Validity of applying TRISS analysis to paediatric blunt trauma patients managed in a French paediatric level I trauma centre

Abstract  Objective: Using a weighted combination of the Revised Trauma Score (RTS), the Injury Severity Score (ISS), the type of injury (blunt or penetrating) and patient age, the TRISS method is used to calculate the probability of survival (ps) in trauma patients. The goal of this study was to compare the ability of the American Major Trauma Outcome Study (MTOS) norm for adult blunt trauma patients (ADULT) and the specific norm for paediatric patients (PED) to estimate the ps of injured children using TRISS methodology.  Design: Retrospective analysis using a paediatric trauma patient database.  Setting: a French level 1 paediatric trauma centre.  Patients: Four hundred seven consecutive paediatric blunt trauma patients, treated over a 3-year period.  Measurements: The observed and expected survivals were compared, using the M, W and Z scores, with both ADULT and PED. The W score is the number of survivors more or less than expected from the MTOS predictions for 100 patients. A Z score, which measures the significance of W, between −1.96 and +1.96, indicates no significant difference between observed and expected survivors. A value of M less than 0.88 indicates a disparity in the severity match between the study group and the MTOS group. We calculated the standardised W score (Ws), which represents the W score that would have been observed if the case mix of severity was identical to that of the MTOS group. Accordingly, a standardised Z score (Zs) was also calculated. In addition, we calculated the area under the receiver operating curve (aROC) using both norms, while calibration was also assessed by calculation of the Hosmer-Lemeshow goodness-of-fit tests.  Results: Using PED, the number of actual survivors (n = 364) was not significantly different from the MTOS (n = 358). The value of M, 0.65, indicated a disparity in the severity match between the study group and the MTOS group, due to a higher proportion of patients with lower ps (TRISS < 0.95, 52 vs 27%). Ws was +1.06% (95% confidence interval −0.34 to 2.08) and Zs was 1.48, indicating no significant difference from the MTOS. Using ADULT, the number of observed survivors (n = 364) was significantly higher than that expected (n = 354), with a W score of +2.70% (Z = +1.98, p < 0.05). There was a disparity in the severity match (M = 0.67) between the study group and the MTOS group, due to a higher proportion of patients with lower ps. Ws was +1.32% (95% confidence interval −0.12 to 2.37) and Zs = +1.79 (NS), indicating no significant difference from the
MTOS. The Hosmer-Lemeshow statistics indicated that ADULT (Cg = 7.24, p = 0.51; Hg = 4.45, p = 0.81) and PED (Cg = 6.08, p = 0.64; Hg = 3.55, p = 0.90) provided sufficient goodness-of-fit. There was no significant difference in the aROC of the TRISS between the two norms (0.935 ± 0.050 vs 0.936 ± 0.050; NS).

Conclusion: Both adult and paediatric norms were equally good predictors of the probability of survival of injured children, provided that Ws and Zs are used when there is a disparity in the severity match between the study group and the MTOS group.

Key words: Children · Trauma · Outcome · TRISS

Introduction

Trauma is the leading cause of death and a major cause of disability among children in “developed” countries [1, 2]. In the last 25 years, many scores have been proposed to assess trauma patient status, describe injuries and, finally, to predict outcome. Such a data set can be used to develop models for predicting the probability of an outcome occurring. However, the application of a model to a new data set is only valid if this new data set has a similar distribution of factors related to mortality, when considered in combination, as that existing in the data set from which the model is derived. Using a weighted combination of the Revised Trauma Score (RTS), the Injury Severity Score (ISS), the type of injury (blunt or penetrating) and patient age, the TRISS method is used to calculate the statistical probability of survival in trauma patients. This methodology has led to the Major Outcome Study (MTOS) in the USA, allowing comparative evaluation of hospital care of injured patients [3, 4]. However, it has been demonstrated that the TRISS model was not suitable for evaluating the survival outcome of British trauma patients, mainly because trauma admissions differ significantly in the distributions of age and trauma scores from that of the American MTOS [5]. It is unlikely that this incompatibility with American MTOS data is peculiar to British patients and, hence, the relevance and benefit of using a model based on American trauma cases may be questioned for the trauma care of other countries.

The TRISS methodology has been used to assess outcome in paediatric trauma [6, 7, 8, 9, 10, 11, 12, 13, 14], and has been shown to be a valid tool for predicting outcome in traumatised children [15]. In one study, the ability of the TRISS methodology to predict outcome in traumatised children has been evaluated, using either the MTOS TRISS norm for adult patients with blunt injury or a newly derived paediatric population-specific norm [16]. Given that both norms were equally good predictors, the authors recommended the continued use of the adult blunt trauma norm for estimating survival probability in children. Moreover, using TRISS methodology, with the MTOS TRISS norm for adult patients with blunt injury, Hall et al. [17] were able to show that the outcome for children with blunt trauma was best at a paediatric trauma centre. However, it should be noted that all the reports using TRISS methodology to assess outcome in paediatric trauma patients have originated from the USA.

Given the results of the study by Jones et al. [5], the question arises whether TRISS methodology may be used to assess outcome in paediatric trauma patients in other countries, including some European countries such as France, especially because there are marked differences between the French and American systems of trauma care [18]. In the French system, critical care is initiated on scene by field physicians, with venous access achieved in all children and endotracheal intubation performed in more than 90% of the more severely injured [19, 20]. In contrast, in the American system prehospital care is provided by paramedics and venous access and endotracheal intubation are usually underused or associated with a high rate of failure [21, 22, 23]. The aim of this study, therefore, was to assess the outcome of severely injured children seen in a single French regional paediatric trauma centre, using TRISS methodology, with both the MTOS TRISS norm for adult patients with blunt injury [3] and the derived paediatric population-specific norm [16].

Methods

The case histories of 407 consecutive paediatric blunt trauma patients (15 years of age or younger), treated in our trauma centre over a 3-year period, were analysed. All of them were cared for by a mobile intensive care unit (SAMU system) and the severity of trauma was considered as high enough by the pre-hospital team to warrant direct admission of these paediatric patients to the emergency room of a level 1 paediatric trauma centre. The SAMU system has been described elsewhere [24]. Briefly, advanced cardiac life support (ACLS) and advanced trauma life support (ATLS) is provided to paediatric trauma patients by the team of a mobile intensive care unit, with care rendered by field physicians [20]. The on scene triage was based on the clinical assessment of the trauma patient [25]. Our paediatric trauma centre is located in a university hospital and serves a population of 9,500,000.

The critical care management of the patients on arrival in the trauma room has also been previously described [19]. Briefly, on arrival in the trauma room of our institution, trauma care is provided by the trauma team. The trauma team consists of ten or more medical and paramedical personnel summoned by bleepers to the trauma room, who are assigned specific duties and responsibilities to perform efficiently the initial management of children who are victims of traumatic injuries. The team is directed by a senior paediatric trauma anaesthesiologist, acting as a co-ordinator. During the primary survey and resuscitation phase, the “ABCs” are cov-