Adjustment of Trauma and Injury Severity Sccore (TRISS) and Revised Trauma Score (RTS) in Predicting Mortality of Multitraumapatients in Sanglah Hospital Bali

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The Trauma and Injury Severity Score (TRISS) is the most applied tool to predict the multi trauma outcome. It is shown that the predictive value of TRISS could be improved by adjusting the coefficient. Originally this study aims to evaluate our hospital in treating multitrauma patients, with good outcome we propose adjustment to TRISS formula. This study is a diagnostic test to determine the accuracy of TRISS scores to predict mortality of multitrauma patients treated in Sanglah General Hospital. Fifty two multitrauma patients with ISS score > 18 with at least 2 body regions being injured. The TRISS diagnostic test was obtained with a sevsitivity 81.8%, specificity 97.6%, positive predictive value 90%, negative predictive value 95.2%, prevalence 21%, accuracy rate of 94.2%. Adjustment to TRISS formula coefficient for better prediction is proposed. Physiological parameter in RTS that does not include respiratory rate shows reliable prediction, which can be used in emergency setting when anatomical diagnostic has not yet to be obtained.

Keywords: Multi Trauma; RTS; TRISS; Revised Score.

The Trauma and Injury Severity Score (TRISS) is the most widely used tool to predict the outcome of trauma patients. Initially TRISS was made in 1983 using a combination of the patient's age, Injury Severity Score (ISS), and Revised Trauma Score (RTS) to predict the probability of patient safety. The TRISS coefficient was measured using an ordinary logistic regression model in 1987, and was revised in 1995 by American College of Surgeons Committee on Trauma Coordinated Major Trauma Outcome Study (MTOS).1,2In 2010, TRISS coefficients were further revised using data obtained from the American College of Surgeons Committee on the Trauma National Trauma Data Bank (NTDB) and NTDB National Sample Project (NSP).[1,2,3]

TRISS system combines injury assessments based on physiological (RTS) and anatomical (ISS) status, with age and trauma mechanism (blunt or penetrating) to calculate the safety probabilities of each individual patient. TRISS has the best prediction rate for patients with multiple injuries due to blunt trauma. The TRISS methodology is currently used as a standard for adjusting performance standards in America, and has been widely accepted in many parts of the world.[4,5]

Since it was first implemented, many attempts have been made to improve TRISS through recalibration of the coefficients, careful consideration and inclusion of missing data, or through new or specifically modified variables. Recently it has been demonstrated that an important and fundamental development in predicting the power of TRISS is to make a simple re-classification of variable components and treat variable categories nominally in the logistic regression model.[1,6]

METHODS

This is diagnostic research that underwent from June 2018 to December 2019 in Sanglah General Hospital. Ethical approval was granted by Udayana University Medicine Faculty / Sanglah Hospital's Research Ethical Comitee, without informed consent needed.

The inclusion criteria is multi-trauma patients who suffered injuries on two body regions or more with AIS score of each = 3 in.7 The exclusion criteria are patients with comorbid that can affecting outcome, i.e chronic heart failure, diabetes mellitus, chronic obstructive pulmonary disease, chronic kidney disease. The TRISS score obtained was divided into two categories, where the probability of survival = 33.3% were included in the deceased category, and the probability of survival > 33.3% was included in the survivors category.[8,9] All patients received therapy according to protocol standards.

We collected data comprised of patient characteristic, age, gender, prehospital time, mechanism of injury, trauma type, hospital length of stay, Glasgow Coma Scale (GCS) score, systolic, and respiratory rate. The patients were followed-up through their stay in the hospital and the final outcomes were noted, either patients have deceased or survive. Data analysis was undertaken in SPSS version[23].

RESULTS

There were 52 multi-trauma patients admitted to Sanglah Hospital during the study period (Table 1). The mean age of patients was 32.4 years, with 94.2% of them aged <55 years. The ratio of male to female was 7.6:1. Fifty-one patients experienced a blunt trauma injury, of which 85% were traffic accidents, while only one patient had a penetrating injury due to a knife stab. The head and neck were the organs most frequently injured, which were found in 35 patients (67.3%), followed with extremities (50%), face (48.1%), external (40.4%), thorax (38.5%), and abdomen (28.8%). The observed mortality rate was 21.2% (11 cases), with a predicted mortality rate of 19.2% (10 patients)

By using a 33.3% cut-off point, 9 patients were predicted to die, of which 11 were deceased, with a sensitivity of 81.8% and a specificity of 97.6%. PPV was obtained at 90%, and NPV 95.2%, Accuracy Rate was 94.2% with the prevalence of death among multitrauma patients at 21% (Table 2).

