PATTERNS AND MANAGEMENT OUTCOMES OF EXTREMITY INJURIES SECONDARY TO MOTOR CYCLE-RELATED ACCIDENTS AT MOI TEACHING AND REFERRAL HOSPITAL, ELDORET, KENYA

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THIS THESIS IS SUBMITTED IN PARTIAL FULFILLMENT OF REQUIMENTS FOR THE AWARD OF THE MASTERS OF MEDICINE IN ORTHOPEDIC SURGERY OF MOI UNIVERSITY

DECLARATION

Declaration by the Candidate

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DEDICATION

This work is dedicated first of all to God, who has made all this possible. I would also like to dedicate this work to my loving family and my teachers who have continued to support and encourage me to excel in my studies.

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LIST OF ABBREVIATIONS AND ACRONYMS

IREC	Institutional Research and Ethics Committee
MCAs	Motorcycle- related Accidents
MTRH	Moi Teaching and Referral Hospital
ORIF	Open Reduction and Internal Fixation
RTA	Road Traffic Accidents
WHO	World Health Organization

OPERATIONAL DEFINITION OF KEY TERMS

Extremity Injury: Fracture of any long bone in the upper or lower limb.

Motorcycle- related accidents: Motorcycle being the dominant player in the mechanisms of injury, hence referred to (as motorcycle- related accidents), whichever the collisions with (motorcycle- motor vehicle, motorcycle- motorcycle, motorcycle- pedestrian, motorcycle- bicycle), or even in situations of lone motorcycle involvement.

Outcomes: State of patient at time of discharge with regard to successful treatment of fracture

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ABSTRACT

Background information: The use of motorcycles as a means of transport in Kenya has increased dramatically over the last five years. This has consequently been accompanied with an increase in motorcycle- related accidents which have significantly increased the trauma burden in hospitals. These accidents are among the leading causes of disability and death among trauma patients. The victims who include the riders, passengers and pedestrians are mostly young in their productive years. There is paucity of published data describing the patterns, management and early outcomes of these types of injuries at Moi Teaching and Referral Hospital (MTRH) and Kenya.

Objective: To determine the patterns, management options and early outcomes of extremity injuries following motorcycle-related accidents at MTRH.

Methods: A prospective study was conducted among the orthopedic inpatients at MTRH, between November 1st, 2017 and March 31st, 2018. The study population comprised of patients who had extremity injuries secondary to motorcycle- related accidents. Sample size of 175 patients was determined using the modified Fisher's formula. After obtaining informed consent primary data on demographics, mechanisms and patterns of injury, management and outcomes using a standardized questionnaire administered by the researcher was collected. Secondary data was also retrieved from hospital medical records. Analysis was done using SPSS version 20 at a confidence level of 95%, for the study variables.

Results: Median age was 28 years (IQR 25, 34), with a range of 13-69 years, males more affected than females with a ratio of 2.2:1. Most patients (61%) had secondary education and 28% of the patients were unemployed. The commonest mechanism of accidents was collision between motorcycles and motor vehicles (35%). The lower to upper extremity injury ratio was 1.9:1. In the upper extremity the humerus was most affected (51 %); most of the upper limb fractures (56%) were closed, while in lower extremity the femur was most affected with femur to tibia- fibula ratio of 1.4:1, with 61% of all lower limb fractures being open. Majority of patients (80%) had received pre-hospital care at some peripheral facility before reception at MTRH; with 54% arriving within the hour after the accident. Majority of patients (79%) had operative management, with 48% on external fixators. At time of discharge, 167 (95%) had adequately reduced fractures, while 8 had amputations. They were discharged for follow-up at outpatient clinics-orthopedics, physiotherapy and occupational therapy.

Conclusion: Majority of patients with extremity injuries due to collision between motorcycles and motor vehicles were young males. Most of the patients received operative management. Early outcomes were good. No mortalities were recorded during this period of study.

Recommendations: Create awareness and sensitize the group at risk on safety measures. Ensure affordable implants are readily available to maximize patient management and hence improve outcomes of these injuries. Further study on long term outcomes of the injuries will help in improving management protocols. The Highway Code modification to accommodate motorcyclists and pedestrians.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Study Background

The use of motorcycles as a mean of transport in Kenya has increased dramatically over the last five years. Between 2005 and 2011 registration of motorcycles increased 40-fold and made up almost 70% of all registered motor vehicles (WHO, 2011). This has consequently been accompanied by an increase in motorcycle- related accidents by 29% between 2004 and 2009 (Saidi & Mutisto, 2013). It has in turn meant a significant increase of the trauma burden in hospitals. Currently, these accidents are among the leading causes of morbidity, disability and death among trauma patients in hospitals. In one hospital in Kenya motorcycle- related injuries comprised 39% of all traffic injuries. The victims who include the riders (45%), passengers (39%) and pedestrians (16%) are mostly young people with a mean age of 30 (SD: 13) years in their productive years (Sisimwo, Mwaniki, & Bii, 2014).

There is paucity of published data describing the patterns, management and early outcomes of these injuries at MTRH and even in other health institutions in Kenya.

1.2 Problem Statement

Globally, road traffic accident injuries are responsible for a significant proportion of overall injury morbidity, disability and mortality; 90% of mortalities are seen in developing countries (Solagberu, 2006). Motorcycle- related accidents are one of the major factors contributing to this proportion. The MTRH casualty and inpatient records show a two-fold increase in the number of patients admitted or treated for motorcycle-related accident injuries during the last two years. However, there is no documented record of the patterns, the overall burden or various outcomes of these injuries.

1.3 Justification

Data acquired from this study might greatly help to inform the MTRH management team and stake holders on the trauma burden, demographics, patterns, management options and early outcomes of these injuries. The research will also generate information on the needs and challenges posed by these injuries at MTRH. It will also help to inform policymakers and implementers on prevention and the most effective management modalities of these accidents.

1.4 Research Question

What are the patterns, management options and early outcomes of extremity injuries following motorcycle- related accidents (MCAs) in patients at MTRH?

1.5 Objectives

1.5.1 Broad Objective

To determine the patterns, management options and early outcomes of extremity injuries following MCAs in patients at MTRH.

