Outcome of In-Patient Trauma Cases: Accident and Emergency Unit, Khon Kaen University

Chaiyut Thanapaisal MD*,
Narongchai Wongkonkitsin MD*, O-Tur Sae Seow MD*,
Dhanes Rangsrikajee MD*, Kriangsak Jenwitheesuk MD*,
Ake Phugkhem MD*, Vajarabhongsa Bhudisawadi MD*

* Accident and Emergency Unit, Department of Surgery, Faculty of Medicine,
Khon Kaen University, Khon Kaen

Objectives: To study and report the outcome of in-patient trauma cases based on the Trauma and Injury Severity Scoring (TRISS) method and compare the outcome with the registry data from the Major Trauma Outcome Study (MTOS).

Material and Method: A descriptive study was performed by retrospective data collection. From 1 January 2002 to 31 December 2002, all admitted trauma patients in the Accident and Emergency Unit, Department of Surgery, Faculty of Medicine, Khon Kaen University were included in the present study. Survival analysis was completed for all of the patients.

Statistical analysis: TRISS method and W, M and Z-statistics (Z-score) on the basis of definitive outcome-based evaluation (DEF) method for comparing with MTOS data.

Results: The majorities of patients were men (76.85%) and mean age was 30.81 years. One hundred and ninety five patients (96.06%) sustained blunt trauma, the vast majority resulting from motor vehicle crashes. The observed survivors were 182, whereas the expected survivors were 183.582. The W, M and Z-statistics were -0.779, 0.843 and -0.493 respectively.

Conclusion: Z-score -0.493 indicated no statistical difference between observed and expected survivors.

Keywords: Injury severity score, Revised trauma score, Trauma and injury severity score, Abbreviated injury score, Trauma, Outcome, Probability of survival, Major trauma outcome study

Trauma is an important problem and trauma related mortality is increasing in Thailand. Trauma is the leading cause of death and disability in all developed and developing countries[1,2]. The standard of trauma management is the factor effect trauma outcome. By the time, there are many methods or indices to measure or compare the standard of trauma management such as AIS (Abbreviated Injury Scale), ISS (Injury Severity Score), RTS (Revised Trauma Score), TRISS (Trauma and Injury Severity Score), ASCOT (A Severity Characterization of Trauma), ICISS (ICD-9-based Injury Severity Score). Nowadays, TRISS methodology is widely applied to review the quality of trauma outcome[3-6].

TRISS methodology was established by Boyd CR et al in 1987[7]. TRISS is the summary of physiology and anatomic scoring system. To calculate the TRISS score (probability of survival, Ps), we must know RTS, ISS, and age and match these values to the equation.

$$Ps = 1/(1 + e^{-\beta})$$

Whereas e = 2.7182818, β is the coefficient value[5].

$$\beta = \beta_0 + \beta_1(RTS) + \beta_2(ISS) + \beta_3(Age\ index)$$

Calculated Ps can not directly predict the prognosis of trauma patient. The authors must match the calculated Ps to the analytic processes and use the analytic result to compare with the standard data base. Definitive outcome-based evaluation (DEF)

Correspondence to : Thanapaisal C, Accident and Emergency Unit, Department of Surgery, Faculty of Medicine, Khon Kaen University, Khon Kaen 40002, Thailand.

methodology was established by Flora JD in 1978, is the one method used to compare survival probability with the standard data base[8,9]. At first, this method was used for burn patients and then was extended to trauma patients by MTOS. It is composed of 3 statistics such as W-statistic, Z-statistic (Z-score), and M-statistic[9].

W-statistic is used to indicate the difference between the predicted number of survivors (given by summing the predicted survival probabilities for each patient) and the actual number of survivors, divided number of excess survivors per 100 patients, compared with the prediction[8,9].

$$W = \frac{\text{(actual number of survivors – predicted number of survivors)}}{\text{(number of patients/100)}}$$

A positive value of W indicates that the institution has more survivors than predicted, and so its performance is above the standard in the prediction data base.

Z-statistic is used to assess whether the W-statistic is significantly different from zero, and hence if the institution's performance is significantly different from that defined by the prediction data base[7,9].

$$Z = \frac{\text{(number of survivors – predicted number of survivors)}}{\sqrt{\text{sum of [Ps X (1-Ps)]}}}$$

Z-statistic can be compared with a standard normal distribution. Therefore a $Z < -1.96$ indicates a significantly worse performance than the prediction data base, and $Z > 1.96$, a significantly better performance.

M-statistic is used to examine the similarity in the mix of severities in the observed data, compared with the prediction data set[1,2,7,9].

M = summing of minimum (Fj, fj)

Fj = fraction of prediction data base cases in interval j

fj = fraction of observed cases in interval j

The value of M is between 0 and 1, with value close to 1 indicating a very similar mix of severities. A value of less than 0.88 has been deemed unacceptable for the purpose of comparison with the MTOS data base and hence for interpretation of W and Z-statistic.

