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Case study

Patients with head trauma: A study on initial prehospital assessment and care

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ABSTRACT

Background: Best evidence guidelines are intended to standardise assessment and treatment of patients with head trauma and improve outcomes for TBI patients. The primary aim was to explore pre-hospital emergency care nurses' (PECNs') documented assessment and care of patients with head trauma and the secondary aim to study gender differences in the documented care and interventions given by the PECNs.
Methods: A retrospective observational study was conducted by evaluating 2750 prehospital medical records.
Results: The results showed that 25.2% of the patients were assessed according to all four core-elements in the guidelines and 78.6% of the patients underwent at least one intervention by the PECNs. Male patients were to a higher extent assessed according to guidelines and were given higher transport priority while females were more often assessed for vital parameters and received significantly more analgesics. The assessment documented by the PECNs was not optimal concerning documentation using the Glasgow Coma Scale, but the documented assessment of circulation and, especially, respiratory rate was high (77.2%) compared to previous studies.
Conclusion: The findings of this study showed a low degree of documented assessment of parameters related to head trauma and might also indicate some gender differences in the assessment and management.

1. Background

The incidence of traumatic brain injury (TBI) varies around the world [1] and can be regarded as a major public health issue which affects about 10 million people globally [2] every year. In Sweden, about 10,400 people are hospitalized due to a TBI [3]. According to The Swedish Brain Injury Association, about 80% of the TBI patients are classified as having a mild head injury, 10% a moderate and 10% a severe head injury [4]. The most usual external causes of head injury are road traffic accidents, sports, falls and violence [5,6]. Young males have a higher risk of a severe TBI, but with increasing age, both males and females are affected more and more to the same extent [7]. At present, the most usual cause of TBI in the Nordic countries is falls [8,9].

To improve patient outcomes after a head trauma with suspected TBI, the best evidence guidelines for pre-hospital management have been developed and established in several countries [10,11]. These guidelines are intended to standardize the assessment and treatment and, by so doing, to improve outcomes for patients with TBI especially for patients with severe TBI. The key components of these guidelines focus on the importance of immediate care in order to prevent secondary insult. Therefore, monitoring and assessment, as well as interventions in terms of maintenance of airway, cervical spine protection, keeping $SaO_2 > 90\%$ and systolic blood pressure > 90 mmHg, as well as re-evaluation of level of consciousness and pupils in addition to direct transport to an optimal level of care (when possible, hospitals with neurosurgical expertise) are regarded as essential [10,11,12].

There is research pointing towards gender differences in physiological response to TBI that might affect patient outcome [5,13,7,14]. However, current guidelines on pre-hospital management of TBI patients do not take account of the possible gender differences [10,12] As, at this point, it is unclear whether these difference in outcome result from physiological differences, symptom presentation, or the assessment [15].

Some studies have evaluated pre-hospital assessment and management of TBI patients [9,16,17], but there is still a knowledge gap concerning how the assessment and care by the pre-hospital personnel correlates with the elements in the guidelines when they handle

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patients with TBI. Only one study investigated possible gender differences in the management of patients with severe TBI in the prehospital setting and [17].

The primary aim of this study was to explore pre-hospital emergency care nurses' (PECNs') documented assessment and care, of patients with head trauma in a large Scandinavian city area. As a secondary aim we studied gender differences in the documented assessment and care given by the PECNs.

2. Material and methods

This is a retrospective study based on pre-hospital electronic Patient Care Records (ePCR) and was conducted within the Emergency Medical Services (EMS) in Stockholm, Sweden, in 2012. The Regional Ethical Review board approved the study (Dnr: 2010/1925-31/3).

2.1. Setting and sample

The Stockholm County Council (SCC) is responsible for the EMS for a population of about 2.1 million inhabitants. The EMS are provided both by the companies owned by the SCC and by private companies contracted by the SCC. A single Emergency Medical Communications Centre (EMCC) operates in the area. The EMCC does not use the same triage system as the EMS.

This study was based on data from one of three companies contracted by the SCC to provide EMS in the city of Stockholm accounting for 40.9% of all 185,990 EMS responses in the Stockholm area during the study period. The responses are distributed among 60 ambulances and one physician- staffed ambulance during the daytime. During night-time (21:00–07:00) there is no physician- staffed ambulance and, in total, 38 ambulances operating [18] in the area. All ambulances are staffed by two people, a PECN and an emergency medical technician (EMT), both re-certified every other year.

