Characteristics and Health Outcomes of Patients with Road Traffic Injuries managed in Critical Care Unit at Kenyatta National Hospital: A One Year Retrospective Cohort Study

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Summary

Road traffic accidents are rapidly increasing in developing countries due to rapid motorization. There is limited data on outcomes of patients admitted in critical care units in Kenya.

The study aimed at assessing characteristics and health outcomes of patients with road traffic injuries managed in the critical care unit at Kenyatta National Hospital. A retrospective cohort study was conducted where 71 patients' files were reviewed using a data collection sheet. Data was analyzed using SPSS version 21.0.

Male to female ratio was 3.5:1. Mean age was 30 years. Motor vehicles and motor cycles accounted for 30.3% and 27.3% of injuries respectively. Head Injuries accounted for up to 97.5% of all injuries. Glasgow coma scale (GCS) on admission was below 8 among 81.7% of the patients. Low GCS was significantly associated with age below 40 years, p<0.02. The mean CCU stay was 18 days. Referrals were 69% (n=49) of the patients and was significantly associated with GCS below 8, p<0.01. GCS below 8 was strongly associated with Computerized tomography scan services, p<0.00.Mortality rate was 36.6% (n=26). The mean cost of management was ksh.450195.67.

More resource allocation to county CCUs and enhanced evacuation can improve the outcomes of the patients.

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Introduction

According to the global status report on road safety 2013, a Road Traffic Injury (RTI) is a fatal or non-fatal injury incurred as a result of a collision on a public road involving at least one moving vehicle [1.2]. Between 20- 50 million people suffer non-fatal injuries, with many incurring a disability as a result of their injury [1, 3]. The global report on road safety in 2015 reports that the number of road traffic deaths globally has plateaued at 1.25 million between 2007 -2013. Currently, Kenya ranks among countries with the highest rate of road traffic crashes globally with an average of 3,400 deaths annually [1].

Road traffic accidents (RTA) are a major cause of severe head injuries (SHI) among Kenyan citizens. It mostly affects the productive age comprising 14.3% of adult Intensive Care Unit (ICU) /High Dependency Unit (HDU) admissions, most frequently in young men [2]. Traumatic brain injury (TBI), according to the World Health Organization (WHO), will surpass many diseases as the major cause of death and disability by the year 2030. About 10 million people are affected annually by TBI imposing a burden of mortality and morbidity on society, making TBI a pressing public health and medical problem [5]. The burden of this often neglected injury disproportionately affects low and middle income countries (LMICs) which face a higher risk for TBI and have less developed health systems to deal with the associated health outcomes [5, 6].

Road traffic injuries (RTI) are putting pressure to health care facilities which are poorly equipped to provide the needed services [9]. Though there have been improvements in health care delivery systems in Kenya, many hospitals still refer patients to hospitals with better facilities like KNH [10].

Studies have shown that trauma was the leading cause of admission to CCU especially patients with head injuries and was associated with very high mortality rates [12]. Disability may occur after the initial head injury and surviving patients with brain injury are more impaired than patients with injuries to other parts of the body [13].

The management of road accident victims remains a highly expensive and disruptive effort given that normal services such as scheduled theatre services have to be postponed to attend to the critically injured victims. The management involves Intensive Care Unit facilities and expensive medical consumables. Lack of proper medical finance schemes has also put a heavy financial strain on KNH as most of the patients seen in KNH are unable to pay for the services [11].

Kenyatta National Hospital is a preferred hospital for many people in Kenya because of its proximity and public status. The hospital receives the bulk of road accident victims from Nairobi and its environs which is a region with a high rate of road accidents from surrounding major highways [1]. The hospital was reported to have received up to 40 injured patients from several accidents in a span of 12 hours in one

night and about 216 accident victims in three weeks which was alarming [16]. The hospital spends Sh10 million every week to treat victims of road accidents [16].The objective of this study was to assess the characteristics and health outcomes of patients with road traffic injuries managed in CCU at Kenyatta National Hospital.

