Evaluation of the quality of trauma care service through the study of deaths in a tertiary hospital

Avaliação da qualidade do atendimento ao traumatizado através do estudo das mortes em um hospital terciário

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A B S T R A C T

Objective: To characterize deaths from trauma in a tertiary hospital and evaluate the quality of care provided to these victims. **Methods**: This was a retrospective study in a referral center for trauma in the period of one year. Through the methodology Trauma Score - Injury Severity Score and the review of medical records, preventable, potentially preventable and non-preventable deaths were identified and studied. **Results**: Seventy-five patients were included in the study. There was a predominance of deaths in young, male victims of traffic accidents. The mean Revised Trauma Score, Injury Severity Score and Trauma Score - Injury Severity Score were 5.60, 30.7 and 62.2%, respectively. The rate of deaths considered preventable was 61.3%, potentially preventable, 24%, and non- preventable, 14.7%. **Conclusion**: The study sample had epidemiological features similar to other studies, except for the high rate of preventable deaths and the high values of the Revised Trauma Score. There were difficulties in obtaining data from medical records, medical imaging and autopsy findings. The quality of care provided to trauma victims in the institution proved unsatisfactory because of problems in collecting and storing data.

Key words: Wounds and injuries. Multiple trauma. Trauma severity indices. Mortality. Quality of health care.

INTRODUCTION

Trauma has been a prominent cause of morbidity and mortality in Brazil , mainly from the 1980s, when it started being considered an important public health issue [1], reaching almost epidemic proportions [2]. It represents the third cause of death in Western countries, after cardiovascular diseases and cancer [3]. As for years of potential life lost, injuries from external causes occupy the third position, accounting for 15.1% worldwide, traffic accidents being the ninth specific cause of disability and premature death [4].

Quality control in the care of trauma victims and organization of trauma systems have proved essential to reduce avoidable deaths and complications in the care of traumatized [5,6]. Avoidable deaths have been used as a filter in quality control programs and are considered markers of overall quality of care [7].

Several methods are used to quantify the severity of an injury in order to evaluate the results obtained in the treatment of trauma and study the quality of care [8]. One of the most widely used in national and international trauma centers today is the calculation of the Trauma Score - Injury Severity Score (TRISS) [9,10]. This score is used to quantify the probability of survival (Ps) according to parameters of gravity and, thereafter, determine whether a death is avoidable or not [11].

This study aimed to characterize the deaths due to trauma in a tertiary hospital during one year and evaluate the quality of care provided to victims through the identification and study of avoidable, potentially avoidable and unavoidable deaths with the use of TRISS.

METHODS

This was a retrospective study conducted at the Base Hospital, São José do Rio Preto, a reference trauma center in a macro-region of about 1.5 million inhabitants [12].

Trauma care in this hospital is conducted by a team of two surgeons and four or five residents, 24 hours a day, seven days a week, according to the precepts advocated by the current Advanced Trauma Life Support (ATLS ®) [13]. This group is called Trauma Team.

Study conducted at the Base Hospital, São José do Rio Preto, São Paulo State – SP, Brazil.
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In addition to physicians of all surgical specialties, the hospital has Computerized Tomography (CT), Magnetic Resonance Imaging (MRI), angiography, radiography, laboratory tests and blood products for transfusion, 24 hours a day.

The study included all trauma patients admitted to the hospital who died in the period from June, 1st 2009 to May, 31st 2010, provided that the corps had been sent to the Coroner's Office (CO) to verify the cause of death.

We excluded patients who: have not been evaluated by the Trauma Team at hospital admission, came to the hospital emergency department already in cardiac arrest (dead on arrival), had no medical record found, had the cause of death determined by the CO as not compatible with trauma, have been admitted more than 24 hours after the occurrence of trauma and patients under 13 years

We calculated the indices Revised Trauma Score (RTS)[14], Injury Severity Score (ISS) [15] and Trauma Score - Injury Severity Score (TRISS) [9]. We carried out reviews of medical records to obtain information through the sections of emergency care, surgical descriptions, clinical evaluation, radiological reports and CO's reports.

