Original Article

Correlation of Coagulopathy of Trauma and Revised Trauma Score in Predicting Outcome in Trauma Patients

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Abstract

Background: Trauma is a major worldwide public health problem. It is one of the leading causes of death and disability in both industrialized and developing countries. Coagulopathy is present immediately at admission in 25% of trauma patients and is associated with a 5-fold increase in mortality. The Revised Trauma Score (RTS) is a physiological scoring system, with high inter-rater reliability and demonstrated accuracy in predicting death. The purpose of this study was to correlate coagulopathy of trauma and RTS in predicting outcome in trauma patients.

Methods: In this prospective study, 75 traumatic patients were studied over a period of one year (May 2010 to April 2011) in The Department of Surgery, Tribhuvan University Teaching Hospital, Kathmandu, Nepal.Patients were evaluated on arrival in emergency room (ER) and data was collected on patients' demography,time from injury to arrival in ER, fluid administered before referral,vital signs,GCS and RTS was calculated.Coagulation profile was determined by measuring prothombin time(PT) and activated partial thromboplastin time(aPTT).

Results: Of 75 patients studied, 84%(63) were male and 16%(12) were female with 47%(35) in the 21-40 year age group.Road traffic accident was most common type of injury(60%) followed by fall from height (29%).The median time after injury was 8 hours and fluid administration before referral was 1000ml. Traumatic coagulopathy was present in 24%(18) of patients and mortality was 16%(12). Coagulopathy was significantly associated with time of presentation in ER following injury (P=0.01),GCS(P=0.012), SBP(P<0.001), respiratory rate(P=0.001), RTS(P<0.001),PT(P<0.001),aPTT(P<0.001).But there was no significant association of coagulopathy with amount of fluid received at scene (P=0.886) and age of the patient(P= 0.617).There was negative linear correlation between RTS and PT (r =-.623) and aPTT (r =-.596).

Conclusion: There is clinically significant traumatic coagulopathy which correlates with RTS and it has effect on poor outcome in traumatic patients.

Key Words: Trauma, Coagulopathy, Revised Trauma Score (RTS), Outcome

Introduction

Trauma is a major worldwide public health problem. It is one of the leading causes of death and disability in both industrialized and developing countries. Globally, injury is the seventh leading cause of death, with 5.8 million deaths attributable to trauma in 2006. Injury fatalities, however, represent only a small fraction of the scope of injury.[1]

Disabilities due to violence and injuries are increasing in Nepaldue to increasing population,rapid urbanization, industrialization, migration and changing of the lifestyles. Injuries account for about 8% of death in Nepal.[2] But injuries, disabilities and deaths are not

always systematically recorded or used for the purpose of prevention. There is no systematic surveillance system in place. In Nepal, road traffic accident (RTA) is more common in urban region. RTA is the major cause of injuries and disabilities including occupational injuries, burns, violence, falls and drowning.In Nepal as per estimates of morbidity and mortality for 1998-1999, injury contributed 9% to total mortality and was the third leading cause, with road accidents occupying the eighth position in the overall ranking. Fifty eight per cent of the injuries occurred in the 15-44 years age group with the male to female ratio of 3:1.[3]

Coagulopathy is present immediately at admission in 25% of trauma patients and is associated with a 5-fold increase in mortality.[4]Accepted causes of traumatic coagulopathy are consumption of clotting factors, acidosis and hypothermia leading to reduced activity, and dilution from intravenous fluids and packed cell administration. However traumatic coagulopathy is present early in the post-injury phase, before fluid administration and in normothermic patients.[4] Further, while acidosis per se affects coagulation protease function, clot time and maximum clot firmness are only impaired at very low pH (<6.8).[5]

Revised Trauma Score

The Revised Trauma Score (RTS) is a physiological scoring system, with high inter-rater reliability and demonstrated accuracy in predicting death. It is scored from the first set of data obtained on the patient, and consists of Glasgow Coma Scale, Systolic Blood Pressure and Respiratory Rate.

Table 1 : Revised Trauma Score (RTS)

Glassgow Coma Scale(GCS)	Systolic Blood Pressure(SBP)	Respiratory Rate(RR)	Coded value
13-15	>89	10-29	4
9-12	76-89	>29	3
6-8	50-75	6-9	2
4-5	1-49	1-5	1
3	0	0	0

RTS = 0.9368 GCS + 0.7326 SBP + 0.2908 RR

Values for the RTS are in the range 0 to 7.8408. The RTS is heavily weighted towards the Glasgow Coma Scale to compensate for major head injury without multisystem injury or major physiological changes. A RTS of < 4 has been proposed to identify those patients who should be treated in a trauma center, although this value may be somewhat low.[6,7]

Aim of the study: Correlation of traumatic coagulopathy and revised trauma score in predicting outcome in trauma patients.

