PATTERN OF LIMB INJURIES RESULTING FROM MOTORCYCLE ACCIDENTS IN IFE / ILESA OSUN STATE, NIGERIA.

by

DR. OLUWADIYA KEHINDE SUNDAY

F.M.C.S.

MAY 2001
“And now you live dispersed on ribbon roads,

And no man knows or cares who is his neighbour,

Unless his neighbour makes too much disturbance,

But all dash to and fro in motorcars,

Familiar with the road and settled nowhere,

Nor does the family even move together,

But every son must have his motorcycle,

And daughters ride away on casual pillions”

T. S. Eliot¹.
## Table of contents

DECLARATION ........................................................................................................ VI
ATTESTATION ...................................................................................................... ERROR! BOOKMARK NOT DEFINED.
ETHICAL CLEARANCE .................................................................................. ERROR! BOOKMARK NOT DEFINED.
DEDICATION ....................................................................................................... VII
ACKNOWLEDGEMENT ....................................................................................... VIII
LIST OF ABBREVIATIONS ............................................................................... IX
ABSTRACT .......................................................................................................... X
INTRODUCTION ................................................................................................... 1
LITERATURE REVIEW ........................................................................................ 3
OBJECTIVES ........................................................................................................ 32
LIMITATIONS OF STUDIES .............................................................................. 32
PATIENTS, MATERIALS AND METHOD ........................................................... 34
RESULT ................................................................................................................ 37
SUMMARY OF FINDINGS .................................................................................. 59
DISCUSSION ......................................................................................................... 61
RECOMMENDATIONS ....................................................................................... 72
REFERENCES: ..................................................................................................... 73
APPENDIX ... ...................................................................................................... I
List of tables

TABLE 1A: CAUSES OF ACCIDENTS.................................................................8
TABLE 1B: DEATHS RESULTING FROM ACCIDENTS..................................8
TABLE 2: FREQUENCY DISTRIBUTION OF THE PATIENTS’ MODE OF INVOLVEMENT AND SEX. .................................................................37
TABLE 3: THE EFFECT OF THE LIMB INJURED AND THE MODE OF INVOLVEMENT ON THE LATERALITY.............................................46
TABLE 4: DISTRIBUTION OF INJURIES TO THE VARIOUS TYPES OF TISSUES IN THE LIMBS. .................................................................47
TABLE 5: DISTRIBUTION OF LIMB FRACTURES ACCORDING TO THE PART OF THE LIMB INVOLVED AND THE INDIVIDUAL BONE FRACTURED.................................................................48
TABLE 6: DISTRIBUTION OF OPEN FRACTURES AND THE BONES INVOLVED..............................................................................................50
TABLE 7: THE MEANS AND THE RANGE OF DURATION OF IMMOBILIZATION OF THE DIFFERENT TYPES OF FRACTURES...........53
TABLE 8: SURGICAL PROCEDURES DONE FOR THE PATIENTS...........53
TABLE 9: COMPLICATIONS OF TREATMENT ..............................................55
TABLE 10: MORTALITY ANALYSIS...............................................................58
List of figures

FIGURE 1: SAFETY DEVICES AND PROTECTIVE HEADWEAR AVAILABLE TO THE MOTORCYCLIST ................................................................................................................. 16
FIGURE 2: AGE GROUP AND MODE OF INVOLVEMENT OF THE PATIENTS ................................................................................................................................. 38
FIGURE 3: AGE GROUP AND SEX DISTRIBUTION OF THE PATIENTS ................................................................................................................................. 39
FIGURE 4: TIME OF OCCURRENCE OF THE ACCIDENTS ................................................................................................................................. 40
FIGURE 5: PRESENTATION OF MCA PATIENTS AT OAUTHC ILE-IFE BY THE DAY OF THE WEEK ........................................................................................................... 41
FIGURE 6: MONTHLY DISTRIBUTION OF A&E ATTENDANCE, RTA AND MCA VICTIMS AT OAUTHC, IFE-IFE ........................................................................ 42
DECLARATION

I, Dr. Kehinde Sunday OLUWADIYA, hereby declare that this research was carried out by me under appropriate guidance of my supervisors. I have not submitted the work in either part or full for any examination.

Dr. K. S. Oluwadiya
DEDICATION

To the dead and the maimed,

victims all

of

the two-wheeled menace.
ACKNOWLEDGEMENT

I wish to express my thanks to my supervisors, Dr. LM Oginni and Dr. (Chief) EA Bamgboyce for their immense contribution to this work. Their incisive counsel had been very important in the making of this project.

I am grateful to the other consultants in the department, Dr. AL Akinyoola and Dr. IC Ikem for the use of their patients and their helpful advice and comments. I owe my fellow residents in the department, especially Drs. Badru, Olasinde and Adegbehingbe – my fellow “inmates” at Ilesa a debt of gratitude for their support.

My thanks also go to Professor Adejuyigbe for his interest in my progress.

I am most appreciative of the staff of the Accident and Emergency wards of the Wesley Guild Hospital, Ilesa and Ife State Hospital Ille-Ife, most especially, Dr. Haasturp for their kind assistance.

To my friends, Yinka, Sola, Teevee and Biola, succours and refuge when NEPA struck I offer my thanks and appreciation for the inconveniences they must have experienced while preparing this work.

My gratitude goes also to my parents, Mr and Mrs Oluwadiya, my brothers ‘Demola and Gbenga for being there all the time.

Finally, my wife, ‘Ronke had been very encouraging and caring throughout the period of this study. Thank you very much, Love.
LIST OF ABBREVIATIONS

1. RTA - Road traffic accident
2. A & E - Accident and Emergency Unit
3. MRI - Magnetic resonant imaging
4. CAT scan - Computerized axial tomography
5. USS - ultrasound scan
6. MCA – Motorcycle accident.
7. OAUTHC – Obafemi Awolowo University Teaching Hospitals Complex, Ile-Ife.
8. ORIF – Open reduction and internal fixation.
10. MUA – Manipulation under anaesthesia.
11. K-nail – Kuntschers nail
12. GCS – Glasgow Coma Scale.
13. ISH – Ife State Hospital, Ile Ife.
14. WGH – Wesley Guild Hospital, Ilesa.
ABSTRACT

Eleven thousand four hundred and seventy three patients were seen at the accident and emergency department of the Wesley Guild Hospital (WGH), Ilesa and the Ife State Hospital (ISH), Ile-Ife units of the Obafemi Awolowo University Teaching Hospitals Complex (OAUTHC) between June 1, 1998 and May 31, 1999. 682 (5.9%) were due to road traffic accidents, and 143 (21.3% of RTA) of these were due to injuries sustained from motorcycle accidents (MCA). 115 (79.3% of MCA) had injuries to the limbs and were selected for this prospective study.

The Male to Female ratio was 2.8:1. The mean age was 31.88 ± 16.65 years; the 20-29 years age group was the most commonly involved. All the riders were males while most of the pedestrians were either children or females. 79.1% of the accidents took place on urban roads but the accidents occurring in the highways were more severe. 42.2% of the accidents were due to collisions with motor vehicles and 22.6% were pedestrians. The use of safety devices was poor.

The lower limbs alone were injured in 76 (66.1%) patients, the upper limbs alone in 25 (21.7%), and both the upper and lower limbs in the remaining 14 (12.2%) patients. The left side was injured in 60 (52.2%) patients, the right in 46 (40%) and both sides in the remainder.

The skin (88; 33% of injuries) was the most frequently injured tissue, followed by the bone (79; 29.7%), and joints (32; 11.9%). Laceration was the commonest skin injury seen. Both tibia and fibula were fractured together in 25 patients; the femur in 25 patients while the tibia alone was fracture in 7 patients. The radius and ulna were the most commonly fractured bones in the upper limb. 24 (30.4%) fractures were open. The tibia had the highest proportion of open fractures (72%). No patient had a major limb arterial injury.
The knee was the most commonly injured joint. The commonest type of joint injury was intra-articular fracture. Dislocations and subluxations were seen in 13 and 8 patients respectively. Two cases of open joint injuries were recorded and both involved the wrist.

41 (16.5%) patients had associated injuries to other systems of the body, 32 of these involved the scalp and the face. Only 7 were admitted with Glasgow Coma Scale (GCS) less than 12. The quality of pre-hospital care was low.

Most of the fractures were managed conservatively with manipulation under anaesthesia (MUA) and plaster of Paris (POP) or traction. 18 had open reduction and internal fixation (ORIF); Kuntschers-nail (K-nail) was the most commonly used implant.

264 complications were recorded in 67 patients. The most common was joint stiffness in 60 (63.8%) patients followed by muscle weakness and wasting. Fracture non-union, delayed union and malunion were seen in 4 (4.3%), 14 (15.0%) and 8 (8.5%) respectively.

59% had a satisfactory outcome while 26 (22.6%) did not. 14 (12.2%) patients took their discharged against medical advice and 9 (7.8%) were lost to follow up. 4 (3.5%) patients died. The associated injury most commonly seen in the fatal cases was cervical vertebrae injury.
INTRODUCTION

It is not generally recognized that today, the loss of life and incapacity resulting from accidents are greater than from any known disease entity. This is true for both developed and developing countries. Road traffic accidents account for a substantial part of these accidents and it is the commonest cause of fatality from accidents in most parts of the world. Motorcycle accidents are the second most common causes of road traffic accidents after automobiles. Oyemade and Adeloye in Ibadan reported that between 18% and 20% of all road traffic accidents involved a motorcycle.

Both the case fatality and the injury rate are higher in motorcycle accidents than automobiles. The National Safety Council of United States of America concluded that there is a 17 time greater chance of fatality in a motorcycle trauma than those involving automobiles. The motorcyclist is also more likely to be injured in 80-90% of the times when involved in an accident. This is a significantly higher chance than in automobile occupants.