To calculate the RTS we considered the values of systolic blood pressure, respiratory rate and Glasgow Coma Scale (GCS) [16] on admission of the patient in the Emergency Unit of the Base Hospital. When there were missing data about respiratory frequency in the emergency sheet or when the patient was mechanically ventilated, this parameter was considered normal. GCS was determined even when the patient was under sedation or with definite airway.

Those who had a probability of survival (Ps) calculated as greater than 50% were considered avoidable. Those with Ps between 25% and 50% were considered potentially avoidable deaths, and those with Ps less than 25%, unavoidable deaths [17].

The work was submitted to the Ethics Committee in Research of the São José do Rio Preto Faculty of Medicine and was approved by protocol 6004/2010.

RESULTS

We initially considered 193 deaths, of which 118 were excluded. Figure 1 summarizes the ratio of total deaths, patients included, excluded, and the motives of exclusion.

Most deaths occurred in male victims and were caused by blunt trauma. Table 1 shows the summary of patients' demographic characteristics and frequency of trauma mechanism.

The most frequent cause of trauma was car accident, in 16 patients (21.3%). Both motorcycle accidents and falls totaled 15 cases each, representing 20% of all deaths. A detailed list of causes of trauma are illustrated in Figure 2. The term "Others" in this graph refers to a case of burial due to land sliding.

The average age of the patients was 45.8 years, with a maximum of 93 years, minimum of 16 years and a median of 43 years. The age distribution showed the highest prevalence among the victims ranged between 21 and 30 years (Figure 3).

Considering a cutoff of 54 years of age, as used by TRISS methodology, the results are that 64% of patients were 54 years or less when they were admitted to the Emergency Department of the Base Hospital.

Systolic blood pressure was higher than 89 mmHg in 64 patients (85.3%), between 76 and 89 mmHg in three

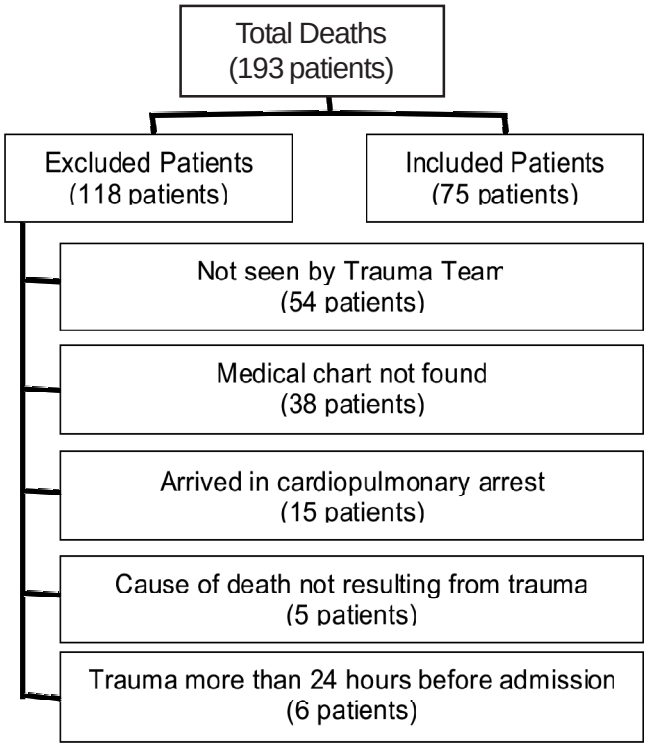

Figure 1 - *Total number of deaths and trauma patients included and excluded in the study with details of the exclusion criteria.*

Table 1 - Demographic characteristics of patients and their classification according to the mechanism of injury.

Characteristic	n	%
Gender		
Male	63	84.0%
Female	12	16.0%
Origin		
São José do Rio Preto	28	37.3%
Other cities	15	20.0%
Indefined	32	42.7%
Mechanism of trauma		
Blunt	65	86.7%
Penetrating	10	13.3%

patients (4%), between 50 and 75 mmHg in five patients (6.7%) and non-audible in three patients (4%). The average heart rate was 98.5 beats per minute.

The respiratory rate was normal in 74 patients (98.7%). Only one patient (1.3%) presented with tachypnea, with respiratory rate above 29 breaths per minute.

