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INITIAL INJURY CARE IN NAIROBI, KENYA: A CALL FOR TRAUMA CARE REGIONALISATION

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ABSTRACT

Objective: To describe the emergency care of injuries at a main city hospital.

Design: A prospective study.

Setting: Data were collected between February 1st, 1999 and 30th April, 1999 from the records of the 2000 bed Kenyatta National Hospital (KNH) in Nairobi, Kenya.

Subjects: Two hundred and forty injury patients admitted at KNH were analysed.

Methods: All patients were analysed for demographics, environment of injury hospital arrival and Emergency Department times. The effects of injury severity, place of injury and time of day on these time intervals were analysed statistically.

Results: Road injury admissions formed 31% of all injury admissions. The mean age was 30 years. Males comprised 84.6% of all patients. The proportions of patients under 20 years of age was 20% with a peak age of 20-29 years. Majority (43.3%) of the injured resided in deprived neighbourhood of East Nairobi. The mean pre-hospital time was 2.56 hours. The Emergency Department disposition time was 3.36 hours. Injuries of all severities, as determined by the Injury Severity Score (ISS), were treated. The pace of care did not match severity of the injuries. Only 17.5% reached their areas of definitive care within sixty minutes.

Conclusion: Injuries following road traffic accidents (RTAs) are common in Nairobi. The response to injury is slow and haphazard. The insitution of a care incorporating the city's health centers and pre-hospital triage may optimise care.

INTRODUCTION

Injuries cause profound morbidity and are one of top 10 causes of death and disability in both developing and developed economies (1). There are however, considerable regional and country variations in the proportions of death due to injury. These are the results of differences in industrialisation, urbanisation, motorisation, emergency services development and data capture systems. The United States, Germany and Canada have developed trauma care based on networks of designated trauma systems and fast transport. These developments have addressed deficiencies in trauma care with resultant reductions in the numbers of preventable trauma deaths of between 15% and 20% (2-4).

Kenya, like other developing countries, lacks organised efforts to reduce the burden of injuries. Although there is debate as to whether trauma systems in high-income countries are transferable to developing economies, baseline studies providing accounts of injury and injury trends in least developed countries are scanty. Media reports have raised concern over rising road accident injuries in Kenya. Most of these occur in the capital city, Nairobi (5). Those injured mainly receive treatment at the Kenyatta National

Hospital (KNH) the city's main hospital. The city lacks a systematic pre-hospital care and the patients arrive at the institution at any time and unannounced. To develop an emergency system, information on the distribution of injuries and the current pattern of pre-hospital trauma care practice would be contributory. This study describes the environment of traffic injury in the city of Nairobi and presents an analysis of the efficiency of the initial care of the injured.

MATERIALS AND METHODS

Setting and design: Patients were recruited prospectively for a three-month period between February and April, 1999 at the Kenyatta National Hospital (KNH). KNH is a central tertiary referral and teaching hospital in Kenya. It has 2,000 beds and receives both direct trauma patients and inter-hospital trauma referrals. It also serves as a general hospital for more than 3.0 million inhabitants in Nairobi and its environs. The hospital has a discrete Emergency Department (ED) with a resuscitation area and trauma theatre. The ED is manned by medical officers, some whom have received ATLS training. Residents from general surgery orthopaedics and trauma, medicine and paediatrics are on-site at the ED on a 24 hour basis. Most patients arrive at the KNH via private cars and taxis. There are a few ambulance units around the city but are prevalent modes of transport during inter-hospital transfers. KNH is fairly centrally located and can

be reached from all the sectors within half hour of average speed driving. KNH receives and treats all patients presenting at the ED. Those unable to pay the user fees have their charges waived upon recommendation by social workers.

Study Population: All first time road trauma admissions were included. This case definition excluded pre-hospital deaths and inter-hospital trauma referrals.

