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Accuracy of the field triage protocol in selecting severely injured patients after high energy trauma

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ABSTRACT

Background: For optimal treatment of trauma patients it is of great importance to identify patients who are at risk for severe injuries. The Dutch field triage protocol for trauma patients, the LPA (National Protocol of Ambulance Services), is designed to get the right patient, in the right time, to the right hospital. Purpose of this study was to determine diagnostic accuracy and compliance of this triage protocol.

Study design: Triage criteria were categorised into physiological condition (P), mechanism of trauma (M) and injury type (I). A retrospective analysis of prospectively collected data of all high-energy trauma patients from 2008 to 2011 in the region Central Netherlands is performed. Diagnostic parameters (sensitivity, specificity, negative predictive value, positive predictive value) of the field triage protocol for selecting severely injured patients were calculated including rates of under- and overtriage. Undertriage was defined as the proportion of severely injured patients (Injury Severity Score (ISS) $\geq$ 16) who were transported to a level two or three trauma care centre. Overtriage was defined as the proportion of non-severely injured patients (ISS $<$ 16) who were transported to a level one trauma care centre.

Results: Overall sensitivity and specificity of the field triage protocol was 89.1% (95% confidence interval (CI) 84.4–92.6) and 60.5% (95% CI 57.9–63.1), respectively. The overall rate of undertriage was 10.9% (95%CI 7.4–15.7) and the overall rate of overtriage was 39.5% (95%CI 36.9–42.1). These rates were 16.5% and 37.7%, respectively for patients with M+I−P−. Compliance to the triage protocol for patients with M+I−P− was 78.7%. Furthermore, compliance in patients with either a positive I+ or positive P+ was 91.2%.

Conclusion: The overall rate of undertriage (10.8%) was mainly influenced by a high rate of undertriage in the group of patients with only a positive mechanism criterion, therefore showing low diagnostic accuracy in selecting severely injured patients. As a consequence these patients with severe injury are undetected using the current triage protocol. As it has been shown that severely injured patients have better outcome in level one trauma care centres further optimisation of this protocol aiming at lowering undertriage is therefore essential, preferably without incrementing overtriage too much.

Introduction

One of the most important components in the organisation of trauma care is prehospital triage of trauma patients and thereby getting the right patient, in the right time, to the right hospital [1–6]. It is of utmost importance to identify patients who are at great risk for severe injury, due to the difference in level of care that hospitals are able to provide [7,8].

For the distribution of trauma patients between different hospitals in the Netherlands, the Dutch field triage protocol was developed, the LPA (National Protocol of Ambulance Services) [9]. This protocol is used nationwide. In 2007 a revised version of this protocol was implemented, the LPA 7.1 (Fig. 1) [10]. The purpose of the triage protocol was to improve pre-hospital triage and transport patients with different severity of injuries to the correct destination facility, resulting in decreased morbidity and mortality and also decreased long term injury related disabilities [3,11,12]. We believe that improving a trauma system starts with a thorough evaluation of the current system.

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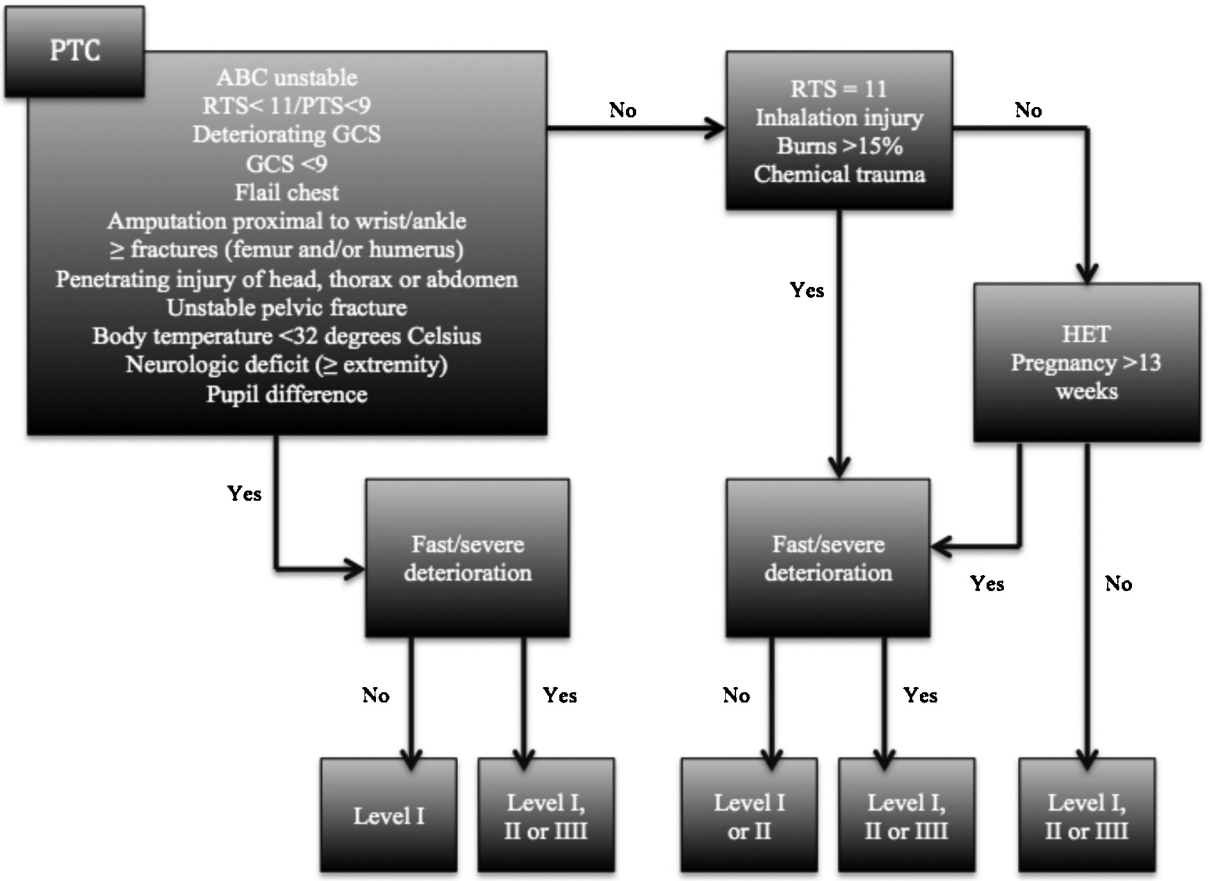