Methods

A retrospective cohort study was conducted. Admission and discharge register was used to identify all patients admitted to CCU due to road traffic injuries from 1/1/2013 -31/12/2013. Cochranes formula was used to calculate the sample size. A total of 71 patients' files were randomly selected. A desktop review the files was done using a data collection sheet. Data was analyzed using SPSS version 21.0. Chi square test was used to test for associations. Ethical Clearance for the study was sought from the KNH/UON- Ethics & Research Committee (KNH-ERC/ A/24).Permission to use hospital records of both adults and children was sought from the KNH management. Anonymity and confidentiality were observed.

Results

The mean age for road traffic accident patients was 30.3 ± 2.1 years. Glasgow coma scale below 8 was significantly associated with age below 40 years ($p< 0.02$). The number of male patients was 78.5% (n=51).The male to female ratio was 3.5:1. Majority of the accident victims were single at 66.2% (n=43). Patients who had secondary school level education and below were (92.9%). Unemployed patients were 38 %. Up to sixty nine patients (97.5%) had head injuries with 42.3 % of the patients having multiple injuries (n= 30) There was a significant association between GCS and type of injury ($p<0.01$).The Glasgow coma scale on admission for 81.7 % of the patients was below 8/15 indicating severe head injury**.** The number of accidents attributed to motor cycles was 27.3 % (n=18), while motor vehicles caused 30.3% (n=20) of the accidents. However, the cause was unclear in 34.9 % (n=23) of the patients. There was no significant association between GCS and cause of injury as shown on **table 1.**

Referrals from other hospitals were 69% (n= 49).The mean stay in CCU was 18 days. The relationship between referral status and GCS below 8 was significant ($p<0.01$). Majority of the patients improved and were discharged to the general wards 63.4% (n=45), while mortality rate was 36.6% (n=26). There was no significant relationship between GCS, age and length of CCU stay with mortality, ($p>0.05$) as shown in **table 2.**

Table 1: Relationship between GCS on admission and socio demographic characteristics of RTA patients admitted in CCU at KNH.

Variables		GCS at admission		Total	Chi-square value	Df	P-value
		Below 8	Above 8				
Age	0-20 years	16 (22.5%)	1 (1.4%)	17 (23.9%)			
	21-40 years	31 (43.7%)	4 (5.6%)	29 (49.3%)	10.056	2	.007
	Above 40 Years	11 (15.5%)	8 (11.3%)	19 (26.8%)			
Marital status	Single	40 (56.3%)	8 (11.3%)	48 (67.6%)			
	Married	16 (22.5%)	4 (5.6%)	20 (28.2%)	1.692	3	.639
	Divorced	1 (1.4%)	1 (1.4%)	2 (2.8%)			
	Separated	1 (1.4%)	0 (0.0%)	1 (1.4%)			
Education level	NONE	4 (5.6%)	1 (1.4%)	5 (7.0%)			
	Primary	28 (39.4%)	7 (9.9%)	35 (49.3%)			
	Secondary	21 (29.6%)	5 (7.0%)	26 (36.6%)	1.212	4	.876
	College	4 (5.6%)	0 (0.0%)	4 (5.6%)			
	University	1 (1.4%)	0 (0.0%)	1 (1.4%)			
occupation status	Unemployed	25 (35.2%)	2 (2.8%)	27 (38.0%)			
	Casual Labourer	10 (14.1%)	3 (4.2%)	13 (18.3%)			
	Self Employed	21 (29.6%)	8 (11.3%)	29 (40.8%)	4.460	3	.216
	Formal Employment	2 (2.8%)	0 (0.0%)	2 (2.8%)			
Gender	Female	13 (18.3%)	2 (2.8%)	15 (21.1%)	.315	1	.575
	Male	45 (63.4%)	11 (15.5%)	56 (78.9%)			
Type of injury	Severe Head Injury	32 (45.1%)	7 (9.9%)	39 (54.9%)			
	Fracture Femur	0 (0.0%)	2 (2.8%)	2 (2.8%)	9.423	2	.009
	Multiple injuries	26 (36.6%)	4 (5.6%)	30 (42.3%)			
Cause of Injury	Stampede	0 (0.0%)	2 (3.0%)	2 (3.0%)			
	Motor cycle	16 (24.2%)	2 (3.0%)	18 (27.3%)			
	Hit and run	20 (30.3%)	3 (4.5%)	23 (34.8%)			
	Motor Vehicle	16 (24.2%)	4 (6.1%)	20 (30.3%)	11.377	6	.077
	Fall from Height	1 (1.5%)	0 (0.0%)	1 (1.5%)			
	Assault	1 (1.5%)	0 (0.0%)	1 (1.5%)			
	Train crash	1 (1.5%)	0 (0.0%)	1 (1.5%)			
ICU stay	< 20 days	43 (60.6%)	11 (15.5%)	54 (76.1%)			
	≥ 20 days	15 (21.1%)	2 (2.8%)	17 (23.9%)	.640	1	.424
Total		58 (81.7%)	13 (18.3%)	71 (100%)			