The causes of motorcycle accidents are multifactorial and they cut across all age groups and sexes. While previous studies have shown that males are affected predominantly, there is a wide variation in this preponderance. It ranges from non-involvement of females seen in the cases reported by Adeloye in Ibadan, Nigeria to the 46:1 ratio reported by Deaner in California, USA. The peak ages of incidence in most studies fall in the late teens to the late twenties. There are also seasonal variations as well as variations in the weekday and the time of the day in the pattern of the accidents. Other variations are the mode of involvement of the patient, the engine capacity of the motorcycle and the population of motorcycle users in the area.
Any part of the body can be injured in motorcycle accidents either singly or as a combination of injuries\textsuperscript{12, 16}. The treatment of these patients starts at the site of the accident\textsuperscript{5, 17,18,19,20, 21} and this continues through the accident and emergency unit\textsuperscript{22} to the definitive management by the appropriate specialty units\textsuperscript{5, 22}. The management plan consists of resuscitation, diagnosis, treatment and rehabilitation\textsuperscript{5, 17,24,25,26,27,28}. It may also involve a multidisciplinary approach\textsuperscript{5}.

The outcome of limb injuries sustained in motorcycle accidents depends on numerous factors which include the severity of injury, associated injuries and the part of the body involved by such injuries, the pre-hospital treatment as well as the time interval between the accident and initiation of treatment. Skeletal injury itself is the cause of the highest rate of morbidity\textsuperscript{5}.

This study was designed to determine the pattern of limb injury resulting from motorcycle accidents as seen in the Obafemi Awolowo University Teaching Hospitals Complex, Ile-Ife, Nigeria. This pattern was then compared with those from similar institutions in Nigeria and abroad to highlight any similarities or differences therein. It also highlighted the size of the problem from motorcycle accidents, which have become a very popular method of public transportation in Nigeria.
LITERATURE REVIEW

HISTORICAL BACKGROUND

Motorcycle accidents, the second most common cause of road traffic accidents are defined as accidents on streets and highways involving motorcycles. The word motorcycle means all two wheeled motor powered vehicles and a motorcycle injury defined as injury resulting from mechanical energy damage sustained by the driver or passenger as a result of a crash. Pedestrians who sustain injuries when they are crashed into by motorcycles are also included in this definition.

The machine

The first gasoline engine motorcycle to appear publicly was built by Gottlieb Daimler, of Bad Commstatt, Germany in 1885. The popularity of the vehicle has grown ever since, especially among the young.

Small machines have engine capacities below 250 cubic centimetres; medium sized engines are from 250-500 cubic-centimetres engine capacity while bigger engined motorcycles can be up to 1000cc and even more. Controls on the handlebar grips govern the throttle action and often the front-wheel brake system as well; a foot pedal usually controls the rear-wheel brake. The motor scooter (vespa) originated in Italy soon after World War II.

Epidemiological history

In the United States of America, the number of registered motorcycle increased from 600,000 units in 1961 to 3.3 million units in 1971, a 450% increase within a decade. This pattern was also echoed in Nigeria, which showed an increase from 144,480 units to 284,124 units between 1976 and 1981, an increase of almost 200% within 5 years.
The first documented cases of deaths from motor vehicles accidents were recorded in Britain and the United States in 1899. By 1951, the United States of America has recorded its one-millionth death from road traffic accidents. Yet the carnage continues, it was estimated in 1978 that by the end of the last century, a century that has been dubbed the “century of trauma”, another 70 million would have been disabled worldwide – a staggering 3.2 million per year rate of disability! The motorcycle accounts for between 18% and 20% of these accidents.

Cairns in 1941 did one of the earliest works on the epidemiology of motorcycle accidents. As quoted by Bothwell, he noted that lower limb fractures accounted for only 5 deaths out of the 149 motorcycle accident deaths he analysed. Head injuries killed 89 of the lot. He carried out other important works on motorcycle accidents in 1943 and 1946 that resulted in improved helmet design.

**Treatment history**

The first documented writing on trauma was mentioned in the Edwin Smith papyrus, which were written between 3000 and 1600 B.C. It was a description of 48 cases of trauma described from head to foot; “a capite ad calcem” a principle which is still practiced today.

The next major advancement was by the Greeks, particularly of the Hippocratic School who believed in keeping the wound at rest, adding little or nothing from the outside, and trying to gain healing by careful coaptation of the edges. It was Hippocrates too, who was credited with the first use of splints for fracture management.

Two major advancements occurred in the nineteenth century that improved the art and the outcome of surgery tremendously. These were the introduction in America of anaesthesia in 1847 and the development of antiseptic surgery in 1867 by Joseph Lister.
The twentieth century brought about a bewildering array of developments in the field of surgery and medicine. These included the development of antibiotics, the understanding of shock and metabolism, intravenous fluid replacement, blood transfusion, immunology and the concept of first aid medicine and triage.

Plaster of Paris, the most commonly used external splinting material was first described by Eton, in 1798. In 1852, it was converted to its present usage, in the form of a bandage by Matthysen. This amplified both its ease of use and scope in the treatment of fractures.

Hey Groves first described the technique of intramedullary nailing in 1916. Since then implant surgery has witnessed a tremendous amount of growth both in technique and in material development. These improvements had been made possible mainly by developments not only in medicine, but also in engineering, chemistry and physics. A better understanding of biomechanical principles has led to a better implant design. In 1956, the association for the study of internal fixation [ASIF or AO (Arbeitgemeinschaft für Osteosynthesefragen)] was founded by Maurice E. Muller to research concepts propounded by Robert Danis. The association is responsible for the development of a series of plates, screws and other devices, and the corresponding instrumentation, which has contributed to the popularity of internal fixation.

**MAGNITUDE OF THE PROBLEM**

Trauma is the leading cause of death between 15 to 45 years age group. The fact that the majority of the accident victims are in the younger age groups implies an enormous total of “potential life years” lost prematurely.

After falls, road traffic accident is the second commonest cause of injuries and hospital admissions in the United States of America in 1985 accounting for 9% of all cases of injuries recorded that year. However, its higher mortality rate is witnessed to by the fact
that in that same year, it was the commonest cause of accidental death responsible for 32.2% of all trauma related death 5.

In 1976 there was an estimated 250 million automobiles in the world, the persons to cars ratio was 15:10. Just ten years before, the ratio was 137:20. It was also estimated that annually 150,000 deaths occurred on the roads due to vehicular accidents, in the world. Every year, nearly 1.2 million people sustain serious injuries and 3.8 light injuries on roads in the world 37.

Though this problem has a worldwide distribution, the problem is relatively of far greater magnitude in developing countries as compared to the industrialized nations 38, 39. For example in 1970, whereas the number of persons per car was twenty-five in Guyana, eighteen in Jamaica and less than two in the USA, the number of deaths per 100,000 motor vehicles was only five in the U.S.A. but greater than fifty in each of the two Caribbean countries 40.

In Nigeria, Owosina 30 in a report on road traffic accidents in Nigeria prepared for the World Health Organization in 1981 gave a breakdown of the accident statistics in Nigeria (tables 1a and 1b). Though based on police record, the weakness of which he himself commented on, nevertheless, it gives an insight into the relative incidence of the causes of injuries in Nigeria. And as shown in table 1a, road traffic accident was the second commonest cause of injuries in that part of Nigeria between 1977 and 1981.

The author did not indicate the region for which the statistics was collected, however it could not possibly be for the whole country; for one, similar statistics for 1976 and 1980 quoted for Nigeria by Onabowale showed a much higher figure for road traffic accidents 33; secondly as reported by Jaja 32 in 1976, road traffic accidents cases seen in the then Royal (now National) Orthopaedic Hospital, Igbobi, Lagos, Nigeria were 9,360 in 1973, 5,618 in 1971; 7,212 in 1972; and 6, 643 in 1973 – figures that were almost as
many as those quoted in table 1b. It will be absurd to think that the figure for a hospital – first among equals though it may be - will take so high a proportion of the figure for the whole country.
Table 1a: Causes of accidents

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Road traffic accidents</td>
<td>7140</td>
<td>6137</td>
<td>5349</td>
<td>7765</td>
</tr>
<tr>
<td>Other transport accidents</td>
<td>354</td>
<td>416</td>
<td>292</td>
<td>39</td>
</tr>
<tr>
<td>Accidental fall</td>
<td>10,373</td>
<td>9927</td>
<td>8452</td>
<td>9485</td>
</tr>
<tr>
<td>Accidents caused by fire</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Accidents mainly of industrial type</td>
<td>1251</td>
<td>993</td>
<td>634</td>
<td>448</td>
</tr>
<tr>
<td>All other accidents</td>
<td>923</td>
<td>726</td>
<td>303</td>
<td>175</td>
</tr>
<tr>
<td>Homicide &amp; injury purposely inflicted by other persons</td>
<td>156</td>
<td>363</td>
<td>588</td>
<td>166</td>
</tr>
<tr>
<td>Injury undetermined</td>
<td>64</td>
<td>244</td>
<td>47</td>
<td>54</td>
</tr>
<tr>
<td>Total</td>
<td>20,261</td>
<td>18,806</td>
<td>15,665</td>
<td>18,132</td>
</tr>
</tbody>
</table>

Table 1b: Deaths resulting from accidents.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Road traffic accidents</td>
<td>114</td>
<td>192</td>
<td>154</td>
<td>137</td>
</tr>
<tr>
<td>Other transport accidents</td>
<td>-</td>
<td>3</td>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td>Accidental fall</td>
<td>6</td>
<td>5</td>
<td>11</td>
<td>7</td>
</tr>
<tr>
<td>Accidents caused by fire</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Accidents mainly of industrial type</td>
<td>1</td>
<td>12</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>All other accidents</td>
<td>-</td>
<td>7</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>Homicide &amp; injury purposely inflicted by other persons</td>
<td>-</td>
<td>2</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>Injury undetermined</td>
<td>-</td>
<td>3</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td>121</td>
<td>224</td>
<td>182</td>
<td>153</td>
</tr>
</tbody>
</table>

Abstracted from ANNEX VIII in Owosina F.A.O.
The traffic scene in Nigeria - An African example. The WHO/OBCD/World Bank's Conference on road traffic accidents in Developing Countries. Mexico City 9 -13 November 1981.
Yet, road traffic accidents seemed to be on the increase in Nigeria and most developing countries. This may be due partly to the increasing number of vehicles on the Nigerian road, as noted by Bothwell, there is an almost directly proportional increase in the motorcycle accident rate and increasing motorcycle population. Oyemade in Ibadan apart from the above reasons, also felt that the poor state of the roads were also contributory. The present increasing use of motorcycles for commercial commuter services is likely to worsen this ugly scenario. This commercial motorcycle commuter service is popularly called Okada in the southern part of Nigeria and Achaba in some Northern States of the Country.