1.5.2 Specific objectives

i. To outline the social demographics for patients with extremity injuries following motorcycle- related accidents at MTRH.

ii. To describe the mechanisms and patterns of extremity injuries following motorcycle- related accident sin patients at MTRH.

iii. To describe the treatment modalities and overall early outcomes of extremity injuries following motorcycle- related accidents in patients at MTRH.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1Social Demographics

In a Kenyan study, the average age of the trauma victims was 30.7 years with a male predominance (87%) for hospitalized patients suffering trauma secondary to MCAs (Muguku,2013). In Uganda however, Kigera and Naddumba, (2010) had average age of 21.9 years.

Young single men, coming from the state capital in Brazil were more likely to sustain open fractures secondary to MCA as compared to the other patients (Matos, *et al.*, 2014). Male riders with mean age of 30 (SD: 13) years contributed to the majority of injuries after MCA in Kitale, Kenya (Sisimwo, et al., 2014). Somewhat older male riders (mean age 43 years) were found to be the most common casualties with lower limb injuries in another study (Kortor, *et al.*, 2010).

While comparing injuries secondary to motorcycle trauma among different age groups over time, injuries among older motorcyclists were seen to increase threefold as compared to a twofold increase among younger motorcyclists showing a greater risk in former group (Jackson & Mello, 2013). In some studies the ages ranged between 26 years and 32 years with a male predominance (Asuquo & Ugare, 2009; Mcharo, 2012; Mogaka, et al., 2011). Another study done in USA found that most of the patients (66%) were below 39 years, and that a vast majority (95%) were men (Dischinger, Ryb, Ho & Braver, 2006). While Kigera and Naddumba, (2010) in Uganda reported male to female ratio of 4.4:1, Zargar, et al., (2000) documented ratio of 15:1 in Tehran (Iran).

2.2 Mechanisms and Patterns

Motorcycle- related accidents occurred by various mechanisms and the injuries sustained manifested in various patterns. A collision between a motorcycle and a motor vehicle was found to be the most common injury mechanism (46%). For these collisions head and neck injuries were as common as lower extremity injuries (40%) while chest injuries were less frequent (9%) (Sisimwo, et al., 2014). Mcharo, (2012) in Tanzania documented rate of 50%, while Zargar, et al., (2000) had 72.5% in Iran. Dischinger, et al., (2006) in Maryland State of United States however while comparing different age groups (older versus younger) involvements in MCAs, the older victims were more likely to fall off the motorcycle rather than in collisions.

Injuries secondary to MCAs were mostly to the extremities (61 %) and less frequent for injuries to the head and neck (32 %). Fractures were commonest in the lower limbs (73%), closed fractures being more common than open fractures. Regarding the fractures of the lower limb it was most frequent for the tibial shaft (Kortor, *et al.*,2010).In another study in Brasil, lower limb fractures were found to be 60% of all the extremity fractures (Flamarion, et al., 2015).

In another study, the commonest injury mechanism of accident was a motorcycle being hit by a car (57%). The second most frequent cause was a collision with another motorcycle (15%), followed by pedestrians running into a motorcycle (12%), over-speeding/ loss of control (6%), animal/ object on the road (4%). Most patients (42%) had fractures of the extremities (Dongo, et al., 2013).

A general trend is seen in majority of data collected in different studies showing the highest number of MCAs being secondary to being hit by a car and the commonest pattern of injury being closed fractures of the lower limb, especially tibial fractures

(Beall, 2011; Ganveer & Tiwari, 2005; Nzegwu, Aligbe, Banjo & Akhiwui, 2008; Odelowo, 1994; Yan, Ma, Huang, Abdel-Aty &Wu, 2011).

However, data from another publication showed that the most common injuries secondary to MCAs were open wounds and superficial injuries to the head (69%), followed by upper extremity injuries (27%), while lower extremity injuries were less frequent (24%) (Fitzharris, Dandona, Kumar & Dandona, 2009).

2.3 Management and Overall Outcomes

It has been generalized that globally, road traffic accident injuries are responsible for a significant proportion of overall injury morbidity, disability and mortality, with over 90% of mortalities seen in developing countries (Solagberu, 2006). With the increasing number and use of motorcycles, the morbidity and mortality are bound to further increase, especially in the developing countries.

The management outcomes ranged from outpatient treatment at the emergency unit and consequent discharge with intact full functionality to inpatient and operative treatment either with return of full function or with varied degrees of disability to mortality. Among the total mortalities, incidence was lowest in patients with extremity injuries (2%) as compared to those with open wounds of the head-neck (40%), intracranial injuries (31%), crush injuries of the head (17%), and fractures of the head-neck (14%).Other injuries with relatively high mortality rates were thoracic fractures (9.5%) and intra-abdominal injuries (9.5%) (Fitzharris, et al., 2009).

Data from Nigeria showed non operative management sufficed in majority of the patients who had closed tibiofibular fractures while few (44%) required operations. Mortality was found to be at 6.8% (Odelowo, 1994). A study in USA showed that patients who were treated and released as outpatients was at 83%, those admitted were

12%, while 4% were discharged against medical advice and there was 1% mortality. Of those who were hospitalized, there was less than 1% mortality recorded while 82% were discharged and about 17% were transferred to the rehabilitation centers (O ’brien, Pitoniak-Morse & Jacobs, 2005).

According to Dongo, et al., (2013) and Matos, et al., (2014), majority of patients reported within 6 hours of injury for management. The former however reported mortality rate of 6% in Nigeria. Beall, (2011) in Jamaica documented a mortality of 4%.

CHAPTER THREE

3.0 METHODOLOGY

3.1 Study Area

The study was conducted at the MTRH, Eldoret, Kenya. MTRH is the second largest referral hospital in Kenya and serves part of the former Great Rift Valley and Western Provinces in Kenya. It also serves part of Uganda and Southern Sudan. The catchment area has a population of 15-20 million people. The study was done at the Orthopaedics wards in the hospital.

3.2 Study Design

This was a descriptive prospective study. Patients admitted to the Orthopedic wards diagnosed with extremity injuries secondary to motorcycle- related accidents were evaluated and variables of interest determined.

