Hospital Mortality Following Trauma: An Analysis of a Hospital-Based Injury Surveillance Registry in sub-Saharan Africa

Anna F. Tyson, MD,† Carlos Varela, MBChB,† Bruce A. Cairns, MD,† and Anthony G. Charles, MD*†

*Department of Surgery, Kamuzu Central Hospital, Lilongwe, Malawi; and †Department of Surgery, University of North Carolina, Chapel Hill, North Carolina

IMPORTANCE: Injuries are a significant cause of death and disability, particularly in low- and middle-income countries. Health care systems in resource-poor countries lack personnel and are ill equipped to treat severely injured patients; therefore, many injury-related deaths occur after hospital admission.

OBJECTIVES: This study evaluates the mortality for hospitalized trauma patients at a tertiary care hospital in Malawi.

DESIGN: This study is a retrospective analysis of prospectively collected trauma surveillance data. We performed univariate and bivariate analyses to describe the population and logistic regression analysis to identify predictors of mortality.

SETTING: Tertiary care hospital in sub-Saharan Africa.

PARTICIPANT: Patients with traumatic injuries admitted to Kamuzu Central Hospital between January 2010 and December 2012.

MAIN OUTCOME MEASURES: Predictors of in-hospital mortality.

RESULTS: The study population consisted of 7559 patients, with an average age of 27 years (±18 years) and a male predominance of 76%. Road traffic injuries, falls, and assaults were the most common causes of injury. The overall mortality was 4.2%. After adjusting for age, sex, type and mechanism of injury, and shock index, head/spine injuries had the highest odds of mortality, with an odds ratio of 5.80 (2.71-12.40).

CONCLUSION AND RELEVANCE: The burden of injuries in sub-Saharan Africa remains high. At this institution, road traffic injuries are the leading cause of injury and injury-related death. The most significant predictor of in-hospital mortality is the presence of head or spinal injury. These findings may be mitigated by a comprehensive injury-prevention effort targeting drivers and other road users and by increased attention and resources dedicated to the treatment of patients with head and/or spine injuries in the hospital setting. (J Surg 72:e66-e72. ©2015 Association of Program Directors in Surgery. Published by Elsevier Inc. All rights reserved.)

KEY WORDS: trauma, trauma sub-Saharan Africa, trauma mortality, developing health care systems

COMPETENCIES: Patient Care, Medical Knowledge, Systems-Based Practice

INTRODUCTION

Injuries are a growing health concern around the world, resulting in 16,000 deaths per day and more than 5 million deaths per year.[1-5] The leading causes of injury-related deaths include road traffic injuries, interpersonal and self-inflicted violence, drowning, burns, poisoning, and falls.[4,6] The burden of injuries worldwide is disproportionately concentrated in low- and middle-income countries (LMICs).[7] According to the World Health Organization, in 2004, more than 91% of unintentional injury deaths and 94% of disability-adjusted life-years lost occurred in LMICs.[1,3] Despite the poor quality of vital statistics available on the causes of death in sub-Saharan Africa,

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Correspondence: Inquiries to Anthony G. Charles MD, MPH, FACS, Gillings School of Global Public Health, University of North Carolina, 4008 Burnett Womack Building, CB 7228; fax: (919) 966-0369; e-mail: anthchar@med.unc.edu

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several studies have identified the high proportion of deaths due to injuries, particularly among male young adults.

The disproportional number of injury-related deaths in LMICs is likely due to a combination of factors, including hazardous environments and workplaces, income and sex inequalities, poorly designed roads, inadequate enforcement of traffic regulations, poorly maintained motor vehicles, alcohol abuse, lack of efficient emergency medical response systems, and overburdened health care infrastructure.[8] Prehospital injury-related deaths generally do not present the opportunity for clinical intervention. However, an estimated 44% of deaths are estimated to occur after hospital admission.[9] High inpatient mortality may signal inadequacies with trauma resuscitation and management, and therefore presents an opportunity for intervention.