Thirty-three patients (44%) had a Glasgow Coma Scale equal to three at the time of admission to the hospital emergency room, two (2.7%) had GCS equal to four or five, eight (10.7%) between six and eight, five (6.7%) between nine and twelve, and 27 patients (36%) had GCS greater than or equal to 13.

The mean RTS was 5.60, maximum of 7.84, minimum of 1.16 and median of 6.00. The mean ISS was 30.7, with a maximum of 66, minimum of four and a median of 30. The average TRISS was 62.2%, with a maximum of 99.5%, minimum of 1.1% and median of 70%.

Forty-six patients (61.3%) had TRISS greater than 50%; in 11 patients (14.7%) TRISS was less than 25% and in the remaining 18 (24%), between 25% and 50% (Figure 4). Of the 46 patients with TRISS greater than 50%, 18 (39.1%) had a cause of death "traumatic brain injury" (TBI) indicated by the official CO's report.

Considering only patients with a Ps greater than 50%, the mean age was 46.9 years and the trauma was blunt in 87%. The mean RTS was 6.77, median 7.80, and maximum and minimum values of 7.84 and 4.09, respectively. The mean ISS of this same group was 27, median 26.5, maximum of 45 and minimum of four. The mean TRISS was 83.9%, with a median of 90%, maximum of 99.5% and minimum of 50.5%.

DISCUSSION

In 1987, Shackford [11] used TRISS values to determine whether a death was avoidable, potentially avoidable or unavoidable, considering those avoidable deaths in trauma victims with over 50% Ps. Some authors state, however, that TRISS is a useful tool in determining which deaths should be investigated, but should not be considered separately for determining whether a death is avoidable or not [18,19]. To do so would require expert opinion after a systematic review of medical records and thorough investigation of the evolution and behavior taken in each specific case [20-22]. Despite its limitations, TRISS is still considered the standard rate of trauma in studies on quality of trauma care [8,23].

The high exclusion rate (61.1%) of patients in this study is attributed to the large number of patients not evaluated by the Trauma Team at the time of hospital admission and patients who did not have located their emergency charts. Together, these two groups amounted to 77.9% of all exclusions. No other reason can explain the loss medical records except for the lack of systematization and organization in their storage.