Accident and emergency unit, Department of Surgery, Faculty of Medicine, Khon Kaen University is the responder for trauma care in Srinagarind Hospital that received the trauma patients from the responding area and from the neighboring hospitals. The authors

report the outcomes of trauma management in Khon Kaen University Hospital in the year 2002 and the outcomes were compared with the norms established from the Major Trauma Outcome Study (MTOS).

Material and Method

The study design is a descriptive study. All trauma patients admitted from 1 January to 31 December 2002 responding to the accident and emergency unit, Department of Surgery, Faculty of Medicine, Khon Kaen University were included in the present study. The authors excluded the out-patients and all trauma patients responding to other units such as ophthalmology, orthopedics, ENT, gynecology units. The study protocol was approved by the Institutional Review Board (IRB).

Setting

Srinagarind Hospital is a government teaching hospital in the Faculty of Medicine, Khon Kaen University. The hospital is a tertiary care and referral hospital that received the referral of patients from the North-East region of Thailand.

The accident and emergency unit, department of surgery is the responder for trauma patient care, and is available 24 hours for trauma management.

Data collection and analysis

All data were collected as retrospective data collection. The out-patient charts, in-patient charts, and trauma protocol record forms of all patients who are included in the study were reviewed.

The authors used the descriptive statistic such as percent to describe the geographic data of the patients. The TRISS methodology and DEF methodology (Z-statistic, M-statistic, and W-statistic) were used to compare the data outcome with the norm from MTOS

Results

From 1st January 2002 to 31st December 2002, among 203 patients who were included in the present study, 156 (76.85%) patients were male and 47 (23.15%) patients were female. The patients' ages ranged from 1-86 years (mean 30.81 years, median 26 years). One-hundred and ninety five (96.06%) patients suffered from blunt trauma, and penetrating trauma accounting for 8 (3.94%) patients.

Seventy eight (38.42%) patients had ISS less than or equal to 15, and 125 (61.58%) patients had ISS more than or equal to 16.

The range of RTS was 0-7.841. One-hundred and fourteen (56.16%) had RTS of 7.841. The range of TRISS was 0.017-0.997.

The M-statistic for the presented patients was 0.843 indicating a not good match between the presenred group of patients and the norm from MTOS (Table 1). The presented group of patients had a higher number of patients in Ps interval 0.26-0.50, 0.51-0.75, 0.76-0.90 and 0.91-0.95 than the MTOS, whereas the presented group had fewer patients in Ps interval 0.96-1.00 than the MTOS. These data indicated the severity of trauma in the presented group was higher and probability of survival was lower than the norm of MTOS. The W-statistic was -0.779, it means the survivors of the presented group was lower than the norm of MTOS 0.779 patient per 100 patients.

Z-score was calculated as -0.493. This result was in the range of ±1.96, indicated the standard of treatment of the presented group was not significantly different (p < 0.05) from the norm of MTOS.

The non survivors of the presented group were 21. All of them were blunt trauma patients. ISS of these patients was 20 to 75. From the study of MTOS, they reported the mortality of the patients who had ISS above or equal to 16 was 10%, that is similar to the presented group that was 16.8%.

Discussion

Even the TRISS methodology has a worldwide reputation for consistency and reasonable prediction of outcome, but the TRISS methodology and the MTOS database have their origin in the United States. Therefore, their validity may be limited to the specific conditions of the countries with patient populations that have similar characteristics as the United States[1,2].

Multiple factors such as the epidemiology of trauma, the availability of emergency medical services and referral system, the medical care and insurance system, and the high incidence of neurotrauma have been discussed to be limitations of the validity of the TRISS methodology in combination with the MTOS database in the developing countries[1,10].

However, the TRISS methodology was advocated as the international reference system in the Cologne Validation Study and it is still widely accepted in many parts of the world[10]. Nowadays, in developing countries, the regional database and the more appropriated methodology has still not been established. For these reasons, the TRISS methodology was chosen in the present study to evaluate the quality of trauma care in the Accident and Emergency Unit, Department of Surgery, Faculty of Medicine, Khon Kaen University, Thailand. The authors used M-statistic to evaluate match of injury severity between the presented patients and the MTOS database. The W-statistic was calculated to evaluate the difference between actual and predicted number of survivors per 100 patients based on the MTOS norm. The significance of W-statistic was quantified by the Z-statistic.

The majority of trauma victims were young male subjects (76.85%), and the mean age was 30.81 years old. Most of the injuries encountered were blunt (96.06%) resulting from motor vehicle crashes. The observed survivors were 182, whereas the expected survivors were 183.582. The Z-statistic was -0.493 indicating no significant difference in outcome between the study subjects and the MTOS group.