Objective: To determine the incidence of a clinically important traumatic coagulopathy in a tertiary care center in Nepal.To evaluate the correlation between traumatic coagulopathy and RTS in predicting outcome in trauma patients.

Methods: Tribhuvan University Teaching Hospital (TUTH) is a tertiary care center, situated in the center of the capital. The study was performed in the Department of Surgery of this hospital from May 2010 to April 2011. A total of seventy five patients were included in the study. Approval from Institutional Review Board, Institute of Medicine, Tribhuvan University, was taken. Patients who met inclusion criteria were enrolled in the study.

Inclusion Criteria: Patients with multiple trauma presenting within 24 hours of trauma at TUTH emergency who were admitted and treated.

Exclusion criteria:

1. Patients with minor injury. (Minor injury is defined as the injury which is expected to heal with minimal medical intervention.[8])
2. Patients on anticoagulants.
3. Patients with documented cirrhosis of liver.
4. Patients with known coagulopathic disorders (e.g. Hemophilia).

The patients were evaluated by a resident doctor in emergency by taking history and performing thorough systemic examination.Data was collected prospectively on:

- Patient demographics – age, sex, address, occupation
- Time from injury to arrival in the emergency department
- Amount of fluid administration before referral
- Injury characteristics

- GCS
- Vital signs
- RTS

Immediately, blood sample was taken with a nonheparinized syringe and Prothrombin time (PT) and activated partial thromboplastin time (aPTT) was determined from this sample, and represented the coagulation state before further resuscitation.

The presence of a coagulopathy was defined as PT over 18 seconds aPTT over 60 seconds, (1.5 times normal)[These values are taken from the British National Blood Transfusion Service and the American College of Pathologists' guidelines and indicate a coagulopathy requiring blood product replacement therapy in the presence of active or impending hemorrhage.]

Duration of hospital stay, blood transfusion requirement was recorded. In hospital mortality was used as outcome measure.The above findings were recorded in preformed proforma.

Statistical Analysis

Data was analyzed using the Statistical Program for Social Science (SPSS) for windows (release 17.0, Aug'2008). Mean ± 95% confidence intervals for parametric data. Median (interquartile range) for nonparametric data. Student's t test and, the $[chi]^2$ test was used where applicable.The correlation between coagulopathy and RTS was evaluated by using Spearman correlation test, which is a nonparametric test. A p value < 0.05 was considered significant.

Results

Out of 75 patients,63(84%) were male and 12(16%) were female .Thirty five (47%) of the patients fell in 21-40 year age group(productive age group) followed by < 20 year 20(27%), 41-60year age group 16 (21%) and >61year 4 (5%). The mean age was 32.2±17.4 years.

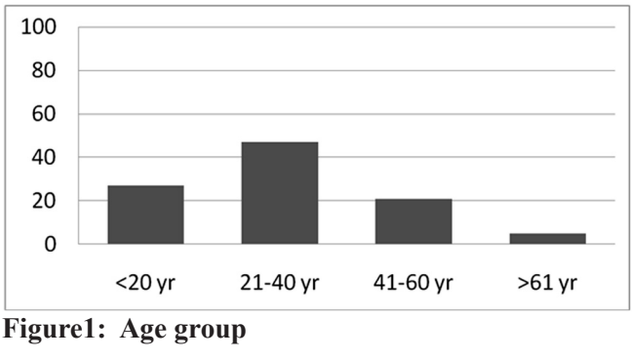

Figure1: Age group

Forty five (60%) of our patients were involved in RTA followed by fall from height 22 (29%) and physical assault 8 (11%).

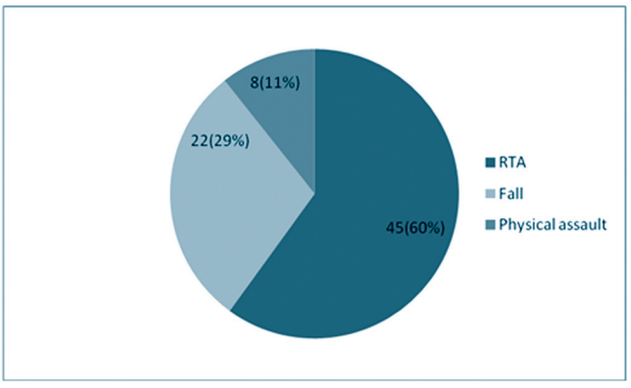

Figure 2: Mode of injury

Sixty nine (92%) of the patients had blunt injury and 6 (8%) had penetrating injury.The mean time of presentation after injury was 9.5±7.7 hours and the mean of amount of fluid administration at scene was 1033.3±745.8 ml.Eighteen (24%) of the patients were coagulopathic at presentation.