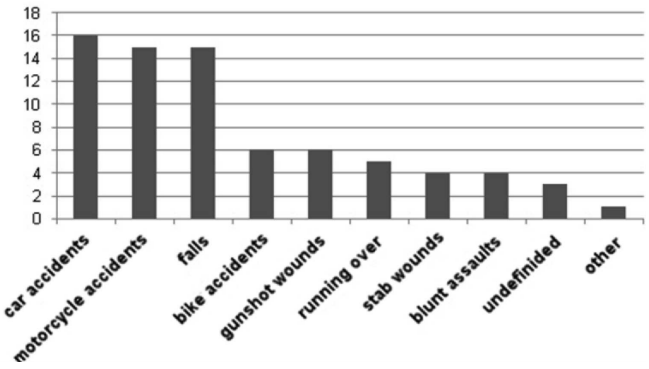

Figure 2 - *Classification of deaths according to etiology of trauma.*

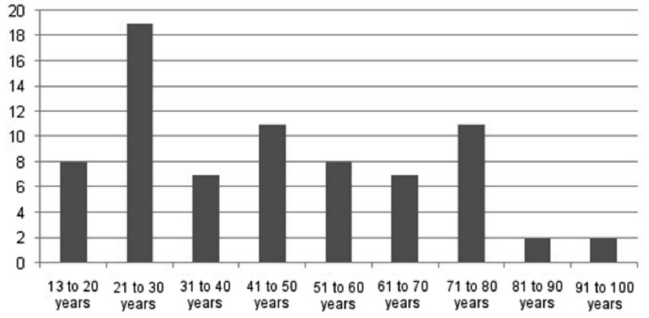

Figure 3 - *Distribution of deaths by age group.*

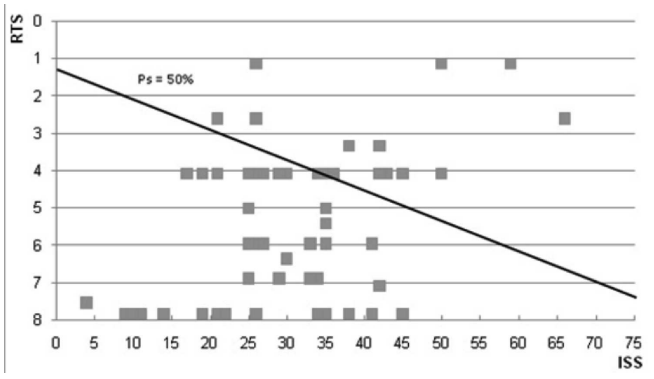

Figure 4 - *Relationship between the values of RTS and ISS of patients who died.*

In June 2010, the hospital operating system was fully computerized. This remedied the problem of location of medical records, as currently all documents of the patient's records are available on the computerized database of the hospital system.

The data relating to the most prevalent gender and age group resemble previously published studies' [24-26], but not the ones from Yagi [27], in a previous study conducted in the same institution in 1999. This sample, however, included all trauma victims attended in the service, not just deaths. One might expect a higher death rate in elderly patients compared to younger ones [28] and this is probably

the cause of the higher average age of our study when compared to Yagi's [27].

Corroborating data from the literature, the most frequent mechanism of trauma was blunt [24-27], and its largest stratum resulting from automobile accidents (21.3%). If we consider the traffic accidents in one segment, they would total 41.3%, which is also consistent with previous studies [25].

Systolic blood pressure greater than 89mmHg in 85.3% of patients reflected the hemodynamic stability of the vast majority of patients upon admission, possibly the result of intervention in pre-hospital fluid management of severe cases. Normal pressure levels lead to increased RTS, which, in turn, interferes with TRISS value, increasing the estimated probability of survival.

The respiratory rate remained in the normal range in 98.7% of cases, however this figure reflects little about the actual clinical condition of patients at hospital admission. As already stated, we considered normal values of respiratory rate in patients on mechanical ventilation or in those whose medical records lacked this information. It is believed that this bias does not interfere significantly in the amount of RTS, as already shown in previous studies [29].

As for GCS, two peaks of prevalence were observed: GCS three (44%) and the GCS between 13 and 15 (36%). Grouping the patients according to severity of head injury, the severe (GCS between 3 and 8) were present in 57.4% of patients. However, this percentage may not represent reality because a large proportion of patients with multiple injuries may have had their level of consciousness lowered by the use of sedatives during and after obtaining a definitive airway. This ends up reducing the value of RTS, underestimating Ps.

The mean RTS of 5.6 can induce misinterpretation of bad physiological conditions of the victims of the sample, but when taken as a parameter the median value of 6.0 it is clear that most patients had a high RTS. In comparison, these values are higher than those found in studies of avoidable trauma deaths [30].

Taking as a parameter the value of gravity of the ISS alone, which averaged 30.7 and had a median of 30, it can be said that patients in the series were, in general, patients with anatomical lesions of high gravity. Long *et al.* [31] stated that patients with ISS values greater than 16 should be considered victims of severe trauma and should be referred to a trauma center due to the significant chance of adverse developments. Trunkey [32], in 1991, demonstrated that patients with ISS greater than 25 have less than 90% chance of survival. In 1992, Collopy *et al.* [33] characterized lesions were with ISS greater than 21 as critical from the point of view of mortality.

The mean and median TRISS (62.2% and 70% respectively) and the number of patients with TRISS above 50% (61.3%) deviate much from the literature data. However, such a comparison is very difficult to achieve because different methods of review are used in studies of avoidable deaths. In addition, the forms of judgment adopted and the inclusion criteria of these studies vary greatly [26,34]. In 1985, in a review by Cales and Trunkey [35], the rate of avoidable trauma deaths ranged from 2% to 50%.