Data Collection, Data Instruments and Definitions: Data were abstracted by two research assistants (medical students) using a pre-coded questionnaire. Following institutional approval, data entry commenced on the day of admission and sequential entries were entered till discharge or death of patient. Data sources included the admission register at the ED, the ED case notes, nursing cardex (log), operation notes and discharge summaries. All data were checked for accuracy and completeness by the author.

Information gathered included patient demographics, place of residence and road crash, time of day accident occurred, mode of arrival to hospital, transport time, pre-hospital care, ED disposition time and the injury severity scores (ISS) were determined. The sites of road crashes were classified as major roads leading into the city (Jogoo, Thika, Waiyaki, Ngong, Langata, Mombasa roads), main roads, residential roads and roads outside the city limits. The usual place of residence was used to determine the relative affluence or deprivation of the environment of injury (Figure 1). East Nairobi has a mixture of medium socio-economic level estates, deprived estates and slum dwellings. North Nairobi has the affluent estates while West and South Nairobi an admixture of affluent and medium level estates and isolated pockets of informal settlements (Figure 1). Transport time was defined as time from injury incident to arrival at KNH. ED disposition time was the time from ED arrival to discharge to the ward, ICU or operating theatre. In the determination of ISS, six body regions were considered: head/neck, face, thorax, abdomen/pelvis, extremity/pelvis and skin (external). Injuries sustained in each of the regions were scored on a scale of 1-6 (minor to critical). The injury severity scores were computed from the sums of the squares of three highest (6) regional scores. Severe injuries were defined as having an ISS >15, moderate injury 9-15, and mild injury <9.

Analysis: The data were collected on a standard data sheet, entered into a personal PC computer and analysed using the SPSS version 10.0 statistical software. Variables likely to influence the different times recorded were ISS, place of injury and time of day injury occurred. Descriptive summary statistics were made for the demographic, time and injury severity variables. χ^2 and student t-tests were used where appropriate. The level of significance was $p < 0.05$.

RESULTS

During the study period, 240 road traffic accident survivors were admitted (31% of all hospital trauma hospitalisations). There were 203 (84.6%) males and 37 (15.4%) females. The male:female gender ratio was 5.5:1. The age range was 5 to 81 years with a mean age of 30 (± 13.4) years. Twenty per cent of the patients were 20 years of age and younger. The peak age was 20-29 years (36.6%). Most (65%) were pedestrians.

East Nairobi was the residence of the injured in 43.3% of patients. North Nairobi contributed 5.8%, of the injured while 23.1% of the injured resided outside the city.

Eighty six RTAs (38.2%) occurred along major roads while 62 (27.4%) happened in built-up residential areas. Thika road had the highest casualties (thirty three) compared to Waiyaki way (fourteen), Jogoo road (twelve), Mombasa road (nine), and Limuru/Kiambu road (nine). The distribution was 13.3% and 21.2% for city-center streets and other roads respectively.

Majority of the RTAs occurred during the day (72.4%). Extrication/evacuation of the injured was performed by members of the public (by-standers) and other road users in 65% of the injuries. Ambulance and military medical personnel evacuated 2.8% and 6.2% respectively. The predominant means of transportation to hospital was by use of private cars and taxis (75%). Ninety two per cent of the survivors had no medical interventions instituted before arrival at the hospital.

The mean transport time (incident to hospital arrival, encompassing scene and transport times) was 2.56 (± 3.1) hours. This time was 2.97 hours for East Nairobi, 1.52 hours for West, 3.31 hours for South, 4.6 hours for North Nairobi and 1.97 hours for areas outside the city limits. The time of day and injury severity did not appear to influence the mean arrival time for patients. The average transport time was 2.65 hours for those with mild/moderate injuries (ISS < 16) and 2.23 hours for severe injuries (ISS ≥ 16) ($p = 0.509$). Eighty five patients (44.5%) arrived in hospital within one hour. The rest arrived within two (20.9%), three (11.5%), four (8.4%) and five or more hours (14.7%). Forty eight per cent of those severely injured and 45.2% of those less injured arrived to the hospital less than one hour from the time of the accident incident ($p = 0.76$). These proportions were similar for the different scenes of accidents.

