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The Care of Injured Patients Admitted to Mulago National Referral Hospital in Kampala, Uganda

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Abstract

Background: Injury represents a growing global health crisis. Uganda, like much of Sub-Saharan Africa, faces little pre-hospital and medical infrastructure, severe shortages of healthcare workers and a large and growing disease burden from injury. This study aimed to describe the epidemiology of injured patients admitted to Mulago National Referral Hospital in Kampala, Uganda and determine their use of surgical resources.

Methods: We used data from a cross-sectional study in 2007-08 involving 1833 patients admitted to Mulago Hospital with ICD 10-based injury diagnoses to analyze inpatient injury care based on demographics, mechanism of injury, diagnosis, operative care, hospital length of stay, and outcomes.

Results: The median age was 25y, 76% were men. Injuries from road traffic crashes (61%) or assault (25%) resulted orthopedic (37%) or head injuries (28%). 30% of patients (n=542) underwent operation, mostly orthopedic (n=312, 58%). Needing operations and needing orthopedic procedures had longer hospital stays (6d vs. 1, p<0.0001) and (11d p<0.0001), respectively. Only four cases of intracranial drainage and 58 deaths were noted (3%).

Conclusions: Orthopedic and head injuries are main causes for injury-related admission to Mulago Hospital. Patients requiring orthopedic procedures have long stays. Tracking injury morbidity and mortality is a worthwhile priority in this setting, but require greatly improved medical record systems and public health surveillance.

Keywords: Injury; Uganda; Mulago hospital; Epidemiology

Abbreviations

LMICs: Low- and middle-income countries; RTCs: Road traffic crashes; ICD-10: International Classification of Disease-10th Revision; WHO: World Health Organization

Introduction

Injury represents a growing global health crisis. Over the next 20 years, injury disease burden is expected to increase by 28%, surpassing the total burden of all infectious diseases by 2030 [1]. A disproportionate amount of this burden exists in low- and middle-income countries (LMICs) with some of the highest injury-related mortality estimates found in Sub-Saharan Africa [2,3]. Nonetheless, existing data are crude and sparse making it difficult to reliably plan for much needed interventions. Available data are primarily from community surveys, trauma registries and mortuary records. Complete data sets are not available for most LMICs, and thus data are often extrapolated from other countries in the region, with limited applicability. Few studies in LMICs have evaluated injured patients who are admitted to the hospital for definitive care and measured their surgical resource utilization as well as their short-term outcomes [4].

Uganda, like much of Sub-Saharan Africa, faces little pre-hospital and medical infrastructure, severe shortages of healthcare workers and a large and growing disease burden from injury [5,6]. Existing data on injury in Uganda are limited to community surveys, hospital-based trauma registries, or police and mortuary records. Kobusingye et al. surveyed 11,000 households in Kampala and reported an injury mortality rate of 217/100,000, which is several times higher than rates in high income countries [7]. Analyses of trauma registry data in Kampala suggest that half of injured patients presenting to Emergency Departments in the city are due to road traffic crashes (RTCs) [8]. However, access to care is limited by a lack of formal pre-hospital emergency care among many other factors, therefore the actual number of injuries is likely much larger [8-10]. Of those patients who reach the hospital, 33% are admitted to the hospital for further care [8].

Little is known about injured patients who require hospitalization in Uganda. No data are available regarding the surgical needs and outcomes of injured patients in this setting. Mulago National Referral Hospital is a government-run 1500 bed tertiary care facility that has the only 24-hour public emergency unit for trauma in Kampala and treats approximately 6000 injured patients every year from the city's population of 1.2 million [11]. This study aims to analyze the needs of injured patients who are admitted to Mulago Hospital, including the type of operative care and outcomes at discharge and evaluate the accuracy of existing data collected by the hospital medical records department.

