Assessment of the correlation between the Vittel criteria and the ISS score: A novel approach to pre-hospital severe trauma patient's triage

Evaluation de la corrélation entre les critères de Vittel et l'ISS score: Une nouvelle approche de triage pré hospitalier des patients traumatisés sévères

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ABSTRACT

Introduction-Aim: Validated triage tools such as the Vittel criteria are essential to improve the care of trauma patients. The aim of this study was to evaluate the correlation between the Vittel triage criteria and the Injury Severity Score (ISS) to improve the accuracy of pre-hospital triage.
Methods: We conducted a longitudinal study of all trauma patients transported by EMS over a two-year period (November 2021- November 2023). Vittel and (ISS) scores were calculated on admission. Predictive Vittel criteria were defined by independent risk factors for ISS>15 using a multiple logistic regression model with p-value < 0.05 and/or sensitivity (se) >50%, with positive Youden index (Yi).
Results: A total of 461 trauma patients were transported by EMS during the study period were included. The sex ratio was 5.3 and road traffic accidents accounted for 77.2%. An ISS>15 was found in 41% of participants, 25% required ICU admission and 23.9% died within 30 days. Using the above selection criteria, we identified seven key predictive criteria (OR CI 95%, se%, Yi) Glasgow coma scale<13(3.16 [1.91 5.24],44,0.25); fall>6 m(4.031[1.61-10.08],10,0.07); severe burn(23.89[10.21-55.93],6,0.02); Pelvic fracture (4.93 [1.19-20.32], 28, 0.25),suspected spinal cord injury(6.89 [2.79-16.96], 6, 0.05); Fluid resuscitation>1000 ml(-, 60.0. 11); Catecholamine (2.02 [1.09-3.75],51.0.27). Physiological variables (se 30%, Yi 0.16) and pre-hospital resuscitation(se 46%, Yi 0.18) were among the most relevant categories for predicting severity, similar to the full Vittel score.
Conclusion: Seven criteria were associated with severe trauma (ISS score >15). Physiological variables and pre-hospital resuscitation were significant categories that may help to predict the severity of trauma and its impact on patients.

Key words: trauma, triage, vittel score, injury severity score (ISS), prehospital

RÉSUMÉ

Introduction-Objectif: Des outils de triage validés comme les critères de Vittel sont essentiels pour améliorer le pronostic des patients traumatisés. L'objectif de cette étude était d'évaluer la corrélation entre les critères de triage de Vittel et le score de gravité des blessures (ISS) afin d'améliorer la précision du triage pré-hospitalier.
Méthodes: Nous avons mené une étude longitudinale auprès des patients traumatisés transportés par le SAMU sur une période de deux ans, de novembre 2021 à novembre 2023. Les scores de Vittel et (ISS) étaient calculés à l'admission. Les critères prédictifs de Vittel étaient définis par des facteurs de risque indépendants pour ISS>15 en effectuant un modèle de régression logistique multiple, avec une valeur p <0.05 et ou, une sensibilité (se%) supérieure à 50% avec un indice de Youden positif (Yi).
Résultats: Au total, 461 patients traumatisés étaient transportés par le SAMU au cours de la période d'étude. Le Sex-ratio était de 5,3 et les accidents de la route représentaient 77,2 %. Un ISS>15 était trouvé pour 41% des participants, 25% étaient admis en USI et 23,9% sont décédés dans les 30 jours. En appliquant les conditions de sélection susmentionnées, nous avons identifié sept critères prédictifs clés (OR CI 95%, se%, Yi) : score Glasgow < 13(3.16 [1.91-5.24],44,0.25), chute> 6 m(4.031[1.61-10.08], 10, 0.07) ,brûlure sévère(23.89[10.21-55.93],6,0. 02), fracture du bassin(4,93 [1,19-20,32],28,0,25),suspicion de lésion de la moelle épinière(6,89 [2,79-16,96],6,0,05) ; réanimation liquidienne > 1000 ml(-, 60,0. 11), Catécholamine(2,02 [1,09-3,75],51,0,27). les variables physiologiques (se 30%, Yi 0,16) et la réanimation pré-hospitalière (se 46%,Yi 0,18);étaient parmi les catégories les plus pertinentes pour prédire la gravité de la même façon que le score de Vittel complet.
Conclusion: Sept cratères ont été associés à un traumatisme grave (score ISS > 15). Les variables physiologiques et la réanimation pré-hospitalière sont des catégories significatives qui peuvent aider à prédire la gravité du traumatisme et son impact sur les patients