Asogwa in Nigeria reported that death from road traffic accidents exceeded by far the deaths from several major communicable diseases between 1967 and 1974. An alarming feature of road traffic accidents is the increasing role of motorcycles and scooters. Thus, Adeloye in Ibadan and Odelowo in Ilorin showed that motorcycle accidents accounted for between 18 and 35.7% of the road traffic accidents in their centers.

Road traffic accidents have taken on the characteristics of a mass disease of epidemic proportions. Thus, epidemiological principles and methods developed for the analysis and control of mass diseases will be of value in the understanding and control of the causes of accidental trauma. Accidents occur when there is disequilibrium between the host, the agent, which is the machine and the environment (the road). Both Kraus and Norman have reported the age and the experience of the rider as important host behavioural factors in the aetiology of motorcycle accidents.

In the tropical climate, the rainy season is the time of highest incidence of road traffic accidents but Odelowo in Ilorin found that the incidence of motorcycle accidents was not influenced significantly by seasonal variations.
Hospital incidence
Accidents on the road accounted for about 20% of all injuries seen in Nigerian hospitals. In Birmingham, England, road traffic accidents accounted for 10% of all accident cases in their hospitals and it was also responsible for no less than 25% of all in-patient hospital admissions. In Ilesa, Nigeria, injuries in general accounted for 9% of all admissions to the children emergency room. 26.6% of these cases were due to road traffic accidents and pedestrian accidents due to motorcycles accounted for 19.45% of the road traffic accidents cases so recorded.

Accident parameters
In Ilorin, 62.6% of the motorcycle accident patients were riders, 6.8% were passengers, and 22% were pedestrians while 1.3% was not clearly categorized. Motorcycle accident occurring within the city involved 70.3% and those occurring on the highway involved the remaining 29.7%. 87.5% of the patients were primarily admitted while 12.2% were referred to the hospital from other health centres.

In both Jos and Ilesa, the leg most commonly broken was the right: 61.4% in Ilesa and 21 out of 27 in Jos. However, in Calabar, also in Nigeria, both legs were equally involved.

Age and sex incidence
In a prospective study spanning two years at the teaching hospital in Ilorin, Nigeria; Odelowo showed that the 18-30 years age group was the most frequently affected, and the male to female ratio was 5.7: 1 in the 74 patients reviewed. Most of the children in this work, like in many other similar studies, were pedestrian victims. However, Deaner in California recorded only 7 female victims of motorcycle accidents out of 324 patients. This obviously skewed ratio (1:46) may be due to two main factors:

1) This study was based on a military population, the female population in an average military formation is usually lower than that for the community in general, and
2) Only victims who were actual occupants of the machine i.e. passengers or riders, were included in the study. Pedestrian injuries were not included.

In general the peak age of incidence among the developing countries is higher than in the more technologically advanced countries; the cause of this has been attributed to the delayed access to motorcycle in the developing countries\textsuperscript{33}.

**Type of machine**

The relative casualty rates per vehicle mile as reported by Bothwell\textsuperscript{16} (cars = 1) are: motorcycle: 18 killed; 20 seriously injured, motor scooter: 11 killed; 16 seriously injured, and moped: 13 killed; 15 seriously injured. But the accident rates of scooters and motorcycles of the same capacity did not differ\textsuperscript{16}.

**Types of accident**

Most of the studies previously done on motorcycle accidents have been silent on the type or nature of accident in which the motorcycles had been involved. In California, 62.9\% of injury-producing motorcycle accidents were due to collisions with another vehicle, 12 percents were the result of running off the road, and overturning of the motorcycle caused the remainder\textsuperscript{15}. Deaner also in California recorded fifty-six injuries resulting from collisions between cycle and car or truck, and seven because of cycles colliding. This was in 324 patients studied; he was silent on the type of collision sustained by the other patients. This is perhaps because it was a retrospective study\textsuperscript{9}.

**Injury-treatment interval**

Reducing the time between injury and definitive surgery is known to decrease morbidity and mortality from the injuries sustained\textsuperscript{42, 44, 48, and 49}. During the Napoleonic war, Larrey\textsuperscript{5, 48} introduced his ambulance volante or “flying ambulance” concept of concentrating timely operative intervention as close as possible to the battlefield because of this principle.
In Ilorin, 77.0% of the motorcycle accidents cases were seen within 24 hours, 10.85% at 24 hours and 5.4% was at 3 days to one week. However, due to poor documentation, the relevant information on 50% of the cases could not be obtained.

**The pattern of injuries (injury parameters).**

The pattern of injuries sustained in motorcycle accidents varied depending on who carried out the study and the place where the study took place. Odelowo in Ilorin and Haddad and Zettas in California; and Ross in Bristol showed a preponderance of limb trauma followed by those involving the head; the reverse was the case in Bristol, England as reported by Bothwell, however, Bothwell was reporting a survey of only the fatal cases that were done by Cairns. Everyone considered head injury as the commonest cause of fatality. The tibia and the femur are the long bones most commonly fractured. The tibia fracture is most commonly open. Single system injuries made up about 50% to 55.8% of the cases according to Odelowo and Haddad.

Lower extremity injuries accounted for 33.8% of all motorcycle accidents injuries seen at Ilorin while upper extremity and pelvic injuries accounted for 9.5% and 2.7% respectively. 74 patients were included in this study, 25 injured the lower extremity, 15 each injured the chest and the cranioccephalic region, 7 injured the upper extremity, 5 other head/neck (scalp, face and the jaws), and 4 injured the abdomen while 2 patients injured the pelvis and the remaining one had soft tissues injuries. Given that 50% of the patients in this study sustained single injury while the remainders sustained multiple traumas, it is perhaps surprising that the total number of the injuries sustained based on the anatomical region affected were not more than the actual number of patients. No further analysis of the extremity injuries was given in the study.

In the Ross series, 64% of all the patients were recorded as having lower extremity fractures; a figure the author regarded as being too low because only the severe cases
were considered. This seemingly unusually high percentage (unusual when compared to other series who were reporting - sometimes much- lower figures for both extremities taken together) may be because the proportion he used was based on the number of motorcycle accident patients, and not on the total number of injuries that were sustained by them.\textsuperscript{50}

In California, in the United States of America, fractures and dislocations accounted for a majority of the patients with motorcycle accidents injuries hospitalised at the Naval Regional Medical Centre, Oakland between 1971 and 1973. 240 major fractures occurred. 229 (71\%) of the 324 patients in the study sustained at least one fracture. One patient sustained twelve. “Minor” fractures (patella, scapular, foot etc) were also documented. The tibia accounted for 68 cases with the radius and ulna next (37 cases) while the femur accounted for just 29 cases. Of the 43 patients with dislocations, 14 involved the acromioclavicular joint. The hips, ankles and the knees were injured in five, four, and two cases respectively.\textsuperscript{9}

In Ilesa and Jos, motorcycle accidents accounted for more cases of tibia fractures than any other cause\textsuperscript{46, 47}.

The force to which the cyclist is subjected is tremendous.\textsuperscript{9} A 150-Ib cyclist travelling at 30 mph colliding head on with a 1,500-Ib auto travelling at 30 mph is subjected to a force in excess of 80,000 foot-pounds (mass x velocity). In contrast, a 150-Ib skier brought to an abrupt halt from 30 mph experiences only 6,600 foot-pounds of energy.\textsuperscript{9} This high-energy trauma in motorcycle accidents perhaps explains the genesis of what Findlay described as the “motorcycle tibia”- very severe tibia injuries with a great tendency to fracture nonunion.\textsuperscript{9}
**Risk factors**

Comparison of automobile and motorcycle accidents showed that the later has by far the greater morbidity and mortality\(^9,10,15\). The fatality rate for motorcyclists was twice that for the other occupants of all other types of motor vehicles\(^9\). Bothwell showed that 97% of casualties in collisions between motorcycles and other vehicles are motorcyclists and that in an accident, a motorcyclist stands 18 and 20 times risk of being killed or seriously injured respectively\(^16\). In Jamaica there were about twelve cars to every motorcycle but the later accounted for almost 50 percent of road traffic accidents\(^39\).

The motorcyclist also has the highest degree of risk per distance travelled\(^52\). In the same vein, among the occupants of the motorcycle, the pillion passenger has a 5% greater risk than the rider\(^16\). But the pedestrian is the most vulnerable category of road users to injuries\(^44\).

*Alcohol consumption*

In a review article of the effect of alcohol on driving, Havard\(^53\) concluded that driving performance deterioration occurs at a relatively low concentration of alcohol in the tissue which certainly is much lower than that required to produce the conventional clinical picture of intoxication. At such concentrations, both drivers and pedestrians are more likely to be involved in accidents.

Eighteen of the 324-motorcycle accident patients reported by Deaner showed unequivocal instances of alcohol ingestion by chemical, biochemical and physical findings\(^9\). However, in this environment most authors report a low incidence of alcohol use at the time of the accident\(^8,14\). This may be because it is difficult to obtain such unequivocal information\(^54\) because as Odelowo observed, few patients admit alcohol ingestion for medico-legal, sociocultural and religious reasons\(^14\).