Materials and Methods

All medical records of injured patients who were admitted to Mulago Hospital from July to December 2007 had been identified for a previous pre-hospital quality improvement project in 2007-08, using the International Classification of Disease-10th Revision (ICD-10) classification [12]. A dataset from that project, consisting of hospital registration number, demographics, mechanism of injury, diagnoses by description and ICD-10 codes, operative care, length of stay in the hospital, and disposition, had been created in Microsoft Excel (Seattle, WA) but had not been previously analyzed or published. This dataset was used to evaluate the care of injured patients admitted to Mulago Hospital as outlined below. The dataset was cleaned to remove duplicates and then each of the variables in the dataset was evaluated for analysis.

The mechanism of injury was further classified into eight groups including RTCs, assault, fall, animal-related, burn, drowning, other and unspecified. The diagnoses were combined into body regions injured including: all orthopedic injuries including any extremity or pelvic injury; all head and neck; torso, including chest, abdomen and back; vertebral column or spine; multiple-body regions or system-wide and other/unspecified. Operative care was categorized into orthopedic, if fracture or dislocation management was performed and soft tissue procedure, if only local wound care was performed. The operations were otherwise categorized by body region involved such as intervention for head, eye or airway injury, chest or abdominal injury or amputation. Length of stay was measured with date of admission being day zero except in cases where the length of stay was only one day.

The Medical Records department in Mulago Hospital assigns ICD10 codes to each patient based on the primary condition noted in the chart. To evaluate accuracy of this coding, the ICD10 codes were correlated with the primary diagnoses recorded in the chart for a random sample of 187 cases (10% of total cases) using an online random number generator [13]. The correlation was recorded as accurate if the classification noted the correct major ICD10 category, i.e., all femur fractures that were coded S72.x were accepted as accurate even if the subcategory code did not represent the subtype of femur fracture correctly. Sub-categories were not taken into account in order to give the coding maximum likelihood of accuracy. The code was considered not accurate if the code did not identify the major ICD10 category correctly. For example, intracranial hematoma would sometimes be coded as a scalp hematoma by the medical records staff but further review of our dataset would reveal that an intracranial component existed. The ICD10 code was also not considered accurate if it was not specific enough, for example, comminuted fractures of multiple toes may be coded as open wound of foot, not otherwise specified by medical records staff.

Data were analyzed using SAS (version 9.4). Descriptive and univariate analyses were performed to describe patterns of injuries, determine potential relationships between variables and the strengths of such relationships and p values less than 0.05 were considered to be statistically significant. Institutional Review Board approvals for this project were obtained from the University of California San Francisco, Mulago Hospital, and the Ugandan National Council of Science and Technology prior to initiation of this project.

Results

A total of 1833 injured patients were admitted to the hospital's inpatient wards during the six-month period (Table 1). Of these, 76% were men. The median age was 25 years (range: two months to 98 years). Adults over 18 years were most represented (n=1257, 69%), followed by adolescents (16%) and children between 0-5 years (5.7%). Age was missing in 179 (10%). Patients were predominantly from the area around the hospital-Kampala district, Kyadondo county (n=983, 53%), and 25% were from remaining districts around the country (missing data: n=412, 22%).

Age Groups (y)	**N**	**%**
0-1	15	0.8%
>1-5	86	4.7%
>5-12	124	6.8%
>12-18	168	9.2%
>18	1257	68.6%
unk	179	9.8%
Mean age	28	SD: 15.4, CI:14.6-16.1
Median age	25	Range: (<1, 98)
Sex	**N**	**%**
Men	1388	75.7%
Women	437	23.8%
Not recorded	4	0.2%
	N	%
Deaths	58	3.2%
Total	1833	
Types of Operations and Procedures Performed	**N**	**%**
Orthopedic related procedures	312	57.56%
Soft tissue procedures	182	33.58%
Laparotomy	24	4.43%
Eye procedures	8	1.48%
Intracranial drainage	4	0.74%
Multiple operations	2	0.37%
Tube Thoracostomy	1	0.18%
Airway procedure	1	0.18%

Unknown	8	1.48%
Total operations	542	
SD: Standard Deviation		

Table 1: Characteristics of trauma patients admitted to Mulago hospital.

