Specific opportunities for improvements

Add a Subtitle if Needed

Maja Martos

Introduction

Traumatic injuries cause 5 million deaths every year worldwide. However, mortality and morbidity related to trauma have been significantly reduced in modern countries since the introduction of trauma systems. (1) Trauma systems have a long tradition within the military but were not implemented in civil health care until the 1960s-1970s when the report "Accidental Death and Disability: The Neglected Disease of Modern Society" was published in the US in 1966. (2) Since then, trauma systems have been put into practice in most modern countries with the aim to coordinate and improve management of critically injured patients, from onset of injury to high-level care in designated trauma centres. (3)

The American College of surgeons committee on trauma provide guidelines for the ideal trauma system covering all components of the system: (I) trauma centres, (II) referral hospitals, (III) rehabilitation as well as a (IV) data collection and quality improvement. Quality improvement through continuous evaluation and identification of opportunities for improvement with subsequent corrective action plans constitute a cornerstone in the trauma system and should be systematically proceeded by all trauma centres. (4,5)

Opportunities for improvement (OFI), include all aspects of the trauma system and can be defined as deficiencies at any stage of care that could be corrected if replaced with more optimized actions. (6) Both unanticipated (preventable) and anticipated (non-preventable) mortality can be presented with-or without OFIs. Unanticipated deaths can further be categorised as preventable or potentially preventable. (7) Two widespread systems to study unanticipated deaths prevail; autopsy and multidisciplinary reviews through mortality and morbidity (M&M) conferences. (8)

While autopsy provides information on cause and mechanism of death, it is costly and not always feasible due to ethical, legal and religious considerations. (9) Neither does it provide information regarding the process of care. In this respect, (M&M) reviews offer a more comprehensive assessment of the patient case. (5) However, when discussing preventability of death, a mined landscape is entered where reviewers are reluctant to point fingers at fellow colleagues. In addition, it is not always clear whether death is correlated to inappropriate care or not. To simply assess opportunities for improvements unrelated to death, therefore constitute a more robust and feasible method to improve care of trauma patients. (8)

To date a variety of studies based on OFIs have been conducted for different cohorts, with or without respect to preventability of unanticipated deaths. The aim is to identify recurrent errors for a specific patient group or trauma facility. Dependent on socioeconomic, cultural and geographic issues, trauma characteristics and healthcare vary between countries and rural/city areas. In 2020, a study in northern Alberta was conducted with challenging geography and limited health care resources in mind.

Nordic countries differ from other countries with colder climate, fewer cases of serious trauma annually and long distances to trauma centres as few hospitals are equipped to treat trauma-1 patients. (11) (12). Yet a systematic review covering trauma-related studies in Nordic countries the years 1995–2018, show that they fall behind when it comes to number of publications on the subject compared with other economically similar countries. (11)

Methods

Study design

A registry-based cohort study linking data from the Swedish trauma registry SweTrau and trauma care quality database at the KUH. The combined data will further be assessed through multinominal logistic regression to identify specific opportunities for improvements (OFI), identified by the multidisciplinary review board at the KUH All data will be managed and analysed in R software.

Settings

From 2010, The Swedish Trauma society holds a national registry over patients suffering serious trauma in Sweden. Patients included in the registry have either suffered traumatic events leading to either a trauma alarm or a new injury severity score (NISS) over 15. In 2021, a total of 10,528 patients were registered (an increase of 17% from 2020). Of these, 90% were assigned to blunt traumas such as falls, traffic accidents and blunt force traumas with objects and the rest to penetrating trauma such as gun shots and stabbing. (SweTrau2021)

In Sweden the Karolinska University hospital (KUH) covers the regions of Stockholm, Gotland, Södermanland and Västmanland, equivalent to 3 million residents. This is just on pair with the minimum number of patients needed to be recognized as a quality trauma centre internationally. The hospital is also the only facility in Sweden to qualify as a trauma-1 hospital by American standards. (13)

To detect non-optimal treatment, treating hospitals evaluate trauma patients at a mortality/morbidity (M&M) conference held by a multidisciplinary board appointed by the hospital. The board consists of a surgeon, an anaesthetist, a trauma nurse and in presence of specific injuries (e.g., intracranial, orthopaedical or thoracic/vascular), specialists from appropriate specialties. Competences involved in the direct care of the patient are free to attend the conference but should not take part in the review. (Dödsfallsanalys2021)