*Personal characteristics*
In the Nigerian situation, the motorcyclist is particularly vulnerable, partly because of his and other road user’s road-behaviour. The motorcyclists sometimes appear as if they think that their movement on the road is not subject to any traffic regulation. They overtake on the wrong side. They cross other vehicles without signals. Where traffic is halted, they do not observe the halt sign and signal.

*Motorcycle factors*

Small-engined motorcycles have the smallest ratio of accident producing collisions, probably because they are easier to control, and because their speed is limited. The state of maintenance of the vehicle is also very important, as a poorly maintained vehicle is a bad risk. It has long been known that protective helmets protect the motorcyclist from head injuries. Crash bars, fitted to the motorcycles have also been shown to protect the legs from injuries particularly when the impact is from the side. Goggles or visors protect the eyes against wind and grits. Figure 1 depicts some of the protective devices that can be fitted to motorcycles or worn by the cyclist.
Figure 1: Safety devices and protective headwear available to the motorcyclist
Adapted from Ross DJ. The prevention of leg injuries in motorcycle accidents. Injury 15: 76.
Environmental factors

Environmental risk factors include the season\textsuperscript{11}, time of the day\textsuperscript{15} and the condition of the road\textsuperscript{30}. The condition of the road in West Africa is often bad. The road surface is uneven with lots of potholes. When they are not paved, in the dry season, dustiness inhibits road visibility thus creating conditions, which often ended in head-on collision. Shifting sands arising from the wearing out of the road surface sometimes led to loss of control of vehicles and consequent crashes into roadside objects. In the rainy season, road surfaces were in places softened by rainwater thus leading to slipperiness, which in turn, sometimes caused accidents\textsuperscript{56}.

MANAGEMENT OF TRAUMA PATIENTS

Studies have shown that a large percentage of trauma death is preventable\textsuperscript{57, 58, and 59}. The means to accomplishing this is by fulfilling the "three Rs" of trauma care i.e., get the right patient to the right hospital at the right time\textsuperscript{57}. Both Trunkey and Baker emphasized the critical importance of the interval between injury and treatment to the probability of survival\textsuperscript{57, 58}. Getting the right patient to the right hospital involves the process of categorization, which the American Medical Association Committee on Emergency Services described as follows\textsuperscript{48}:

\begin{quote}
"To identify the readiness and capability of the hospital and its entire staff to receive and treat, correctly and expeditiously, emergency patients. Ambulance personnel, law enforcement officers, and other citizens of the area, having advanced knowledge of the designated categories of emergency capabilities of the various hospitals in an area, may thus select the proper institution to which the patient may be taken"
\end{quote}

It is now generally agreed that the successful management of injured patients requires a well-organised system of trauma care providing optimal care at all stages\textsuperscript{57, 58}. 
These requirements are the Pre-hospital (first aid) care and transportation, Accident and Emergency care, Definitive treatment and, Rehabilitation\textsuperscript{5, 19, 57, 58}.

**PRE-HOSPITAL CARE AND TRANSPORTATION**\textsuperscript{5, 17, 19, 21, 60, 61, 62.}

This involves the first aid given at the scene of accident and the subsequent transport to the hospital for definitive care\textsuperscript{5, 21}. This is as important to the outcome of the management as the subsequent treatment in the hospital\textsuperscript{63}.

In developed countries, this aspect of trauma care has grown in importance and it involves alerting the hospital staff about the emergency, providing ongoing medical support while transporting the patient to the hospital, stabilizing fractures and providing psychological support for the patient\textsuperscript{5}. It has been found to be responsible in no small measure to the reduced morbidity and mortality following trauma in recent times\textsuperscript{57, 58}. Unfortunately, this is sadly lacking in most West African countries\textsuperscript{63}

A number of publications have advocated lay assistance at the accident scene\textsuperscript{20, 42, and 21}. In any road traffic accidents, the first person on the scene is likely to be another driver, and these people should be singled out for training\textsuperscript{20}. In the United Kingdom, a chapter on first aid has been included in the Highway Code. In Germany and Australia, an examination in first aid is obligatory for obtaining a driver’s licence. In Norway, road safety and first aid are in the school curriculum\textsuperscript{20}; the establishment of a similar practice has been advocated in Nigeria\textsuperscript{42}. In Nigeria the police believe they are the first on the accident scene\textsuperscript{64}. This is hard to believe\textsuperscript{20}.

The aim of the pre-hospital care is to maintain the functions of the vital organs of the body. Adequate respiration and circulation will accomplish this. The maintenance of constant oxygenation to the brain by means of adequate circulation and respiration is of utmost importance. Oxygenation is dependent on the maintenance of patent airways,
adequate lung function and effective cardiac activity. Effective circulation is a function of effective cardiac activity and adequate blood volume, and venous return\textsuperscript{5}.

Transportation to the nearest hospital should be done immediately in ambulances or any other available vehicle, but it is important to realise that treatment at the scene and during transportation is more important than the speed of transportation\textsuperscript{21}. The provision of a two way radio communication between the physician in the hospital and the ambulance crew will improve the effectiveness of the treatment offered thereof\textsuperscript{21, 22, 23}. In developing countries, the means of transportation may be by taxi, minibus, an ordinary truck or an ambulance\textsuperscript{63}. In 66 trauma victims seen in a hospital in Ghana, 34 were brought in taxis, 4 each in minibuses and passenger trucks (mammy wagons), and the remaining 24 in ambulances, of the 9 deaths subsequently recorded, 3 each were brought in taxis and minibuses, 2 in trucks and only one in an ambulance\textsuperscript{63}. Thus, the safest way to transport trauma victims is by ambulance, manned by well-trained staff in constant touch with the physician in the hospital. Extreme care should be taken, especially in unconscious patients in whom one is never sure of the status of the cervical spine to avoid further damage to them\textsuperscript{5, 24}. They should be log rolled and the cervical spine kept immobile by adequate and rigid support\textsuperscript{21}.

**ACCIDENT AND EMERGENCY MANAGEMENT**

Trauma is the number one killer below 35 years of age\textsuperscript{4}. Fully 25-35\% of these deaths can be prevented by a more effective initial management\textsuperscript{57, 58}. But accident and emergency wards in most West African countries evolved from a system, which worked well in the age of the horse and carts, such services are unsuited to the present age\textsuperscript{63}. Accident units must be easily accessible by roads and possibly air\textsuperscript{42}. In many developing nations with poor pre-hospital care system, the casualty may be the first contact of the patient with trained medical personnel.
This aspect of patient's care is best carried out sequentially:

I. Primary survey and resuscitation\textsuperscript{5, 19, and 21}. This is the time when those conditions that are crucial to the patient's survival are identified and simultaneously treated. Trained paramedics may have accomplished this at the scene of accidents; otherwise, it is done in the emergency unit.

It progresses in a logical manner based on the ABC\textsuperscript{21} of resuscitation i.e. airway with cervical control, breathing and ventilation and circulation and control of haemorrhage. It also includes a brief history viz. allergy, current medication, past medical history, last meals and events preceding the accidents i.e. AMPLEx\textsuperscript{5}.

II. Secondary Survey: This is a more detailed physical examination in which any other injuries are identified and the response to therapy initiated during resuscitation phase is evaluated. Radiographs, compartmental pressure measurement\textsuperscript{67, 68} and other investigations are carried out during this phase. This phase prepares the patient for the definitive care\textsuperscript{5}.

**INVESTIGATIONS**\textsuperscript{5, 18,24,25,26,25,24}

In most cases of trauma involving the limbs, the diagnoses are made clinically; however, investigative examinations are necessary not only for the confirmation of our clinical suspicion but also to determine the extent of the injury, the tissues involved, the presence of fractures as well as the presence of foreign particles in the injured part.

They are also carried out to determine the systemic effect of the trauma and baseline study to monitor progress of treatment.

A. **Radiology**\textsuperscript{5, 26,24,65}

There is a great variety of imaging modalities available and the quantity and quality of information attainable by each modality vary considerably.
**Ai  Plain Film Radiology**

This is still the best way to visualize the skeleton during the early survey. It is also the mainstay of routine orthopaedic examination. At least two views must be taken before the fracture can be characterized. It will also reveal the presence of radio opaque foreign bodies in the wound.

However, plain radiography is bedevilled by certain limitations such as limited capacity to diagnose soft tissue trauma, poor localization of injuries and a high rate of false positive and false negative findings especially in skull radiography\(^6^6\).

However, in a developing country, this may still be the only form of imaging technique available to the surgeon.

In his study of 74 motorcycle accident victims, Odelowo reported that 59.5% of the victims had positive documentation, negative in 18.9% and not ordered in 21.6% of the patients\(^1^4\).

**Aii  Cross sectional and radionuclide imaging**

There are four modalities; these are ultrasound, computerised axial tomography scan, magnetic resonant imaging and radio-nuclei imaging.

When available, CAT scan is by far the method of highest value to the trauma surgeon. It combines a relatively high resolution of the image with the capacity of demonstrating soft tissue and skeletal wounding in three dimensions. It also has the ability to differentiate between normal and abnormal soft tissue. Its main limitation is the high cost and non-availability, especially in the developing countries.

Ultrasound is widely used in paediatric abdominal trauma; however, its value in the management of limb trauma is limited. Doppler ultrasound is useful for the diagnosis of arterial injury and obstruction.
MRI has superior ability to diagnose soft tissue trauma and detect metabolic changes to a level unparalleled by other imaging techniques. But there is a logistic problem in doing MRI studies on severely injured patients, life support equipment contain ferromagnetic alloys and can interfere with MRI scanning. It is also very expensive and not widely available in developing countries.

Diagnostic angiography is the only reliable, non-surgical direct diagnostic procedure in search of vascular injury or haemorrhage from any arterial source. The indication for angiography is absolute whenever vascular injury is suspected, except when conditions requiring immediate surgery are present. The radiologist at the same setting can carry out angiographic haemostasis.

