who were alive.

Test Analysis

Normality Test of Revised Trauma Score (RTS) Data Distribution Using Kolmogrov Smirnov Test

Table 4 Results of the Test of Normality of RTS Data Distribution

Variabel	Statistik	df	*Sig.*
RTS	0,384	70	,000

The normality test in Table 4 shows that the significance value of the RTS variable (Sig.) is 0.000, less than 0.050. Thus, the distribution of data of RTS variables is abnormal.

Normality Test of Mortality Rate Data Distribution Using Kolmogrov Smirnov Test

Table 5 Results of the Normality Test of the Distribution of Mortality Rate Data

Variabel	Statistik	df	*Sig.*
Angka Mortalitas	0,488	70	,000

Based on the results of the normality test in table 5, data was obtained that the significance value (Sig.) for the mortality rate variable was 0.000<0.050. So it can be concluded that the distribution of data on the mortality rate variable is not normal.

The Relationship between RTS and Mortality Rate in Head Injury Patients

Table 6 *Cross* Tabulation of RTS with Mortality Rates

RTS		Mortality Rate			Total
		Live	Died (>24-72 Hours)	Died (<24 Hours)	
Category	Light (11 – 12)	45	1	0	46
	Medium (8 – 10)	12	1	0	13
	Heavy (6 – 7)	0	1	0	1
	Serious (<6)	0	2	8	10
Total		57	5	8	70
p *Value*		0,000			
Correlation coefficient (r)		0,725			

This study used the *Spearman's Rank correlation test* for bivariate analysis because the data were not normal. A normal test p-value of 0.000 indicates this. Table 6 shows a significant relationship between head injury mortality rates and RTS. The statistics show a p value of 0.000, indicating a strong link. Furthermore, the correlation coefficient of 0.725 indicates a strong relationship. According to the data of 46 respondents in the light RTS category, there are 45 respondents alive and 1 respondent died (>24-72 hours). 13 respondents were in the medium RTS category, there were 12 respondents alive and 1 respondents died (>24-72 hours). 1 respondent was categorized as severe RTS and died (>24-72 hours). 10 respondents were categorized as serious RTS, there were 2 respondents who died (>24-72 hours) and 8 respondents who died (<24 hours). The coefficient of the relationship between variables is in line with a positive value, showing that the lighter the RTS category, the mortality rate decreases and vice versa, the more severe the RTS category, the mortality rate increases. So it can be concluded that H0 is rejected and H_1 is accepted.

DISCUSSION

Interpretation result The research was contrasted with the literature evaluation and other research results described earlier. The researcher elaborates this discussion in a structured manner based on the research objectives.

RTS Levels in Head Injury Patients at Dr. Saiful Anwar Hospital Malang

Based on the findings of the analysis, most of the 46 respondents (65.7%) who arrived at the emergency room of dr. Saiful Anwar Malang Hospital experienced a head injury with a mild RTS category (11 – 12). A small number of 13 respondents (18.6%) had a head injury with a moderate RTS category (8-10), a small number of 10 respondents (14.3%) had a head injury with a serious RTS category (<6) and a small number of 1 respondent (1.4%) had a head injury with a severe RTS category (6-7). Of the 70 respondents who suffered head injuries, almost all of them 63 respondents (90%) were caused by traffic accidents. The respondents who suffered head injuries were almost all 60 respondents (85.7%) were male.

This study supports the findings of Mapgressuka 2019 that head injury patients have an RTS (*Revised Trauma Score*) of 11, which is 85.4% of the mild group. In a separate investigation conducted by Saudin (2017), similar findings were observed in 95% of individuals with head injuries who had RTS scores ranging from 11 to 12, indicating moderate severity. Although the RTS 11 value indicates a change in a physiological parameter, the change that occurs in the value is known to be insignificant so it is classified as mild and stable. According to the research of Song (2016), Hsu (2018), Siahaya et al., 2020, the high frequency of head injuries in men is caused because men are mostly outside every day and do a lot of physical activity and work. Men are more likely to exhibit deviant behaviors related to vehicle speed and violation of regulations while driving (Wahjoepramono, Rawis LM, and Song (2016)).

The age group most often affected by head trauma is individuals between the ages of 17 and 27. Faulin et al. found that adolescents and young adults had the highest incidence. Additional studies show that adolescents are the demographic group most often affected by head trauma. This can be due to the adolescent's reduced attention while driving, as they are still in the exploration stage to engage in new experiences.