3.3 Study Population

This comprised of inpatients at the Orthopedic wards with extremity injuries caused by motorcycle- related accidents.

The patients gave their informed consent for participation.

3.4 Eligibility Criteria

3.4.1 Inclusion Criteria

All inpatients with extremity injuries due to motorcycle- related accidents.

3.4.2 Exclusion Criteria

i) Patients with previous extremity injuries prior to the motorcycle-related accidents.

3.5. Sample size Estimation

Sample size of 175 patients was determined using the modified Fisher's formula.

Modified Fisher's formula

$$n = \frac{Z^2P(1-P)}{d^2}$$

where:

- **n** =desired sample size
- **z** = standard normal distribution
- **p** = highest percentage occurrence for the most affected bone (tibia 38%) in similar study.
- **d**= the level of significance desired

$$\frac{1.96^2 \times 0.38(0.62)}{0.05^2}$$

$$= \frac{3.8416 \times 0.2356}{0.0025} = 362$$

This number was adjusted according to the average population of patients with extremity injuries secondary to MCAs at MTRH in three years (338):

- $n_1 = \frac{n}{1+n/N}$, where n_1 = final sample size

N =Average population at MTRH

n =calculated sample size

362/1+362/338 =**175** =adjusted sample size.

3.6 Data Collection, Handling and Analysis

3.6.1 Data Collection and Handling

Data was collected between November 1st 2017 and March 31st 2018. Patients meeting the eligibility criteria were enrolled at time of diagnosis by the investigator or his assistant.

Entries were made in the researcher administered questionnaires and later transferred to a computer database.

Data collected included patient and /or guardian's responses, patient information from his/ her hospital file and physical findings obtained by the researcher or his assistant.

Double entry was used to ensure accuracy of the data.

Patients enrolled from the wards were followed up during their entire hospital stay till discharge or death.

All patient details were kept confidential and data was only available to the investigator and the supervisors via password access. Serial numbers were used in order to protect patients' identity.

Data collection forms were verified for completeness and coded appropriately.

3.7.2 Data Analysis

Data was analyzed using SPSS version 20 statistical program for patterns, management modalities and early outcomes of extremity injuries secondary to MCAs at MTRH.

3.7.2.1 Descriptive Statistics

Numerical data such as age was presented using means, standard deviation for normal distribution or median and interquartile ranges when the distribution was skewed.

Categorical data such as sex, education level and occupation were presented in the form of frequencies and percentages. Tables and box plots were used to show distribution of various variables accordingly.

All data analysis was performed at 95% level of significance ($p < 0.05$).

3.8 Ethical considerations

- Approval to carry out the study was granted from IREC (IREC/2016/121; Approval Number: 0001711, dated 1/9/2016) and permission obtained from the Hospital Director (CEO: ELD/MTRH/R.6/VOL.II/2008, DATED 8/9/2008), MTRH before commencement of the study.
- Informed consent was sought from patients above 18 years and guardians of those below 18 years.
- All patients/guardians were informed about the study and the procedures.
- All patients received medical attention as necessary regardless of whether they did or did not consent to participate in the study.
- No added cost on investigation or otherwise was be added to the patients' bills.
- No incentives or inducements were used to lure patients to participate in the study.
- Confidentiality was maintained throughout the study. The data collection forms used neither contained the names of the patients nor their personal identification numbers. Questionnaires were kept in a locked cabinet during the study period.
- All patients were free to withdraw from the study at any point in time as they wished and without need to seek prior authorization to do so and without any

consequences whatsoever for so doing as per the Helsinki Declaration, 1964.

- The results of the research would be disseminated to Moi University and IREC through bound books (thesis), conferences and peer review journals.

It will also be available for academic reference in the College of Health Sciences Resource Centre.

3.9 Study Limitations

Management options were limited by inability of some patients to purchase implants and cater for treatment fees. Social services department aided waiving of hospital charges.

CHAPTER FOUR

4.0 RESULTS

4.1 Introduction

The findings presented are based on the 175 patients with extremity injuries secondary to motorcycle- related accidents at MTRH, who met the inclusion criteria. They were interviewed between November 1st 2017 and March 31st 2018.

4.2 Social Demographics

Graph 1: Age distribution

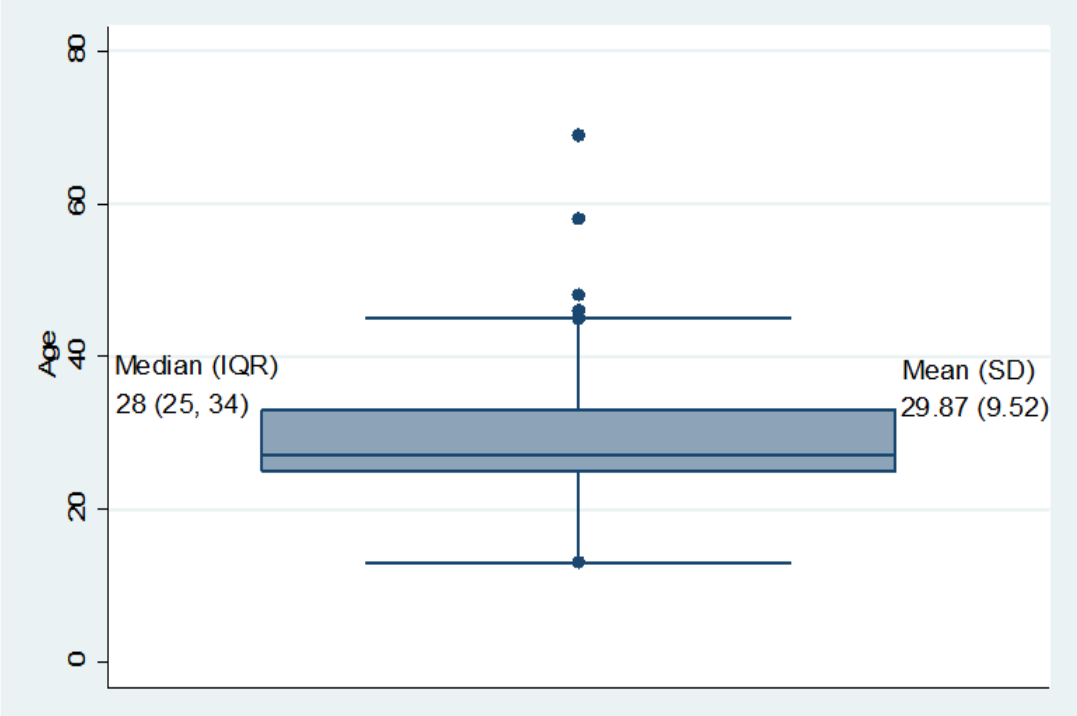

Figure 1: Age distribution

The median age of patients was 28 years (IQR 25, 34), ranging from 13 to 69 years while the average age of individuals involved in MCAs was 29years.