Mots clés: Traumatisme, triage, score de Vittel, score de gravité des lésions (ISS), pré-hospitalier

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INTRODUCTION

Seriously injured patients represent 15% of all trauma cases and remain the leading cause of death among individuals under 40 years old, resulting in a significant burden on health care systems (1, 2).

The management of these patients is a real challenge, requiring accurate pre-hospital assessment to determine the resources required and ensure appropriate referral to the most appropriate care facilities (3, 4). Numerous studies have shown that the transfer of major trauma patients to specialized Trauma Centres (TCs) significantly reduces mortality (5-7).

Pre-hospital over-triage can result in significant costs, geographical limitations for patients and excessive burden on referral centres (8). This over-triage diverts critical resources away from patients who do not necessarily require care at level I TCs, and may result in under-treatment of patients at these referral centres. This in turn can increase morbidity and mortality among patients with severe injuries (4).

A well-designed triage algorithm can limit under-triage to less than 5% and control over-triage within a range of 25 to 50% (9). The initial field triage algorithms were developed in the United States and served as a reference for French emergency physicians who created their own triage algorithm within the French trauma system. In 2002, these physicians developed the Vittel Criteria Algorithm which consists of 24 different criteria divided into five categories (10). Several studies have evaluated the Vittel Criteria, with most indicating a higher frequency of over-triage than under-triage (11).

These findings could be explained by the large number of criteria included in this score and its rules of use, as only one criterion is required to define trauma severity, except for patient-related characteristics. Therefore, it may be relevant to develop simpler versions of the Vittel score, taking in to account the criteria with the highest discriminatory characteristics. Such approach may also save time and facilitate the triage process.

The aim of this study was to evaluate the correlation between the Vittel triage criteria and the Injury Severity Score (ISS) in order to improve the accuracy of pre-hospital triage.

METHODS

Study Design

This is a longitudinal analytical study that includes Trauma patients who were transported by teams of Mobile Emergency and Intensive Care Units (MEICU) of the Tunisian Center -East (EMS 03) over a two-year period from November 2021 to November 2023.

Study Population

Sampling procedure: We included all eligible patients according to the inclusion and exclusion criteria.

Eligibility criteria

Our study included patients with suspected major trauma according to the Vittel triage criteria. We excluded patients who were transferred to another facility or for reasons other than trauma, those who died in the pre hospital setting, those with incomplete medical records and those for whom data were missing.

Data collection

Data were collected from medical observations based on a pre-designed data collection sheet. For each patient, we collected data from the field examination to calculate the pre-hospital triage score (Vittel score). Subsequently, the Injury Severity Score (ISS) was calculated on admission based on clinical and radiological injury assessment.

Follow-up was ensured via a first telephone interview with the receiving service on the patient's arrival (to obtain the ISS score and the patient's disposition) and a second interview at 30 days to inquire about the patient's progress (recovery, death, ICU admission…).

Operational definitions

Severely traumatized: a patient who has suffered a violent trauma that is likely to have caused multiple injuries and/or is life-threatening or functional (2).

Vittel Criteria: to determine the need for a whole-body scan in a severely traumatized patient, allowing the detection of serious injuries not suspected on clinical examination at the expense of an increased number of normal scans. This is a pre-hospital triage score that helps to define patients who need to be transferred to a level 1 trauma center. The presence of a single criterion is sufficient to characterize the severity of the trauma, except in the area where it is a case-by-case assessment (10).