B. General Investigations

These tests are useful in determining the systemic sequelae of trauma and the therapeutic need of the patient. They are carried out on the patient as the need arise.

Ci. **Packed Cell Volume**: This is a reflection of the concentration of red blood cell. However, it is an unreliable index of the extent of blood loss in the early stages of post trauma period because of haemoconcentration. When it is repeated serially though, it gives an indication of the magnitude of the blood loss and the need for transfusion.

Cii **Blood grouping and crossmatching**: This is a necessary investigation for patients who have lost a lot of blood and require transfusion with blood.

Ciii **Blood biochemistry**: This is especially important in patients who presented in shock. Depending on the degree of shock, the PH may be low while the potassium and the blood non-protein nitrogen may be high especially when there is concomitant impairment of renal function. The serum concentration of sodium will also be of help in determining the degree of hypovolemia and hence, aid in the restoration of the vascular volume.
DEFINITIVE MANAGEMENT\textsuperscript{5,18,23,24}  
The injuries sustained by the patients to the limbs can be classified into skeletal and soft tissue injuries\textsuperscript{61}.

Wounds\textsuperscript{5}  
Most soft tissue injuries to the limbs affect the skin\textsuperscript{5}. Most simple laceration of the skin can be adequately treated in the accident and emergency department, but injuries requiring open reduction of fractures, neurorrhaphy, vascular anastomosis, tendon repair or extensive debridement are usually best treated in an operating theatre where good lighting, instruments and assistance render the procedure eminently safer.

Surgical debridement has been considered by many trauma surgeons to be the single most important factor in the management of the contaminated wound\textsuperscript{69}. It consists of complete removal of all contaminants and devitalised tissue, adequate irrigation with sterile isotonic fluid and closure.

The timing of the closure itself is very critical. A decision must be made as to whether the closure should be immediate or delayed. Over the centuries, it has been learnt that primary closure of infected or heavily contaminated wounds results in the development of purulent discharge, wound dehiscence and eventual sepsis. Wounds contaminated by faeces, saliva, soil, as well as those in which treatment has been delayed longer than 6 hours should be considered for open management.

The rationale for delayed primary closure is that the healing open wound gains sufficient resistance to infection to permit an uncomplicated closure\textsuperscript{5}.

Fractures and dislocations\textsuperscript{5,24,35,36}  
Fractures are either closed or open\textsuperscript{32}:

Closed fractures and dislocations: not all fractures require reduction. In those requiring reductions, the methods available are:

Manipulation under anaesthesia.
Continuous traction, especially in fractures of the femur.

Open reduction of the fractures is carried out in certain cases; where conservative measures have failed to give a satisfactory reduction or where it is considered that the best method of supporting the fracture involves internal fixation, and exposure of the fracture is a necessary part of the procedure.

Methods available for immobilization are:

- Non-rigid methods of support e.g. arm sling, bandages, and adhesive strapping.
- Continuous traction either through the skin or through bone.
- Plaster fixation: POP is the commonest method of supporting fracture. There are a number of POP substitutes that are now available e.g. scotch cast, but none as yet combine the unique properties of POP with moderate cost.
- External fixation device: The main advantage of external fixation devices over POP is that it offers excellent access for the dressing of open wounds in patients with open fractures with extensive skin injuries.
- Cast bracing: this technique is sometimes employed weeks after the initial conservative management of a fracture. Its advantage is that it reduces the chances of the patient developing joint stiffness because it is hinged at the joint to permit movement.

Internal fixation: this is indicated

- Where a fracture cannot be reduced by closed methods.
- Where a reduction can be achieved, but cannot be satisfactorily held by closed methods.
- A higher quality of reduction and fixation is required than can be obtained by closed methods.

The implants used for internal fixation are many; they include plates and screws, intramedullary nails, wires and blade plates. Prosthetic devices like Austen-Moore and Thompson prostheses are used for femoral head replacement arthroplasty in certain cases.
of femoral neck fractures. The possibilities of introducing infections, the cost of instrumentation for the different implants, the high level of expertise needed on the part of the surgeon are some of the disadvantages of internal fixation.

**Open fractures and dislocations:** These are classified according to the Gustillo - Anderson classification as follows:  

- **Type I:** An open fracture with a wound, which is less than 1 cm, and clean.
- **Type II:** An open fracture with a wound which is more than 1 cm long and which is not associated with extensive soft tissue damage, avulsions, or flaps.
- **Type IIIA:** An open fracture where there is adequate soft tissue coverage of bone in spite of extensive soft tissue lacerations or flaps; or there is high-energy trauma irrespective of the size of the wound.
- **Type IIIB:** An open fracture with extensive soft tissue loss, with periosteal stripping and exposure of bone. Massive contamination is usual.
- **Type IIIC:** An open fracture associated with an arterial injury, which requires repair. It also includes traumatic amputation.

Treatment is directed at the wounds because failure of treatment of the wound means failure of treatment of the entire injury. The immobilization technique that is to be used is guided by a lot of things; the age of the patient, the Gustillo – Anderson grade, the degree of contamination, the fracture line, and the available expertise.

TYPE I fractures are generally treated as if it were closed i.e. the most appropriate immobilization technique suitable for the fracture is used. Most TYPE II fractures, if gotten early enough are generally treated along similar lines. TYPE III fractures are best immobilized with external fixators, but in certain cases, they may be treated using intramedullary nail without reaming. Other ways of immobilizing open fractures include the use of POP with an opening created for wound dressing.
**Tendons and nerve repair**<sup>5,24,25</sup>

The initial management of injuries to these tissues takes second seat to the management of associated injuries to the skin, bone, and artery. When a divided nerve or tendon is encountered at the time of an arterial repair, for example, the ends should be tagged with non-absorbable sutures and left for a delayed repair later. Otherwise; if the wound is clean, it is repaired primarily or a delayed exploration and repair done at 6 weeks –3 months if wound is contaminated.

**The use of antibiotics and tetanus immunoprophylaxis**<sup>5,24,25</sup>

The timing of administration, the wound bacterial concentration, the presence of soil infection potentiating proteins, and the mechanism of injury influence the relative success of antibiotic therapy in the prevention of infection in traumatic wounds. Antibiotic treatment is mandatory in wounds containing inflammatory pus, those contaminated by faeces, saliva, those with extensive soft tissue injury especially when the magnitude could not be accurately ascertained soon after the injury<sup>5</sup>.</p>

Recommendations on tetanus prophylaxis are based on the condition of the wound and the patient’s immunization history. The wound’s condition is either tetanus-prone or non-tetanus-prone. A wound is said to be tetanus-prone when it is more than 6 hours old, it is of stellate or irregular shape (rather than linear), penetrating (>1cm), devitalised, with contaminants and signs of infections present, and it was due to missiles, burns or crushing forces.

**Blood transfusion**<sup>5,18</sup>

Mortality from road traffic accidents could be greatly reduced by replacing blood loss in time to save life, but blood is not always available in West Africa<sup>70</sup>. The main indication for blood transfusion in the initial trauma management in an uncomplicated trauma patient is an evidence of symptomatic hypovolemia shock, which is unrelieved by non-blood fluid replacement. The need may also be based on the anticipation of future...
losses in days or hours to come\textsuperscript{70}. But blood transfusions must always be done very carefully because of its well-known side effects\textsuperscript{71}. These complications include transfusion reactions and circulatory overload.

**COMPLICATIONS**

Victims of motorcycle accidents are prone to developing various complications depending on the severity of their injuries and the region of the body involved.

The types of pre-hospital care\textsuperscript{63,21}, the time interval\textsuperscript{42} and adequacy of the hospital treatment\textsuperscript{72} have all been found to have a direct bearing on the complications seen in these patients. These complications contribute to the mortality and morbidity of these patients.

Brain and cervical spine injuries are the commonest cause of mortality in victims of motorcycle accidents while fractures are the highest cause of morbidity\textsuperscript{5,16}. In our community, untrained personnel bring most of the patients to the hospitals; this may complete an incomplete cord lesion\textsuperscript{73}.

In a study of 324 motorcycle accident victims who were navy personnel, 42 of these patients sustained permanent disability, 21 were severe enough to preclude further military service\textsuperscript{9}. However, the study did not give a breakdown of the disability or other kind of complications that may have arisen.

Oguachuba\textsuperscript{74}, in Jos reported a 27.4\% infection rate in post-operative orthopaedic trauma cases. This rate is much higher than the normally published range of between 2\% and 20\%\textsuperscript{62}. He however, failed to indicate the extent to which the wounds were initially contaminated, and this may be responsible for the difference.

Alabi\textsuperscript{47}, in Ilesa in a study of tibia fractures the majority of which were due to motorcycle accident 92.8\% of which were treated by close manipulative reduction and immobilization in POP, and in whom the remaining 6\% had open reduction and internal fixation. 34\% of these patients had wounds that were already contaminated or infected at
admission. He recorded a case each of delayed wound healing and delayed fracture union; two cases of malunion and unspecified numbers of quadriceps muscle wasting and ankle stiffness as complications.

It is surprising that no cases of osteomyelitis or wounds infection were recorded considering the high rate of those infected before admission. However, he did not state whether any of the infected cases were operated.

In a similarly designed work in Jos 46, Oguachuba went a step further by comparing the surgically treated to the conservatively treated patients and showing that the later is fraught with more complications. The only complication among the 12 cases that had surgery was ankle stiffness and oedema in 5 patients. However, of the 21 cases treated conservatively, 21 had ankle stiffness and oedema, 15 had quadriceps wasting; while 2 patients each had malunion, delayed union and delayed wound healing. The unexpected absence of post operative infection is rather baffling; considering the finding by the same author in a previous study that 27.4% 74 of orthopaedic trauma cases developed post-operative infections.