Table 2: Relationship between Referral status and other variables among RTA patients managed in CCU at KNH

Variables		Referral status		Total	Chi-square value	Df	p-value
		No	Yes				
Waiting time	< 30 min	6 (12.2%)	20 (40.8%)	26 (53.1%)	2.125	2	.346
	31-60 min	1 (2.0%)	5 (10.2%)	6 (12.2%)			
	> 60 min	7 (14.3%)	10 (20.4%)	17 (34.7%)			
Total		14(28.6%)	35 (71.4%)	49 (100%)			
GCS at admission	≤ 8	14(20.0%)	43 (61.4%)	57 (81.4%)	6.716	1	.010
	> 8	8 (11.4%)	5 (7.1%)	13 (18.6%)			
Total		22(31.4%)	48 (68.6%)	70 (100%)			
Fate of patients	Improved	16(22.5%)	29 (40.8%)	45 (63.4%)	1.200	1	.273
	Died	6 (8.5%)	20 (28.2%)	26 (36.6%)			
Total		22 (31.0%)	49 (69.0%)	71 (100%)			
ICU stay	< 20 days	16 (22.5%)	38 (53.5%)	54 (76.1%)	.194	1	.660
	≥20 days	6 (8.5%)	11 (15.5%)	17 (23.9%)			
Total		21 (31.0%)	50 (69.0%)	71 (100%)			

There is significant association between referral status and GCS at admission (chi-square value (1) = 6.716, p<0.05). This indicate that most of the patients who were referred had a GCS at admission below 8

There is significant association between GCS at admission and computerized axial tomography of the head (chi-square value (1) = 13.975, p<0.001). This indicates that patients who had GCS at admission below 8 were more likely to undergo computerized axial tomography of the head as compared to those who had GCS above 8 as shown on **table 3**.

Table 3: Relationship between GCS of RTA patients on admission and services given in CCU at KNH

Variables		GCS at admission		Total	Odds Ratio	Chi-square value	df	P-value
		Below 8	Above 8					
Computerized Axial Tomography of the Head	No	0 (0.0%)	3 (4.2%)	3 (4.2%)	6.800	13.975	1	.000
	Yes	58 (81.7%)	10(14.1%)	68(95.8%)				
X-Ray	No	12 (16.9%)	3 (4.2%)	15(21.1%)	.870	.036	1	.849
	Yes	46 (64.8%)	10(14.1%)	56(78.9%)				
Full Hemogram	No	10 (14.1%)	3 (4.2%)	13(18.3%)	.694	.242	1	.623
	Yes	48 (67.6%)	10(14.1%)	58(81.7%)				
Grouping and Cross matching	No	39 (54.9%)	11(15.5%	50(70.4%)	.373	1.539	1	.215
	Yes	19 (26.8%)	2 (2.8%)	21(29.6%)				
Urea and Electrolytes	No	12 (16.9%)	4 (5.6%)	16(22.5%)	.587	.618	1	.432
	Yes	45 (64.8%)	9 (12.7%)	55(77.5%)				
Arterial Blood gas analysis	No	7 (9.9%)	2 (2.8%)	9 (12.7%)	.755	.105	1	.745
	Yes	51 (71.8%)	11(15.5%)	62(87.3%)				
Abdominal Ultrasound	No	56 (78.9%)	11(15.5%)	67(94.4%)	5.091	2.846	1	.092
	Yes	2 (2.8%)	2 (2.8%)	4 (5.6%)				
Total		58 (81.7%)	13(18.3%)	71 (100%)				

There was no significant relationship between fate of the patient, age, gender, type of injury sustained and ICU stay at $p>0.05$ as shown on **table 4**.

