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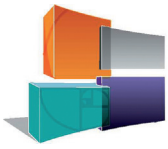

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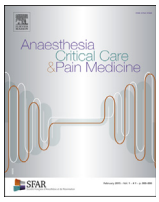

Original Article

Vittel criteria for severe trauma triage: Characteristics of over-triage

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ABSTRACT

Aim: Over-triage rates related to the use of Vittel criteria are unknown. We compared severe stable trauma patients with and without significant visceral injuries.
Study design: A single-centre retrospective analysis of a single-centre prospective cohort.
Patients and methods: Trauma patients with at least one positive Vittel criterion from June 2010 to January 2012 in a level-1 trauma centre. Initial management included a systematic whole-body scanner. All significant lesions in stable trauma patients were recorded.
Results: A total of 252 trauma patients were admitted. One hundred and twenty were stable. In this group without vital distress, 72 (60%) had at least one occult lesion, 21 (17.5%) had an isolated orthopaedic injury and 27 (22.5%) had no injury. Thoracic injuries accounted for 44% of visceral injuries, abdominal for 17%, spinal for 16% and cerebral for 15%. Overall, the over-triage rate was 19%. Surgery for significant visceral injury was performed in 13 patients (18%) and arteriography in 4 patients (5.5%). Admission in an intensive care unit was required for 13 patients with occult injuries and for one patient without such a lesion (18% versus 2%, $P = 0.008$). Hospital stays were longer in the group with visceral injuries (4 ± 7 versus 9 ± 8 days; $P = 0.006$).
Conclusion: Vittel criteria use in trauma patients induces an acceptable over-triage rate. A large proportion of stable trauma patients have occult lesions. These visceral injuries frequently require special care. These data highlight the imperative need to transport major trauma patients immediately to a dedicated trauma centre and supports whole-body scanner use.

1. Introduction

The proper triage of severe trauma patients affects their prognosis [1,2]. The FIRST study has demonstrated a substantially lower risk of death when major trauma care is provided in a dedicated trauma centre instead of a general hospital [1]. The prehospital triage process is performed on incomplete and scattered clinical data. To improve its discriminating performance, the Vittel criteria were proposed by Riou et al. in 2002 [3]. This French national triage algorithm includes five categories: physiological variables, kinetic components, anatomical injuries, resuscitation prior to admission and patient predisposition.

The Vittel criteria have recently been shown as correctly avoiding under-triage [4]. The triage of critical, unstable patients with obvious major injuries is generally easy, allowing them to be quickly directed towards a specialized trauma centre. For stable patients with anamnestic elements predicting potential severity, the decision is less obvious. These patients are at risk of over or under-triage. A significant visceral injury is not always symptomatic on the initial clinical examination and may go unnoticed [5]. A secondary worsening is possible, requiring specialized care. This is why a systematic whole-body scanner in all severe trauma patients can detect unsuspected injuries. The benefit associated with whole-body CT scans has already been demonstrated [1,6]. Babaud et al. [7] showed that the use of the Vittel criteria to determine the need for a scanner compared to a clinically based

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targeted prescription detects injuries that would have been missed in 15% of cases.

The impact of over-triage is regularly seen as a time-consuming and cost-consuming disorganization factor. However, the characteristics of over-triage related to the use of the Vittel criteria have never been studied.

The first aim of our study was to analyse the characteristics of severe, stable trauma patients without vital distress in order to describe over-triage related to the use of the Vittel criteria. The second aim was to identify the spectrum of unsuspected SVI involved and to study their therapeutic impacts.

2. Patients and methods

2.1. Study design

This was a monocentric, retrospective analysis. The data of the cohort were prospectively collected from June 2010 to January 2012 in our level I trauma referral centre (Sainte-Anne Military Hospital, Toulon). The data processed were declared to the French Data Protection Authority (CNIL, MR-001 No. 1578624vO). Trauma patients with at least one positive Vittel criterion, transported directly from the scene of injury to the trauma centre, were included. Inter-hospital transfers from lower level facilities were excluded, as well as patients under 18 years of age.

2.2. Technique

The Sainte-Anne Military Hospital is a Level-1 tertiary trauma centre providing advanced technology and highly trained teams for the management of critical injury with an emergency department, an intensive care unit, a burn unit, and an interventional radiology unit. All complementary surgical subspecialties and necessary allied health care professionals are available in the hospital (visceral and thoracic surgery, orthopaedic surgery, and neurosurgery).