The ED disposition times (hospital arrival to discharge from the ED) ranged from 6 minutes to 10 hours. The mean disposition time was 3.36 hours. The proportion of the injured that reached their areas of definitive care (wards, ICU, operating room) in less than one hour was 17.5%. The remainder was discharged within two (17.5%), three (19.5%), four (12.0%) and five or more hours (16%).

Analysis showed that the severity of injury had minimal effect on the pace of care. Most casualties (57.9%) had injury scores greater than 9. Casualties who sustained severe injuries (ISS >15) had a mean disposition time of 3.47 hours. The average time was 2.72 hours for ISS < 16 but the difference was not significant ($p = 0.08$). When stratified to those discharged within one hour and those still in ED after this time, 31% of those with ISS >15 were admitted within one hour compared to 15% of those with ISS ≤ 15 ($p = 0.043$). The scene of accident and the time of the day the accident occurred did not affect ED disposition time.

Table 1

Distribution of traffic injuries by age sex and site of occurrence

Characteristic	Number	%
Age		
0-9	11	5.4
10-19	30	14.6
20-29	75	36.6
30-39	49	23.9
40-49	24	11.7
50-59	10	4.9
60	6	2.9
Total	205	100.0
Sex*		
Male	203	84.6
Female	37	15.4
Residence		
East Nairobi	90	43.3
West Nairobi	32	15.4
South Nairobi	26	12.5
North Nairobi	12	5.8
Outside Nairobi	48	23.1
Total	208	100

* This information was available for all the patients. The lower totals for the other characteristics were due to missing data.

Figure 1

Mean ISS for the different transport times for traffic admissions

DISCUSSION

Injury prevention and control involves studying the patterns and causes of injuries and applying the findings to public policy with the goal of reducing the frequency and severity of injuries (7). The results of this study highlight important aspects of the problem of injury in Kenya. Traffic injury constituted 31% of the injury burden at the KNH. Most of this injury involved young pedestrians. This young male preponderancy is a feature of a number of studies describing the injury situation in other cities

of developing countries (8,9). The potential for high Disability Adjusted Life Years (DALYs) losses suggested by injuries in this group clarifies the need for greater efforts to address injury prevention.

The risk of injury is disproportionately borne by the under-privileged. Majority of the patients in this study come from the deprived settlements in East Nairobi. Densely populated informal shelters in this part of Nairobi are notorious for poverty and crime. The significance of East Nairobi roads (Thika and Jogoo) comprising half of injuries on major roads is unclear. In a revelation by the Nairobi area traffic commandant (The Daily Nation, August 30, 2001), public minibuses operating on routes in East Nairobi are manned by a crew most notorious in breaking traffic laws. It appears that social indiscipline manifests in high prevalence rates for traffic injuries. A possible explanation for fewer injuries in West South and North Nairobi is the smaller proportion of informal shelters and lower population densities in the areas. A plausible economic explanation is that those injured in those areas preferred to go to other private institutions for care.

The transport time recorded in this study is much longer than those in other studies in high and middle-income communities. The injured here arrived after an average time of 176 minutes. Only 44.5% of the casualties arrived in less than one hour. In the paper by Arreolarisa *et al.*(10) the injury to hospital arrival times in Monterrey in Mexico was 73.0 ± 37.7 minutes (≤ 30 min for 2% of the patients). In Seattle, Washington, combined response, scene, transport time was 31.3 ± 9.8 minutes (≤ 30 min for 54% of the patients). Our results also contrast those from nearby Uganda where 66% of the injured reached Kampala hospitals within one hour (9). The long pre-hospital times in this study has profound implications for outcome and may have its basis in the predominant pedestrian population. When injured, this group is at the mercy of bystanders and useful time is spent organising for transport to the KNH. A road traffic accident survey at a private Nairobi hospital revealed a predominant vehicle occupant population (11) but gave no indication of whether this pattern positively influences hospital arrival time. In Uganda, there is no significant difference in arrival times between Kampala hospitals (9).

