Retrospective Study

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Evaluating the benefit of medical adjustment on the predictive accuracy of the revised trauma index

Abstract

In the early 1970s, data from emergency trauma units was used to develop the trauma index (TI) as a triage tool for non-physicians. Over the next two decades several modifications were made to the TI, and in 1990 a revised trauma index (RTI) was published. Throughout the 1990s, modifications to the RTI concerning pre-existing medical conditions (PEC) have been studied. Our study incorporated a PEC scoring system into the RTI, and evaluated its performance against using the RTI alone. The addition of PECs to the trauma index improved its accuracy in predicting overall outcome as shown by the increase in the kappa score from 0.42 to 0.73. Based on this finding, we suggest incorporating a PEC scoring system into the revised trauma index to better predict patient outcomes.

Keywords: trauma index, revised trauma index, pre-existing medical condition, revised trauma index modification, triage tool

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Background literature

The trauma index was originally developed by Kirkpatrick and Youmans[1] as a useful tool for non-physicians to evaluate trauma; it was then subsequently modified by Ogawa[2] to help non-physicians separate critical trauma patients from less injured patients. The trauma index was later simplified by Lindsey[3] to be used as a tool for retrospective analysis of trauma and a method of introducing new clinical clerks to trauma evaluation. Other examples of the trauma index modifications include the Schreinlechner-Eber modification that is used in Germany[4] and the hospital trauma index used in Holland and other European countries.[5]

The revised trauma index (RTI) was developed by Smith and Bartholomew[6] as a simple and easy triage tool which enables the emergency medical technician (EMT) to direct patients towards the correct treatment in the most efficient manner. The RTI correlates well with the trauma score, fatality and prognosis,[7] and has a better overtriage rate of 37% than mechanism of the trauma, which could be as high as 60%.[8] RTI exhibits a higher sensitivity of 73% compared to the injury severity score (ISS) with a sensitivity of 49%[4]

The role of pre-existing medical problems in outcome of trauma has been emphasized by many authors. Osler[9] has stated that the outcome of traumatized patients with a pre-existing medical condition (PEC) is often dictated by the pre-existing medical disability; hence the existing trauma scoring systems will continue to perform poorly in this group of patients unless this issue is addressed. This opinion is confirmed by a large study of 27,000 patients by Mackenzie[10] which indicated that the presence of PECs increased the hospital stay of patients with injury scores between 13-15 by about 40%, but had an even greater effect in patients with scores less than 12. This effect was more profound in patients younger than 55 years of age.

The modification of the RTI would involve incorporating PECs into the evaluation of trauma patients both in the field and in the emergency room. The hypothesis of this study is that modifying the RTI by incorporating PECs will improve the predictive accuracy of patients in the field and by the triage team. The outcome measures are based on the score as calculated from the trauma index. The outcomes consisted of discharge, probable admission, certain admission, and intensive care.

Materials and methods

The study was conducted at the Royal University Hospital, which is the trauma hospital in Saskatoon, and one of the major trauma hospitals in the province of Saskatchewan. Admission of patients was based initially on the mechanisms of trauma and subsequently by anatomic and physiologic parameters. The EMT had an on-the-scene assessment of trauma which ranged from no patients[1] to fatal[5] and these scores were based on the experience of the EMT.

Materials

This was a retrospective study of 40 trauma patients who were part of another trauma study and were 15 years of age and above. These patients were seen at the Royal University Hospital, Saskatoon, Canada between the months of April and September of the year 2000. Smith and Bartholomew's revised trauma index (RTI) was compared with our medical modification that includes the pre-existing medical history of the patient. Tables 1 & 2 are examples of the data collection tools used in the study.

Table 1 Outcome measures

Scores	Predicted outcome
2 to 9	Discharge
10 to 16	Probable Admission
17 to 20	Certain Admission
>20	Intensive Care
>17	Multi-System Trauma

Table 2 Medical modification of the trauma index

Scores	1	3	5	6
Region	limbs/skin	back only	head only	chest/ abdomen/ multiple
Type	minor open	single blunt impart/ 2° burns	major open wound/ 3° burns/ stab	[1]GSW/SGW/ multiple blunt
Cardiovascular	SBP >100 P<100	SBP 80-100 P 100-140	SBP<80	No Pulse
Respiratory	RR 10-25 Chest Pain	RR 25-35	RR>35 or <10	Apnea
[2]CNS ([3]GCS)	13-15 Drowsy/ Confused/ Disoriented	9-12 Response to verbal	5-8 Response to pain	3-5 unresponsive
Premorbid Medical	nil/acute medical	1 medical disability	>1 medical disability	
Total	3-9 minor	10-14 moderate	15-19 severe	>20 critical

[1]*GSW/SGW- Gunshot wounds/ shotgun wounds*

[2]*CNS- Central Nervous System*

[3]*GCS- Glasgow Coma Scale*

Statistical analysis

The statistical analysis was done using the IBM SPSS (Statistical Package for the Social Sciences) statistics program, and the accuracy of the trauma indices was done using the Kappa score.

