Authors

Steve Bell, Consultant Paramedic, North West Ambulance Service NHS Trust; Email: steve.bell@nwas.nhs.uk

James E Hill, University of Central Lancashire, Colne, Lancashire

Commentary on:

Gianola S, Castellini G, Biffi A, Porcu G, Fabbri A, Ruggieri MP, Stocchetti N, Napoletano A, Coclite D, D'Angelo D, Fauci AJ, Iacorossi L, Latina R, Salomone K, Gupta S, Iannone P, Chiara O; Italian National Institute of Health guideline working group. Accuracy of pre-hospital triage tools for major trauma: a systematic review with meta-analysis and net clinical benefit. World J Emerg Surg. 2021 Jun 10;16(1):31. doi: 10.1186/s13017-021-00372-1. PMID: 34112209; PMCID: PMC8193906.

Abstract

Effective triage is critical to ensure patients suffering major trauma are identified and access a pathway to definitive major trauma care, typically provided in a major trauma centre as part of an established major trauma system. The pre-hospital triage of trauma patients often relies upon the use of major trauma triage tools; this commentary critically appraises a recent systematic review which sought to evaluate and compare the accuracy of pre-hospital triage tools for major trauma.

Key findings include:

- There is substantial variation in sensitivity and precision in pre-hospital trauma triage tools.

- Further research is required in the use of these tools in non-European countries, particularly in lower-middle income countries

- Further research is required to identify possible mediating factors in the accuracy of these tools.

- In this review the Northern French Alps Trauma System (TRENAU) appears to be the most accurate tool for predicting an injury severity score (ISS) > 15, and;

- The New Trauma Score appears to be the most accurate for predicting mortality.

Key Words

- Major Trauma
- Pre-hospital triage
- Major trauma triage tool
- Systematic review

Introduction

Trauma remains one of the commonest causes of death and disability worldwide, with an estimated five million adults and children dying from traumatic injuries globally each year (World Health Organisation, 2014). Evidence exists from developed healthcare systems internationally, which demonstrates trauma care can be optimised by the regionalisation of trauma services with both pre-hospital and hospital providers collaborating to form networks centred around Major Trauma Centres (MTC) (Gabbe et al, 2012 & Gruen et al, 2012). However, the effectiveness of trauma systems in

ensuring patients are correctly identified and therefore access specialist trauma care relies, in the main, upon pre-hospital care providers having effective processes in place for major trauma triage. Major trauma triage tools are commonly utilised to differentiate patients who should be taken direct to definitive care at a MTC and those who are suitable for management elsewhere. In the United Kingdom the National Institute for Health & Care Excellence (NICE) advocate the use of triage tools which includes a pre-hospital assessment of the patient's physiology and anatomical injury whilst making the necessary adjustments for older patients, children and high-risk populations (NICE, 2016). NICE also advocate the monitoring and audit of major trauma triage tools to ensure effectiveness and to allow for adjustments where necessary to maximise sensitivity and specificity. The systematic review undertaken by Gianola et al (2021) seeks to evaluate and compare the accuracy of pre-hospital triage tools for major trauma.

Aim of commentary

This commentary aims to critically appraise the methods used within the review by Gianola et al (2021) and expand upon the findings in the context of clinical practice.

Methods of the systematic review by Gianola et al (2021)

A comprehensive multi-database updated search was undertaken from 2015 to November 2019. Only random controlled trials or observational studies which included children, young people or adults who have experienced trauma and were assessed in a pre-hospital setting were included. Furthermore, studies were required to use a relevant trauma assessment tool which was compared to a reference test of injury severity score higher than 15, survival/mortality or a type of intensive care unit admission measurement were included. A thorough screening process was undertaken by two reviewers with arbitration by a third reviewer. The number of reviewers who undertook the data extraction and

assessment of bias were unclear. The assessment of bias and applicability was undertaken using the Quality Assessment of Diagnostic Accuracy Studies version 2 tool (QUADAS-2). Data synthesis and subsequent assessment of test accuracy was undertaken using three main outcomes of the area under the receiver operating characteristics (ROC) curve, sensitivity, and specificity. Test accuracy data was separated into children and adults. Where there were five or more studies per test and per threshold, a diagnostic meta-analysis (Bivariate method) was undertaken. Net benefit was calculated as a proportion of using the prediction model compared to sending all patients to a MTC (true positive proportion of false-positives × weight).

Results

After duplicate removal, 7285 papers were identified and screened, and 15 observational studies were included. The majority of the included studies were undertaken in Europe, of which five were in France, three in England, three in Netherlands, one each in Spain, Denmark and Norway and one in multiple countries across Europe. One study from Australia was also included. For the accuracy of pre-hospital triage tools in adults 13 studies were identified of which 13 tools were assessed. Due to substantial heterogeneity the meta synthesised mean estimates of sensitivity and precision were not presented for any tool for any group.

Out of the 11 tools assessed which used the reference test of an injury severity score (ISS) > 15, the American College of Surgeons Committee on Trauma (ACS-COT) tool demonstrated the third highest levels of sensitivity (Median: 0.79, 95% confidence interval (CI): 0.73 to 0.83, GRADE: low certainty evidence) and the highest specificity (Median: 0.76, 95% CI: 0.72 to 0.81, GRADE: low certainty evidence) for adults. However, on visual inspection of the trajectory on the ROC graph, the Northern French Alps Trauma System (TRENAU) tool was deemed to have the best trajectory and highest net clinical benefit (Sensitivity: 0.92, 95% CI: 0.90 to 0.93 & Specificity: 0.41, 95% CI: 0.39 to 0.44, GRADE:

high certainty evidence). There was notable variation across all tools in the percentage of under-triaging ranging from 3.6 to 66.8% and over-triaging ranging from 3 to 87%, using ISS > 15 as the reference.

