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Abdominal gunshot wounds—a comparative assessment of severity measures

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ABSTRACT

Background: Penetrating abdominal trauma is a common feature of trauma treated in low- and middle-income countries (LMICs). The penetrating abdominal trauma index (PATI) and the injury severity score (ISS) are severity-measures most often used to gauge injury severity. It remains unclear which measure better accounts for the severity of sustained injuries. This study compares the predictive ability of both injury severity measures in patients presenting to an LMIC in South Asia.

Methods: All isolated gunshot wounds to the abdomen presenting to a university hospital between 2011 and 2012 were included. ISS and PATI were calculated for each case. Primary outcome measures included all-cause mortality and complications. Multivariable analysis adjusting for age, sex, referral status, hypotension, tachycardia, and injury severity measures was performed. The area under the receiver operating characteristic (AUROC) curve were further calculated to compare the respective abilities of ISS and PATI at predicting death and complications.

Results: A total of 70 patients were included. The average age on presentation was 34.5 y (±11.4) within a predominantly male (n = 68, 97.1%) cohort. Most gunshot wounds were intentionally inflicted (n = 67, 95.7%). The crude rates of death and complications were 34.3% and 15.7%, respectively. The median ISS was 14 (interquartile range: 11–21), and the median PATI was 16 (interquartile range: 9–26). AUROC analysis revealed that ISS was comparable with PATI at predicting mortality (AUROC [95% confidence interval]: 0.952 [0.902–1.00] *versus* 0.934 [0.860–1.00]) and complications (AUROC [95% confidence interval]: 0.868 [0.778–0.959] *versus* 0.895 [0.815–0.975]).

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Conclusions: The predictive ability of ISS and PATI severity measures was found to be comparable. The results suggest that both measures can be used to risk-stratify patients with isolated abdominal gunshot wounds in an LMIC.

1. Introduction

Traumatic injuries account for 9.6% of the global burden of disease and represent the third most common cause of death in adults and adolescents ≤40 y [1,2]. Among patients admitted to the hospital with traumatic injuries, penetrating abdominal trauma remains an important cause of morbidity and mortality [3–5]. Worldwide, homicidal gunshot injuries occur at a rate of 0.2–4.8 per 100,000 patient population [6], with mortality rates approaching 88% [5]. Improvements in trauma systems in high-income countries such as the United States have resulted in a significant improvement in survival from penetrating abdominal trauma (including gunshot wounds) [7–9]. For low- and middle-income countries (LMICs), where the burden of gunshot injuries is vast [10–12], there remains a need to establish evidence-based severity measures predictive of complications and mortality to facilitate development of enhanced trauma reporting and care.

A myriad of injury severity measures are currently available to quantify and risk-stratify penetrating abdominal injuries [13–17]. Presence of shock and the number of abdominal organs damaged have been demonstrated as injury severity markers in work among patients with abdominal trauma [18]. Similarly, delays in operative interventions and a high injury severity score (ISS) have also been linked to high rates of complications [19]. Many of these measures, notably including the ISS, are based on assessments of injuries to multiple body regions. In an effort to offer a predictive measure for isolated abdominal trauma, the penetrating abdominal trauma index (PATI) was formulated in 1981 [17]. Few studies have directly compared its utility to the other most commonly used injury-severity scoring system, the ISS [18,20,21].

For LMICs with a high burden of relevant injuries [10–12], even less is known. Thus, in an effort to establish which severity measure is superior as an indicator for patients presenting to health care settings in LMICs, the present study aimed to describe patient outcomes for penetrating abdominal gunshot wounds presenting to a tertiary-care hospital in South Asia. Furthermore, in an attempt to provide a head-to-head comparison of the ability of the ISS and PATI to predict mortality and complications in such patients, we assessed the relative predictive ability of both measures.

2. Methods

A retrospective assessment of institutional medical records was conducted at the Aga Khan University Hospital (AKUH) in Karachi, Pakistan. The facility comprises of 577 beds in 15 inpatient units and 55 critical care beds. All study patients received initial resuscitation based on the Advanced Trauma Life Support guidelines [22,23].

All patients admitted between January 2011 and December 2012 with an International Classification of Diseases, Ninth revision, Clinical Modification code or primary admission for an abdominal gunshot wound were identified. Medical records for adult patients (≥16 y) presenting to the emergency department (ED) with isolated abdominal gunshot wounds were reviewed. Exemption of ethical approval was obtained from the ethics review committee of AKUH.

Patients who had been surgically operated on for their injuries at an outside facility and those with incomplete medical records were excluded. This was done so that all records represented a single admission to the facility and to address delays in access to definitive care as a result of inter-facility transfer. Medical records were deemed complete if the initial trauma evaluation sheet, in-patient progress notes, outpatient follow-up notes, intraoperative notes, and reports of laboratory and radiologic investigations were complete. Medical records were thoroughly and systematically reviewed using a structured, predefined data extraction sheet to ensure that data pertaining to demographic parameters (age and sex), injury characteristics (ISS and PATI scores, ED vitals, Glasgow coma-scale [GCS] score, and associated injuries), laboratory parameters at admission (hemoglobin, hematocrit, prothrombin time [PT], activated partial thromboplastin time, international normalized ratio), transfusion details, operative characteristics, critical care management (fluids, transfusions, and ventilator requirements), short-term postoperative complications, which included any short-term complications of consequence identified in consultation with the senior trauma fellow and attending, length of hospital stay, and in-hospital mortality were adequately recorded. ISS and PATI were calculated in accordance with published definitions [17,19,24].

Data entry, management, and analysis were carried out using Stata Statistical Software: Release 12 (College Station, TX). Normally distributed continuous data were presented as means (±standard deviation). Non-normally distributed continuous data were presented as median (interquartile range [IQR]). Categorical data were presented as *n* (%). Receiver operating characteristic (ROC) curves for both ISS and PATI were constructed by plotting false positive (x-axis) *versus* true positive (Y-axis) rates. Areas under the respective ROC (AUROC) curve were determined as a measure of model discrimination and predictive validity for both complications and mortality.

3. Results

A total of 88 patients presented to the ED with gunshot wounds to the abdomen between January 2011 and December 2012. Of these, 70 patients were included in the final study population (Fig. 1). Average age at presentation was 34.5 y