In summary, complications of fractures may be due to the following:

- Complications of any tissue damage e.g. haemorrhage, hypovolemia shock, infections, and metabolic derangement.
- Complications of prolonged recumbency e.g. hypostatic pneumonia, pressure sores, deep vein thrombosis, muscle wasting, and osteoporosis.
- Complications of anaesthesia and surgery e.g. atelectasis, pneumonia, wound infection, and failure of internal fixation devices.
Complications peculiar to fracture e.g. (I) disturbances of the rate and quality of union – fracture non-union, malunion, delayed union, and shortening- (ii) joint stiffness, (iii) infections, (iv) avascular necrosis, (v) neurological, vascular, and visceral complications (vi) Sudeck’s atrophy, and (vii) implant failure.

REHABILITATION

Patients convalescing from limb trauma need intensive physiotherapy. This has being defined as the restoration of an ill or injured person to self-sufficiency or gainful employment at his highest attainable skill, in the shortest possible time. The aim is to restore the limb function to as close to the pre-morbid state as possible. This may be a demanding process requiring a lot of hard work, pain and monotony.

Patients may have to be taught new occupations and they may have to change or modify their hobbies and therefore requires counselling and care of the occupational therapist.

OUTCOME

The outcome of the patient’s treatment depends on a lot of factors like the severity and the nature of the injury, the type of pre-hospital treatment given, and the definitive treatment in the hospital. The patient’s perception of his problem will determine where he goes for treatment. If he believes it is as a result of evil machination of an antagonist, then patient may seek the help of a native healer.

PREVENTIVE MEASURES

In the past decades, there has be a growing interest in finding ways to reduce the loss of limbs and lives from motorcycle accidents. To help reduce the alarming toll and to help make motorcycling a safe means of transportation, the Committee on Medical Aspect of Automotive Safety of the America Medical Association made some suggestions which include:

Concerning the health of the driver
1. The use of alcohol adds tremendously to the normal hazards of motorcycling and should not be used if the individual intends to drive. If the driver does drink, a one-hour wait before driving will help to keep the driver from becoming intoxicating.

2. Drugs and narcotics must not be used before or while driving.

**Concerning the vehicle**

1. The importance of upkeep cannot be overemphasized: it can easily be the difference between life and death.

2. Different sizes and types have different handling qualities, and the driver should not switch to other machines without learning about their characteristics.

**Concerning vehicle operation**

1. All motor vehicle laws, both as to licensing and operation, should be learned and obeyed.

2. Special care must be taken when unfavourable road or weather conditions exist.

3. A safe distance must be kept between the motorcycle and any vehicle in front.

4. Passengers should not be carried unless the motorcycle is equipped to do so, and never more than one.

5. Driving abreast should be avoided.

7. The motorcycle should never be driven between traffic lanes since a suddenly swerving automobile may be difficult to avoid.

8. Objects, which prevent both hands from being on the handlebars at all times, should not be carried.

9. Motorcyclists should slow down and be especially alert if animals are in the vicinity. The same applies to children who often do unexpected things.
Concerning clothing and equipment (fig. 2)

1. The driver and passenger should always wear approved protective headgear.
2. Clothing should be heavy enough to protect and of preferably highly visible colour.

Concerning emergency care

Immediate care should be provided for the victims with life or limb threatening injuries starting from the scene of the accident, through transportation, to the hospital.
OBJECTIVES

GENERAL

The general objective of this study is to study the pattern of trauma to the limb as a result of motorcycle accidents as seen in the Obafemi Awolowo University Teaching Hospitals Complex, Ile-Ife, Nigeria with a view to suggesting ways to reduce morbidity and mortality.

SPECIFIC

The specific objectives of this study are:

1. To determine the types of limb injuries sustained and if they fall into any patterns.
2. To determine some of the host and environmental factors that were involved in sustaining such patterns.

LIMITATIONS OF STUDIES

The objectives stated previously may not be realized perfectly because of the following limitations.

i Because this is a hospital based study, some patients who sustained their injuries in Ile-Ife and Ilesa may present themselves in other hospitals apart from Obafemi Awolowo University Teaching Hospitals Complex thereby lessening the total number of injured patients.

ii Since the management of some of these patients requires a multi-disciplinary approach, the author may not be involved in making some of the decisions in the management of some of these patients.

iii Some patients may need to be referred to other hospitals where material and manpower resources, not available in Obafemi Awolowo University Teaching Hospitals Complex, are present.
iv Some patients might discharge themselves against medical advice due to financial, social or cultural reasons.

v Adequate follow-up may be impossible because of the limited span of time available for the study and default by patients after discharge from hospital (Lost-to-follow-up cases).

vi The petroleum scarcity in August 1998 and the resident doctors’ strike in December 1998-April 1999 reduced the total number of cases seen. It also made comparison of the seasonal variation in incidence difficult.
PATIENTS, MATERIALS AND METHOD

STUDY AREA

The centres used for this study were the Ife State Hospital, Ile Ife and the Wesley Guild Hospital, Ilesa units of the Obafemi Awolowo University Teaching Hospitals Complex, Ile-Ife. Both Ile-Ife and Ilesa are towns located in Osun State of Nigeria. Both are located along a major road network linking various urban centres in the South West part of Nigeria. Ile Ife has a University while Ilesa has a College of education. Both have a large population of commercial motorcycle riders popularly known as "okada."

Obafemi Awolowo University Teaching Hospitals Complex consists of four hospital units. Two of the units are community based primary health centres while the remaining two –Ife State Hospital and Wesley Guild Hospital- are the two units, which function as the tertiary arm of the institution. Ife State Hospital is the larger of the two. Each hospital has an accident and emergency reception ward with an attached recovery ward where patients are temporarily lodged before admission into the ward. There are 88 trauma beds in the hospitals. However, other beds are co-opted for trauma victims whenever the need might arise.

The hospitals are well equipped to cater for injured victims. Each has a radiology unit with plain radiography and ultrasound scan facility. In addition, there is a CT scan machine, an angiography unit and other form of contrast study facilities at the Ife state hospital. Each has a suit of operating theatres to cater to both elective and emergency cases. Ife State hospital as well has a modest ICU facility.

Both hospitals are easily accessible by road.

STUDY POPULATION

This is a hospital-based study, the study population consisted of all victims of motorcycle accident of all age groups and both sexes presenting at Obafemi Awolowo
University Teaching Hospitals Complex, Ile-Ife between June 1 1998 and May 31 1999. It also included all referred cases that had not developed complications secondary to treatment offered at the referral hospital.

It was a prospective study and the duration was a year.

EXCLUSION CRITERIA

Motorcycle accident patients presenting with complications secondary to treatments that has been given in other hospitals were excluded from the study.

METHODOLOGY

All patients that came to the hospital through the accident and emergency unit between June 1 1998 and May 31 1999 who were victims of motorcycle accidents were fully assessed according to the pro-forma that has been formulated to that effect. Copies of this pro-forma were already in the accident and emergency ward. These initial assessments were made most times by the author who would have been informed by the orthopaedic resident on call. Nevertheless, whenever the author could not attend to the patient personally, the residents, who were already trained on how to complete the form assisted in doing so.

Resuscitation was carried out as necessary. Investigations and the subsequent management were done as required. The author participated in these procedures as much as it was practicable. However, because the study was done in two hospitals, situated in different towns that are thirty kilometres apart, the author could not personally participate in the management of some of the patients. Nevertheless, as soon as possible the author visited these patients to re-administer the pro-forma to them. Investigations were done based on the evaluation of the clinical status and the need for them. Microscopy culture and sensitivity of wounds were carried out only if the wound showed signs of infection.
Where facilities and the manpower needed for managing a patient were not obtainable in Obafemi Awolowo University Teaching Hospitals Complex, such patient was referred. Some of these patients at times requested such referrals for personal reasons. Such requests were granted. All patients managed at Obafemi Awolowo University Teaching Hospitals Complex were followed up for one year with a view to highlighting their morbidity and mortality. The eventual outcome of all patients in the study were reviewed and recorded as any one of six possible outcomes: satisfactory; unsatisfactory; discharge against medical advice; lost to follow up; referred and dead. A satisfactory outcome is one in which the patient is fully recovered after a year of follow up but if the patient still has complications either as a result of the initial injury or the subsequent treatment the outcome is deemed unsatisfactory. A patient is said to be lost to follow up if he/she defaults from the clinic before one year. Clinical, operative and post mortem findings were used in ascertaining the final and correct diagnosis.

METHOD OF PRESENTATION AND DATA ANALYSIS

The result of the study was presented as tables and diagrams. The tables included the frequency distribution showing the frequency of the specific characteristics and contingency table showing the correlation of characteristics. The diagrammatic presentation of the data was in the form of histograms, line diagrams; scatter diagrams, bar diagrams, pie charts etc.

Analysis was by the determination of the standard deviation, the mean, mode median, and proportions. The level of statistical significance using chi-square or student's T-test were all determined at \( p < 0.05 \). These determinations were made using EPI -Info and SPSS data analysis software.
RESULT

Eleven thousands, four hundred and seventy three patients were attended to at the accident and emergency wards of the Obafemi Awolowo University Teaching Hospitals Complex, Ile Ife between June 1 1998 and May 31 1999. 682 or 5.9% of these were road traffic accident victims. 145 or 21.3% of these road traffic accident victims were due to motorcycle accidents and 115 or 79.3 % of these had injuries that involved the limbs. 59 (51%) and 56 (49%) patients with limb injuries sustained from motorcycle accidents were seen at the Ife State Hospital Ile - Ife and the Wesley Guild Hospital Ilesa respectively.

Age and sex incidence

There were 85 (74%) males and 30 (26%) female patients in the study, a male to female ratio of 2.8:1. Table 2 shows the relationship between the patient’s sex and his/her mode of involvement in the accident. All the female victims were either pedestrians or passengers; none was injured as a rider. This association between the sex of the patient and their mode of involvement was highly significant (P=0.00000036).

