Injury, Int. J. Care Injured 45 (2014) 1236–1241

Contents lists available at ScienceDirect

Injury

journal homepage: www.elsevier.com/locate/injury

Inclusion of 'minor' trauma cases provides a better estimate of the total burden of injury: Queensland Trauma Registry provides a unique perspective

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ARTICLE INFO

Article history:
Accepted 31 March 2014

Keywords:
Minor injury
Burden of injury
Public health impact

ABSTRACT

Introduction: Injury is recognised as a frequent cause of preventable mortality and morbidity; however, incidence estimates focusing only on the extent of mortality and major trauma may seriously underestimate the magnitude of the total injury burden. There currently exists a paucity of information regarding minor trauma, and the aim of this study was to increase awareness of the contribution of minor trauma cases to the total burden of injury.

Methods: The demographics, injury details, acute care factors and outcomes of both minor trauma cases and major trauma cases were evaluated using data from the state-wide trauma registry in Queensland, Australia, from 2005 to 2010. The impact of changes in Abbreviated Injury Scale (AIS) versions on the classification of minor and major injury cases was also assessed.

Results: Over the 6-year period, minor cases [Injury Severity Score (ISS) $\leq$ 12] accounted for almost 90% of all trauma included on the Queensland Trauma Registry (QTR). These cases utilised more than half a million acute care bed days, underwent more than 66,500 operations, and accounted for more than 48,000 patient transport episodes via road ambulance, fixed wing aircraft, or helicopter. Furthermore, more than 5800 minor trauma cases utilised in-hospital rehabilitation services; almost 3000 were admitted to an ICU; and more than 20,000 were admitted to hospital for greater than one week. When using the contemporary criteria for classifying trauma (AIS 08), the proportion of cases classified as minor trauma (87.7%) and major trauma (12.3%) were similar to the proportion using the traditional criteria for AIS90 (87.9% and 12.1%, respectively).

Conclusions: This evaluation of minor trauma cases admitted to public hospitals in Queensland detected high levels of demand placed on trauma system resources in terms of acute care bed days, operations, ICU admissions, in-hospital rehabilitation services and patient transportation, and which are all associated with high cost. These data convincingly demonstrate the significant burden of injury imposed by minor trauma cases serious enough to be admitted to hospital.

Introduction

Injury is recognised as one of the most frequent causes of preventable mortality and morbidity, and was responsible for almost 5.1 million deaths [1] and more than 278 million disability-adjusted life years [2] worldwide in 2010. In Australia, injury comprised 7% of the total burden of disease and injury in 2003 [3], and accounted for $4.1 billion (8.3%) of total health expenditure in 2000–2001 [4]. Unfortunately, this is an escalating problem, with costs related to caring for the injured projected to increase 116% by 2033 [5]. This increasing economic burden is a major concern for injured individuals and their families, with the potential to have an even greater impact on hospital systems, both public and private. This principally reflects the significant costs that accrue while

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http://dx.doi.org/10.1016/j.injury.2014.03.023
0020–1383/

providing medical care for acute traumatic injuries, their sequelae, and the associated rehabilitation necessary to attempt to restore those injured to the best possible level of function.

Developing an estimate of the burden of injury would at the very least require contemporaneous quality data regarding both fatal and non-fatal injuries [6,7], and a more complete description of the total burden of injury would ideally encompass all levels of the injury pyramid: deaths, hospital admissions, emergency department presentations, general practitioner visits and self-reported injury events [6,7]. Trauma registries have been established in many countries [8], and are an essential tool for monitoring injury epidemiology [9], in addition to their use for evaluating trauma system effectiveness, trauma-related research [10], and for use in developing appropriate policy and practices. While cataloguing the type and extent of injuries incurred in a population, trauma registries can also describe the demand placed on healthcare systems associated with the management of injury.

Although inclusion criteria for trauma registries vary, a common feature is the exclusion of 'minor' trauma cases. The use of the term 'minor' can be misleading, given that these cases are often admitted to hospital, and the designation of minor is only based on their physical injury severity score falling within a predefined cut off score. A recent article by Tohira et al. [8] compared 17 trauma registries worldwide and found many specified inclusion criteria with an Injury Severity Score (ISS) > 15, which is a common criteria for 'major' trauma, and/or death. In Australia, inclusion on the national trauma registry [11,12] and some state trauma registries [13,14] are also restricted to major trauma only. [The Western Australian Registry has collected some minor injury data (ISS < 16) in two hospitals since 1998 and 5 hospitals since 2012.] However, focusing on mortality and major trauma represents only a fraction of the total injured, and these data may seriously underestimate the extent and magnitude of the total burden. This may, in turn, lead to suboptimal development and implementation of new trauma management policies and practices. Although the importance of considering 'minor' trauma has already been established [14–17], there currently exists a paucity of information regarding the magnitude of the effect that excluding minor trauma has on total burden of injury estimates.

