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Assessment of the predictive value of the International Classification of Diseases Injury Severity Score for trauma mortality in urban India

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ABSTRACT

Background: Trauma is the cause of 1.2 million deaths in India annually. Injury severity scores play an important role in trauma research and care because these scores enable the adjustment of trauma severity when comparing mortality outcomes. The generalizability of the International Classification of Diseases Injury Severity Score (ICISS) between different populations is not fully known, and the validity of the ICISS has not been assessed in the Indian context. The aim of this study was to assess the predictive performances of three international versions of the ICISS, derived from data from Australia, New Zealand and pooled data from seven different high-income countries, in trauma patients admitted to four public hospitals in urban India.

Material and methods: We used patient data from an Indian cohort of 16,047 trauma patients. The patients were assigned an ICISS based on International Classification of Diseases codes using survival risk ratios from publicly available data sets from Australia and New Zealand and with pooled data from seven different high-income countries. Predicted mortality based on the ICISS was compared with observed patient mortality, and the predictive performance was assessed in terms of discrimination and calibration.

Results: Discrimination and calibration did not reach the threshold for predictive performance in any of the ICISS versions used. The threshold value used was 0.8 for discrimination, which was not significantly different from one for the calibration slope and not significantly different from zero for the calibration intercept.

Conclusions: None of the international versions of the ICISS adequately predicted mortality within the study population, indicating the need for an ICISS version specifically adapted to the Indian context.

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Introduction

Trauma causes 10% of the world's annual deaths,[1] with over 90% of these deaths occurring in low- and middle-income countries.[2] In 2013, over 1.2 million trauma deaths occurred in India alone.[3] Hence, India accounts for 25% of trauma-related deaths worldwide. Experiences from high-income countries show that comparisons between different hospitals, as well as over time, are of great importance for the improvement of trauma care and research.[4]

To be useful, such comparisons should be risk adjusted to account for differences in care and the patient case mix.[5] In trauma, one of the most important patient case mix characteristics to adjust for is injury severity.[6] Several different injury severity scores (ISSs) exist for this purpose,[7] including the International Classification of Disease Injury Severity Score (ICISS).[8] In contrast to other established scores, such as the ISS, the ICISS can be calculated based on injuries coded according to the commonly used International Classification of Diseases (ICD).[9]

The validity of the ICISS has primarily been studied in high-income countries.[10] The ICISS requires an empirically estimated survival risk ratio (SRR) for each ICD code.[8] Some studies from high-income countries have shown similar predictive performance of the ICISS when using SRRs derived from other high-income countries.[6,11] However, the generalizability of such SRRs to low- and middle-income countries, such as India, has not been researched. Therefore, the aim of this study was to validate international versions of the ICISS in patients with trauma at four public university hospitals in urban India.

Ethical approval

Ethics committees at all participating centers approved the collation of the database and granted a waiver of consent for trauma patients. This study was conducted using anonymized data. The ethics approval registration numbers were EC/NP-279/2013 RP-O1/2013 for the All India Institute of Medical Sciences Ethics Committee, IEC/11/13 for the Lokmanya Tilak Municipal Medical College and Lokmanya Tilak Municipal General Hospital Institutional Ethics Committee, IEC/279 for the Institute of Post-Graduate Medical Education and Research (IPGME&R) Research Oversight Committee (Institutional Ethics Committee), and IEC(I)/OUT/222/14 for the Seth GS Medical College and King Edward Memorial Hospital Institutional Ethics Committee.

Methods

Study design

This was a retrospective analysis of a prospective cohort study registered at clinicaltrials.gov under accession number NCT02715739.

Setting

We used data from the Towards Improved Trauma Care Outcomes in India project, which was conducted at four public university hospitals in urban India. The four centers included Lokmanya Tilak Municipal General Hospital in Mumbai, King Edward Memorial Hospital in Mumbai, Jai Prakash Narayan Apex Trauma Center in Delhi, and the Institute of Post-Graduate Medical Education and Research and Seth Sukhlal Karnani Memorial Hospital in Kolkata. These study centers are tertiary referral hospitals.

Data were collected between July 2013 and December 2015. Patient data were collected by one project officer at each study center. The project officer worked 8-h shifts per day, with a rotating schedule between day and night shifts. All the project officers had at least a health science master's degree and were continuously trained and supervised by project management. The data collectors did not perform their own recordings but relied on the findings of the physician on duty. Data, including radiological findings and surgical findings, were collected from medical records. Further details on the data collection process have been published elsewhere.[12]

Participants

Eligibility criteria

The study population included patients with a history of trauma admitted to any of the study centers or those who died between arrival and admission. Patients who were dead on arrival to the hospital, or alive but not admitted, were excluded. The reason for this was that our outcome was in-hospital mortality. Patients with isolated limb fractures without vascular injuries were excluded because of the clinical pathway of these patients in the study centers. All patients who arrived at any of the study centers during the time of data collection were included in the study, given they fulfilled the eligibility criteria.

Source and methods of participant selection

Eligible patients were identified by project officers through direct observation in the emergency room and/or through extraction from patient records. Data from patients admitted outside of the shifts were collected retrospectively within days. Patients were followed up until discharge, death in the hospital, or 30 d, whichever occurred first. Patients transferred to other hospitals were considered as discharged. As the study centers are tertiary referral hospitals, trauma patients admitted to these hospitals are rarely transferred to other hospitals, especially if the patients are in critical condition.

Variables

Primary outcome

The primary outcome was in-hospital death within 30 d of arrival to the hospital.

Secondary outcome(s)

The secondary outcome was in-hospital death within 24 h of arrival to the hospital.

Covariates

The explanatory variable was the ICISS. Other covariates comprised age, sex, mechanism of injury, mode of