Table 1: Social Demographics

Variables	Category	Frequency	Percentage
Age	**Median** 28yrs **(**IQR:25**,**34**)**	**-**	**-**
	Min-Max: 13- 19		
Sex	**Male**	**121**	**69**
	Female	**54**	**31**
Education level	**Not attended**	**7**	**5.00**
	Primary	**46**	**26.29**
	Secondary	**107**	**61.14**
	University/college	**15**	**8.57**
Occupation	**Employed**	**40**	**22.86**
	Self-employed	**39**	**22.29**
	Student	**47**	**26.86**
	Unemployed	**49**	**28.00**

Males were more affected as compared to females with a ratio of 2.2:1. Most of the patients had secondary education at 61.14% with only 8.57 % having acquired university education; 28% were unemployed while the rest were either employed, self-employed or students.

4.3 Injury Mechanism

Table 2: Mechanism of injury

Mechanism	Frequency	Percent
Motorcycle - motor vehicle	61	34.86
Motorcycle – motorcycle	32	18.29
Motorcycle-pedestrian	50	28.57
Lone motorcycle(falling)	30	17.14
Motorcycle – bicycle	2	1.14
Total	175	100

The most common mechanism of MCAs was collision between motorcycles with a motor vehicle at 34.86%. Motorcycle hitting a pedestrian was the second most common at 28.57%, colliding with another motorcycle was at 18.29%, while the least common mechanism of injury was collision between a motorcycle and a bicycle at 1.14%.

4.4 Patterns

Table 3: Limb Affected

Variable	Category	Frequency	Percentage
Limb affected	**Upper right**	**52**	**77.61**
	Upper left	**15**	**22.39**
Total Upper Limb		**67**	**100**
	Lower right	**70**	**55.12**
	Lower left	**57**	**44.88**
Total Lower limb		**127**	**100**

The lower right extremity was most affected as compared to the upper extremity (1.9:1). However, in both upper and lower limbs, the right extremity was most affected.

Table 4: Upper Limb Fracture Patterns

	Open%	Closed%	Total%
Humerus	**39**	**62**	**51**
Radio ulnar	**52**	**38**	**44**
Ulna	**9**	**0**	**4**
Total	**100**	**100**	**100**

In the upper extremity the humerus was most affected at 51 % as compared to the other upper limb long bones. Isolated ulnar fractures were the least frequent. Most of the upper limb fractures were closed at 56%. Radioulnar fractures were the second most common fracture type in the upper limbs.

Table 5: Lower Limb Fracture Patterns

	Open	Closed	Total
Femur	**46**	**27**	**73**
Tibiofibular	**32**	**22**	**54**
Total	**78**	**49**	**127**

In the lower extremity the femur was most affected with a ratio of 1.4:1 as compared to tibia and fibula; 61% of all lower limb fractures were open.

4.5 Management and Treatment modalities

Table 6: Management

Variable	Category	Frequency	Percentage
Pre hospital care	**No**	**34**	**19.43**
	Yes	**141**	**80.57**
Arrival time	**<1 hour**	**95**	**54.29**
	1-6 hours	**77**	**44.00**
	6-12 hours	**3**	**1.71**
Management	**Outpatient**	**21**	**12.00**
	Inpatient	**154**	**88.00**
Inpatient	**Non –operative**	**9**	**6.12**
	Operative	**138**	**93.88**

Majority (80.57%) of all patients had received pre-hospital care at some peripheral facility in terms of resuscitation, stabilization and pain control before being referred to MTRH.

At least half (54.29%) of patients arrived within the hour after being involved in the MCAs, while 44% arrived within 6 hours after the accident.

After admission, 93.88% of the patients received operative management of their fractures while the rest were treated non operatively and discharged immediately on follow-up at the outpatient clinics.

Table 7: Treatment Modalities

Treatment modality	Frequency	Percentage
External Fixator	**84**	**48.0**
ORIF	**61**	**34.9**
Closed Reduction and Casting	**29**	**16.6**
Amputation	**8**	**4.6**
Traction	**5**	**2.9**

Open reduction and external fixation (48%) were the most common modalities of treatment used, followed by open reduction and internal fixation (ORIF) (34.9%); 8 amputations were performed, that was about 4.6% of the treatment modalities. The least used modality was traction at 2.9%.

4.6 Outcomes

All patients were alive at time of discharge with 167(95%) having adequately reduced fractures. They were discharged through outpatient and physiotherapy clinics.

Eight patients had a form of disability at time of discharge secondary to amputations. Of these one had a trans-humeral amputation, 4 had below knee amputations, while 3 had above knee amputations. These were followed up through the physiotherapy and occupational therapy clinics.

