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CASE REPORTS

THE APPLICATION OF THE KAMPALA TRAUMA SCORE FOR PREHOSPITAL ASSESSMENT OF SEVERITY OF INJURIES AND PREDICTION OF OUTCOME AFTER SEVERE TRAUMA

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ABSTRACT

Severe trauma is the main cause of mortality and disability in modern society. Emergency medical doctors are usually the first to establish contact with the injured person, and the extent of definitive care largely depends on their correct assessment of the severity of the injury, using an adequate pre-hospital trauma score. Injury severity scores are used to numerically categorize the type and extent of the injury. They represent an important additional instrument, which is used to enable faster triage, the categorization of injury severity, adequate care, treatment, and transport of patients with multiple injuries to the appropriate hospital. They are also important in research. This paper aims to suggest, using several case reports, the possibility of pre-hospital use of the Kampala Trauma Score (KTS) as an easily applicable and very suitable system for monitoring the condition and predicting the outcome of seriously injured patients. The patients were primarily assessed at the pre-hospital level and assigned a certain injury severity score according to the KTS, which later proved to reflect their definitive outcome. It can be concluded that the KTS is an effective scoring system that can be used during initial triage of the seriously injured for categorization of the severity of the injury, prediction of mortality and necessity of hospitalization. The possibility of its potential application during emergency care of the seriously injured, both for differentiating the severity of injuries and for predicting the definitive outcome, is indicated. However, due to the limited number of patients, original research should be conducted on a larger sample.

Keywords: Kampala Trauma Score, trauma, outcome

INTRODUCTION

Severe trauma is the main cause of death and disability in the young and healthy population of modern society [1]. In an interesting article by authors from America and Great Britain, the question arose if trauma was the forgotten pandemic, which was supported by the data that it causes the deaths of more than 6 million people annually [2].

In previous decades, because the treatment process became ever more complex followed by large financial costs, it became necessary to create a system for a faster and more objective assessment of the patient's condition and the prediction of treatment outcome [3], even at the prehospital level. The Emergency Medical Doctors (EMD) in the field are usually the first to establish contact with the injured patient, which is why the extent of medical care the patient will eventually receive largely depends on their primary assessment.

Numerous scoring systems have been defined and they play an important role in treating trauma patients. By assessing the patient's condition using the scoring system, patients can be classified into large groups that enable us to draw conclusions about the patient's condition, possible complications, the outcome of the treatment, and even to plan the type and extensiveness of treatment [4].

Scoring systems have become particularly applicable in the field of trauma because of the urgent need to determine accurate parameters for patient triage [5]. Those parameters are necessary because time is short and the decisions on how to care for the injured patients are made right at the scene of the accident, without the possibility to consult other specialists [6].

All scoring systems are divided into those based on anatomy deformities (AIS - Abbreviated Injury Scale; ISS - Injury Severity Scale), functional disorders (GCS - Glasgow Coma Scale; TS - Trauma Score; RTS - Revised Trauma Score; APACHE II - Acute Physiology and Chronic Health Evaluation), or both (TRISS - Trauma Injury Severity Score).

Anatomy-based scoring systems that focus on visible injuries are commonly used to assess trauma patients. Their disadvantage is that they can only be completed retrospectively after X-ray and other diagnostic procedures have been performed, and sometimes only after an autopsy [1]. This is why they are unreliable for assessing the severity of injury in the prehospital setting.

Physiology-based scoring systems that focus on physiology parameters are more suitable for assessing trauma patients in the prehospital and initial hospital setting [3].

All scoring systems, especially those used at the prehospital level, have their limitations and none are ideal, which is why new scoring systems are constantly being sought to achieve the goal known as the 3Rs: "The right patient at the right time transported to the right hospital" [3].

One of the more recently developed trauma scores from the anatomy-physiology-based group is the Kampala Trauma Score (KTS) (**Table 1**) [7]. Due to its simpler application, it is a valid alternative to the RTS (Revised Trauma Score) and the ISS (Injury Severity Scale) in predicting death outcomes [8].