Table 4: Relationship between fate of RTA patients managed in CCU at KNH and other variables

Variables		Fate of the patient		Total	Chi-square value	df	P value
		Improved and transferred to ward	Died				
Age	0-20 years	11 (15.5%)	6 (8.5%)	17 (23.9%)	.341	2	.843
	21-40 years	23 (32.4%)	12 (16.9%)	35 (49.3%)			
	>40 Years	11 (15.5%)	8 (11.3%)	19 (26.8%)			
Gender	Female	12 (16.9%)	3 (4.2%)	15 (21.1%)	2.263	1	.132
	Male	33 (46.5%)	23 (32.4%)	56 (78.9%)			
Type of injury sustained	Severe Head Injury	24 (33.8%)	15 (21.1%)	39 (54.9%)	1.213	2	.545
	Fracture Femur	2 (2.8%)	0 (0.0%)	2 (2.8%)			
	Multiple injuries	19 (26.8%)	11 (15.5%)	30 (42.3%)			
ICU stay	< 20 days	37 (52.1%)	17 (23.9%)	54 (76.1%)	2.565	1	.109
	≥ 20 days	8 (11.3%)	9 (12.7%)	17 (23.9%)			
Total		45 (63.4%)	26 (36.6%)	71 (100%)			

The chi-square test above shows that there is no significant relationship between fate of the patient, age, gender, type of injury sustained and ICU stay at p>0.05.

The Mean cost of hospital management was Kenya shillings 450,195.67. Most patients were cleared on credit 55.6% while 31.8 % cleared by National Hospital Insurance Fund as shown on figure 1. Infections was a complication in 35.5% of the patients while electrolyte imbalance occurred in 35.2% of the patients.

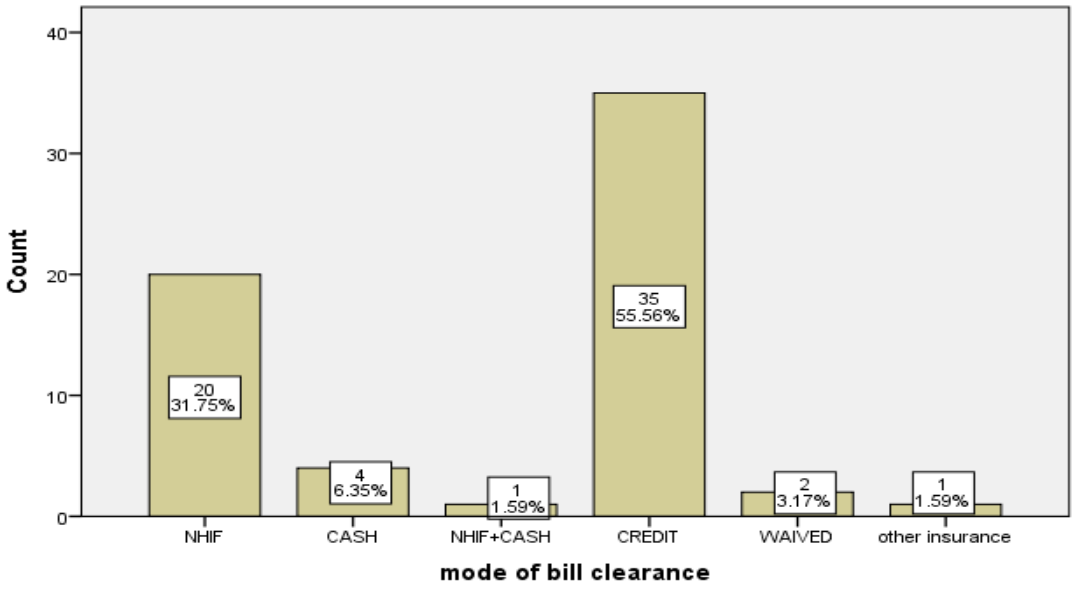

Fig 1: Mode of Hospital Bill Clearance among RTA patients managed in CCU- KNH

Discussion

The study was conducted among 71 RTA patients admitted to the CCU at KNH in 2013.The study is supported by a research carried out in Tanzania which concluded that trauma resulting from road traffic crashes is a leading cause of intensive care utilization in the hospital [12.17].