The high rate of severe head injuries in this series, with lesions AIS 5 in the head-neck segment, is one of the reasons for the high rate of avoidable deaths shown in the study. This is because severe and isolated central nervous system lesions determine a maximum ISS of 25. If one considers as a clinical pattern, as seen in previous data from this study, patients with normal SBP and RR, GCS of three, age below 54 years, and the mechanism blunt trauma, the value of TRISS is always above 50%. However, according to the definition of AIS, lesions with a score of five are considered critical and these patients often have an unsatisfactory development, which is not consistent with the estimate provided by the TRISS methodology, especially when it comes to penetrating trauma [36].

Considering only the group of "avoidable deaths", the data are even more informative. Mean RTS for this group was 6.77, 7.80 median, which can be considered a surprising result to a group with average ISS of 27. The figures show that patients in this group, despite showing severe anatomical lesions, had their estimated chance of survival above 50%, mainly due to the high value of the RTS, this being, as mentioned, probably influenced by the intervention of pre-hospital care.

The fact that almost 40% of deaths whose chance of survival was greater than 50% have TBI as the cause of death determined by the CO reaffirms this lesion as a factor of overestimation of survival.

The unexpected adverse change in these patients, however, if not a bias of the instruments used for the calculation of TRISS, may have been due to a flaw in the process of attending to the victim. All these possibilities should be examined by an expert group to establish whether a death was preventable or not, and whether there was any opportunity for improvement in trauma care in the institution. However, given the difficulties encountered in obtaining patients' data, it became impossible to get them in the detail necessary for a definitive analysis. From the incomplete or lack of standardization in completing medical records, lack of documentation of some records, the difficulty or impossibility of recovering some imaging tests, the lack of official reports of many X-rays and CT scans performed in the emergency, to the scarcity of details on the CO's report, all contributed to the failure to carry the discussion of cases, as it is believed that without this information such assessments would be superficial and unreliable.

The computerized system of data used in the hospital should improve the accessibility of medical records, but does not standardize a routine in the conduct of cases and data collection. This could be supplied by the creation of a Trauma Unit at the institution, a space reserved for the exclusive monitoring of trauma victims, with specially trained

personnel for assistance to this kind of patients and to collect data daily.

Inadequate completion of medical charts supports the hypothesis of lack of systematization and standardization in their filling, resulting in poor quality of the information, probably by the delegation of collection and transcription of data to residents, who most times have no available time, not even proper training, for the realization of such a thorough job. It is of utmost importance to have a team specifically designated for the real-time collection of data available for emergency care, as well as its typing and posterior statistical interpretation.

Furthermore, the transcript in the patient's emergence chart of data provided by the pre-hospital care team would be unnecessary if it were provided a copy of the rescue char to the hospital staff who is admitting the patient. This would even allow the use of pre-hospital data for the calculation of RTS, making its value more reliable.

The display and storage of digital imaging, already available in the institution, enhances the availability of exams in most cases. However, they do not fill the gap of lacking X-rays official reports. Maybe the adequacy of human resources sector of radiology with the demand for hospital tests help in solving this problem.

The brevity of the reports provided by the Coroner's Office is another difficulty to be overcome. However, the brevity of the reports is legally justified when "the cause of death is evident." Eventually, in future studies, perhaps this information should be investigated prospectively.

The study allowed the characterization of deaths due to trauma by assessing the quality of care provided to trauma victims in the institution, which proved unsatisfactory due to problems in the collection and storage of data.

Since the suggestions made to remedy the problems identified were accepted, further studies are needed to evaluate its impact on quality of trauma care in the hospital.

R E S U M O

Objetivo: *Caracterizar os óbitos decorrentes de trauma em um hospital terciário e avaliar a qualidade do atendimento prestado a essas vítimas.* ***Métodos:*** *Tratou-se de um estudo retrospectivo realizado em um centro de referência em trauma no período de um ano. Através da metodologia* Trauma Score – Injury Severity Score *e da revisão de prontuários foram identificadas e estudadas as mortes evitáveis, potencialmente evitáveis e inevitáveis.* ***Resultados:*** *Setenta e cinco pacientes foram incluídos no estudo. Houve predomínio de mortes em pacientes jovens, do sexo masculino, vítimas de acidentes de trânsito. As médias do* Revised Trauma Score, Injury Severity Score *e* Trauma Score – Injury Severity Score *foram 5,60, 30,7 e 62,2%, respectivamente. A taxa de mortes consideradas evitáveis foi de 61,3%, potencialmente evitáveis, 24%, e inevitáveis, 14,7%.* ***Conclusão:*** *A amostra do estudo apresentou características epidemiológicas semelhantes às amostras de outros estudos, exceto pela alta taxa de mortes evitáveis e pelos altos valores do* Revised Trauma Score*. Houve dificuldades na obtenção de dados em prontuários, laudos de exames de imagem e laudos de necropsia. A qualidade do atendimento prestado às vítimas de trauma na Instituição se mostrou insatisfatória por problemas na coleta e armazenamento dos dados.*