Table 1. The Kampala Trauma Score

Age in years	**Points**
<5	1
6-55	2
>55	1
	a ____
Number of serious injuries	**Points**
None	3
One	2
Two or more	1
	b ____
Systolic blood pressure	**Points**
>89	4
50-89	3
1-49	2
Undetectable	1
	c ____
Respiratory rate	**Points**
10-29	3
>30	2
<9	1
	d ____
Neurological status (AVPU)	**Points**
alert	
responds to verbal stimuli.	4
responds to painful stimuli.	3
unresponsive	2
	1
	e ____
Total KTS	a+b+c+d+e ……

Interpretation: KTS values range from 5 to 16; a value lower than 11 indicates severe trauma, 11-13 indicates moderate trauma and 14-16 indicates mild injury.

In this paper, we use case reports to suggest the possibility of prehospital use of the Kampala Trauma Score as an easily applicable and very suitable system for triage, categorization of injury severity, condition monitoring and the prediction of outcome in seriously injured patients.

CASE REPORTS

Case 1

The patient was a 46-year-old man who had acquired multiple injuries in a car accident as a driver of a motor vehicle. Upon arrival at the scene of the accident, the Emergency Medical Team (EMT) found the patient under the influence of alcohol, but fully conscious and oriented, with eyes open and moving spontaneously. He denied losing consciousness or suffering from chronic disease.

His blood pressure was normal (105/75 mmHg), as was his respiratory rate (16/min), but he was a bit tachycardic (116/min), with normal heart and lung sounds. His abdomen was distended and tender, with audible peristalsis. There were no pathological reflexes. A quick trauma examination revealed superficial injuries to the head, chest, and abdomen. His estimated Kampala score was 14 (2+1+4+3+4), which classified him as a **mildly injured patient**. He was treated with oxygen therapy (5l/min) and an intravenous infusion of 500ml Ringer's solution once the IV line had been secured. With the working diagnosis of polytrauma, completely immobilized and continuously monitored, he was transported to the Emergency Centre. Through personal enquiry, we learned that after a period of evaluation, hemodynamic stabilization, and observation, he was discharged to go home.

Case 2

The patient was a 94-year-old woman who had acquired multiple injuries after falling in her apartment. Upon examination, she was conscious and oriented, with her eyes open and spontaneous movement. She denied losing consciousness or suffering from chronic disease. Her blood pressure was 145/80 mmHg, her radial pulse was 80/min, and her respiratory rate was normal (14/min), with normal heart and lung sounds. Other physical examination findings were normal. A quick trauma examination revealed injuries to her left upper arm and upper leg. Her estimated Kampala score was 13 (1+1+4+3+4), which classified her as a **moderately injured patient**. She was treated with an IV line and an analgesic IV injection. With the working diagnosis of polytrauma, completely immobilized and continuously monitored, she was transported to the Emergency Centre. We later received information that she was transferred after 18 days to continue her treatment at a secondary-level hospital.

Case 3

The patient was a 23-year-old man who had acquired multiple injuries when falling from a height. Upon arrival at the scene of the accident, the Emergency Medical Team (EMT) found the patient unconscious. A quick trauma examination revealed injuries to the head, chest, and abdomen. His systolic blood pressure was 80 mmHg, his radial pulse was 92/min, and his respiratory rate was 12/min. Upon auscultation, his heart sounds were soft and arrhythmic, and his breathing labored. His abdomen was distended with abdominal guarding and no audible peristalsis. His estimated Kampala score was **10 (2+1+3+3+1)**, which classified him as a **severely injured patient**. He was treated with oxygen therapy (10l/min), hemostasis, and an intravenous infusion of 500ml Ringer's solution once the IV line had been secured. With the working diagnosis of polytrauma, completely immobilized and continuously monitored, he was transported to the Emergency Centre. After 32 days of hospitalization, he was discharged to continue his treatment at home.