This study found that the majority of the patients were male (78.5%). The mean age was 30 years. The male to female ratio was 3.5:1.Majority of the patients were single with secondary school education level and below who were unemployed. Studies have found that RTAs were a major cause of severe head injuries (SHI) among Kenyan citizens' mostly young men in the productive age comprising 14.3% of adult ICU/HDU admissions **[2,27].** A study conducted in Tanzania found that road traffic accidents account for 56% of all patients admitted to Muhimbili Medical Centre due to injuries [18]. Predominance by males is likely to be due to general risk taking behaviors.

There may be need to investigate the role of low education level in RTA.

This study revealed that majority of the RTA patients managed in CCU were referrals from other hospitals (69%). Referred patients were significantly associated with GCS below 8 ($p<0.01$). Patients are generally referred to KNH for specialized services like ICU and CT scan services. The number is higher than in the neighboring countries. Mulago hospital in Uganda has referral patients accounting for 42.9% of all patients in CCU [28]. Muga et al further established that despite improvement in health care delivery systems in Kenya, many hospitals still refer patients to hospitals with better facilities like KNH. Studies have reported that patients with head injuries are the most likely trauma patients to be transferred to KNH for specialized investigation and critical care [7].As a result, the transfer of RTA patients to KNH further increases bed occupancy and duration of stay since these patients are usually chronically sick. The process of transfer of this patients is likely to cause deterioration of GCS and delayed CCU care. If this services were available at the county level, the RTA patients would receive ICU care promptly thereby improving the outcomes.

This study found that majority of the patients sustained head injuries with GCS below 8/15 (81.7%).There was a significant relationship between GSC below 8 and age below 40 years ($p<0.02$). The finding is consistent with other researchers who reported that most of the patients admitted in CCU had severe head injuries [20, 23]. It was further reported that head and neck injuries were the most common cause of morbidity, mortality and temporary or permanent disability in most developing countries. Osoro et al established that head and neck injuries are followed by lower extremity injuries [20].

Motor vehicles and motor cycles accounted for 30.3% (n= 20) and 27.3% (n=18) of the patients respectively. The cause of the injuries in 34.9% of the patients was not clear as these patients were brought to hospital by police and good Samaritans having been abandoned at the accident scene by the drivers /cyclists. This finding was of concern and may have contributed to delayed transportation to hospital as well as initiation of CCU care. Considering the number of passengers carried on a motor cycle at a given time compared to motor vehicles, the number of motorcycle accidents are quite high and more needs to be done to curb the accidents. However there was no significant association between GCS and cause of injury. A study conducted by European Brain Injury Consortium (EBIC), reported 52% of head injuries were related to Motor Vehicle Accidents (MVAs) [13].

This study found that the mean length of stay in CCU was 18 days. The length of CCU stay was not significantly associated with mortality ($p>0.05$). Studies from other countries have shown a shorter length of stay (LOS) in CCU. A study in Italy reported that the LOS in CCU was 11.1 days [33].

Other Studies in Africa have shown a shorter LOS among all patients in a surgical ICU ranging between 5-7 days [31, 32]. Other researchers report that patients who stayed for long had a better outcome [2].