Severely injured patients were initially treated according to the local protocol in the resuscitation room located in the emergency department. The multidisciplinary team consisted of an anaesthesiologist/critical care specialist, a general surgeon, an emergency physician and nurses. A Focused Assessment with Sonography for Trauma (FAST) was always performed, completed with a biological assessment and standard x-rays of the chest and pelvis. Mean duration of initial resuscitation was 25 min (SD 22 min).

After the initial resuscitation, patients who had become haemodynamically stable had a whole-body scanner. Patients who were still haemodynamically unstable were first transferred to the operating room or to the arteriography room to stop the bleeding process before the scanner was performed. Patients were then admitted to the intensive care unit, the operating room or the arteriography room according to their lesions. Patients without lesions were taken back to the emergency department and then discharged home. Obtaining the scanner, including transfer time, took around 40 minutes.

All imaging was performed with a 64-slice computed tomography scanner (General Electrics, United States) using a standardized protocol that included several acquisitions. The images exploring the skull and the cervical spine were acquired before the intravenous contrast injection. Then, an iodinated contrast injection of Omnipaque® (350 mg, 120 mL) was performed. The contrast-enhanced arterial phase explored the supra-aortic vessels, the chest, the abdomen and pelvis. A final contrast-enhanced portal time analysed the abdomen and pelvis a second time.

2.3. The data collected

The following data were collected for every patient included: demographic characteristics, prehospital physiological parameters (Glasgow coma scale, blood pressure, heart rate, oxygen saturation), the prehospital resuscitation protocol (fluids, mechanical ventilation, catecholamines), the Vittel criteria, the circumstances of the accident, the laboratory tests results (haemoglobin, platelet count, prothrombin time, fibrinogen and lactate), the transfusion of red blood cells during the first 24 hours and the hospitalization unit required. The Injury Severity Score (ISS) and the Mechanism, Glasgow coma scale, Age, arterial Pressure (MGAP) score were calculated.

Patients were split in two groups depending on the presence or absence of a vital distress. A vital distress was defined by the presence of at least one of the Vittel criteria related to abnormal prehospital physiological data, need for intensive resuscitation or obvious severe neurological impairment: saturation $< 90\%$, systolic blood pressure < 90 mmHg, Glasgow coma scale < 13, vascular filling > 1000 mL, use of catecholamines, intubation and mechanical ventilation, clinical suspicion of spinal cord injury (paraplegia and quadriplegia) [3].

In the group without vital distress, a significant visceral injury was defined by a visceral injury (brain, spine, chest, abdomen or pelvis) potentially capable of affecting vital or functional prognosis (initially or after a delay) or likely to imply a therapeutic intervention or at least a specific medical observance. The spectrum of visceral and orthopaedic/pelvic injuries was collected. The outcome was analysed (admission unit, length of hospital stay, hospital mortality), as well as the need for surgical and interventional radiology procedures during the first 24 hours.

2.4. Statistical analysis

The sample size calculation was based on assumptions from a paper by Babaud et al. [7], who found at least one injury in 55.8% of whole-body scans performed for trauma. For an alpha risk of 5% and a power level of 80%, 259 participants were required.

Statistical analysis was performed using SPSS version 18.0 (SPSS Inc., Chicago, IL, USA). Quantitative variables are expressed as means $\pm$ SDs or as medians with interquartile ranges (according to their distribution), and categorical variables are reported as counts and percentages. Comparisons of mean values between two groups were performed using student *t*-tests or Mann-Whitney tests. Comparisons of percentages were performed using Chi^2 tests or Fisher's exact tests, as appropriate. All tests were two-sided. Statistical significance was defined as $P < 0.05$.

3. Results

3.1. Population characteristics

Two hundred fifty-two trauma patients using Vittel criteria were included (Table 1). The mean age was 40 ± 18 years and 81% of the patients were male. Motor vehicle accidents were the leading cause of trauma (67%), followed by falls (22%) and penetrating trauma (5%). The median values of ISS and MGAP scores were 20 (9–34) and 24 (17–27), respectively. One hundred and eight patients (43%) were hospitalized in an intensive care unit. The hospital mortality rate was of 11%.

3.2. Vittel criteria

The median number of Vittel criteria per patient was 3 (IQR 2–4) (Figs. 1 and 2). The distribution of Vittel criteria is depicted on

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