Descritores: *Ferimentos e lesões. Traumatismo múltiplo. Índices de gravidade do trauma. Mortalidade. Qualidade da assistência à saúde.*

REFERENCES

1. Reichenheim ME, de Souza ER, Moraes CL, de Mello Jorge MH, da Silva CM, de Souza Minayo MC. Violence and injuries in Brazil: the effect, progress made, and challenges ahead. Lancet. 2011;377(9781):1962-75.
2. Iunes RF. III - Impacto econômico das causas externas no Brasil: um esforço de mensuração. Rev saude pública. 1997;31(4 Suppl):38-46.
3. World Health Organization. The global burden of disease: 2004 update. Geneva: World Health Organization; 2008.
4. Murray CJ, Lopez AD. Global mortality, disability, and the contribution of risk factors: Global Burden of Disease Study. Lancet. 1997;349(9063):1436-42.
5. McDermott FT. Trauma audit and quality improvement. Aust N Z J Surg. 1994;64(3):147-54.
6. Sampalis JS, Denis R, Lavoie A, Fréchette P, Boukas S, Nikolis A, et al. Trauma care regionalization: a process-outcome evaluation. J Trauma. 1999;46(4):565-79; discussion 579-81.
7. Teixeira PG, Inaba K, Hadjizacharia P, Brown C, Salim A, Rhee P, et al. Preventable or potentially preventable mortality at a mature trauma center. J Trauma. 2007;63(6):1338-46; discussion 1346-7.
8. Gabbe BJ, Cameron PA, Wolfe R. TRISS: does it get better than this? Acad Emerg Med. 2004;11(2):181-6.
9. Boyd CR, Tolson MA, Copes WS. Evaluating trauma care: the TRISS method. Trauma Score and the Injury Severity Score. J Trauma. 1987;27(4):370-8.
10. Scarpelini S, de Andrade JI, Dinis Costa Passos A. The TRISS method applied to the victims of traffic accidents attended at a tertiary level emergency hospital in a developing country. Injury. 2006;37(1):72-7.
11. Shackford SR, Hollingsworth-Fridlund P, McArdle M, Eastman AB. Assuring quality in a trauma system—the Medical Audit Committee: composition, cost, and results. J Trauma. 1987;27(8):866-75.
12. Bolçone OJ, organizador. Conjuntura econômica de São José do Rio Preto. São José do Rio Preto: Secretaria Municipal de Gestão Estratégica; 2009.