Injury Severity Score (ISS): considered the gold standard (13). Major trauma (or Polytrauma) is defined by a score greater than 15. It correlates with mortality, morbidity and length of hospital stay after trauma. It issued to define the term major trauma. The Association for the Advancement of Automotive Medicine (AAAM) committee is responsible for the development and refinement of the scale (2).

Medically assisted transfers: transfers by mobile emergency and intensive care teams.

Primo-secondary transfers: transfers from peripheral emergency departments without adequate technical facilities by teams of mobile emergency and intensive care units. (They cannot be considered as primary interventions because, unlike primary interventions, they take place within the hospital).

Statistical Analysis

Data entry and analysis: Data entry and analysis were performed using the Statistical Package for Social Sciences (SPSS 10.0 (IBM, Chicago, IL, USA)). Absolute frequencies (counts) and relative frequencies (percentages) were calculated to describe the distribution of qualitative variables.

Quantitative variables were assessed using both means and standard deviations (SDs) after confirming normality of distribution, or medians and variances where appropriate. The chi-squared test of independence was used to assess the relationships between the explanatory variables (ISS >15, ICU admission and 30-day mortality) and the 24 individual Vittel score criteria. Results were expressed as odds ratios (OR) with corresponding 95% confidence intervals (CI) and p-values.

Vittel criteria with p-values less than 0.20 were selected for inclusion in step-down back ward logistic regression analysis.

Three distinct models were developed to predict the risk of ISS >15; ICU admission; 30-day mortality.

The results of this analysis were presented as adjusted odds ratios (ORa) with associated 95% CIs.

The criteria that appear in the final multiple logistic regression model for ISS>15 are considered independent risk factors for severity. Thus, each criterion alone and independently of the other criteria can predict severity.

Criteria with a p-value less than 0.05 were considered statistically significant throughout the analysis.

For the main outcome variable (ISS >15), Receiver Operating Characteristic (ROC) curves were generated for all Vittel criteria, together with the corresponding Area under the Curve (AUC) values, as described in (14). These ROC curves provided a visual representation of the performance of the Vittel score criteria in predicting patient outcomes. In addition, sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) and Youden's index were calculated for a comprehensive assessment of test validity (15-17).

Youden's index serves as a measure of the overall effectiveness of a diagnostic method and includes both sensitivity and specificity.

In conclusion, predictive Vittel criteria are defined by the independent risk factors for severity in multiple logistic regression for ISS>15, along with criteria that have a sensitivity greater than 50% and a positive Youden index.

Ethical considerations

This study was approved by the relevant institutional ethics committee. Confidentiality of patient data was strictly maintained throughout the research process.

RESULTS

Demographic characteristics

The median age of the study population was 30 years (interquartile range: 21-49 years), and ranged from 1 to 87 years. The sex ratio was 5.3, with the cohort being predominantly male. The most common mechanism of injury was road traffic accidents, accounting for 77.2% of cases. Blunt trauma was the predominant type of injury, occurring in 47.3% of patients (Table 1).
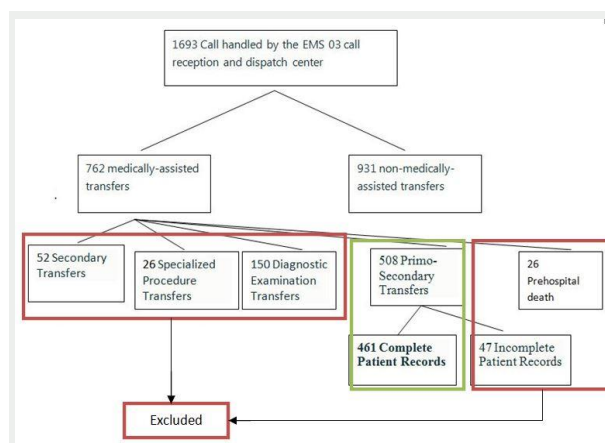