Diagnosis, Body Region Injured and Mechanism of Injury

The most common injury diagnoses noted were orthopedic (n=673, 37%), involving injury to upper or lower extremity or pelvis. Head injury was the second most commonly injured area accounting for 28% of cases (n=513). In 9% of cases, multiple body regions were affected (Figure 1).

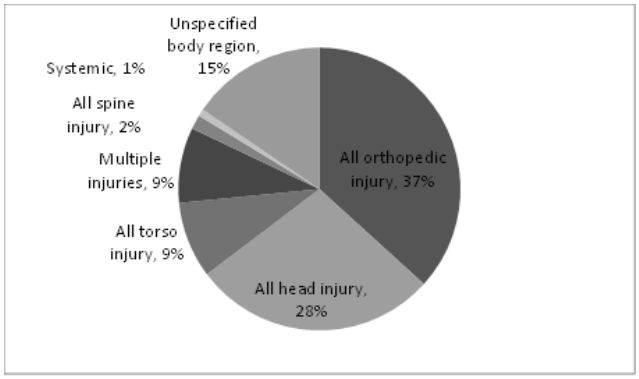

Figure 1: Diagnoses by body region Injured in admitted trauma patients at Mulago hospital.

When diagnoses noted in the chart and ICD10 codes assigned by the medical records department were correlated, 55% of codes accurately represented the primary diagnosis recorded in the chart. A total of 12.3% of assigned codes were incorrect and did not correlate with the primary diagnosis listed in the chart. In 32.6% of assigned codes, codes could not be correlate with diagnoses because the diagnoses recorded were vague or unknown (Table 2).

Coding Accuracy	N	%
Accurate	103	55.1%
Not accurate	23	12.3%
Not clear	61	32.6%
Total	187	

Table 2: Correlation between assigned ICD10 codes and diagnoses noted in the medical record.

Road traffic crash was the most common mechanism of injury (n=1119, 61%), followed by assault (n=457, 25%) (Figure 2). Road traffic crash included any transport-related cause including motor vehicle, motorcycle, bicycle, other transport, and pedestrian. The detailed mechanism of injury data was not unavailable in 60% of cases that noted RTC as the mechanism of injury. When it was available, 21% of injured patients reported a crash involving a car (n=238) and 14.5% involving a motorcycle (n=162).

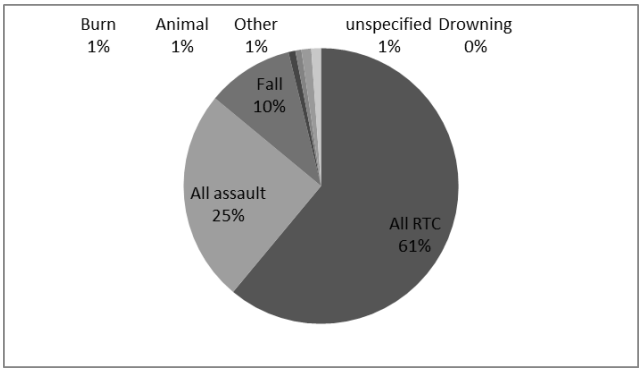

Figure 2: Mechanisms of injury in admitted trauma patients at Mulago hospital.

Operative care and outcome

A total of 542 operations and procedures were performed on the 1833 patients admitted with injury (30% of all patients). Orthopedic related procedures were the most common (n=312, 58%) and included the following types of procedures: amputations, femoral nailing, open reduction internal fixation, application of plaster of paris, closed reduction/manipulation and debridement and closure of soft tissue defects overlying open fractures. There were only four cases of intracranial drainage recorded although 513 patients (28% of all patients) were admitted with head injury (Table 1).

The median length of stay overall was two days (range: 1 to 140). Patients who had an operation had a longer stay in the hospital compared to those who did not (6 days vs. 1d, χ^2=189, p<0.0001). Patients who needed orthopedic related procedures had a significantly longer median length of stay compared to all others (11 days vs. 1day, χ^2=228, p<0.0001) (Table 3).