CHAPTER FIVE

5.0 DISCUSSION

5.1 Social Demographics

This study established that mainly younger male individuals were involved in motorcycle- related accidents as compared to females or older age groups. The average age was 29 years with a median age of 28 (IQR 25, 34) ranging from 13 to 69 years. This was in agreement with other similar studies done in Kenya and in other countries around the world where the ages ranged from 28 to 35 years. Sisimwo, et al., (2014) in Kitale, Kenya found a similar mean age of 30 (SD: 13) years whereas Muguku, (2013) found average age of 30 years in his study in Nakuru, Kenya. Dongo, et al., (2013) in Nigeria found average age of 33 years while Kigera and Naddumba, (2010) got average age of 21.9 years in Uganda. In some studies the ages ranged between 26 years and 32 years with a male predominance (Asuquo & Ugare, 2009; Mcharo, 2012; Mogaka, et al., 2011). Other studies showed a slightly older age group of patients with mean ages of above 40 years. Kortor, et al., (2010) had a mean age of 43 in Nigeria whereas Fitzharris, et al., (2009) in India had a mean age of above 40 years. On the contrary, while comparing injuries secondary to motorcycle-related accidents or trauma among different age groups over time, injuries among older motorcyclists were seen to increase threefold as compared to a twofold increase among younger motorcyclists showing a greater risk in former group (Jackson & Mello, 2013). Males were more affected in this study at MTRH with a male to female ratio of 2.2:1, which concur with various other studies. In comparison, the male to female ratios varied from 2.5:1 in a study in Nigeria (Nzegwu, et al., 2008), while 4.4:1 in Uganda (Kigera & Naddumba, 2010), to as high as 15:1 in Tehran (Zargar, et al., 2000).

5.2 Mechanisms and Patterns

The most common type of accident was collision between a motorcycle and a motor vehicle at 34% which concurs with a study done in Nigeria whereby this type of collision accounted for 68% of accidents (Nzegwu, et al., 2008).The percentage was 50% in Tanzania (Mcharo, 2012) and even higher in Iran at 72.5% (Zargar, et al., 2000).In another study done in the United States in Maryland State, comparing motorcycle- related accidents in different age groups showed that in the older patients the most common mechanism was falling off the motorcycle rather than a collision (Dischinger, et al., 2006).The above findings could be attributed to the increase of motor vehicle use both developing and developed countries.

In this study at MTRH, the lower limb was the most involved extremity as compared to the upper limbs at a ratio of 1.9:1 with femur fractures being more common than tibiofibular fractures at a ratio of 1.4:1. Of these open fractures were more common in the femur as compared to closed. This is in agreement with various other studies. In Brasil, lower limb fractures were found to be 60% of all the extremity fractures (Flamarion, etal., 2015). In India, Ganveer and Tiwari, (2005) recorded a similar picture with lower limb fractures being more common at 46%; a percentage of 55% was noted by Kortor, et al., (2010) in Nigeria but in their study closed tibial shaft fractures were more common than femur fractures. Most other studies as much as they were in agreement with the type of extremity, they differed in that the tibia was mostly affected as seen in Tanzania (Mcharo, 2012) and in Jamaica (Beall, 2011). Higher cases of lower limb fractures could be attributed to direct impact at time of accident. Upper extremity injuries secondary to MCAs were found to be more common than lower extremity injuries by Fitzharris, et al., (2009), which contrasted this study finding at MTRH.

5.3 Management and Overall Outcomes

Majority of the patients in this study had received prehospital management before being seen at MTRH at 80%. More than 55% of the patients arrived to hospital within the hour and more than 90% arrived within 6 hours. The time of arrival concurs with that in a study done in Nigeria whereby over 47% of patients arrived within the hour while 52% arrived later than 1 hour but within 6 hours (Dongo, et al., 2013).On the contrary in another study in Brasil the earliest a patient was treated from the time of accident was 6 hours with an average time of 27 hours from time of accident to time of being treated (Matos, et al., 2014).The time of arrival and treatment at MTRH can mainly be attributed to the adequate and well-coordinated referral systems in Uasin Gishu County and the MTRH trauma team.

After admission, 79% of the patients received operative management of their fractures with external fixation being the most commonly used modality at 48%. This was in contrast to a study done in Nigeria whereby the mainstay of treatment was non operative (Odelowo, 1994). This could be explained by the fact that in the latter study, most of the injuries were closed tibiofibular fractures.

All of the patients were alive at time of discharge with 95% having adequately reduced fractures. They were discharged through outpatient and physiotherapy clinics. Eight patients had some form of disability at time of discharge due to amputations and there were no mortalities. In other studies mortalities were reported from 4% (Beall, 2011) in Jamaica, to 6% in Nigeria (Dongo, et al., 2013). Fitzharris, et al., (2009) however documented 2% mortality in extremity injuries, and that closed injuries generally had lower mortality rate compared to the open, as well as involvement of other regions which had higher rates. In the latter, the rate varied from 9.5% for intra-abdominal to as high as 40% for open head and neck injuries.

In another study by O ’brien, Pitoniak-Morse and Jacobs, (2005) involving hospitalized patients, they recorded less than 1% mortality while 82% were discharged and about 17% were transferred to rehabilitation centers. As documented by Solagberu, (2006) globally, road traffic accident injuries are responsible for a significant proportion of overall injury morbidity, disability and mortality. Currently with the ever-increasing number of motorcycles and consequent increase in usage, there has been an increase in motorcycle- related accidents by at least 29%, a figure that had been documented for the period 2004-2009 (Saidi & Mutiso, 2013), and hence increased health burden in terms of morbidity and mortality. Solagberu, (2006) has documented that over 90% of mortalities being registered in developing countries, painting grave picture.

CHAPTER SIX

6.0 CONCLUSION AND RECCOMENDATION

6.1: Conclusion

There was a high number of patients being admitted at MTRH wards as a result of injuries secondary to motorcycle- related accidents. Young males constituted the highest risk group. Most of them were referrals from other facilities, which greatly increased the trauma burden at MTRH. These accidents were mainly caused by collision between motorcycles and cars. Majority of the injured required operative management which was delayed due to patients being unable to buy implants in time as they lacked funds. Despite the delays, hospital outcomes were good though a lot is still needed to maximize efficiency and outcomes of these injuries and reduce the burden they put on the hospital.

6.2: Recommendation

The young males as a highest risk group need to be sensitized on precautions to be taken to minimize the incidences of MCAs. County health sector need to be well equipped so as to deal with MCAs, hence lessen burden experienced at MTRH.

This study did not cover long term outcomes of management of the injuries and the researcher also recommends follow-up studies that will further investigate these types of cases to know long term outcomes of the injuries. This will help in improving protocols of management of the same.