The revised trauma score (RTS) was calculated and found that only 56.16% of the victims had RTS 7.841. M-statistic for the study group was 0.843 which was lower than 0.88 indicating a poor match between the presented group of patients and the MTOS group. When the authors looked in detail, the study fraction of the presented patients in Ps interval 0.26-0.50, 0.51-0.75, 0.76-0.90 and 0.91-0.95 was higher than

Table 1. Distribution of M-statistic in the group of patients and the MTOS dataset

Ps interval	Number of patients	Study fraction of patients	MTOS fraction of patients	Minimum fraction
0.96-1.00	138	0.679	0.828	0.679
0.91-0.95	25	0.123	0.045	0.045
0.76-0.90	16	0.079	0.044	0.044
0.51-0.75	11	0.054	0.029	0.029
0.26-0.50	7	0.034	0.017	0.017
0.00-0.25	6	0.029	0.036	0.029
Total	203	1.000	1.000	0.843

the MTOS group, whereas in Ps interval 0.96-1.00 was lower than the MTOS group. The presented data indicated that the presented group was more severely injured than the MTOS group. The likely explanation is associated with the inclusion and exclusion criteria. In the present study the authors included the victims who were admitted into the ward or ICU, but excluded those who needed only observation within 24 hours such as cerebral concussion, impaired consciousness from alcohol or drugs, multiple minor soft tissue trauma, etc.

The W-statistic was calculated as -0.779, the result indicated a higher mortality of the study group when compared to the MTOS group per 100 victims. This result might be affected by the more severely injured victims.

Even the TRISS methodology is a Western-oriented methodology and may not be a totally appropriate comparison when applied to a developing country. The regional database, the trauma scoring system that will account for geographical, economic and physical attributes of the developing countries are still needed for more accurate evaluation[1,2,10]. But in the meantime, the authors believed that the TRISS methodology and the MTOS norm can be used as a guide line for evaluation of trauma outcome and quality of care.

There are multiple factors which attribute to the high standard of trauma care, but in the authors' unit, it is believed that the most important factor is that the victims should be cared for by a trauma surgeon. Prompt action and appropriate management are needed. The surgical consultation is mandated in severely injured patients.

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ผลการรักษาผู้บาดเจ็บจากอุบัติเหตุ ซึ่งรับไว้เป็นผู้ป่วยใน ของหน่วยอุบัติเหตุและฉุกเฉิน ภาควิชา
ศัลยศาสตร์ คณะแพทยศาสตร์ มหาวิทยาลัยขอนแก่น

ไชยยุทธ ธนไพศาล, ณรงชัย ว่องกลกิจศิลป์, โอวตือ แซ่เซียว, ธเนศ รังษีขจี, เกรียงศักดิ์ เจนวิถีสุข, เอก ปักเข็ม,
วัชรพงศ์ พุทธสวัสดิ์

วัตถุประสงค์: เพื่อศึกษาผลการรักษาผู้บาดเจ็บ ซึ่งรับไว้เป็นผู้ป่วยใน ของหน่วยอุบัติเหตุและฉุกเฉิน ภาควิชาศัลยศาสตร์
คณะแพทยศาสตร์ มหาวิทยาลัยขอนแก่น เปรียบเทียบกับฐานข้อมูลมาตรฐาน

วัสดุและวิธีการ: ทำการศึกษาแบบพรรณนา เก็บข้อมูลย้อนหลัง ในผู้ป่วยบาดเจ็บทางด้านศัลยกรรมของโรงพยาบาล
ศรีนครินทร์ ประเภทผู้ป่วยในทุกราย ในความดูแลของหน่วยอุบัติเหตุและฉุกเฉิน ภาควิชาศัลยศาสตร์ คณะแพทยศาสตร์
มหาวิทยาลัยขอนแก่น ตั้งแต่ 1 มกราคม พ.ศ. 2545 ถึง 31 ธันวาคม พ.ศ. 2545

สถิติ: ใช้การวิเคราะห์ทางสถิติตาม TRISS method และ definitive outcome-based evaluation (DEF) method
ได้แก่ Z- statistic, M-statistic และ W-statistic เพื่อหาค่า Z, M, และ W มาใช้เปรียบเทียบกับฐานข้อมูล MTOS

ผลการศึกษา: ผู้ป่วยทั้งหมด 203 คน ผู้ป่วยส่วนใหญ่เป็นผู้ชาย (76.85%) อายุเฉลี่ย 30.81 ปี การบาดเจ็บส่วนใหญ่
เป็นแบบกระแทก (96.06%) ซึ่งเกิดจากการอุบัติเหตุทางจราจรเป็นหลัก ผู้ป่วยรอดชีวิตจริง 182 คน (89.66%) ผู้ป่วย
รอดชีวิตจากการคำนวณ 183.582 คน ค่า W, M และ Z เท่ากับ -0.779, 0.843 และ -0.493 ตามลำดับ

สรุป: ผลการรักษาผู้บาดเจ็บ ซึ่งรับไว้เป็นผู้ป่วยใน ของหน่วยอุบัติเหตุและฉุกเฉิน ภาควิชาศัลยศาสตร์ คณะแพทยศาสตร์
มหาวิทยาลัยขอนแก่น เปรียบเทียบกับฐานข้อมูลมาตรฐาน ไม่มีความแตกต่างกันอย่างมีนัยสำคัญทางสถิติ