Figure 1. Flowchart of study

Table 1. Characteristics of the study population among trauma patients transported by EMS 03 from November 2021 to December 2022 (n = 461)

Characteristics	n(%)
Gendre :	
Male	385(83.5)
Female	77(16.5)
Trauma Circumstances:	
Road Traffic Accident	356 (77.2)
Home accident	63 (13.6)
Work accident	22 (4.7)
Assault	20 (4 .3)
Mechanisms of injury	
Blunt trauma	218 (47.3)
Penetrating trauma	72 (15.6)
Burn	59 (12.8)
Other injuries	112 (24.3)

Trauma Severity Criteria

Vittel Triage Criteria: According to the Vittel criteria, the frequency of each component in our study population was as follows: Physiological variables showed a Glasgow Coma Scale score below 13 in 29.9% of patients. Among kinetic variables, «overall assessment " was the most frequently observed, occurring in 37.5% of the cohort. Assisted ventilation was required in 54% of patients, fluid resuscitation exceeding 1000 ml was required in 34.7%, and catecholamines were used in 16.9%. Injury severity and outcomes: Among the 461 trauma patients enrolled, 189 (41%, CI 95% [36.9 - 45.3]) had an Injury Severity Score (ISS) greater than 15. A total of 119 patients (25%, CI 95% [22.1 - 30.2]) were admitted to intensive care, and 110 patients (23.9%, CI 95% [20.2 - 27.8]) died within 30 days of admission (Table 2).

Table 2. Patient severity according to ISS>15, admission to intensive care and death within 30 days among trauma patients transported by EMS 03 from November 2021 to December 2023

Severity	Effectif n (%)	IC à 95%
ISS >15	189 (41)	[36.9 - 45. 3]
Intensive care unit admission	119 (25)	[22.1 - 30.2]
30-day mortality	110 (23.9)	[20.2 - 27.8]

A Univariate analysis was conducted to test the association between an Injury Severity Score
(ISS) greater than 15 and the individual components of

the Vittel triage scale. Eleven Criteria were significantly associated. However, the multiple logistic regression analysis, aimed at explaining an ISS score greater than 15 using the Vittel criteria, identified six independent predictors: Glasgow Coma Scale<13, fall from>6 meters, Severe burn, pelvic fracture and spinal cord injury (OR=6.89, 95% CI: 2.79-16.96, p<0.001) (Table 3)

Table 3. The association between the various Vittel criteria and ISS score > 15 in Univariate and multivariate analysis