13. Comitê do Trauma do Colégio Americano de Cirurgiões. Suporte avançado de vida no trauma para médicos: manual do curso de alunos. 8ª ed. Chicago: American College of Surgeons; 2008.
14. Champion HR, Sacco WJ, Copes WS, Gann DS, Gennarelli TA, Flanagan ME. A revision of the Trauma Score. J Trauma. 1989;29(5):623-9.
15. Baker SP, O'Neill B, Haddon W Jr, Long WB. The injury severity score: a method for describing patients with multiple injuries and evaluating emergency care. J Trauma. 1974;14(3):187-96.
16. Teasdale G, Jennett B. Assessment of coma and impaired consciousness. A practical scale. Lancet. 1974;2(7872):81-4.
17. Shackford SR, Hollingworth-Fridlund P, Cooper GF, Eastman AB. The effect of regionalization upon the quality of trauma care as assessed by concurrent audit before and after institution of a trauma system: a preliminary report. J Trauma. 1986;26(9):812-20.
18. Karmy-Jones R, Copes WS, Champion HR, Weigelt J, Shackford S, Laenick M, et al. Results of a multi-institutional outcome assessment: results of a structured peer review of TRISS-designated unexpected outcomes. J Trauma. 1992;32(2):196-203.
19. Masella CA, Pinho VF, Costa Passos AD, Spencer Netto FA, Rizoli S, Scarpelini S. Temporal distribution of trauma deaths: quality of trauma care in a developing country. J Trauma. 2008;65(3):653-8.
20. Rutledge R, Messick J, Baker CC, Rhyne S, Butts J, Meyer A, et al. Multivariate population-based analysis of the association of county trauma centers with per capita county trauma death rates. J Trauma. 1992;33(1):29-37; discussion 37-8.
21. Fallon WF Jr, Barnoski AL, Mancuso CL, Tinnell CA, Malangoni MA. Benchmarking the quality-monitoring process: a comparison of outcomes analysis by trauma and injury severity score (TRISS) methodology with the peer-review process. J Trauma. 1997;42(5):810-15; discussion 815-7.
22. Shanti CM, Tyburski JG, Rishell KB, Wilson RF, Lozen Y, Seibert C, et al. Correlation of revised trauma score and injury severity score (TRISS) predicted probability of survival with peer-reviewed determination of trauma deaths. Am Surg. 2003;69(3):257-60; discussion 260.
23. Chawda MN, Hildebrand F, Pape HC, Giannoudis PV. Predicting outcome after multiple trauma: which scoring system? Injury. 2004;35(4):347-58.
24. Gruen RL, Jurkovich GJ, McIntyre LK, Foy HM, Maier RV. Patterns of errors contributing to trauma mortality: lessons learned from 2,594 deaths. Ann Surg. 2006;244(3):371-80.
25. Sugrue M, Caldwell E, D'Amours S, Crozier J, Wyllie P, Flabouris A, et al. Time for a change in injury and trauma care delivery: a trauma death review analysis. ANZ J Surg. 2008;78(11):949-54.
26. Saltzherr TP, Wendt KW, Nieboer P, Nijsten MW, Valk JP, Luitse JS, et al. Preventability of trauma deaths in a Dutch Level-1 trauma centre. Injury. 2011;42(9):870-3.
27. Yagi RK. Aspectos epidemiológicos e aplicação da metodologia TRISS em trauma [dissertação]. São José do Rio Preto: Faculdade de Medicina de São José do Rio Preto; 1999.
28. Wardle TD. Co-morbid factors in trauma patients. Br Med Bull. 1999;55(4):744-56.
29. Offner PJ, Jurkovich GJ, Gurney J, Rivara FP. Revision of TRISS for intubated patients. J Trauma. 1992;32(1):32-5.
30. Fatovich DM, Burrell M, Jacobs IG. Major trauma deaths at Perth secondary hospitals. Emerg Med Australas. 2011;23(6):754-60.
31. Long WB, Bachulis BL, Hynes GD. Accuracy and relationship of mechanisms of injury, trauma score, and injury severity score in identifying major trauma. Am J Surg. 1986;151(5):581-4.
32. Trunkey D. Initial treatment of patients with extensive trauma. N Engl J Med. 1991;324(18):1259-63.
33. Collopy BT, Tulloh BR, Rennie GC, Fink RL, Rush JH, Trinca GW. Correlation between injury severity scores and subjective ratings of injury severity: a basis for trauma audit. Injury. 1992;23(7):489-92.
34. MacKenzie EJ. Review of evidence regarding trauma system effectiveness resulting from panel studies. J Trauma. 1999;47(3 Suppl):S34-41.
35. Cales RH, Trunkey DD. Preventable trauma deaths. A review of trauma care systems development. JAMA. 1985;254(8):1059-63.
36. Rowell SE, Barbosa RR, Diggs BS, Schreiber MA, Trauma Outcomes Group, Holcomb JB, et al. Specific abbreviated injury scale values are responsible for the underestimation of mortality in penetrating trauma patients by the injury severity score. J Trauma. 2011;71(2 Suppl 3):S384-8.

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