Malawi, a low-income country in the southeast region of sub-Saharan Africa, lacks both an organized trauma management system and a national trauma registry. We have previously described our work in setting up a minimal data set hospital-based trauma registry and defining injury epidemiology at Kamuzu Central Hospital (KCH) in Lilongwe, Malawi.[10] Using this registry, we sought to determine inpatient trauma-related mortality at our institution and identify predictors of increased mortality within the trauma cohort.

METHODS

This study is a secondary analysis of prospectively collected hospital-based trauma registry data described previously.[11] KCH is a 750-bed tertiary care hospital in Lilongwe, Malawi, with a catchment population of more than 5 million people in the central region of Malawi. There were 4 full-time general surgeons, 2 full-time orthopedic surgeons, and 6 clinical officers for the entire study period, and in 2012, there was also a 10-resident general surgery residency training program. No neurosurgeons were present at KCH during the study period. There are 4 intensive care unit beds with 4 ventilators. Plain film and contrast radiography, abdominal ultrasound, and echocardiography were consistently available, whereas computed tomography and magnetic resonance imaging were not available.

We included all subjects who were admitted to KCH with traumatic injuries between January 2010 and December 2012. Demographic and injury-specific data were collected at the time of admission, including injury type and mechanism, date and time of injury, vital signs, and disposition from the emergency room. First recorded vital signs at presentation in the emergency room such as heart rate and blood pressure were entered into the database and used to calculate the Shock index (defined as heart rate/systolic blood pressure). Follow-up clinical data, including operative intervention, length of hospital stay, and survival, were collected at the time of discharge. Burn injuries were excluded in this analysis, as those patients are generally managed in a separate unit.

Patients had up to 3 injuries listed in the trauma registry. The most severe injury was listed as the primary injury and was used to categorize body region of injury for this study. However, patients with injuries to more than one body region were also categorized as having polytrauma. Therefore, each patient had one variable for primary body region of injury and one variable for presence or absence of polytrauma.

We performed univariate and bivariate analyses to describe the population, using the Pearson chi-square test and 2-sample *t*-test for categorical and continuous variables, respectively. We used logistic regression analysis to determine the odds of mortality based on body region injured. We used extremity injuries as the reference category, as these patients had the lowest overall mortality. We adjusted the regression model for age, sex, polytrauma, mechanism of injury, and shock index. We also performed a Kaplan-Meier survival curve analysis to illustrate the differences in time to death by body region injured. Patients with missing outcome data were included in the description and analysis of the general population but excluded from the logistic regression.

All statistical analysis was performed using Stata SE 12, StataCorp LP, College Station, TX. Both the University of North Carolina Institutional Review Board and the National Health Sciences Research Committee of Malawi approved this study.

RESULTS

A total of 7559 patients were admitted to KCH for the management of traumatic injuries, representing 18% of the trauma patients treated at KCH during the time period. The average age of the inpatient trauma population was 27 years (±18 years), with a male predominance of 76%. Patients who died tended to be older than patients who survived, and mortality was increased in men (Table 1). Vital signs were incompletely recorded during the study period, but in general, patients who died had lower levels of consciousness on arrival, as measured by alert, verbal, pain, unresponsive (AVPU) scale and Glasgow Coma Scale (GCS). AVPU and GCS were recorded in 4983 (66%) and 2524 (33%) patients, respectively. Shock index was not statistically different between patients who lived and those who died ($p = 0.2$). The overall mortality for the inpatient trauma cohort over the study period was 4.2% (Table 2); however, mortality decreased over the years, from 6.5% in 2010 to 3.1% in 2012.

Road traffic injuries, falls, and assaults were the most common causes of injury resulting in-hospital admission (Fig. 1). Road traffic accidents accounted for 62% of patients who died and was the only injury mechanism associated with higher than average mortality (6.9%

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