The EMS personnel are required to follow pre-hospital medical guidelines [19] and are also required to document their assessment and management concerning the patient care in an EMS ePCR system [19]. According to the guidelines, the EMS personnel should score, after a thorough assessment of the patient, a triage level. The triage level consists of two algorithms assessed simultaneously, one concerning vital signs and one concerning the patients' main complaints, symptoms and signs (Emergency Symptoms and Signs-ESS). According to the ESS algorithm, a patient who is assessed as having a suspected head trauma should be triaged as ESS code number 30 [19] and there are four triage levels (red, orange, yellow and green), depending on severity, where red is the most urgent. The ESS code 30 is only applicable for isolated head trauma.

2.2. Data collection and variables

Inclusion criteria for the study were adult patients (≥15 years old) and assessed by the PECN as having the ESS code 30 (i.e., head injury, trauma and neck injury). Out of a total of 71,959 ePCR-based records during the year 2012, 2843 patients met the inclusion criteria. In total 93 of the ePCR records were excluded due to; an ePCR error (n = 21) owing to the fact that the patient was not transported to a hospital (n = 65), owing to intra-hospitals transports (n = 6) and owing to unknown gender (n = 1), giving a total of 2750 included patients.

All variables reported were collected from the patients' ePCR records. Each variable was considered assessed if it was documented in the ePCR record. Collected variables were related to the elements in the guidelines of head trauma management and were categorized as follows. Four variables emphasized in guidelines were considered "*core*" variables — i.e., systolic blood pressure (mmHg) blood saturation (%), pupil responsiveness, and Glasgow Coma Scale (GCS). Care of the patients airway was categorized into two variables: (1) management of the airway with basic facilities (chin lift, jaw thrust, oropharyngeal or nasopharyngeal airway, bag valve mask ventilation or laryngeal mask) (2) advanced airway management by intubation. Care concerning stabilization of the cervical spine was categorized into two variables: (1) fixation with a backboard and (2) fixation with a cervical collar. Documented drugs administered in the ambulance were categorized into six variables: (1) intravenous analgesics (sufentanil, ketamine, morphine, paracetamol, alfentanil), (2) intravenous sedation drugs (propofol, diazepam, midazolam), (3) intravenous fluids (macrodex, Ringer's acetate, sodium chloride, glucose), (4) intravenous antiemetics (ondansetron, metoclopramide), (5) intravenous vasoactive drugs (phenylephrine, adrenaline) and (6) oxygen. Other collected variables were the National Committee of Aeronautics scoring system (NACA), a 7-graded scale where 0 constitutes no injury and 7 constitutes death, [20,21]. Transport priority was coded using three priority levels: 1. indicating the most urgent level, i.e., blue lights and sirens, 2. urgent but not life threatening and 3. a regular transport.

2.3. Statistical analysis

Statistical procedures were computed using SPSS versions 22.0 and 23.0 for Windows, Chicago, IL, USA. Descriptive statistical analyses were used for documented demographic patient characteristics and PECNs' assessments and care procedures and are presented as means and standard deviations (± SD). Female and male comparisons, concerning frequency in assessment and care, were analysed using Student's *t-test* for continuous variables and X^2 for categorical variables. The significance level α was set at 0.05, and all *P*-values were two-sided.

3. Results

Out of the 2750 included ePCR records, 46.0% of patients were females and 54.0% males. The most frequently documented vital sign was heart rate (96.5%) and the least frequently documented assessment p-glucose and neurological status according to the Glasgow Coma Score, as summarized in Table 1. Males were significantly more often prioritized as the highest priority, (15.2% vs 11.0%, p = .002) (Table 1). No difference in injury severity defined by NACA score was evident between genders. However, in a subgroup analysis more male patients were considered having a NACA score of 4–6 than the female patients (59.4% vs. 43.2% p = .003) in the highest priority group (Priority 1). A significant difference in triage levels was also found (Table 1).

As shown in Table 2, in 25.2% of the patients assessment of all four core-elements was reported. Further, 78.6% of the patients received some type of pre-hospital intervention as documented in the ePCR. In 18.8% (n = 505) of the cases, two interventions were documented, three in 5.6% (n = 154) and at least four in 2.1% (n = 50 patients). Among the patients assessed with the two highest triage levels (red and orange), 74.1% had three or more interventions and, among the patients in the lower triage groups (yellow and green), 62.8% received fewer than two interventions (p < .001).

On comparing males and females, there was a significant difference in the assessment of core-elements, men were assessed in 27.2% of the cases and women in 22.9% (p = .009). No significant differences in the number of documented interventions were noted (78.6% vs 78.6%, p = .272). Female patients received significantly more frequent analgesics (4.5% vs 2.7%, p = .010) compared to males. Vital signs were significantly more documented for females than for males: blood pressure (p = .006), heart rate (p = .001) temperature (p = .001) and saturation (p = .004). The GCS was significantly more frequently documented for males (p = .003) (Table 2).