ROC analysis shows that the area under the ROC curve is 0.897±0.071 (95% confidence interval= 0.758-1.000). An optimal cut-off point analysis has been done to get the best sensitivity and specificity values where the optimal value is between 43.7%-31.05% (Figure 1).

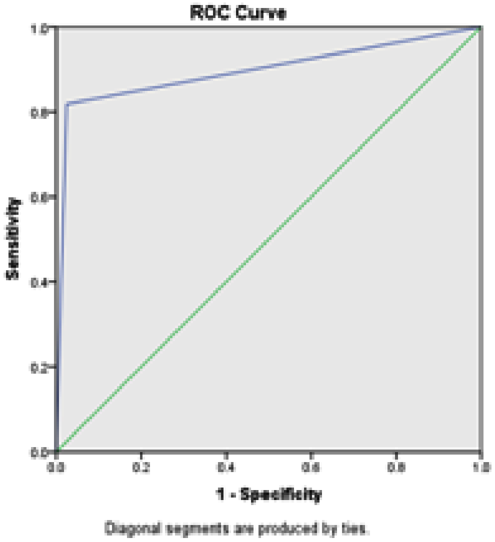

Fig. 1. ROC analysis shows that the area

In this study with a specificity of 97.6%, it can be obtained an equation to determine the mortality rate of multitrauma patients:

Mortality =- 0.717 + (-0,046 x RR) + (0,380 x Sys) + (0,297xGCS) + (-0,45xISS) + (0,038 x Age) + (0,069 x Trauma Type)

Where RR, Sys, and GCS are used are categories according to the RTS scoring system. Age <55 years = 1, and age = 55 years = 2. Blunt injury = 1, and penetrating injury = 2.

Another simplerRTS equation (without respiratory rate) also obtained for faster tools in triage setting :

Mortality = -0.659 + (0,35 x Sys) + (0,255 x GCS)

Table 1. Epidemiology and clinical data

Variable	Deceased	Survivors	Total	p-value
Age (years), n(%)				
< 55	10 (20.4%)	39 (79.6%)	49 (94.2%)	0.518
≥ 55	1 (33.3%)	2 (66.7%)	3 (5.8%)	
Gender, n(%)				
Male	8 (17.4%)	38 (82.6%)	46 (86.5%)	0.101
Female	3 (50%)	3 (50%)	6 (13.5%)	
Mechanism of injury, n(%)				
Traffic accident	10 (22.2%)	35 (77.8%)	45 (86.5%)	0.5
Fall from heights	1 (20%)	4 (80%)	5 (9.6%)	
Natural disaster	-	1 (100%)	1 (1.9%)	
Criminal	-	1 (100%)	1 (1.9%)	
Trauma Type, n(%)				
Blunt	11 (21.5%)	40 (88.5%)	51 (98%)	1
Penetrating	-	1 (100%)	1 (2%)	
Prehospital Time, n(%)				
< 1 hour	2 (25%)	6 (75%)	8 (15.4%)	0.873
1-3 hours	5 (20%)	20 (80%)	25 (48.1%)	
> 3 hours	4 (21%)	15 (79%)	19 (36.5%)	
Hospital length of stay (days), mean±SD	3.27 (SD 3.3)	14 (SD 9.6)	11.57 (SD 9.7)	
Systolic , n(%)				
>89	6 (14.2%)	36 (85.8%)	42 (80.7%)	0.06
76-89	4 (44.4%)	5 (55.6%)	9 (17.3%)	
50-75	1 (100%)	-	1 (1.9%)	
1-49	-	-	-	
0	-	-	-	
Respiratory Rate				
10-29	4 (9.7%)	37 (80.3%)	41 (78.8%)	<0.001
>29	-	3 (100%)	3 (5.7%)	
6-9	2 (66.7%)	1 (33.3%)	3 (5.7%)	
1-5	3 (100%)	-	3 (5.7%)	
0	2 (100%)	-	2 (3.8%)	
GCS				
15-13	2 (6.1%)	31 (93.9%)	33 (63.5%)	<0.001
12-9	-	9 (100%)	9 (17.3%)	
8-6	3 (75%)	1 (25%)	4 (7.7%)	
5-4	2 (100%)	-	2 (3.8%)	
3	4 (100%)	-	4 (7.7%)	