Table 2: Test of significance (dichotomous data)

Variable		Coagulopathy		P-Value
		No	Yes	
Sex	Male	46	17	0.273*
	Female	11	1	
Mortality	No	57	6	**.0001***
	Yes	0	12	

P-value ≤0.05 significant *Fisher Exact Test

Mortality was significantly higher (P value 0.001) in coagulopathic patients. Occurrence of coagulopathy according to sex of patients was not significant (P value 0.273).

Coagulopathy was significantly associated with a low GCS (P value 0.012), low SBP (P value 0.0001), high respiratory rate (P value 0.001), low RTS (P value 0.0001), prolonged PT (P value 0.0001), prolonged aPTT (P value 0.0001).But there was no significant association of coagulopathy with amount of fluid received prior to ER visit (P value 0.886) and age of the patient (P value 0.617).

Table 3: Test of Significance (Continuous Data)

	Coagulopathy	N	Mean±SD	P-Value
Age	No	57	32.8±16.9	.617
	Yes	18	30.4±19.1	
Fluid Prior to ER Visit	No	57	1026.3±664.2	.886
	Yes	18	1055.5±983.5	
Glasgow Coma Scale	No	57	13.9±2.4	**.012**
	Yes	18	11.9±4.0	
Systolic Blood Pressure	No	57	106.8±15.1	**.0001**
	Yes	18	81.6±11.5	
Respiratory Rate	No	57	22.1±3.9	**.001**
	Yes	18	27.1±7.6	
Revised Trauma Score	No	57	7.5670±0.7485	**.0001**
	Yes	18	6.3670±1.3716	
Prothrombin Time(Sec)	No	57	14.1±1.4	**.0001**
	Yes	18	25.1±8.9	
aPTT(Sec)	No	57	32.5±2.8	**.0001**
	Yes	18	72.0±32.6	

P-value ≤0.05 significant.

There was negative linear correlation between PT and RTS and aPTT and RTS.