Evaluation Vittel catégories	Severity Criteria	Frequency n (%)	ISS<15 n (%)	ISS>15 n(%)	Univariate Analysis OR [IC à 95%]	P	Multivariate Analysis P	OR [IC à 95%]
Physiological variables	Glasgow coma scale < 13	138(29.9)	54(19.9)	84(44.4)	3.23 [2.23-4.88]	**<0.01**	0.001	**3.16 [1.91-5.24]**
	Systolic Blood Pressure (SBP)< 90 mm Hg	78(16.9)	27(9.9)	36(19)	2.14 [1.25-3.66]	**<0.01**		
	Oxygen Saturation O2 < 90 %	63(13.7)	29(10.7)	49(25.9)	2.93 [1.77-4.86]	**0.01**		
Kinetic elements	Ejection from a vehicle	64(13.7)	36(13.2)	28(14.8)	1.14 [0.67-1.94]	0.63		
	Other passenger deceased in the same accident	19(4.1)	10(3.7)	9(4.8)	1.31 [0.52-3.29]	0.56		
	fall> 6 m	28(6.1)	9(3.3)	19(10.1)	3.27 [1.44-7.39]	**<0.01**	0.003	**4.031[1.61-10.08]**
	Victim projected or crushed	46(10)	18(6.6)	28(14.8)	2.45 [1.31-4.58]	**<0.01**		
	Overall assessment (vehicle deformation, estimated speed, absence of helmet, absence of seatbelt	173(37.5)	104(38.2)	69(36.5)	0.93 [0.63-1.36]	0.71		
Anatomic injuries	Penetrating trauma : head, neck, chest, abdomen, pelvis, arm, thigh	72(15.6)	38(14.0)	16(8.5)	0.57 [0.31-1.05]	0.07		
	Flail chest	23(5)	12(4.4)	11(5.8)	1.34 [0.58-3.10]	0.49		
	Sever burn, smoke inhalation	59(12.8)	7(2.6)	52(27.5)	14.37[6.36-32.48]	**<0.01**	0.001	**23.89[10.21-55.93]**
	Pelvic fracture	14(3)	3(1.1)	11(5.8)	5.54 [1.52-20.14]	**<0.01**	0.027	**4.93 [1.19-20.32]**
	Suspected spinal cord injury	38(8.2)	7(2.6)	31(16.4)	7.43[3.20 -17.27]	**<0.01**	0.001	**6.89 [2.79-16.96]**
	Amputation at wrist, ankle, or above	06(1.3)	2(0.7)	4(2.1)	2.92 [0.53-16.10]	0.23		
	Acute limb ischemia	02 (0.4)	1(04)	1(0.5)	1.44 [0.09-23.19]	1		
Prehospital ressuscitation	Assisted ventilation	249(54)	135(49.6)	114(60)	1.54 [1,06-2,25]	**0.02**		
	Fluid ressuscitation > 1000 ml	160(34.7)	64(23.5)	96(50.8)	3.35 [2.25-5]	**<0.01**		
	Catecholamine	78(16.9)	27(9.9)	51(27.)	3.35 [2.01-5.59]	**<0.01**	0.024	**2.02 [1.09-3.75]**
Field (to be assessed)	Age > 65 years	32(6.9)	17(6.3)	15(7.9)	1.29 [0.63-2.66]	0.48		
	Heart failure or coronary insufficiency	10(2.2)	4(1.5)	6(3.2)	2.20 [0.61-07.89]	0.33		
	Respiratory insufficiency	3(0.7)	1(0.4)	2(1.1)	2.9 [0.26-32.2]	0.57		
	Pregnancy (second and third trimester)	2(0.4)	1(0.4)	1(0.5)	1.44 [0.09-23.19]	1		
	Coagulation disorder	1(0.2)	-	1(0.5)		0.41		

Performance of the Vittel score in predicting severity (ISS >15)

Identification of Key Vittel Criteria: Taking into account the final multiple logistic regression models, the performance of each Vittel criterion, and through sensitivity and specificity calculations, we identified seven key predictive variables (Table 4).

Vittel category performance

The performance of each Vittel criterion category is shown in (Table IV). Notably, the « pre-hospital resuscitation »category had the highest sensitivity at 46%. This suggests that the variables within this category, such as fluid resuscitation volume and catecholamine use, are particularly relevant in the detection of severe trauma. Furthermore, a Youden index of 0.18 for this category highlights its ability to effectively discriminate cases of interest. On the basis of the various performance metrics calculated, we identified:

A four-step Vittel algorithm (4 STEP): including four categories: physiological variables, kinetic elements, anatomical lesions and pre-hospital resuscitation.

A three-step algorithm (3 STEP): including physiological variables, kinetic elements and pre-hospital resuscitation.

Key Vittel criteria, which include the above seven criteria, including GCS<13 and/or fall>6 m and/or severe burn and/or pelvic fracture and/or spinal cord injury and/or fluid resuscitation>1000 ml and/or use of catecholamines.

Regarding the impact of the key Vittel criteria on predicting an ISS greater than 15, in line with the intra-hospital and institutional definition of severe trauma, the AUC (area under the ROC curve) is 0.73 (95% confidence interval: 0.68 - 0.77) with a p-value less than 0.01(Figure 2A). The Youden index is calculated to be 0.38 when more than two Vittel criteria are considered, giving a sensitivity of 70.4% and a specificity of 68%.