Case 4

The patient was an approximately 30-year-old man who had acquired multiple injuries in a car accident as a driver of a motor vehicle that had run into the back of a truck. Upon examination by the EMT, he was found to be unconscious with agonal breathing, wide unreactive pupils, and bleeding from the nose, mouth, and ears. A quick trauma examination revealed injuries to the head, a broken upper and lower jaw with teeth displaced, and multiple left arm fractures. His systolic blood pressure was 60mmHg, his pulse was 44/min, and his respiratory rate was 8/min. His heart sounds were soft and arrhythmic, and his breathing was paradoxical. His estimated Kampala score was **8 (2+1+3+1+1)**, which classified him as a **severely injured patient with a possible lethal outcome**. He was treated with oxygen therapy (15l/min), hemostasis and an intravenous infusion of 500ml Ringer's solution once the IV line had been secured. With the working diagnosis of polytrauma, completely immobilized and continuously monitored, he was transported to the Emergency Centre. During transport, the patient went into cardiac arrest. The asystole protocol CPR was immediately initiated, but with no result and the patient died in the ambulance.

DISCUSSION

In cases of emergency, doctors were always in a dilemma when faced with the issue of classifying injured patients based on the severity of their injury [9]. During the 1970s, trauma scores were beginning to emerge [9]. The longstanding question in clinical practice was which was the best scoring system to apply for predicting the outcome of major trauma. Currently, there is no uniform scoring system that could be the gold standard [10] for categorizing the severity of injury and be applicable in all countries, developed and underdeveloped.

In a recent attempt to solve this problem, the KTS scoring system has been developed. It is an anatomy-physiology-based scoring system with high reliability for categorizing injury severity and a "solid predictor" of mortality in countries with low and medium economic standing [7]. It is easy to apply and very suitable for monitoring the patient's clinical condition. It represents a combination of the Revised Trauma Score (RTS) and the Injury Severity Score (ISS) score [11], and consists of five clinical components: the patient's age in years (5–55, or >55), systolic blood pressure value (>89 mmHg, 50–89 mmHg, or <50 mmHg), respiratory rate (10–29/min, >29/min, or <10/min), the AVPU scale (conscious, responsive to verbal stimuli, responsive to pain stimuli, unresponsive) and the number of serious injuries (none, one, or more than one) (**Table 1**). The mentioned KTS parameters enable the scoring of patients with points from 5 to 16, whereupon they are assigned to a category based on the severity of their injury.

Although many scoring systems can be used at the prehospital level, we chose to apply the KTS for categorizing the severity of injury (KTS 14-16 = mild injury, KTS 11-13 = moderate injury, KTS <11 = severe injury) assuming that the interpreted findings will adequately reflect the type of treatment, transport to an appropriate trauma centre and the prediction of outcome.

However, this is the first paper in which a series of case reports with the prehospital application of KTS was used to predict the outcome of severely injured patients and their need for hospitalization. In the absence of similar reports, it was impossible to verify the obtained findings.

In our paper, one patient sustained mild injuries (KTS 14), one was moderately injured (KTS 13), and two patients were severely injured (KTS 10; KTS 8). A lower KTS indicates a more severe injury [12], which was confirmed by our reports, where two of the patients were classified as severely injured based on their KTS values.

Rare studies explore the KTS as an isolated predictive diagnostic test in the categorization of injury severity. By researching the bibliographic databases (PubMed and Medlin), several original works that compare the KTS with other scores, e.g. RTS, ISS, GKS, and TRISS [13-15], in predicting fatal outcomes after severe trauma were discovered. The authors of a prospective-retrospective study from Uganda concluded that the KTS is a more reliable score than the GKS for categorizing the severity of injury in severe trauma and that a KTS score of $\leq$ 14 increases the probability of death by at least three times [16] and is directly correlated with the two-week survival after trauma. Our research confirmed that: the patient with KTS 8 died, and the two patients with CTS <14 were hospitalized for more than two weeks after the injury (the patient with CTS 13 was transferred to a secondary-level hospital after 18 days, and the patient with CTS 10 spent 32 days in the hospital before being discharged to go home). Given that functional disorders after trauma increase over time, the value of KTS decreases, and with it the probability of survival.