Trauma regionalization involves classification of hospitals in a region according to the level of care they can provide, transport of patients with major trauma to level 1 (tertiary) centers, establishment of emergency medical service, implementation of triage protocols for transport of trauma patients to the appropriate hospital and a centralised coordination of care (4). There is debate over whether this macro-organisation of care can be transferred to low-income countries (12). As demonstrated in this study, the injured are transported to hospital by private vehicles in the majority of cases. Ninety two per cent of the casualties arrive at KNH without any pre-hospital optimisation. Ali *et al.*(13) have shown that advanced trauma life support training in developing countries

settings can reduce mortality. Whereas the debate in the West is on whether the ambulance staff should "scoop and run" or "stay and play" in the pre-hospital phase of trauma care, our injured are most likely to be evacuated by other road users and passersby. The emphasis then should be on identification and first-aid training of first responders. It is instructive that a basic life support course for conductors and drivers of Nairobi minibuses, notorious for causing traffic injuries, was going on at the Nairobi hospital during the preparation of this paper.

The long pre-hospital times reported here are not occasioned by "staying and playing". Although the analysis did not look at how many of those admitted actually needed pre-hospital fluids, oxygen or advanced airways, an assessment to determine who would have needed those interventions was unlikely when the means of transportation was private. Over 70% of hypotensive trauma patients receive fluids pre-hospitally in Mexico. The figure is 99% in Seattle. Those who miss the interventions are usually those delivered by private vehicles (10). In both Seattle in USA and Monterrey in Mexico, only 4% of the injured arrive at the hospital by self-transport while the remainder arrive by ambulance. If Nairobi is to set up an EMS, priority areas may involve rapid pre-hospital transport. This may be less expensive than enhancing other hospital-based technologies.

The ideal time to maximise outcome of trauma is when injury to definitive care happens within 60 minutes (golden hour of trauma). There is a wide variation in the disposition times from our ED. Over 82% of the injured patients were discharged from the casualty after one hour. There is need to address this delay. Information on whether the greatest delay is in getting specialty reviews, radiological/laboratory results or the slow pace of emergency physicians, ED congestion or operating room availability is crucial. The city of Nairobi has a number of health centers in each of the four regions highlighted. These facilities could be upgraded to community centers capable of handling minor and moderate injuries. The injury clusters this study has depicted may guide the priority placement of these community trauma centers. This may reduce emergency room congestion at the KNH and optimise trauma care of those with severe injuries. Further, the KNH ED is both a filtering and an emergency unit. Its separation into an accident and emergency wing and an outpatient wing may hasten the pace of care of the injured.

This study has several limitations. This single hospital data is a source of selection bias and not representative of all injuries in Nairobi. It is likely that the injured in North, West and South of Nairobi chose to be treated at private facilities not accessible to our group of patients. A city-wide study analysing the distribution and patient transport to hospitals will offer a more inclusive picture of injuries in the city. This limits direct comparisons with

external data. Further, the assumption that the residence of the injured represented the environment of injury may not be completely true. If a trauma registry existed in our hospital the magnitude of missing information in our study may have been limited. Lastly the study could not provide answers as to where the greatest pre-hospital delay was. Data of trauma calls, response time, scene time and transport times will be available once pre-hospital care is in place. This study calls for continued surveillance of injuries in and out of hospitals so that data generated can continuously drive public health programmes.

In conclusion unintentional injuries remain important health problems affecting young males in Nairobi. The responses to the injuries are slow. The institution of a coordinated care incorporating the city's health centers and pre-hospital care may hasten the delivery of care.

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