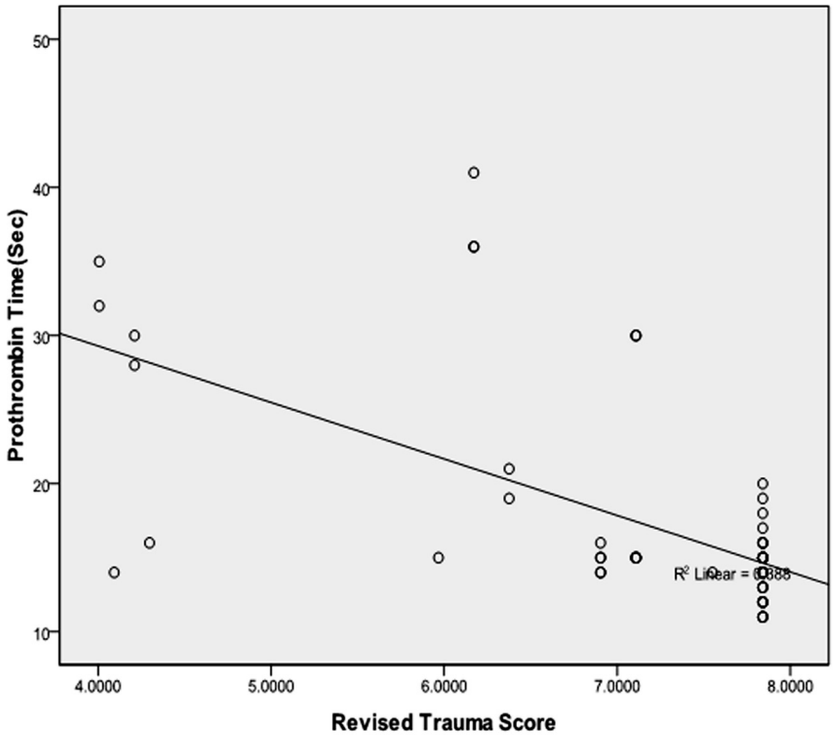

Figure 3: Correlation between PT and RTS

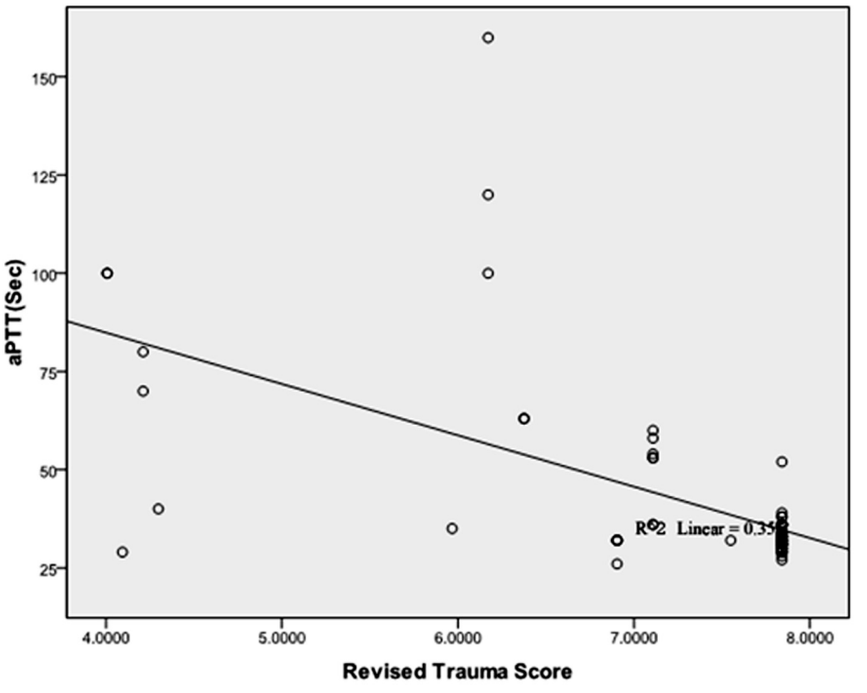

Figure 4: Correlation between aPTT and RTS

Logistic regression analysis of Outcome (dependent variable) with PT (independent variable) shows that the outcome was affected by PT (R2 =0.471 and P value < 0.0001).Logistic regression analysis of Outcome (dependent variable) with aPPT (independent variable) shows that the outcome was affected by PT (R2 =0.651 and P value < 0.0001). Outcome was significantly affected (P value < 0.0001) by low RTS (Std Error=0.025).

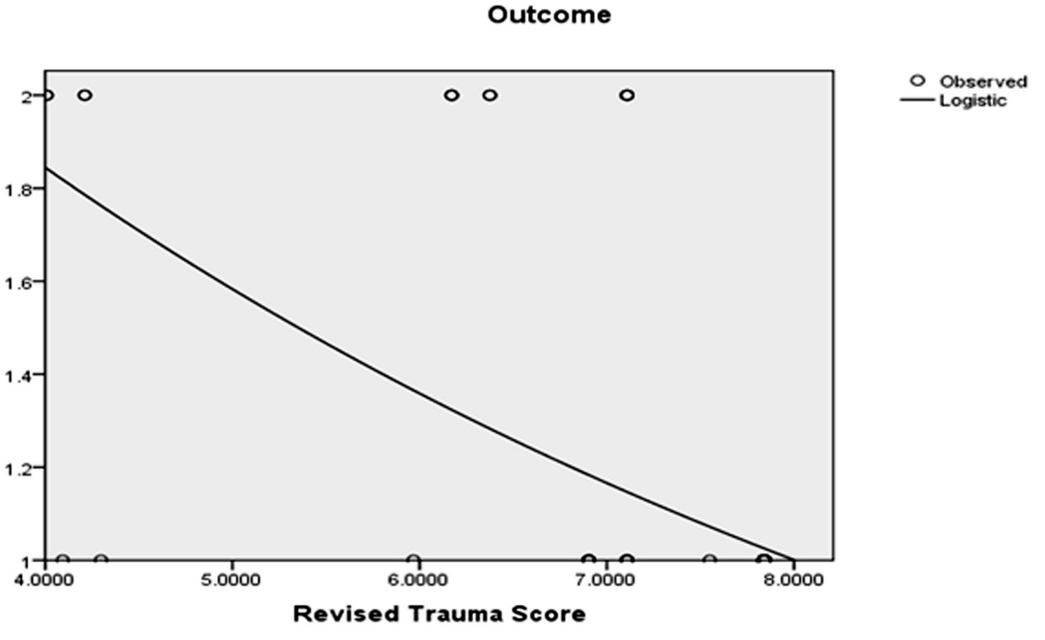

Figure 5: Logistic regression graph of outcome with RTS

At cut off value of 6.2735, RTS has 95% sensitivity and 41% specificity in predicting outcome.