Table 4. Performance of Vittel criteria and category in predicting an ISS > 15 among trauma patients transported by EMS 03 from November 2021 to December 2023

Vittel category	Vittel Criteria	ISS>15						
		Se%	Sp%	VPP%	VPN%	RVP%	RVN%	YOUDEN index
Physiologicalvariables		*30*	*87*	*61*	*64*	*36*	*39*	*0.16*
	Glasgow coma scale < 13	**44**	**80**	**61**	**68**	**33**	**39**	**0.25**
	Systolic Blood Pressure (SBP)< 90 mm Hg	26	89	63	64	37	37	0.15
	Oxygen Saturation O2 < 90 %	19	90	57	62	38	43	0.09
Kinetic Elements		*14*	*89*	*47*	*60*	*40*	*54*	*0.13*
	Ejection from a vehicle	15	87	44	60	41	56	0.02
	Other passenger deceased in the same accident	5	96	48	60	41	53	0,01
	fall> 6 m	**10**	**97**	**68**	**61**	**39**	**32**	**0.07**
	Victim projected or crushed	15	93	61	61	39	39	0.08
	Overall assessment (vehicle deformation, estimated speed, absence of helmet, absence of seatbelt	37	62	40	58	42	60	-0.02
Anatomic Injuries		*10*	*96*	*64*	*61*	*40*	*36*	*0.06*
	Penetrating trauma : head, neck, chest, abdomen, pelvis, arm, thigh	1	100	100	59	41	0	0.01
	Flail chest	6	96	49	60	40	52	-0.06
	Sever burn, smoke inhalation	**6**	**96**	**49**	**60**	**40**	**52**	**0.02**
	Pelvic fracture	**28**	**97**	**88**	**66**	**34**	**12**	**0.25**
	Suspected spinal cord injury	**6**	**99**	**79**	**60**	**40**	**21**	**0.05**
	Amputation at wrist, ankle, or above	16	97	82	63	3	18	0.14
	Acute limb ischemia	2	99	67	59	41	33	0.01
Prehospital Ressuscitation		*46*	*72*	*54*	*66*	*34*	*46*	*0.18*
	Assisted ventilation	1	100	50	59	41	50	0.00
	Fluid resuscitation > 1000 ml	**60**	**50**	**46**	**65**	**35**	**54**	**0.11**
	Catecholamine	**51**	**77**	**60**	**69**	**31**	**40**	**0.27**
Field (to be assessed)		*7*	*98*	*65*	*60*	*40*	*35*	*0.04*
	Age > 65 years	27	9	65	64	41	36	0.17
	Heart failure or coronary insufficiency	27	90	65	64	36	35	0.17
	Respiratory insufficiency	3	99	60	59	41	40	0.02
	Pregnancy (second and third trimester)	1	100	67	59	41	41	0.01
	Coagulation disorder	1	100	50	59	41	41	0.00

Se: Sensitivity Sp: Specificity, **VPP**: Positive Predictive Value, **VPN**: Negative Predictive Value, **RVP**: Positive Likelihood Ratio, **RVN**: Negative Likelihood Ratio, **PAS**: Systolic Blood Pressur

Comparative analysis of the triage algorithms

Comparative analysis of the four triage algorithms, including the reference Vittel score and three alternative approaches, revealed that their receiver operating characteristic (ROC) curves converged, indicating similar performance levels (Figure 2B). This convergence suggests that these methods have comparable predictive accuracy when assessed by ROC curve analysis.