The Queensland Trauma Registry (QTR) collected data on all injured patients admitted for 24 h or more to the main public hospitals where most injured patients received definitive treatment in the State of Queensland. In contrast to many other registries, the QTR included both 'major' and 'minor' injury cases, and linked those cases across all phases of trauma care from pre-hospital through to discharge from acute hospital stay. Given these broad inclusion criteria, QTR data were unique in their capacity to identify and provide details on the minor injury population, as defined by an ISS ≤ 12, across Queensland. In addition, QTR minor trauma data were particularly useful in providing an opportunity to quantify the impact of changes in Abbreviated Injury Scale (AIS) coding versions over time, on which the ISS cut-off for minor trauma is based.

For the current study, data captured on the QTR were used to provide an overview of the demographics, injury details, acute care factors and outcomes of minor trauma cases to evaluate the burden that minor trauma places on health services, and to assess the value of including minor trauma cases in policy and practice planning decisions.

Methods

Data and variables

All injured people who met the criteria for inclusion on the QTR between 1 January 2005 and 31 December 2010 were included in the study. With some exclusions (e.g. iatrogenic injuries, pathological fractures), patients were included on the QTR if they survived to hospital and were directly admitted, or transferred from another hospital for admission, to a participating QTR hospital for 24 h or more for the acute treatment of injury, or died after active treatment had commenced in the Emergency Department (ED) (regardless of admission length), and were coded to ICD-10-AM (International Statistical Classification of Diseases and Related Health Problems 10th Revision—Australian Modification) categories S00 to S99, T00 to T35, T66 to T71, T751 [18]. The QTR consistently collected data from 14 public hospitals between 2005 and 2008 and from 20 public hospitals in 2009 and 2010. These were the main public hospitals where most injured patients received definitive treatment in Queensland [18].

Cases were identified for potential inclusion on the QTR via a standard system report generated by the Emergency Department Information System (EDIS), with additional data abstracted from information documented in the hospital medical record and manually entered on the database by QTR nurses trained and accredited in specialised injury coding, including the Abbreviated Injury Scale (AIS). Cases were included only once per injury event and only on the database of their definitive care hospital; this ensured that transferred cases were not duplicated. To ensure all eligible trauma cases were captured, cases identified through EDIS were cross-matched with hospital morbidity data coded following patient discharge. Further details on data capture, collection and quality assurance methodologies for the QTR are available elsewhere [18].

The following retrospective data were extracted from the QTR database for each case: demographics (age, sex), injury characteristics (external cause of injury, nature and body region of main [dominant] injury, ISS, total number of injuries), definitive care hospital characteristics (mode of transport [recorded from 2006 onwards], admission date, rehabilitation post-acute care), and acute care factors (length of acute hospital stay [LOS], ICU admission, surgery, outcome). Cases that died during the acute care episode (the time from ED presentation to discharge from acute care) were recorded as 'died' on the QTR. A death in hospital occurring after the acute care episode (e.g. during rehabilitation or palliative care) was recorded as 'survived' on the QTR. All 88,610 cases included in the study were categorised into two injury severity groups:

minor trauma cases: ISS ≤ 12 or ISS not calculable; or death subsequent to fractured neck of femur (NOF) in those aged $\geq$65 years;

major trauma cases: ISS > 12; or death (excluding deaths subsequent to fractured NOF in those aged $\geq$65 years).

Ethical considerations

The operation of the QTR was approved by the Human Research Ethics Committee (HREC) of each participating hospital and by the Medical Research Ethics Committee of The University of Queensland. The University of Queensland was recognised within the provisions of the Health Legislation Amendment Regulation (no. 7) 2006 under the Health Services Act 1991 (Queensland) for the purpose of data collection for the QTR, thus there was no requirement for patients to opt-in to the QTR. The release of data for this study was approved by the HREC of the Queensland Health Office of Health and Medical Research, and by the Behavioural and Social Sciences Ethical Review Committee of The University of Queensland.

Statistical analysis

Data were analysed using IBM SPSS version 20 (IBM Corp., Armonk, NY, USA). Descriptive analyses described minor trauma