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APPENDICES

Appendix 1: IREC Approval

INSTITUTIONAL RESEARCH AND ETHICS COMMITTEE (IREC)

MOI TEACHING AND REFERRAL HOSPITAL
P.O. BOX 3
ELDORET
Tel: 33471/2/3

MOI UNIVERSITY
SCHOOL OF MEDICINE
P.O. BOX 4606
ELDORET

Reference: IREC/2016/121
Approval Number: 0001711

1st September, 2016

Dr. Yonah Oluoch Opondo,
Moi University,
School of Medicine,
P.O. Box 4606-30100,
ELDORET-KENYA.

INSTITUTIONAL RESEARCH & ETHICS COMMITTEE
01 SEP 2016
APPROVED
P. O. Box 4606-30100 ELDORET

Dear Dr. Opondo,

RE: FORMAL APPROVAL

The Institutional Research and Ethics Committee has reviewed your research proposal titled:-

"Patterns and Outcomes of Extremity Injuries Secondary to Motor Cycle Accidents at Moi Teaching and Referral Hospital".

Your proposal has been granted a Formal Approval Number: ***FAN: IREC 1711*** on 1st September, 2016. You are therefore permitted to begin your investigations.

Note that this approval is for 1 year; it will thus expire on 31st August, 2017. If it is necessary to continue with this research beyond the expiry date, a request for continuation should be made in writing to IREC Secretariat two months prior to the expiry date.

You are required to submit progress report(s) regularly as dictated by your proposal. Furthermore, you must notify the Committee of any proposal change (s) or amendment (s), serious or unexpected outcomes related to the conduct of the study, or study termination for any reason. The Committee expects to receive a final report at the end of the study.

Sincerely,

PROF. E. WERE
CHAIRMAN
INSTITUTIONAL RESEARCH AND ETHICS COMMITTEE

cc CEO - MTRH Dean - SOP Dean - SOM
Principal - CHS Dean - SON Dean - SOD

Appendix 2: MTRH Approval

MOI TEACHING AND REFERRAL HOSPITAL

Telephone: 2033471/2/3/4
Fax: 61749
Email: director@mtrh.or.ke
P. O. Box 3
ELDORET

Ref: ELD/MTRH/R.6/VOL.II/2008

8th September, 2016

Dr. Yonah Oluoch Opondo,
Moi University,
School of Medicine,
P.O. Box 4606-30100,
ELDORET-KENYA.

INSTITUTIONAL RESEARCH & ETHICS COMMITTEE
08 SEP 2016
APPROVED
P.O. Box 4606-30100 ELDORET

RE: APPROVAL TO CONDUCT RESEARCH AT MTRH

Upon obtaining approval from the Institutional Research and Ethics Committee (IREC) to conduct your research proposal titled:-

"Patterns and Outcomes of Extremity Injuries Secondary to Motor Cycle Accidents at Moi Teaching and Referral Hospital".

You are hereby permitted to commence your investigation at Moi Teaching and Referral Hospital.

08/09/2016

DR. WILSON ARUASA
CHIEF EXECUTIVE OFFICER
MOI TEACHING AND REFERRAL HOSPITAL

CC - Deputy Director (CS)
- Chief Nurse
- HOD, HRISM

Appendix 3: Introductory Letter

I am Dr. Yonah O. Opondo, a medical doctor currently pursuing Master of Medicine Degree in Orthopedic Surgery at the Department of Orthopaedics and Rehabilitation, School of Medicine, College of Health Sciences, Moi University. I am conducting a study entitled: Patterns and outcomes of extremity injuries following motorcycle-related accidents at MTRH

You are being asked to take part in the research study. Information on the study and your participation is detailed below. Please read this form carefully. You are free to ask any question during any time of the study. If you decide to participate in the study, you will be given a copy of this introductory letter and the consent form for your records.

Taking part in the study is voluntary. Choosing not to participate in the study will not, in any way, affect the care you receive at MTRH. If you accept to enroll in the study, you will be free to terminate your participation at any time. Any new information concerning the risks and benefits of the study will be communicated to you promptly after which you will be free to opt out or continue with the study.

The purpose of this study is to describe the patterns and outcomes of extremity injuries secondary to motorcycle- related accidents at MTRH. The process of your participation will involve clinical and radiological examination to evaluate the type of injury/fractures sustained. Your involvement in the study will be from admission into the orthopaedic wards up to time of discharge. There will be follow-up from the outpatient clinic required for the purpose of the study if treated as an outpatient.

The information you provide will be kept confidential at all times and there will be no use of identifiers that may trace back to you.

For more information concerning your rights as a research participant, you may contact the Moi University/MTRH Institutional Research Ethics Committee (IREC) on telephone number 053 – 33471 ext 3008.

Yours faithful,

_____

Dr. Yonah O. Opondo

P.O.Box 766

Kakamega.

Mobile No: 0727757214

Barua Ya Utangulizi

Mimi ni daktarin Yonah O. Opondo. Nimehitimu kama daktari na nimesajiliwa na Bodi ya Madaktari ya Kenya. Kwa sasa, ninasomea shahada ya juu (masters) ya udaktari wa upasuaji wa magonjwa ya mifupa katika Chuo Kikuu cha Moi. Ninafanya utafiti kuhusu majeraha yanayosababishwa na ajali za pikipiki.

Ninaomba ujiunge n autafiti huu. Maelezo yafuatayo yanahusu utafiti wangu. Ningependa usome na iwapo unamaswali yoyote kwa sasa au baadaye kuwa huru kuuliza.

Kujiunga kwako ni kwahiari. Kutojiunga hakutaathiri matibabu yako. Una huru wakujiondoa kutoka kwa utafiti huu wakati wowote. Iwapo kutatokea maelezo zaidi kuhusu utafiti huu tutakueleza na utapata fursa ya kuamua iwapo ungependa kuendelea na kujihusisha na utafiti huu.

Kuhusishwa kwako, utakuwa kwa kupimwa na daktari, kupigwa picha na kupokea matibabu.

Umechaguliwa kuhusishwa na utafiti kwa sababu jeraha uliyonayo nijeraha moja wapo zinazotafitiwa. Hakutakuwa na wakati wa kufuatiliwa kwa minajili ya utafiti kwani tutamaliza shughuli ya utafiti kwa siku moja.

Maelezo yote utakayotoa yatahifadhiwa vyema na kwanjia ya siri. Pia, hatutatumia maelezo yoyote ambayo yanawezesha kukufahamisha.