	LOS (days)	p value
Overall Median	2	
Patients requiring operations	6	<0.0001
Those not requiring operations	1	
Patients requiring orthopedic procedures	11	<0.0001
Patients requiring other procedures	1	
LOS: Length of Stay (median)		

Table 3: Length of stay in admitted trauma patients at Mulago hospital.

Only 58 deaths were recorded in the medical records during this period (3%) in our study population. Of these, 48% were noted to have been in a motor vehicle crash and 28% had required an operative intervention during this admission. The median length of stay of injured patients who died was two days.

Discussion

While Mulago has undergone several changes in the care of injured patients since these data were collected in 2007-08 for a prior study on prehospital trauma care in Kampala, there is still very little literature on the hospital level care of injured patients and their resource needs and outcomes in this setting, making our analysis still relevant. In this study as in other African countries, RTCs are the leading cause of injury morbidity, and young, adult men are the most vulnerable population to be injured [14,15]. Orthopedic and head injuries accounted for the majority of admitting injury diagnoses at Mulago, and a substantial proportion of admitted injury patients required surgical intervention. Patients requiring orthopedic procedures had much longer stays which suggests that limitations in the ability to provide definitive care and rehabilitation services may be a major issue once patients survive to reach the hospital. The high number of head injuries and the rare number of neurosurgical interventions in this subgroup suggests a severe shortage of available emergency neurosurgical services.

The high burden of orthopedic injuries in Kampala requires that government and external funders support efficient delivery orthopedic trauma care at Mulago Hospital to improve resource utilization, streamline care and address long hospital stays. A Canadian collaboration has a long history of working with Mulago Hospital's orthopedic staff to improve the efficiency in a resource-constrained setting but clearly, more needs to be done [16]. Furthermore, there are extremely limited rehabilitation services available in the country and at Mulago and it is quite possible that this shortage results in long hospital stays in the hospital since patients have nowhere else to go. The need to invest in physical and occupational therapy to limit the morbidity from orthopedic injuries is obvious. The societal cost of lost productivity from injury, particularly orthopedic trauma, is another area that needs further exploration. The World Health Organization has guidelines to establish effective programs to limit disability of all forms, especially musculoskeletal disability in the World Report on Disability [17].

Neurosurgical care at Mulago Hospital is provided by a small staff of neurosurgeons, and by convention, all potentially operative neurotrauma is deferred to their management. There were only four documented cases of intracranial drainage performed in the six months of this study. This suggests that either resources needed for appropriate neurosurgical care are grossly lacking or that procedures are not being recorded accurately in the chart. The poor availability and cost of diagnostic equipment and intensive care unit (ICU) resources at Mulago, and lack of appropriate documentation of procedures probably contribute to this figure although some of this is being addressed through collaboration with Duke University through Haglund et al. [18] Mulago Hospital has only four ICU beds for 1500 inpatient beds and only one CT scanner for the hospital which is not readily accessible around the clock. This limits the ability to both diagnose and plan for adequate management of head injured patients as detailed elsewhere [19-21]. We noted that many cases of head and neck injury were simply recorded as open or closed head injury denoting injury to the scalp but not clearly denoting intracranial injury. The lack of detail may be related to the lack of accessibility and affordability of computed tomography.

Our findings support the need for better trauma systems organization in this setting. Injury prevention, emergency medical service infrastructure, in addition to in-hospital medical care and rehabilitation services, are critical pillars of trauma care. In high-income countries, trauma system development has reduced preventable deaths, including those from road traffic injuries, by at least 50% [22]. Improvements in trauma systems in LMICs could avert one to two million deaths per year in severely injured patients [23]. However, there is no organized trauma system in Uganda, and there are limited resources committed to create such a system for the foreseeable future. The WHO suggests that the training of lay first-responders can have a significant impact on the outcomes of injured patients in countries without formal pre-hospital emergency medical systems [24]. We have previously shown the feasibility and cost effectiveness of lay first-responder training in Kampala, however, lack of local government support has limited scaling up of such programs in Uganda [10,25].