Because one of the patients was brought in unconscious to the accident and emergency department and she later died without regaining consciousness, the ages of only 114 patients were known. It ranged from 2 to 79 years. The mean was 31.88 ± 16.65 years while both the median and the mode were 32 years. With 23.7% of the patients, the age group 20-29 years was the most commonly injured in motorcycle accidents.

Table 2: Frequency distribution of the patients’ mode of involvement and sex.

<table>
<thead>
<tr>
<th>Mode of involvement</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Riders</td>
<td>48</td>
<td>0</td>
<td>48</td>
</tr>
<tr>
<td>Passengers</td>
<td>24</td>
<td>17</td>
<td>41</td>
</tr>
<tr>
<td>Pedestrians</td>
<td>13</td>
<td>13</td>
<td>26</td>
</tr>
<tr>
<td>Total</td>
<td>85</td>
<td>30</td>
<td>115</td>
</tr>
</tbody>
</table>
The average ages of the three modes of involvement were: pedestrians = 28.2, riders = 32.5 and passengers = 33.6 years. There is a significant association between the patients’ age group and their mode of involvement (P=0.000077). The patient is more likely to be a pedestrian in the extremes of life (0-19 years, then 50 years and above) while he is apt to be a rider if his age falls between 20 and 45 years – the active years. In fact, no patient was involved as a rider in the two extreme age groups (0-9 and 70-79). This difference in the age group incidence of the mode of involvement is illustrated in figure 2.

Figure 2: Age group and mode of involvement of the patients

On the other hand, figure 3 showed the relationship between sex and age group involvement: the accidents involved more males than females in every other age group except the 0-9 years age group which showed female prevalence. While the male age group frequency distribution showed a bell shaped pattern, the female distribution demonstrated a more uniform pattern. 2/3rd of the patients were less than 40 years old.
The dominant hand and the occupation

*Dominant hand:* The dominant hand of 111 patients was known, 102 (92%) were right-handed while 9 (8%) were left-handed. Two of the remaining four patients whose dominant hand was not known died without regaining consciousness while the other two were young children who had not exhibited any hand dominance. There was no significant association between the dominant hand and the side of the body involved or the limb injured.

*Occupation:* 31 (27%) of the 115 patients were students and they formed the largest group involved in motorcycle accidents, they were followed by artisans 15 (13.1%), okada riders and junior civil servants 13 (11.3%) each, farming, trading, driving and senior civil servants followed in descending order of frequency. Most of these people belonged to the lower class both economically and socially and they were mostly self-employed. Even though only 13 were formally employed as okada driver, another 21 were using their motorcycle for commercial purposes when the accident occurred.
The hourly, daily and monthly incidence.

The hourly variations in the occurrence of the motorcycle injuries are shown in figure 4, which shows 2 and 4pm as the time of the day during which most motorcycle accidents occurred; a slightly lower incidence was shown between 6.00pm and 7.59pm. No accident happened between 10.00pm and 5.00am. Certain types of accident tended to be more frequent at some specific times of the day, for example; 70% of the collisions between motorcycles occurred between 7pm and 8 p.m. The majority of the patients who sustained their injuries from 4.00pm onward delayed for more than 12 hours compared to those who sustained their injury earlier in the day. This delay in presentation between these two periods was statistically significant (P=0.0065). This significance was lost when the patients were further stratified on the basis of whether or not the accidents occurred out of town.

Figure 4: Time of occurrence of the accidents
More accidents occurred on Thursdays, Fridays and Saturdays (52.2%) than in the rest of the week combined (Figure 5). When severity of the injury was compared with the day of the week on which the accident occurred, the injuries sustained by the patients were likely to be more severe when the accidents occurred on the weekends. This difference was statistically significant (P=0.042).

![Figure 5: Presentation of MCA patients at OAUTHC Ile-Ife by the day of the week.](image)

The monthly distribution of accident and emergency ward attendance, road traffic accidents, and motorcycle accidents involving the limbs are shown in figure 6. The accident and emergency ward attendance exhibited an increase from January and peaked in June, showed a slight fall and subsequently maintained roughly the same rate till November when it fell again. A similar picture was exhibited by the attendance of road traffic accident and motorcycle accident victims in the casualty, but in August, these two
causes of trauma showed a reduction in incidence that was not reflected in the total casualty attendance.

As shown in figure 6, more patients had their injuries in June (22, 19%) than in any other month. 72 out of the 115 patients (63%) had their accidents in just four months (June, July, September and October). There was an unexpectedly low incidence in August with just five cases recorded. Again, not many patients were seen from December 1998 to March 1999 (9 patients throughout), the period when Resident Doctors were on strike.

![Graph showing monthly distribution of A&E attendance, RTA and MCA victims at OAUTHC, Ife-Ife.](image)

**Figure 6: Monthly distribution of A&E attendance, RTA and MCA victims at OAUTHC, Ife-Ife.**

**Accident parameters**

*Accident site*: 40 (35%) and 55 (48%) of the patients had their accidents in Ile-Ife and Ilesa environs respectively while the others were referred from other towns. 91 (79.1%) patients had their injuries in urban settings while the remaining 24 (20.9%) patients were involved in accidents that occurred on intercity roads. There was a
significant association between the site of the accident and the severity (P=0.041) for example, 22 (95.7%) of the 23 patients who were injured in intercity accidents had major injuries compared to 45(74.7%) of the 68 patients with injuries sustained in urban settings. In motorcycles that had more than one person riding on them, the intercity accident was also more likely to injure both passengers on the motorcycle when compared with accidents in urban setting. This difference is statistically significant (P=0.0032). However, no significant association was found between the accident site and the type of collision.

**Type of machine**: 96 (83.5%) of the accidents involved motorcycles while the remaining 19 (16.5%) involved motor scooters. There was no moped accident. There was no significant association between the type of machine involved in the accident and the severity of the injury.

**Mode of involvement**: 48 (41.7%) were riders, 41 (35.7%) passengers and the remaining 26 (22.6%) were pedestrians. There were no significant association between the mode of involvement and the following: limb injured (whether upper or lower limb), laterality or severity of the injury.

**Luggage carriage**: Of the 89 patients that were involved as either passenger or rider, the motorcycle was carrying load in 33 (36.7%) of them while in the remaining cases, it was not.

**Number of passengers on the machine**: In 26 (29.2%) cases, the patients were the sole passenger on the motorcycle. There were two and three persons on the machine in the remaining 55 (61.8%) and 8 (9%) cases respectively. The passenger rather than the rider is more likely to be injured when the motorcycle is carrying more than one person (P=0.01). However, there were no significant associations between the number of patients on the machine and the type of collision, the severity of the injuries sustained or the outcome of their treatment. On the other hand, more than 90% of certain unusual types of crashes
such as when the foot is caught in the bike’s wheel spoke or the loss of control by the rider after entering potholes occurred only when two or three persons were on the bike.

The type of collision: Of the 115 patients in the study, 52 (45.2%) were due to collisions between motorcycles and motor vehicles. Pedestrian injuries occurred in 26 (22.6%) patients and collisions between two motorcycles happened in 10 (8.7%) cases. Other types of collisions occurred when the motorcyclist entered potholes and lost control (9 patients), or he simply lost control and ran off the road (6 patients) or the heel of the patient might have been caught in the wheel spokes. 2 riders collided with animals on the road. Further analysis of the accidents involving motor vehicles and motorcycles showed that 44 of the 52 cases involved moving vehicles, 2 collided with stationary vehicles while in the remaining 6, the motorcycle collided with car doors that were unexpectedly opened in front of it.

There was a significant association between the type of collision and the severity (P=0.015). Likewise, in cases involving motorcycles with multiple passengers, there was an association between the type of collision and the likelihood of injuries to everyone on the bike (P=0.00029): collisions between two motorcycles showed the greatest propensity towards simultaneous injuries to both occupants of the machine.

The limb injured is also significantly associated with the type of collision (P=0.014). Collisions between motorcycles were more likely to affect both the upper and the lower limbs together while the lower limb was predominantly involved in collisions with motor vehicles.

Type of garment: 89 patients were involved in the accidents as either passengers or riders, of these 35 (40.3%) patients were wearing loose garments while the remainders wore compact dresses that will not flap or billow out while riding. 89.2% of the 35
patients that were wearing flowing dresses at the time of accident sustained severe injuries compared with 70.9% in those wearing compact dresses.

**Alcohol use:** All the patients were asked if the motorcycle rider who was involved in their accidents was drunk, only 101 of them could respond with certainty, 16 (15.9%) of these reported the rider as being drunk. 9 or 56.3% of these patients were involved as riders while 5 (31.3%) and 2 (12.6%) were involved as pedestrians and passengers respectively. When one compares this proportion with that for all 115 patients (rider = 41.7%, passenger = 35.7% and pedestrians = 22.6%), it reveals the greater relative vulnerability of pedestrian to drunken motorcyclists. On the other hand, passengers appeared to be well protected from drunken motorcyclists, in fact, the two passengers who were injured here were also inebriated at the time. This seeming protection may be because a sober passenger may be very unwilling to ride along with a drunken rider. Accidents involving drunken motorcyclist were also more common at certain times of the day, for example, 10 of the 16 accidents involving drunken cyclists occurred between 6.00pm and 7.59pm. Saturdays had the highest incidence of drunken driving with 35.5% of the patients reporting their rider drunk; none was recorded on Wednesdays while only 10% reported such on Sundays, however, this association was not significant.

**Injury parameters**

The 115 patients in the study sustained 267 types of injuries. This gives an average of 2.3 injuries per patient.

**Limb injured:** 25 (21.7%) patients injured the upper limb, 76 (66.1%); the lower limb and the remaining 14 (12.2%) had injuries involving both the upper and the lower limbs.