The commonest complication suffered were electrolyte imbalance accounting for 35.2%. Infections were detected in tracheal aspirate or urine in 35.2% of patients. Anemia occurred in 22.5% while bedsores and ventilator acquired pneumonia was reported in 9.9% and 14.1% of patients respectively. These complications are likely to have affected the length of CCU admission and mortality rate. The study results are consistent with a study which reported that anticipated duration of hospital stay among in patients for over one month was 51.9 % of RTI patients [9]**.** A study reported the incidence of electrolyte disturbance varied and was associated with bad outcome **[30].** A study in Greece reported that the overall pressure ulcers in CCU in Greece was 29.6% **[31]**

This study found that 63.4 % of the patients improved and were discharged to the general wards while Mortality rate was 36.6 %. There was no significance in the relationship between age and length of CCU stay with mortality, p>0.05. This findings represent a high but better outcome compared with countries in the region. A study in Mulago hospital found an overall mortality rate in ICU to be 40.1% which was higher than that in high income regions who have reported mortality rates of 10-20.9% **[24].** Studies in Nigeria reported mortality rate in ICU as 52.2%- 53.2% with RTA being responsible for 68.6% of the deaths **[27, 2].** Another study reported that mortality rate in a Surgical ICU in Addis Ababa was 31.5% with RTA patients constituting 48% of the death where 13 out of 27 RTA patients died **[28].** A local study in Tenwek hospital in Kenya reported that general overall mortality in ICU was 26.1% **[26]**. Previous studies have found that mortality rate from severe traumatic brain injury was 31% in Argentina **[25].** Previous studies have suggested that inadequate medical and technical equipment in most I CU's in low resource economies contributes to high mortality rates among critically ill patients**[23].**

The mean cost of hospital management was Ksh.450, 195.00. This translates to a daily cost of Ksh. 25,010. Only 6.4% cleared by cash. Credit facilities were given to 55.6% while National Health Insurance Fund (NHIF) cleared for 31.8% of the patients. The cost is high considering the demographic characteristics of those affected and this may explain the mode of bill clearance. Bowley and Boffard reported that the severely brain-injured had the highest mean length of stay and mean hospital costs. It was further established that the average lifetime costs of treating an individual with traumatic spinal-cord injury was estimated to be between US$500 000 and US$2 million **[13].**The high cost of hospital bill is as a result of the services given to patients. Another study reported that casualties affected by RTA account for 45- 60 % of all admissions in surgical wards in Kenya and up to 75% in national spinal injury hospital placing a high demand on hospital

resources [16].Another Study reported that there is also a tendency towards transfer of long stay patients from private to public hospitals due to financial constraints **[9].** This finding is similar to a study conducted in Malawi which found that recovery of the RTA patients takes a long period. This requires huge resources to pay for the high cost incurred from many radiological and laboratory investigations and prolonged hospital stay. Patients in CCU are also predisposed to nosocomial infections because of many invasive treatments like central venous catheters, urinary catheterization and prolonged intubation [18].

Conclusions

Our study found that young males in the reproductive with low education level who were unemployed were most affected by RTA.

Majority of patients were admitted to CCU due to severe head injuries with a GCS below 8/15. Most of the RTA patients in CCU were referrals from other hospitals.

The length of stay and cost of management is high for the common citizen. Mortality rate was high though better than neighboring countries. A comparative study can be done to clearly ratify this observation.

There is need to target this group of people in preventive measures as well as equip ICUs with the necessary resources to improve the outcomes of the patients. Resources should be allocated to CCUs in the counties to cater for patients who need ICU care and CT scan services to reduce the number of referrals to KNH. There is need to enroll more young people with NHIF and other health insurance covers to help them bear the economic burden.

Highway patrols and effective evacuation of RTA patients should be re enforced in order to ensure no casualties are abandoned at the road side.

More studies need to be done to evaluate the role of low education level in RTA.

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What is known about this topic

RTA's commonly affects young males of reproductive age and the number of injuries in low and middle income countries is twice as much as that in high income countries

What this research adds

Comparison between number of road traffic injuries caused by motor vehicles and motor

Cycles.

The demographic characteristics of RTA patients managed in KNH –CCU

The health outcomes of RTA patients managed in CCU at KNH.

The number of Referral patients with RTI's managed in CCU- KNH.

The cost of hospital management for RTA patients in KNH.

Competing interest

All the authors declare that there is no competing interests among the authors

Author's contributions

Eunice chelogoi: Designing the project, performing statistical analysis and preparation of the manuscript

Professor Simon karanja- Advice and guidance on manuscript preparation and submission

Dr. Yeri kombe- Advice and guidance on manuscript preparation and submission.

All authors have read and agreed to the final manuscript.

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