Out of the nine tools which used mortality as the reference test the Mechanism, GCS, and Age and Arterial Pressure (MGAP) score demonstrated one of the highest levels of sensitivity (Median: 0.90, 95% CI: 0.82 to 0.94, GRADE: moderate certainty evidence) and one of the highest levels of specificity (Median: 0.79, 95% CI: 0.77 to 0.81, GRADE: moderate certainty evidence). On visual inspection the New Trauma Score (NTS) demonstrated the best net clinical benefit trajectory when in-hospital mortality was used as a reference (sensitivity: 0.82, 95% CI: 0.71 to 0.90 & specificity: 0.86, 95% CI: 0.84 to 0.88, GRADE: moderate certainty evidence). There was notable variation across tools in the percent of under-triaging ranging from 0 to 21% and over-triaging ranging from 12 to 21% using mortality as the reference.

Two studies assessed 11 different trauma tools in children. Only the Pediatric Triage Tape tool was assessed by both studies which resulted in a median sensitivity of 0.36 (95% CI: 0.31 to 0.42, GRADE: moderate certainty evidence) and median specificity of 0.75 (95% CI: 0.72 to 0.78 GRADE: moderate certainty evidence) using ISS > 15 as the reference. On visual inspection it was identified that the CareFlight instrument had the best net clinical benefit curve (sensitivity: 0.95, 95% CI: 0.94 to 0.97 & specificity: 0.80, 95% CI: 0.80 to 0.81, GRADE: high certainty evidence).

Commentary

This systematic review aimed to evaluate and compare the accuracy of pre-hospital triage tools for major trauma. Critical appraisal of the methods used within the review using the Joanna Briggs Institute Critical (JBI) Appraisal Checklist for Systematic Reviews and Research Syntheses resulted in

this review achieving 9 out of 11 criteria (Joanna Briggs Institute, 2017). Two criteria were not achieved due to issues of reporting within the review, in that it is unclear how many reviewers undertook data extraction and assessment of bias. Subsequently this increases the chance that errors may have been made in data extraction and the assessment of bias process. The inclusion criteria allowed for the consideration of both observational studies as well as randomised controlled trials which is appropriate and justified. However, as no diagnostic RCTs were identified through the search strategy for inclusion, confidence in the overall quality and interpretation of results is impacted given the reliance upon observational data, utilising retrospective design which limits the conclusions that can be drawn. Furthermore, authors of the review acknowledge a limitation in their inclusion criteria, in principally including only papers from European systems, which may lead to the introduction of selection or geographical bias in the results (Skopec et al, 2020). Whilst openly acknowledged by the authors, the results should be interpretated with cognisance of this potential. Additionally, the authors' assessment of quality (utilising the GRADE approach) of the included studies concluded that they were of unclear quality. However, the outcome that there is a 'high certainty of evidence' in two of the identified prehospital triage tools when this is based upon observational data is inconsistent with the GRADE (Grading of Recommendations, Assessment, Development and Evaluations) approach (Guyatt et al, 2011). It is acknowledged that the GRADE approach was originally designed for effectiveness studies, nevertheless diagnostic random controlled trials are still deemed to be the gold standard in test accuracy as much as within effectiveness studies (Rodger et al, 2012).

This review demonstrates that there is high variability in terms of sensitivity and specificity in the pre-hospital trauma triage tools identified. This review suggests that sensitivity (the ability to correctly identify patients with major trauma) is more important than specificity (the ability to correctly identify those without) in the context of pre-hospital major trauma triage. The review also demonstrates substantial variation in the under- and over-triage rates achieved by the various tools, with the under-triage spanning a significant range from 3.6% to 66%, with a similar range demonstrated for over-

triage. In the context of clinical practice these rates are significant at the higher end of these ranges; high under-triage rates risk more patients not accessing specialist major trauma care when it would be appropriate to do so and high over-triage rates may place pressure on pre-hospital providers, major trauma systems and centres in unnecessarily bypassing and admitting patients for specialist care when not needed.

This review identifies that there are no comparable reference standards to articulate the need for access to specialist major trauma care and that this is reflected within the included studies, making interpretation challenging. Given this, further research is needed to identify consistent, agreed, and accepted outcomes for triage to enable empirical comparison. Furthermore, due to the limited geographical diversity of studies included in the review further research is required to examine these tools in non-European countries in particular middle- and low-income countries. This is particularly important as there was notable study-level heterogeneity in sensitivity and precision across multiple tools, suggesting that there may be additional confounding variables which may be contributing to the sensitivity and precision of these tools which requires further exploration. Due to the substantial reliance on observational studies, additional diagnostic random controlled trials are required where ethically appropriate.

CPD reflective questions

Do you know the sensitivity and specificity of the tool you use in clinical practice?

How do the limitations of this systematic review impact upon the generalisability to clinical practice?

How would standardisation in definitions and reference standards contribute to the development of more precise pre-hospital triage tools?

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