Perhaps the most important finding of this study is that investment in data collection infrastructure at Mulago Hospital is both lacking and urgently needed. Investment in radically improving documentation should be a fundamental component of any investment in health care in Kampala. A thoughtful and comprehensive injury surveillance system is essential to understanding the pattern of injury in Uganda. This should include data on pre-hospital care, emergency department visits as captured in trauma registry, injury admissions, rates of disability and use of rehabilitation services, operating room volumes and resource use, as well as mortality from injury throughout the spectrum of care as noted by the WHO [26]. As we have shown elsewhere [14], the lack of a single vital statistics system in Uganda is one of its most neglected problems – one that may not exist on the priority list of any major development partner – but affects the relevance of all health care projects in the country.

Our study has many limitations. Our primary concern is the quality of inpatient clinical documentation. Lack of consistent and accurate documentation and non-standardized charting of deaths and other outcomes severely limit reliable data interpretation. The mediocre correlation between the ICD10 codes assigned by the medical records department and the diagnoses recorded in the patients' charts only further substantiate the limited reliability of the existing clinical data. Detailed charting has the potential opportunity cost of limiting the amount of time for providing clinical care in many settings. However, despite these time pressures, the value of clear and consistent data capture has the ability to inform hospital administrators and policy-makers of clinical burdens and needs, and as such, developing standardized medical records should be a key area of focus.

Second, in this retrospective study, we were not able to calculate any measure of acuity because data were not consistently recorded to enable a retrospective analysis of injury severity or Kampala Trauma Scores [27]. Therefore, we could not correlate length of stay and disposition with severity of injury. Furthermore, we did not correlate our database with the logs of the operating theater to determine the actual cases that were performed. New efforts are currently underway to enhance the data collection systems in the operating theaters at Mulago. Thus, in the future, opportunities to cross-reference bedside and emergency department data with operating theater logs could greatly enhance injury control measures.

Third, we restricted this study to a six-month period at one hospital. While Mulago Hospital is the major government-run referral hospital in the country and the only public hospital in Kampala to have a 24-hour emergency department, our data could be biased because we did not include other facilities in the city such as the private for profit and private non-for-profit hospitals that also provide

some emergency services. However, previous studies have suggested that Mulago Hospital receives at least 75% of all injured patients in the city, and therefore it is likely that this dataset represents the majority of the inpatient volume from trauma in Kampala [8].

Lastly, our dataset had few deaths recorded – only 58 during the study period. However, we previously published from a mortality registry that was created based on the Mulago Hospital mortuary records and covered the same time period as this study and found that 347 deaths occurred in injured patients who were admitted to Mulago Hospital during this time [14]. Thus only 17% of deaths seem to be recorded by the clinician in the hospital chart. Anecdotally, when the hospital charts have been reviewed by the authors, the date of death was often found to be recorded on the face of the charts without any further details. Cause and time of death are rarely, if ever, recorded. Thus, Mulago Hospital's inpatient records likely grossly underestimate the true burden of mortality from injury in Kampala or more broadly in Uganda because of the lack of standardized cause of death certification as recommended by the WHO [28].

This study suggests many next steps including investment in implementing consistent data collection systems, enhancing surgical care capacity for hospitals in LMICs, as well as the need for increased injury prevention and prehospital care efforts. The value of research in injury care is especially important in countries such as Uganda and other LMICs as the global burden of injury has increased by 34% from 1990 to 2010 [5]. There is an increasing role for global advocacy to improve the care of injured patients in resource-constrained settings [29,30].

Conclusions

Trauma has become a leading cause of death and disability in many LMICs. Uganda is no different. Orthopedic and head injuries, especially from RTCs are a significant public health problem in Kampala and are the primary indication for operative intervention for injured patients. Injury burden disproportionately affects young men in Kampala with a significant proportion requiring surgical intervention and subsequent long hospital courses. These data also suggest a critical shortage of emergency orthopedic and neurosurgical care capacity at Mulago. Furthermore, data discrepancies highlight that there is insufficient investment in data collection systems, which poses a significant obstacle to tracking injury burden in Kampala. Investment in injury surveillance, prevention and care has the potential for substantial impact in this setting.

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