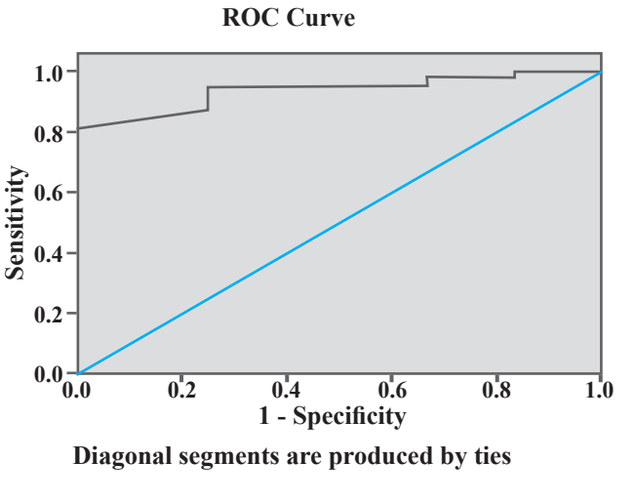

Figure 6 : ROC curve of RTS

Discussion

This study was done in all cases of traumatic patients (according to inclusion criteria) who presented in emergency room to evaluate the correlation of coagulopathy of trauma and RTS in predicting outcome in such patients.

In this study, RTA [45 patients (60%)] was the most common mode of injury followed by fall from height [22 patients (29%)] and physical assault [8 patients (11%)]. In the study conducted by Nepal Health Research Council (NHRC) 30, RTA accounted for 29% followed by fall from height 27% and physical assault 22% (N=37973).

Out of 75 patients, 63 (84%) were male and 12 (16%) were female. Male preponderance may be due to the fact that males are involved in outdoor activities more often compared to females. Male preponderance was also found in the study of NHRC30, 68% patients were male and 32% female.

In this study, 35 (47%) of traumatic patients were in the economically productive age group (21-40) year comparable with the study of NHRC 30 in which about 60% patients were in the age group 15-44 year.

In the study done by Brohi et al[4] of 1088 trauma patients, the median prehospital time was 73 minutes and 800ml of fluid was administered at the scene. In this study the median prehospital time was 8 hours and 1000ml of fluid was administered prior to ER visit. This difference may be due lack of tertiary care facility in periphery of the country.

In the study of Brohi et al[4], 24.4% patients were coagulopathic at admission and overall mortality was 19.5%.

Maegeleet al[9] found that coagulopathy is present in approximately 25 to 35% of all trauma patients on admission to the emergency room (ER).

Spahnet al[10] found that traumatic coagulopathy represents a serious problem for major trauma patients and accounts for 40% of all trauma-related deaths.

Similar result was found in this study also [18 (24%) of patients were coagulopathic at admission and mortality was 12 (16%)].

Table 4: Main Characteristics of papers describing the Revised Trauma Score

Author	Study Type	Clinimetric Property Reported	Main Results
Luk et al[11]	Retrospective Trauma patients (n=2622)	Predictive Validity	RTS Simple to determine Values range 0 – 7.84 Higher values better prognosis Severe Head Injury more accurately reflected by RTS
Champion et al[6]	Retrospective Trauma patients (n>2600)	Predictive Validity Face Validity Item Reduction Item Scaling	RTS is acceptable predictor of survival whilst TS is not. SBP & RR divided into 5 intervals to approximate those of GCS
Kuhls et al[12]	Prospective Trauma Patients (n=9539)	Specificity and Sensitivity Construct Validity	Sensitivity 59% Specificity 82% ISS AUC = 0.93 RTS AUC = 0.84
Roorda et al[13]	Retrospective Injured Patients (n=398)	Sensitivity Specificity Predictive Value	Sensitivity 94% Specificity 26% Performance of RTS poorer than previous studies

In this study, At cut off value of 6.2735,RTS has 95% sensitivity and 41% specificity in predicting outcome.

Although this study has not shown cause and effect, the results are consistent with the theory that trauma results in the release of factors that are responsible for the development of a clinically significant coagulopathy.

Conclusion

There is clinically significant coagulopathy in traumatic patients which correlates with RTS and it has effect on poor outcome.

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