WHO in Rawis et al., 2016 showed that traffic accidents are the main cause. Traffic accidents account for at least 40-50% of head injuries worldwide, according to the study. Most hospital headaches are caused by accidents. Putra research (2019) found that the majority of brain injuries due to traffic accidents amounted to 153 people or reached 82.2% of the total.

The researcher's assumption suggests that RTS is used as a physiological injury assessment system on an ordinal scale. The *Revised Trauma Score* (RTS) assessment, which is primarily used as a physiological assessment technique, allows doctors and nurses to evaluate clinical treatments and changes. The RTS integrates *Glasgow Coma Scale* (GCS) measurements with respiratory rate (RR) and systolic blood pressure. These three variables are partitioned into several intervals and the yield values range from 0 to 12. Larger levels indicate superior physiological conditions. The end result is a score of 0-12 which signifies a high severity.

Mortality Rate of Head Injury Patients in the Emergency Room of Dr. Saiful Anwar Hospital Malang

In this study, the mortality rate in patients with head injuries with the life category dominated from the other two mortality categories. The number of mortality with the living category was almost entirely 57 respondents (81.43%), while the mortality rate (<24 hours) was a small part of 8 respondents (11.43%) and a small part of 5 respondents (7.14%) as the number of mortality (>24-72 hours). Mortality with the life category of patients consisted of 33 CKR patients, 18 CKS patients, 6 CKB patients. Meanwhile, the mortality rate (<24 hours) is entirely 8 patients with CKB. And the mortality rate (>24-72 hours) was 5 respondents with CKB. About half of the 70 victims of head injuries, 33 (47.15%) had minor head injuries. Korea Song's research found that 65.7% of head injuries are minor. Lahdiawan et al. at Ulin Hospital Banjarmasin and Bhuwana Putra at Umbu Rara Meha Hospital Waingapu found that minor head injuries accounted for 47 (64.4%) and 126 (67.7%) of all head injuries.

In this study, the number of mortality in the life category was almost entirely 57 respondents (81.43%). Research conducted by Mapgressuka in 2019 showed that of 48 patients with head trauma, 6 patients (12.5%)

died and 42 patients (87.5%) survived. A study conducted by Maulida et al., 2019 revealed that among individuals who had Respiratory Tract Infections (ISPA), 5 people (5.6%) succumbed to death, while 76 people (85.4%) did not experience death. Meanwhile, as many as 1 respondent (1.1%) who were included in the serious category experienced death. Patients with head injuries in the severe category experienced death as many as 12 respondents (13.5%).

The mortality rate in head injury patients is greatly influenced by the type of head injury and the severity of the head trauma experienced. In addition, it is also influenced by fast, precise, and sustainable handling. The faster, more precise, and more sustainable, the mortality rate of head injury patients can be suppressed. The extent and nature of the damage, as well as the spread of the level The severity is the factors that affect this. It should be noted that most head injuries are relatively mild. This is because a large number of individuals only face head trauma that ranges from moderate to severe. Patients with head injuries receive effective initial medical assistance and immediate referral (Mustahfiroh, 2018). In addition, the patient did not suffer from comorbid injuries. Research (Ristano 2017) states that non-referral clients dominate surviving head trauma patients, this is possible due to the large number of clients.

The Relationship between RTS and Mortality Rate in Head Injury Patients

This section provides a brief overview of the findings from the analysis conducted on the correlation between RTS and mortality in patients with head injuries. Bivariate analysis revealed a statistically significant correlation between RTS variables and patient mortality rates with head injuries. A p value of 0.000 shows a high correlation with a coefficient value of 0.725. The coefficient of the relationship between variables is in line with a positive value, showing that the lighter the RTS category, the mortality rate decreases and vice versa, the more severe the RTS category, the mortality rate increases.

Findings research this revealed that 65.7% of the 46 participants reported moderate head trauma falling within the range of RTS 11-12, and 1 respondent died (>24 – 72 hours). A small number of 13 respondents (18.6%) had a head injury with a moderate RTS category (8 – 10), and 1 respondent died (>24 – 72 hours). A small number of 10 respondents (14.3%) had a head injury with a serious RTS category (<6), and 8 respondents died (<24 hours) and 2 respondents died (>24 – 72 hours). A small number of 1 respondent (1.4%) had a head injury with severe RTS (6-7) and 1 respondent died (>24 – 72 hours).

