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Reviews

Effectiveness of prehospital trauma triage systems in selecting severely injured patients: Is comparative analysis possible?

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ABSTRACT

Introduction: In an optimal trauma system, prehospital trauma triage ensures transport of the right patient to the right hospital. Incorrect triage results in undertriage and overtriage. The aim of this systematic review is to evaluate and compare prehospital trauma triage system quality worldwide and determine effectiveness in terms of undertriage and overtriage for trauma patients.

Methods: A systematic search of Pubmed/MEDLINE, Embase, and Cochrane Library databases was performed, using “trauma”, “trauma center,” or “trauma system”, combined with “triage”, “undertriage,” or “overtriage”, as search terms. All studies describing ground transport and actual destination hospital of patients with and without severe injuries, using prehospital triage, published before November 2017, were eligible for inclusion. To assess the quality of these studies, a critical appraisal tool was developed.

Results: A total of 33 articles were included. The percentage of undertriage ranged from 1% to 68%; overtriage from 5% to 99%. Older age and increased geographical distance were associated with undertriage. Mortality was lower for severely injured patients transferred to a higher-level trauma center. The majority of the included studies were of poor methodological quality. The studies of good quality showed poor performance of the triage protocol, but additional value of EMS provider judgment in the identification of severely injured patients.

Conclusion: In most of the evaluated trauma systems, a substantial part of the severely injured patients is not transported to the appropriate level trauma center. Future research should come up with new innovative ways to improve the quality of prehospital triage in trauma patients.

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1. Introduction

Worldwide, every single minute ten people die as a result of trauma [1]. In order to improve chances of survival, patients at risk for severe injury should be treated at hospitals with corresponding level of trauma care facilities [2–4]. According to the American College of Surgeons Committee on Trauma (ACS-COT), level I and II trauma centers are capable to provide total care for every aspect of injury [5]. In some countries, only level I trauma centers are equipped to care for severely injured patients [6]. When severely injured patients are not taken to a higher-level trauma center, it is referred to as undertriage [5,7–9]. In addition, overtriage refers to patients without severe injury transported to a higher-level facility. Prehospital trauma triage is essential in this process; it ensures transport to the right type of hospital.

In general, reduction of undertriage is priority, in order to decrease mortality and morbidity [2,3]. Other consequences of undertriage include: delay in diagnosis and treatment, missed injuries, and decreased functional outcome [2,3]. The ACS-COT set the goal for undertriage at <5% [10]. In order to lower undertriage, more patients –including the patients without severe injury– have to be taken to a higher-level trauma center, which inevitably increases overtriage. However, overtriage also carries disadvantages, such as an unnecessary burden on higher-level trauma center resources and high trauma care costs [11,12].

The effectiveness of a trauma triage system is based on the patient's initial destination facility. Prehospital trauma triage protocols are designed to help emergency medical services (EMS) providers identify severely injured patients. An overview of the quality of protocols used worldwide was recently published [13]. However, the prehospital trauma triage quality is based on other factors as well, such as: the decision of EMS providers, distances, and regional circumstances. Trauma system quality has been studied extensively in different countries over the past decades [14–19], but an overview of all available trauma triage system studies is lacking. It is currently unknown which prehospital trauma triage system functions best and if there is need for improvement [20]. The aim of this systematic review is therefore to evaluate and compare prehospital trauma triage system quality worldwide, and determine effectiveness in terms of undertriage and overtriage for trauma patients transported by ground ambulance.

2. Methods

2.1. Search and selection

This systemic review was conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines [21]. A systematic search of Pubmed/MEDLINE, Embase, and Cochrane Library databases was performed, using 'trauma', 'trauma center,' or 'trauma system' combined with 'triage', 'undertriage,' or 'overtriage' as search terms, to include all studies published before November 2017 (Appendix 1). Studies describing the ground transport

and actual destination hospital of trauma patients with and without severe injuries, using prehospital trauma triage, were included. All articles, except grey literature (i.e. conference abstracts, editorials, and dissertations), regardless of year of publication or language, were eligible for inclusion. Exclusion criteria were: articles describing only the accuracy of a prehospital trauma triage protocol, including helicopter transport in most patients (> 50%), or including only pediatric patients. Studies on prehospital trauma triage seek to identify patients in need of higher-level trauma center care. Articles on helicopter transport use a separate protocol to identify patients requiring helicopter transport among the patients in need of higher-level trauma center care [22,23]. Estimation of pediatric trauma injury severity and triaging these patients is a challenging task, very different from triaging adults. Therefore, these studies were excluded from this study [24–27].

2.2. Critical appraisal

Available critical appraisal tools were not fully applicable due to the specific design of the studies. Criteria from the critical appraisal tools from the Center for Evidence Based Medicine of the University of Oxford were used for the assessment of the risk of bias [28]. The critical appraisal tool consists of five items that were designed to evaluate the quality of the included studies (Table 1). These items were: study setting, domain, description of initial destination, description of mode of transport, and missing data.

2.3. Data extraction

All duplicates were excluded, before the selection of relevant articles. Two reviewers (EvR and MvH) assessed titles, abstracts, and subsequently full texts. Using the critical appraisal tool, all studies were assessed for methodological design and quality by two reviewers (EvR and MvH). There were no discrepancies between the two reviewers. References of included articles and references of related reviews were screened for additional potential articles. In case of multiple publications regarding the same dataset of patients, the article with the largest cohort was selected.

2.4. Outcomes

Primary outcome parameters were the rates of undertriage and overtriage. Undertriage was defined as the proportion of severely injured patients taken to a lower-level trauma center, divided by the total number of severely injured patients. Overtriage was defined as the number of patients without severe injuries taken to a higher-level trauma center, divided by the total number of patients without severe injuries.

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