Results

Tabulated data from our study and their statistical analysis is shown in Tables 3, 4 & 5.

Table 3 Revised trauma index (rti) versus observed decision cross-tabulation

		Observed decision				Total
		Discharge	Probable admission (single)	Certain admission (multiple)	ICU	
Predicted Trauma Index (RTI)	Discharge	8	9	0	0	17
	Probable Admission (single)	0	10	5	1	16
	Certain Admission (multiple)	0	0	0	4	4
	ICU	0	0	0	3	3
Total		8	19	5	8	40

Table 4 Medical modification of the rti versus observed decision cross-tabulation

		Observed decision				Total
		Discharge	Probable admission (single)	Certain admission (multiple)	ICU	
Predicted Trauma Index (RTI)	Discharge	7	3	0	0	10
	Probable Admission (single)	1	16	0	0	17
	Certain Admission (multiple)	0	0	5	2	7
	ICU	0	0	0	6	6
Total		8	19	5	8	40

Table 5 Summary of statistical analysis

Symmetric measures	RTI vs. observed decision	Modified RTI vs. observed decision
Pearson's	0.701	0.75-0.82
R	P=0.000	P=0.000
Spearman's	0.699	0.76-0.81
Correlation	P=0.000	P=0.000
Kappa	0.419	0.65-0.73
	P=0.001	P=0.000

Discussion

The role of PECs in the response to trauma outcomes has been mentioned in previous studies by Mackenzie and Osler.[9,10] Wurtzler[11] also showed that the presence of specific PECs was associated with increased in-hospital mortality after trauma and that this was independent from age and injury severity.[12] Presence of a PEC was associated with a marked increase in mortality of patients with minor injuries (odds ratio [OR] = 5.9, 95% confidence interval [CI] 4.4, 8.0) or moderate injuries (OR = 2.0, 95% CI 1.4, 2.9. This was also collaborated by a large Japanese study in 2010,[13] which concluded that existence of certain PECs, or the presence of 2 or more PECs increases in-hospital mortality from injury. This effect is particularly conspicuous in middle-aged patients and people with minor injuries. This is further appreciated in a study on effect of PECs on traumatic brain injury (TBI) severity where increasing age was simultaneously associated with an increase in quantity of specific age-related conditions, but also decreasing the TBI severity.[14]

The degree of statistical association of specific PECs on mortality was related to the pattern of injury sustained. However, this has never been included in a scoring system. We can assume that this pattern was the result of patients with PECs having lower baseline red cell glutathione levels than the other three patient groups (p = 0.1). Unlike the other groups, a similar red cell glutathione response was observed in patients with pre-existing medical problems irrespective of their trauma severity score.[15]

This study included our modification of the trauma score in 40 patients retrospectively reviewed from a prospective study. The study also compared the observed decision to the predicted decision by both trauma index and the modified trauma index. The results show a better correlation and a more accurate Kappa in predicting the observed decision. This is in accordance with the findings of the previous studies. The introduction of this modification into the scoring system plays two major roles. Firstly, it enables better planning for patients with PECs. Secondly, it allows for an improvement in communication with the families of patients with PECs after trauma.

Conclusion

Our study confirms that pre-existing medical conditions (PECs) significantly influence trauma outcomes. Incorporating abdominal PECs into the Revised Trauma Index (RTI) substantially improves its predictive accuracy, with the kappa score increasing from 0.42 to 0.73. This enhancement enables better clinical decision-making, resource allocation, and communication with patients' families.

The modified RTI provides a more precise tool for assessing trauma severity, facilitating tailored interventions and improving patient outcomes. Future research should validate this modified RTI across diverse populations and explore integrating additional factors to further refine the index. In conclusion, incorporating PECs into the RTI represents a significant advancement in trauma care, enhancing the accuracy of patient assessments and improving overall management and outcomes.

Acknowledgments

None.

Conflicts of interest

The authors declare that there are no conflicts of interest.

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