The convergence of the ROC curves for the triage methods suggests that they have similar discriminatory ability for identifying severe trauma, as defined by an Injury Severity Score (ISS) greater than 15.
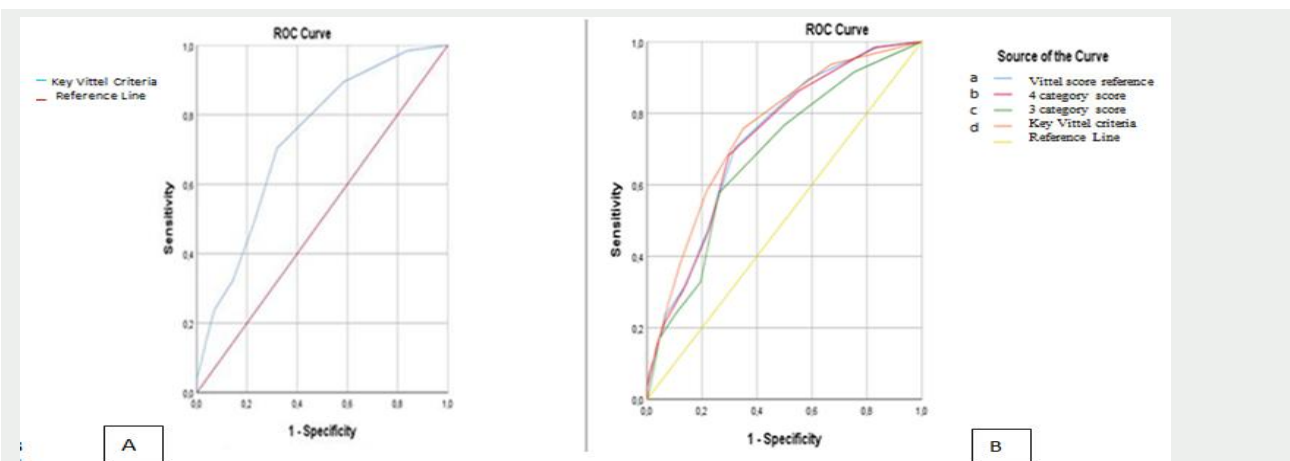

Figure 2. ROC curves illustrating the predictive performance of Key Vittel criteria and 4 approaches regarding an ISS > 15. (a) Vittel score reference (b) first alternative, 4 category score (c) 3 category score (d) key Vittel criteria

DISCUSSION

Our study has identified significant trends in major trauma. Men in their thirties are the most exposed to trauma, mainly due to road traffic accidents. The predominant mechanism of injury is blunt trauma. Pre-hospital resuscitation is often required according to the Vittel criteria. Almost half of the population studied had an ISS >15. The analysis showed that the categories terrain and anatomical lesions were not strongly associated with an ISS>15, in contrast to physiological variables, kinetic lesions and pre-hospital resuscitation. Based on the convergence of the ROC curves, a new simplified approach for predicting an ISS>15 was developed, showing similar performance to the Vittel reference score. Physiological criteria play a predominant role in predicting the severity of trauma, with the Glasgow score and the use of catecholamines as the most significant factors.

These results highlight the equivalence in performance among the triage algorithms studied, which is an important consideration when selecting the most appropriate approach for practical application. However, it also highlights the need to evaluate criteria beyond the ROC curve, such as the simplicity and efficiency of the triage tool. One such alternative is the reduced Vittel score, which uses seven key variables to assess trauma severity. This needs to be validated by additional studies to guide patient referral to the appropriate trauma centre. This stream lined approach may offer advantages in terms of ease of use and clinical implementation, while maintaining comparable predictive performance to the full Vittel score and other algorithms. However, practical factors such as the number of criteria and the potential for improved efficiency that may be achieved with a reduced Vittel approach should also be considered when selecting the optimal triage tool.

The management of severely traumatized patients and their triage by specialized trauma teams in pre-hospital settings significantly improves their outcomes (18). In many countries, severely injured patients are treated at the scene by pre-hospital emergency medical services (EMS) teams. These teams provide immediate resuscitation, direct patients and transport them to the most appropriate hospital (2). The critical concept of the "golden hour" emphasizes the importance of rapid pre-hospital care and timely referral for definitive treatment (3).

Pre-hospital triage criteria are designed to identify severely injured patients and direct them to trauma centres (19, 20). Under-triage, where a critically injured patient is wrongly sent to a general hospital, is associated with increased mortality (21). Conversely, over triage, the sending of a minor trauma patient to a specialized centre, can lead to additional costs and resource utilization. A good triage algorithm should keep the under-triage rate below 5%, even at the expense of an over-triage rate of 25-50% (7, 22).