Table 2. A 2x2 table of diagnostic values of the TRISS

TRISS	Actual outcome		
	Deceased	Survivors	Total
Deceased (≤33.3)	9	1	10
Survivors (>33.3)	2	40	42
Total	11	41	52

DISCUSSION

One of the problems with the multi trauma approach is that the profile of the patient varies with the type and severity of the injury. The heterogeneity and difficulty of adjusting for these variations have stimulated scientific research.[8]

A diagnostic test of TRISS score with a sample size of 52 was performed, at a cut-off point of 33.3%, a sensitivity of 81.8% was obtained, and specificity 97.6%, PPV 90% and NPV 95.2%, Prevalence 21%, Accuracy Rate 94.2%. In accordance with research by Gunawanet al at CiptoMangunKusumo Hospital, the sensitivity was 84.6% and 81.8% using an intersection point <90.5%.10,11 The outcome evaluation based on TRISS by Siritongtaworn, obtained a sensitivity of 90.9%, and a specificity of 97.2% with a cut-off point of 95%. Gorelik et al stated that in Florida there were no significant differences in trauma patient deaths between before and after the initiation of a surgical education program.[12,13,14] So it can be concluded that Sanglah Hospital as an Educational Hospital in providing health services does not reduce the quality of services provided.

RTS was obtained from a combination of 3 categories, the Glasgow Coma Scale (GCS), systolic blood pressure, and respiratory rate, which RTS calculation was obtained with an average of 6.86 (with a deviation of 1.49), ranging from 2,198-7,841. The mean RTS in died patients was 4.56 ± 1.63, and in living patients was 7.48 ± 0.57. Ranti et al stated that the cut-off point used by RTS was 5.88, where the mortality rate in the RTS 5-6 range was 81.92%.15In this study we found that RTS <5 had a mortality of 100%. The weakness of this RTS score is that it does not take into account prehospital time, where patients who experiencing shock in a shorter time will certainly have a worse prognosis than patients with longerprehospital time but the hemodynamic conditions just shows symptoms of shock recently.[16,17] According to Dinhet al patients with prehospital time which in the Golden hour (less than 1 hour) there were no significant advantages compared to patients who came with prehospital time more than 1 hour.[18] Tien et al reported that patients with head injuries showed good results in patients who came at the golden hour.[19] Osterwalderet al reported no difference in mortality in patients who present with a prehospital time of less than 1 hour or more.[20] RTS is a good scoring tool in predicting mortality in multitrauma patients.

Uncontrolled bleeding is the main cause in multitrauma which is the cause of prehospital death up to 35%. Systolic blood pressure <90 mmHg has been generally accepted as a limit for hypotension. But lately this concept has been controversial, where systolic blood pressure 90-109 mmHg in trauma patients or in the operating theatreshows worse outcomes than systolic blood pressure> 110 mmHg.[21]

Among the vital signs in RTS, the respiratory rate is still debatable. Respiratory rate has the lowest weight in RTS calculation compared to systolic and GCS, and is measured clinically which has low reproductive rate. Respiratory rate also has a very wide normal range, moreover respiratory rate does not correlate with ventilation and / or oxygenation disorder in trauma patients, which are often caused by pain and pyschological stress.[22,23]

We found 8 patients with an ISS score = 50 where the mortality rate was 50%. This is in accordance with research from Boyd et al where the ISS 50 value gives a mortality rate of 50%. The most common organs injured were head and neck at 67.3%, followed by extremities (50%), face (48.1%), external (40.4%), thorax (38.5%), and abdomen (28.8%). The injured body region has a distribution similar to other studies, where the head is the organ most frequently injured, followed by the extremity.[24,25] In this study, head injuries with AIS score 5is the cause of death of most multiple trauma patients. The weakness of the ISS scoring system is accurate information on the injured organ has to be known, which is often only obtained when the patient has undergone further investigations such as a CT scan or even during surgery; especially in the abdominal and thoracic organs; so the ISS scoring system is not appropriate when applied in the ED.[23]

CONCLUSION

Adjustment to TRISS formula coefficient might be considered. Physiological parameter in RTS that does not include respiratory rate shows reliable prediction which can be used in emergency setting which anatomical diagnostic not yet obtained.

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