Patients are selected to M&M-conference based on the audit filters listed below and are thereby selected for review algorithmically and independent of mortality to study OFIs. If one or more of the audit filters apply, the patient is manually assessed by a nurse who goes through the patient journal and makes a final judgement of whether the patient should be brought to conference. At conference, the multidisciplinary board determines the cause of death and reviews the case for suboptimal handling and treatment to identify opportunities for improvement. (14)

Audit filters:
- Systolic blood pressure less than 90
- Glasgow coma scale less than 9 and not intubated
- Injury severity score greater than 15 but not admitted to the intensive care unit
- Time to acute intervention more than 60 minutes from arrival to hospital
- Time to computed tomography more than 30 minutes from arrival to hospital
- No anticoagulant therapy within 72 hours after traumatic brain injury
- The presence of cardio-pulmonary resuscitation with thoracotomy
- The presence of a liver or spleen injury
- Massive transfusion, defined as 10 or more units of packed red blood cells within 24 hours.

At the Karolinska University Hospital, results from the conferences are stored in a local trauma care quality database where all areas of improvement are registered and collectively stored in a binary variable (yes/no) named opportunities for improvement (OFI), with outcome = yes if any suboptimal treatment applies for the patient in question. (14)

Objectives

Hitherto, student studies of the trauma registry held by the KUH have used the OFI as a composite measure for all potential deviations leading to unanticipated death. Although this approach offers insight to whether

opportunities for improvement exist, it is insufficient in providing health care workers with guidance to actions that improve care of trauma patients. Hence, in this study, all specific parameters included in OFI will be analysed individually to analyse their explanatory value to OFI for each category of trauma, with the aim to identify which areas of improvement that are most relevant to improve care and outcomes for trauma-1 patients.

Objectives Hitherto, studies of the trauma registry held by the KUH have used the OFI as a composite measure for all potential lapses leading to un-optimal care. Although this approach offers insight to whether opportunities for improvement exist, it is insufficient in providing health care workers with guidance to actions that may improve care of trauma patients. Hence, in this study, all specific parameters included in OFI will be analysed individually to analyse their explanatory value of OFI for four categories of trauma, with the aim to identify the main areas of improvement.

Participants

We will study data of patients registered in both the Swedish trauma registry from SweTrau and the trauma quality data base at the KUH meeting the following criteria:

- Older than 15 year
- A NISS > over 15 or a ISS >9
- Being reviewed at an M&M conference
- Belonging to one of the following cohorts:
  1. blunt multisystem trauma with traumatic brain injury
  2. blunt multisystem trauma without traumatic brain injury
  3. penetrating trauma
  4. isolated severe traumatic brain injury

Variables

The primary outcome (dependent variable) will be opportunities for improvements (OFI) detected by the M&M teams at the KUH. The explanatory (independent) variables will be all factors leading to a binary outcome of OFI. If the M&M team have deemed all handling of the patient as exemplary, the outcome of OFI is no.

- Inadequate procedure
- Missed injury
- Problem with communication
- Inadeqaude competence at site
- Problem at triage
- Problem with management/ trauma criteria
- No neurosurgeon at site
- Problem with Tertriry survey after stabilisation/resuscitation
- Problem with management/logistics
- Wrong level of care
- Inadequate resources
- Problem with logistic and technique
- Exemplary treatment

Apart from the main outcome, descriptive variables; gender, age and mortality will be used. All variables with exception for age are categorical.

Data soures/measurement

The Swedish trauma registry SweTrau includes all trauma patients with a NISS >15 or who have triggered an alarm with trauma team activation in Sweden from 2010 to date. The trauma care quality database at KUH includes data from trauma patients treated at the hospital from 2014-2021. In the years 2014-2017, patients all random set of patients with an Injury severity score (ISS) of 9 or higher were included. From 2017, all patients included in the dataset have been reviewed at a M&M conference held at the KUH.

In this study, all patients within the KUH trauma quality registry reviewed at a M&M conference will be included. For these patients, data from the Swedish trauma registry by SweTrau will be collected to a merged dataset. The merged dataset will then be analysed in four cohorts; (1) blunt multisystem trauma with traumatic brain injury, (2) blunt multisystem trauma without traumatic brain injury, (3) penetrating trauma, (4) isolated severe traumatic brain injury.

Bias

To prevent bias, the multivariable regression model will be developed using a simulated scrambled dataset with random data. The algorithm for the model will be developed step-by-step and then evaluated by a trained programmer and statistician before being applied on the real data. Variables such as ID-number and name will be scrambled and anonymised throughout analysis of the real dataset as well.

Study size