Many scoring systems have been studied in different Prehospital emergency care settings compared to ours, such as the Trauma Related Injury Severity Score (TRISS) (23), the Circulation, Respiration, Abdominal Injury, Motor and Speech Scale CRAMS (24), the Revised Trauma Score RTS (25) and the Trauma Triage Rule (26) developed in North American systems. While these scores are easy to use, they have some significant limitations, including their inability to predict the need for surgery and the lack of precision in evaluating the patient's status; they can introduce biases in its prognostic evaluation and impact the effectiveness of guiding the initial care of trauma patients (12); which tends to overestimate mortality, particularly in the most severely injured patients (12) (27). Our study provided an epidemiological profile of severe trauma patients treated by EMS 03 in the central-eastern region of Tunisia. A new reduced Vittel score can be composed of seven criteria developed to predict ISS >15. Furthermore, the analysis showed that physiological variables, pre-hospital resuscitation and kinetic elements were strongly associated with ISS >15. These findings emphasize the importance of neurological assessment, assessment of cardiovascular and respiratory function, analysis of accident mechanism, management of severe burns and pelvic fractures, and early recognition of spinal injury in trauma patients (28). Advanced respiratory and circulatory support measures are critical for patients with these risk factors.

Further research is needed to investigate different criteria in kinetic elements, anatomical injuries and field categories to determine which are most relevant for predicting ISS>15 in major trauma patients to avoid triage errors (29). Additional studies are needed to determine comprehensive and optimal pre-hospital triage criteria or algorithms that can help clinicians make appropriate decisions to get traumatized patients to the right place at the right time (30). Our study was the first in our Tunisian and African context to investigate the Vittel criteria and ISS >15 to predict a reduced Vittel score. Patient follow-up through telephone interviews allowed for longitudinal data collection and insight into patient progress, while controlling for loss to follow-up.

Strengths of the study: This appears to be the first survey of its kind conducted in Tunisia that aims to be representative of all serious injuries in the central eastern region. This is an important contribution to the limited research in this area.

Potential limitations: The authors acknowledge the possibility of selection bias in their study. This is a valid concern, as cases that resulted in pre-hospital mortality or were transported by means other than the study criteria may have been missed. The authors correctly point out that this type of bias is difficult to avoid in this type of observational study.

In addition, the use of ICU admission as a severity criterion may introduce a classification bias. The authors recognize that some severely injured patients may not have been admitted to the ICU due to resource constraints in the participating centres. This is an important limitation to consider when interpreting the study findings on injury severity.

Recommendations: This study could improve pre-hospital management by providing a quicker and more accurate assessment of trauma severity. By following Vittel's key pre-hospital triage criteria; we can avoid under- or over-triage of potentially serious patients. This could have a

significant impact on the survival and prognosis of the most critically injured patients by ensuring faster access to vital interventions.

The results would disseminate this advance to the Tunisian medical community, which faces specific challenges in pre-hospital trauma care. This would help to improve triage practices and ultimately the management of trauma patients by encouraging

Inter disciplinary collaboration between health professionals, emergency service managers and policymakers to implement uniform triage recommendations and protocols.

Conclusion

Our study identified seven criteria associated with severe trauma (ISS score >15). These findings highlight important factors that may help to predict the severity of trauma and its impact on patients. In particular, physiological variables and pre-hospital resuscitation were among the most important categories in predicting severity. Through a rigorous analysis of the Vittel pre-hospital triage criteria, we aimed to identify the most relevant parameters for assessing trauma severity and effectively directing patients to the appropriate level of care. Despite this, challenges remain in pre-hospital triage, highlighting the need for continued research and evaluation to improve the management of trauma patients. This should be based on scores that are both effective and efficient, such as the validation of a simplified pre-hospital Vittel score.

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