A study from Colombia proved that KTS performed better in predicting death and length of hospitalization than the RTS [17]. The authors of this study conclude, based on solid evidence, that KTS is the simplest method for predicting the lethal outcome in patients because it uses the AVPU system, which is a simpler version of the GKS for determining the patient's neurological status (Alert - awake, fully aware, oriented; V (reaction to verbal stimuli) - reacts to the sound of a voice but is not fully aware, confused; P (reaction to painful stimuli) - unconscious, reacts to painful stimuli; U (unresponsive) - unconscious, does not respond to painful stimuli, has no cough and vomiting reflexes).

Authors of a paper from the United States of America researched electronically available databases on PubMed, Scopus, and CINAHL, as well as individual academic journals published from 1990 to 2017. From a total of 336 papers, they detected 24 papers that researched the severity of injury assessment by implementing KTS [8]. Three papers cautioned against premature integration of KTS into clinical decision-making but highlighted the score's ability to discriminate injury severity using a minimal data set. Continued rigorous evaluation of KTS as a triage score, and its ability to predict fatal outcomes, would increase the confidence in its predictive validity.

In addition to different predictive values, trauma scores also differ in the set of variables necessary to calculate the numerical value of the total score. One of the variables necessary to calculate the KTS is the respiratory rate (RR). It has been observed that this KTS variable is often missing, especially in countries with limited resources, where emergency patients are cared for by paramedics, or where medical equipment (monitors) is lacking, which makes it impossible to determine the total value of the KTS [18]. The most likely argument as to why emergency doctors do not register and/or do not write down the RR in their report is "the burnout syndrome" [19], and not infrequently the urgency of the situation. We have similar problems with doctors in Serbia, who often do not include the value of RR in their medical reports. Our paper presents only the patients whose medical reports had been correctly filled out.

CONCLUSION

We can conclude that the KTS is an effective scoring system that can be used during initial triage of the seriously injured for categorization of the severity of the injury, predicting mortality and the necessity of hospitalization. The possibility of its potential application during emergency care of the seriously injured, both for differentiating the severity of injuries and for predicting the definitive outcome, is indicated. However, due to the limited number of patients in our study, original research should be conducted on a larger sample.

Conflict of interest: The authors declare no conflict of interest.

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PRIKAZI BOLESNIKA

PRIMENA KAMPALA TRAUMA SKORA ZA PREHOSPITALNU PROCENU TEŽINE POVREDA I PREDVIĐANJE ISHODA NAKON TEŠKE TRAUMA

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SAŽETAK

Teška trauma predstavlja glavni uzrok mortaliteta i invaliditeta u savremenom društvu. Lekari hitne medicinske pomoći najčešće prvi uspostavljaju kontakt sa povređenom osobom, te od pravilne procene težine povrede upotrebom adekvatnog prehospitalnog trauma skora zavisi ekstenzivnost definitivnog zbrinjavanja. Skorovi težine povreda služe da numerički karakterišu prirodu i obim povrede. Predstavljaju važan dodatni instrument koji se koristi u cilju brže trijaže, kategorizacije težine povrede, adekvatnijeg zbrinjavanja, lečenja i transporta pacijenata sa multiplim povredama u odgovarajuću hospitalnu ustanovu. Takođe su značajni u istraživanjima. Cilj rada je da se kroz prikaze bolesnika ukaže na mogućnost prehospitalne upotrebe Kampala trauma skora (KTS) kao lako primenjivog i veoma pogodnog za praćenje stanja i predviđanje ishoda teško povređene osobe. Bolesnici su prema KTS procenjeni različitom težinom povrede na prehospitalnom nivou, koje su bili u skladu sa definitivnim ishodom. Može se zaključiti da je KTS efikasan bodovni sistem u inicijalnoj trijaži teško povređenih, kategorizaciji težine povrede, predikciji mortaliteta i neophodnosti hospitalizacije. Ukazana je mogućnost njegove potencijalne primene u hitnom zbrinjavanju teško povređenih kako u razlikovanju stepena težine povreda, tako i u predviđanju definitivnog ishoda. Međutim, zbog limitiranog broja pacijenata, treba sprovesti originalna istraživanja na većem uzorku

Ključne reči: Kampala trauma skor,trauma, ishod