Iwapo utahitaji maelezo zaidi, waweza kuwasiliana na kikundi kinachoangazia utafiti na usawa wake wa IREC katika nambari ya rununu 053 – 33471 (ext 3008)

Mimi wako mwaminifu,

_____

Daktari Yonah O. Opondo
SLP 766-Kakamega

Nambari ya Rununu 0727757214

Appendix 4: Consent Form

CONSENT FORM

RESEARCH TOPIC: PATTERNS AND OUTCOMES OF EXTREMITY INJURIES SECONDARY TO MOTORCYCLE- RELATED ACCIDENTS AT MTRH

Investigator: DR YONAH O.OPONDO

P.O. Box 766, KAKAMEGA. MOBILE NO:0727757214

I…….of P.O. Box……

Tel……..hereby give informed consent to participate in this study at MTRH. The study has been explained to me clearly by Dr. Yonah O.Opondo (or his appointed assistant) of P.O. Box 766 Kakamega.

I have understood that by participating in this study, I shall volunteer information regarding my illness and other comorbidities. I am aware that I can withdraw from this study at any time without prejudice to my right of treatment at MTRH now or in the future. I have also been assured that all information shall be treated and managed in confidence. I have not been induced or coerced by the investigator (or his appointed assistant) to cause my signature to be appended in this form and by extension participate in this study.

Initials of participant……

Signature…… Date……

Name of witness……

Signature…… Date……

FOMU YA KIBALI

MADA YA UTAFITI: PATTERNS AND OUTCOMES OF EXTREMITY INJURIES SECONDARY TO MOTORCYCLE- RELATED ACCIDENTS AT MTRH

MTAFITI - DR YONAH O. OPONDO
P.O BOX 766, KAKAMEGA
RUNUNU: 0727757214

Mimi _____ wa Sanduku la Posta _____, Nambari ya Simu_____ najitolea kwa hiari yangu mwenyewe kutoa kibali cha kujihusisha katika utafiti uliotajwa hapo juu unaendelezwa katika MTRH. Nimepokea maelezo yatafsili kuhusu utafiti huu kutoka kwa Daktari Yonah O. Opondo (au mtafiti msaidizi wake) katika lugha, kanuni na masharti ninayoelewa vyema. Nimehakikishiwa kuwa, sita dhurika kamwe kutokana na kujihusisha kwangu katika utafiti huu. Ilibainishwa kuwa kujihusisha katika utafiti huu ni kwa hiari na nina uhuru wa kujiondoa wakati wowote ule bila ya kuhujumiwa hasa kuhusu haki yangu ya kupokea matibabu katika MTRH. Zaidi ya hayo, nilihakikishiwa kuwa, kanuni zote za maadili ya utabibu, uhuru, haki, na manufaa zitazingatiwa katika utafiti huu.

Jina la Mhojiwa_____

Sahihi _____

Tarehe _____

ina la shahidi _____

Sahihi _____

Tarehe

_____

Appendix 5: Questionnaire

PATTERNS AND OUTCOMES OF EXTREMITY INJURIES SECONDARY TO MOTORYCLE- RELATED ACCIDENTS AT MTRH

Patient's Demographic Data: Reg. No…….

1. Age of the patient ……..

2. Sex a). Male ☐ b). Female ☐

3. Level of Education

a). Not attended ☐ b). Primary education ☐ c). Secondary education ☐

d). University/college education

4. Occupation

a). Employed ☐ b).Self-employed ☐ c).Student ☐ d).Unemployed ☐

5. Place of Residence: County ……/Town……

/Estate…….

6. Place of crash: County ……../Town……/Estate……

7. When did crash happen?

A: Date…. /…. /….

B: Time: 1. Day ☐:Time ……

2. Night: ☐ Time ……..

8. Patient's status**:**

1. Rider/Driver ☐(Go to Q.9)

2. Passenger ☐(Go to Qn12)

3. Pedestrian ☐(Go to Q 18

RIDER EXPERIENCE

9. Do you have a valid driving license? a). Yes ☐…….(go to Qn 10)

b).No ☐…….. (go to Qn 11).

10. Duration since first issue to date of injury?

1. 0-3 month ☐

2. 4-7 month ☐

3. 8-12 month ☐

4. >1 year ☐

5. >2 year ☐

11. How long have you been driving?

1. 0-3 Month ☐

2. 4-7 month ☐

3. 8-12 month ☐

4. >1 year ☐

5. >2 years ☐

12. The Use of Motorcycle: a). Commercial…☐……

b).Private use……☐……

c). Company……☐……

13. Engine size of motorcycle (cc)

1. 50-100 ☐

2. 100-150 ☐

3. 150-200 ☐

4. 200-250 ☐

5. Not known ☐

15. Motorcycle Ownership:

a). Owner ☐

b). Employed/driver ☐

c). Hire/borrowed ☐

14. Number of Victims involved per motorcycle (state if any died at injury site)

a. 1

b. 2

c. 3

d. 4

e. >4

15. Helmet usage a).Yes……..…….. b). No……..……

16. Riding protection used? a).Helmet

b). Reflector Vest

c). Riding Jacket

d). Riding Gloves

e). Riding boots

17. Alcohol use

a). Suspected (by report or observation/confirmed by blood test)

(Concentration…..)

b). No

c). No information available

18. Type of the road where crash took place

a). Highway……..b). Tarmacked street c). Foot path ……..…….

19. Type of collision (Mechanism of injury)

a). Motorcycle –motor vehicle b). Motorcycle- motorcycle

c). Motorcycle- pedestrian d). Lone motorcycle (falling from motorcycle)

e). Motorcycle- Bicycle f).Other collision (state type)…….

TYPE OF INJURY SUSTAINED

20. Extremity Injured

a). Upper Limb: Rt…☐……Lt☐ ……..

b). Lower Limb: Rt☐ …… Lt☐ ……..

c). Type Of Extremity Fracture(s)

i)…….open/closed

ii) ……..... open/closed

iii)……..... open/closed

iv)……. open/closed

v) ……..open/closed

21. Other Injuries Sustained

a). Head injury ☐b). Neck injury (cervical spine) ☐

c). Chest injury☐d). Abdomen injury☐

e) Thoracic spine injury ☐f). Lumber sacral Spine injury ☐

g). Pelvis injury ☐ h). Bladder/urethral injury ☐

i). Dislocations…… j). Sprains/strains…….

k). Soft tissue injuries l). laceration…….....