The Revised Trauma Score (RTS) is associated with death due to its consideration of three main parameters that impact the patient's condition: Glasgow coma scale (GCS), respiratory rate, and systolic blood pressure. Irwan's (2016) study highlighted a critical series of systolic blood pressure for trauma patients, which must be maintained between 90-110 mmHg. Hypotension can also lead to mortality. Changes in respiratory rate decrease blood oxygen saturation, which then also decreases tissue perfusion. Insufficient perfusion of brain tissue can worsen head injuries and improve the prognosis. Greater perfusion of oxygen to the brain is associated with an improved prognosis in patients with head injuries (Safrizal et al., 2013).

The study supports the concept that *the Revised Trauma Score* (RTS) is substantially associated with death, making it a useful prognostic indicator for head trauma patients. Each component of the RTS helps determine tissue oxygenation and blood flow modulation (Ristano et al., 2017). Prediction of head trauma mortality can be standardized on RTS. RTS assessment allows for the evaluation of the physiological state of individuals with head trauma in order to establish appropriate interventions, such as therapy and medicine, for their recovery.

Some research has shown that *Revised Trauma Score* (RTS) can predict the emergency room mortality rate of trauma patients, this is

Because RTS has universal application in pre-hospital care and provides proactive convenience for trauma patients to the hospital emergency room. The findings of the research by Saudin and Rajin (2020) provide evidence that there is a well-known and favorable correlation between RTS and the mortality rate of trauma patients in the initial period of 24-hour hospital care, this is illustrated by the results of previous studies, namely most deaths of patients who suffer from trauma can be seen from the RTS score, trauma patients with poor RTS scores are very sensitive (88% to 90%) experience death, The study also stated that RTS is considered a significant predictor of morbidity and mortality rates in assessing the mortality rate of patients with trauma.

Based on the functions and uses of RTS that have been found in the study, RTS has a better function if it is used in the triage of trauma patients and as a primary predictor of mortality of these patients (patients who have experienced trauma) and will be more optimal when combined with other triage tools, this is due to the nature of RTS which can classify trauma patients by predicting their mortality, especially in the Emergency Department as one of the efforts to prioritize emergency care. The results of other studies show things that are not much different from the results of the above studies such as the results of the research of Ristanto, Zakaria & Nurmayunita (2017) which stated that RTS can be used as a model of mortality prognosis for patients with head trauma, This is feasible because the RTS system plays an important role in showing the normality of the regulatory function of oxygenation and perfusion.

Ristanto's research found that RTS also affects head injury deaths. These findings align with Champion's research, which shows that RTS shows a 77% ability to detect life-threatening diseases. The RTS assessment also revealed more than 97% of people would die without medical assistance. The utilization of RTS showed a statistically significant correlation by predicting premature mortality in patients undergoing treatment in high-acuity units or intensive care units.

The perfection of the application of RTS in predicting mortality of trauma patients is related to several factors, namely blood pressure, GCS and RR. Based on the results of surveys that have been carried out, several factors related to the perfection of the implementation of RTS are the most dominant related to the mortality of trauma patients with RTS assessment is the GCS value. Based on some of the studies above, it shows positive results on the application of RTS in predicting mortality of trauma patients both in the inpatient room and as a predictor of mortality in triage, but some studies say that RTS is better used as a predictor of mortality in triage because if it can be used as a first step in efforts to determine the next treatment in trauma patients, So that it can minimize the possibility of the death of patients with trauma.

Research Limitations

The research has limitations, including that there are cases of multiple trauma such as thorax trauma, abdominal trauma, limb trauma and a history of previous diseases that affect the results of RTS. Which in this study is not included in the inclusion criteria or exclusion criteria.

CONCLUSIONS AND SUGGESTIONS

Conclusion

In head injury patients at dr. Saiful Anwar Malang Hospital, the majority of respondents were classified as having a Revised *Trauma Score* (RTS) level, ranging from 11 to 12. Most of the head injury patients at DR. Saiful Anwar Hospital Malang survived. And there is a significant and strong relationship between *the Revised Trauma Score* (RTS) and the mortality rate in head injury patients at dr. Saiful Anwar Malang Hospital.

Suggestion

For Researchers, future studies should examine other factors that influence head injury deaths, such as some trauma and disease history. It is also hoped that further researchers will research how effective RTS is in assessing the mortality rate of head injury patients. And It is recommended for nurses to further improve the response in assessing the severity of head injury patients so that trauma management is more effective. While for Research Sites, It is hoped that the research site will be able to adopt and optimize the system to assess the severity of trauma patients using RTS or TRISS, or a more effective assessment system to be used in head injury patients in the emergency room at Dr. Saiful Anwar Hospital Malang Both systems are intended to be used in the treatment of patients suffering from head injuries.

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