Fig. 1. The field triage protocol LPA 7.1 for the distribution of trauma patients over the different hospitals.

The aim of the present study was to evaluate the diagnostic accuracy, including rates of under- and overtriage, of our current field triage protocol in high-energy trauma patients. Furthermore, the compliance to this triage protocol will also be analysed.

Materials and methods

This study represents an analysis based on a prospectively collected database of all Emergency Medical Service (EMS) calls in the region Central Netherlands. Patients included in this study were those involved in a high energy trauma from June 2008 until May 2011, of whom the EMS system was activated with the highest emergency and were over 17 years of age. Patients were excluded if they were not transported to a hospital emergency department. For each EMS activation a standardised electronically report was made including demographic information, Glasgow Coma Score (GCS), respiratory rate (RR), blood pressure (BP) and pulse, Revised Trauma Score (RTS), mechanism of injury, pre-hospital treatment and name of the receiving hospital. In all reports the EMS providers gave a description of the mechanism of injury. Patients were included when this either included the term High Energy Trauma (HET) or included one of the triage criteria as presented in Table 1.

Table 1
Criteria for high energy trauma.

Fall of height ≥ 5 m or $\geq 3 \times$ body length
Car accident > 65 km/h
Motor accident > 32 km/h
Vehicle deformity > 50 cm
Vehicle intrusion passenger compartment > 30 cm
Vehicle rollover
Passenger ejection from vehicle
Fatality in same vehicle
Car–pedestrian or car–bicycle impact > 8 km/h

The parameters in our field triage protocol can be categorised into three groups (physiological condition, mechanism of trauma and injury type). The physiological criteria were GCS < 9, deteriorating GCS, RTS < 11, ABC unstable and body temperature $\leq 32\,^{\circ}$C. The injury criteria were penetrating injury to head, thorax and/or abdomen, ≥ 2 fractures of long bones (humerus and/or femur), amputation proximal to wrist or ankle, neurological failure in ≥ 1 extremity, unstable pelvic fracture, pupil difference or flail chest (Fig. 1). In each patient the EMS reports were analysed for physiological or injury criteria. In this paper all mechanism, physiological and injury criteria will be referred to as positive triage criteria (PTC).

The Netherlands is divided in 11 separate trauma regions, in which each region contains a level one trauma centre. This system is based on the American model of trauma regionalisation [3,13]. Level one acute care facilities have necessary expertise and equipment for treating severely injured patients. All other hospitals located in the same region are assigned level two or three based on the 24/7 availability of qualified medical personnel. The University Medical Center Utrecht is designated as level one trauma centre in the region Central Netherlands [14]. Three hospitals are designated level two hospitals that provide care of patients with potentially serious injuries after high-energy trauma, potential ABC-instability, but without severe head or brain injury. Eight hospitals are designated level three hospitals that provide care for patients with no potential severe injuries, *i.e.* no high-energy trauma, no serious external injuries, no (potential) ABC-instability and no serious head or brain injury. As was described in the field triage protocol every patient involved in HET can be