22. Pre hospital care yes☐ no☐

23. Arrival interval

a).< 1hr ☐ b).1-6hrs☐c). 6-12hrs☐

d).12-24 hrs☐e). 24-48hrs☐d). >48 hrs☐

24. Management

A. Treated as outpatient and discharged ☐

B. Admitted

a). ICU

b). (Ward)

i). Treated Nonoperatively☐(Modality(s))……

ii) Treated Intraoperatively☐(Modality(s))…….

C. Died a). At Casualty On Arrival☐

b). In Ward☐

c). Intra-Op☐

d. Discharged: Condition at time of discharge-

i). fully recovered☐

ii). for physiotherapy follow-up☐

iii). With some degree of disability ☐(type)……..

Appendix 6: Proposed Budget and Work Plan

Proposed Budget

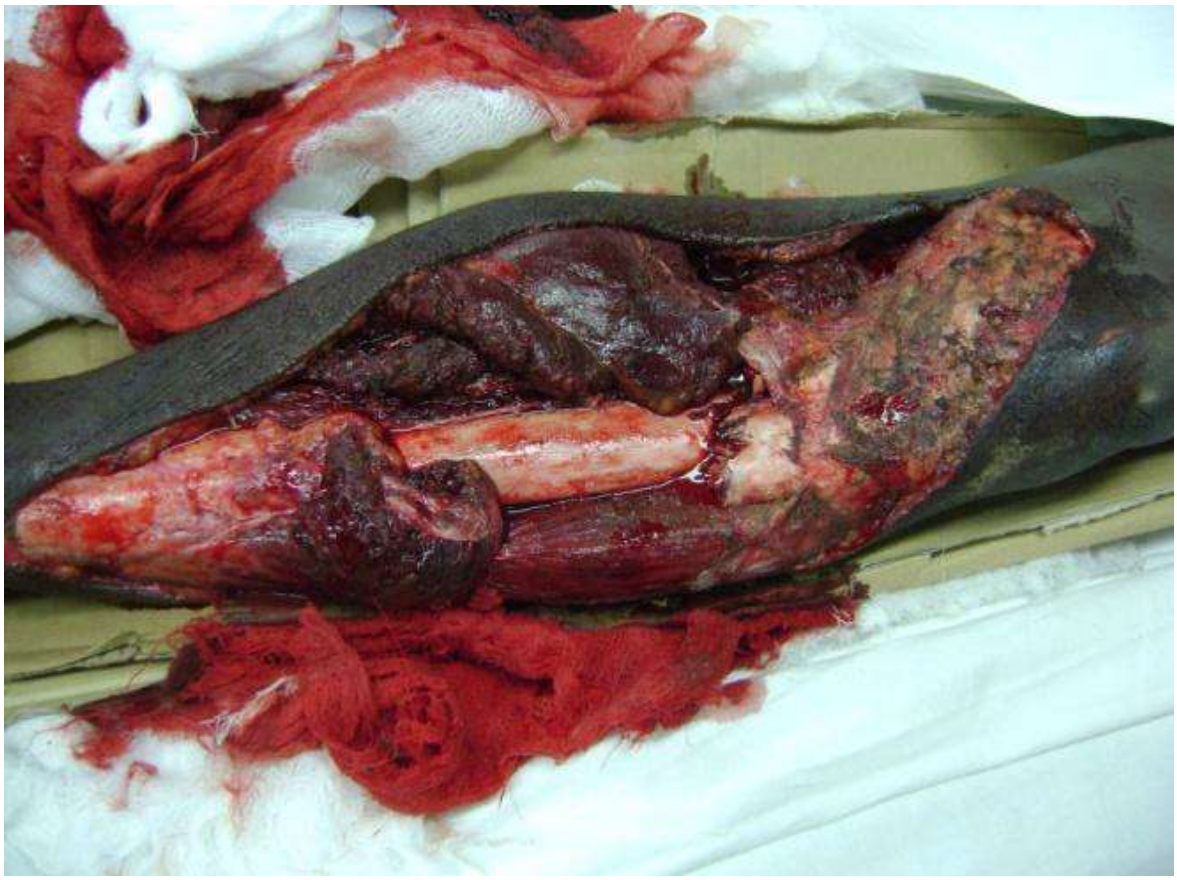
code	Item	Quantity	Unit Price@	Total cost
1	Laptop	1	60000	60000
2	Reams of plain paper	8	500	4000
3	Stationary (pens, pencils, files, etc.)			2000
4	Internet services and communication			20000
5	Computer flash discs	3	1500	4500
6	Research assistant	1		20000
7	Photocopy, printing and binding			25000
8	IREC fees			1000
9	Statistical Consultation	1		10000
10	Miscellaneous			5000
11	10% Contingency			15100
	TOTAL			165100

Appendix 7: Proposed Work Plan

DATE	ACTIVITY	DURATION	RESPONSIBLE PERSON
Sept-Nov 2015	Selection of topic	3 Months	Researcher
Nov 2015-Jan 2016	Literature Review	2 Months	Researcher
Feb 2016	Writing Proposal	1 Month	Researcher and Supervisors
March 2016	Submission to IREC	1Month	Researcher
June 2016	IREC approval	3 Months	IREC
Nov 2017-Mar 2018	Data Collection and analysis	5 Months	Researcher and Assistant Researcher
Apr 2018-Feb 2019	Thesis writing and proof readings	10 Months	Researcher and Supervisors
March 2018	Submission of thesis	-	Researcher
Nov 2020	Oral thesis defense	-	Researcher
Dec 2020- Feb 2021	Editing of thesis	3 Months	Researcher/ Supervisors
Mar 2021	Submission of edited bound thesis		Researcher

Appendix 8: Illustrations

Traumatic amputation of distal leg secondary to a motorcycle accident



Open tibiofibular fracture secondary to a motorcycle- related accident

X-ray showing segmental fractured femur