**The side of the body injured (Laterality):** Of the 115 patients, 60 (52.2%) injured the left limb, 46 (40%) the right limb, while the remaining 9 (7.8%) injured both limbs.
Table 3 shows the distribution of the laterality of the mode of involvement of the patients and also the limb injured. The left limb was predominantly involved in riders and passengers the percentage being almost equal in both cases (56.3% left side occurrence for riders and 56.1% for passengers), but for pedestrians, the right was injured more; furthermore, pedestrians had the highest rate of bilaterality (15.4%). Overall, the laterality is more evenly distributed among the pedestrians than in any other mode of involvement. The laterality of the particular limb injured was also explored; the left side was predominantly involved when the injury occurred on the lower limb and vice versa for the upper limb.

Table 3: The effect of the limb injured and the mode of involvement on the laterality.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Laterality</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Left (%)</td>
<td>Right (%)</td>
<td>Both sides (%)</td>
<td>Total</td>
</tr>
<tr>
<td>Lower limb</td>
<td></td>
<td>44 (57.7)</td>
<td>28 (36.8)</td>
<td>4 (5.3%)</td>
<td>76 (66.1)</td>
</tr>
<tr>
<td>Upper limb</td>
<td></td>
<td>10 (40.0)</td>
<td>15 (60.0)</td>
<td>- (0.0)</td>
<td>25 (21.7)</td>
</tr>
<tr>
<td>Both limbs</td>
<td></td>
<td>6 (42.9)</td>
<td>3 (21.5)</td>
<td>5 (35.6)</td>
<td>14 (12.2)</td>
</tr>
<tr>
<td><strong>Total I</strong></td>
<td></td>
<td><strong>60 (52.2)</strong></td>
<td><strong>46 (40.0)</strong></td>
<td><strong>9 (7.8%)</strong></td>
<td><strong>115</strong></td>
</tr>
<tr>
<td>Rider</td>
<td></td>
<td>27 (56.3)</td>
<td>17 (35.4)</td>
<td>4 (8.3)</td>
<td>48 (41.7)</td>
</tr>
<tr>
<td>Passenger</td>
<td></td>
<td>23 (56.1)</td>
<td>17 (41.5)</td>
<td>1 (2.4)</td>
<td>41 (35.7)</td>
</tr>
<tr>
<td>Pedestrian</td>
<td></td>
<td>10 (38.5)</td>
<td>12 (46.2)</td>
<td>4 (15.4)</td>
<td>26 (21.6)</td>
</tr>
<tr>
<td><strong>Total II</strong></td>
<td></td>
<td><strong>60 (52.2)</strong></td>
<td><strong>46 (40.0)</strong></td>
<td><strong>9 (7.8%)</strong></td>
<td><strong>115</strong></td>
</tr>
</tbody>
</table>

Type of tissue injured: Of the 267 injuries sustained by the patients, the skin was involved in 88 (33%), bones in 79 (29.7%), and joints in 34 (11.9%). No patient had a major arterial injury (Table 4). 41 (16.5%) patients also had injuries involving other parts of the body and among these, the head was the region most commonly injured with 32 (12.1%) of all injuries (or 78% of all associated injuries). Other associated injuries like cervical spine injury occurred in 3 patients, chest injury in 2 while 1 patient each had an
associated injury involving the abdomen (splenic rupture), the rectum, urinary tract and the back.

Table 4: Distribution of injuries to the various types of tissues in the limbs.

<table>
<thead>
<tr>
<th>Type of tissue injured</th>
<th>Number of Patients</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skin</td>
<td>88</td>
<td>33.0</td>
</tr>
<tr>
<td>Bones</td>
<td>79</td>
<td>29.7</td>
</tr>
<tr>
<td>Joints</td>
<td>32</td>
<td>11.9</td>
</tr>
<tr>
<td>Muscles</td>
<td>17</td>
<td>6.3</td>
</tr>
<tr>
<td>Tendons</td>
<td>5</td>
<td>1.9</td>
</tr>
<tr>
<td>Nerves</td>
<td>2</td>
<td>0.7</td>
</tr>
<tr>
<td>Other parts of the body</td>
<td>41</td>
<td>16.5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>264</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

(1) Skin injuries: The skin was the most frequently injured tissue with 88 (76.5%) patients sustaining injury to it (Table 4). The patients sustained 181 different skin injuries (2.1 skin injuries/patient). Laceration was seen in 48 (26.5%), bruises in 45 (24.9%), abrasions in 39 (21.5%) and avulsions in 16 (8.8%) patients. 6 (3.4%) patients sustained puncture wounds.

The fractures: Bone was the second most commonly injured tissue. It was injured in 79 patients (Table 4). Most patients with fractures (46; 58.2%) had single bone involvement while 29 (36.7%) had fractures involving two bones. 3 (3.8%) patients had fractures involving 3 bones while the remaining one (1.3%) had a 5 bone involvement. Therefore, with a total of 118 fractures in these patients, the average number of fractures per patient is 1.5. However, out of the 32 patients with fractures involving more than one bone, the majority involved both the tibia and fibula (25 patients) or the radius and ulna (5
patients). Since the fracture pattern is usually similar when these two bones in the same segment were involved, their patterns will be described as if it were for one fracture.

(a) **Bones involved** (Table 5): The tibia and the fibula were fractured together in 25 of the 79 patients with fractures. In addition, the tibia alone was fractured in 7 patients making a total of 32 (40.5%) patients with tibia fractures – thus making tibia fractures commonest, however, there was no patient in which the fibula alone was fractured. The femur was fractured in 25 (31.6%) of the 79 patients, the pelvis and the ulna in 7 patients each, the humerus and the radius in 6, and the clavicle in 4 patients respectively. Please note that in the table, the second column divides the fracture pattern according to the segment of the limb involved. This enables one to appreciate how differently the bones in each segment were involved. The sum of these fractures is 87, whereas only 79 patients had fractures; this difference reflects those patients with multiple fractures involving different limbs or different regions of the same limb. The third column on the other hand grouped the fractures according to the individual involvement of the bone, this highlights how often each bone was involved and the total gives the actual number of bones fractured.).

<table>
<thead>
<tr>
<th>Bone</th>
<th>Grouping by the segment of the limb involved</th>
<th>Grouping by individual bone involvement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Segment</td>
<td>Patients</td>
</tr>
<tr>
<td>Femur</td>
<td>Thigh</td>
<td>25</td>
</tr>
<tr>
<td>Tibia</td>
<td>Alone</td>
<td>Leg</td>
</tr>
<tr>
<td></td>
<td>Both bones Together</td>
<td>Leg</td>
</tr>
<tr>
<td>Bone</td>
<td>Affected Part</td>
<td>Alone</td>
</tr>
<tr>
<td>--------------</td>
<td>---------------</td>
<td>-------</td>
</tr>
<tr>
<td>Fibula</td>
<td>Leg</td>
<td>0</td>
</tr>
<tr>
<td>Humerus</td>
<td>Arm</td>
<td>6</td>
</tr>
<tr>
<td>Radius</td>
<td>Forearm</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Both bones</td>
<td>5</td>
</tr>
<tr>
<td>Ulna</td>
<td>Forearm</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Pelvis</td>
<td>7</td>
</tr>
<tr>
<td>Clavicle</td>
<td>Shoulder girdle</td>
<td>4</td>
</tr>
<tr>
<td>Patella</td>
<td>Knee</td>
<td>2</td>
</tr>
<tr>
<td>Scapular</td>
<td>Shoulder girdle</td>
<td>1</td>
</tr>
<tr>
<td>Metatarsal</td>
<td>Foot</td>
<td>1</td>
</tr>
<tr>
<td>Phalanges</td>
<td>Hand</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>87</td>
</tr>
</tbody>
</table>

(b) **The nature of the fractures:** Of the 79 patients with fractures, 52 (65.8%) had closed fractures, 24 (30.4%) open and the remaining 3 (3.8%) sustained both types of injuries to different bones. The commonest type of open fracture sustained was Gustillo Anderson type G-2 seen in 8 out of the 24 patients with open fractures. This was followed by G-3A and G-3B with 7 patients apiece, G-1 with 5 patients and G-3C with 1 patient involved. The majority of these open fractures involved the tibia and the fibula together (18 of 27 patients); and then the femur, involving 5 out of 27 patients, the tibia alone seen in 3 patients and the phalanges of the thumb and index finger of the left hand in 1 patient. Table 6 shows the distribution of open fractures, the bones that are affected and the proportion of all the fractures involving each bone that were open. It shows that among long bones, the tibia and the fibula, 72% fractures of which were open, had the greatest tendency of being open. The wrist was the only joint, which suffered open injury, and this was observed in 2 out of the 3 cases of wrist dislocations seen.
Table 6: Distribution of open fractures and the bones involved

<table>
<thead>
<tr>
<th>Bone or joint</th>
<th>Number (a)</th>
<th>Open (b)</th>
<th>Closed</th>
<th>Percentage open (b/a x 100)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phalanges (hand)</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>Tibia &amp; fibula</td>
<td>25</td>
<td>18</td>
<td>7</td>
<td>72</td>
</tr>
<tr>
<td>Wrists</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>67</td>
</tr>
<tr>
<td>Tibia alone</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td>60</td>
</tr>
<tr>
<td>Femur</td>
<td>25</td>
<td>5</td>
<td>20</td>
<td>25</td>
</tr>
</tbody>
</table>

The joint injuries: 34 (29.5%) patients sustained 50 different injuries to the joints. The knee (13, 38.3% of involved joints) was most frequently involved, followed by both the ankle and the hip joints that were involved in 4 (11.8%) patients each. The elbows and the wrists were each injured in 3 (8.8%) patients while the acromioclavicular and the sacroiliac joints each was involved twice (5.9%). The Symphysis pubis, shoulder and the upper radioulna joints had one (2.9%) involvement each. 18 (52.9%) patients had single joint injury, 15 (44.2%) had two while the remaining one (2.9%) had injuries to three joints for a total of 51 injuries and an average of 1.7 joint injuries per patient. Intra-articular fractures seen in 16 (32% of the joint injuries) patients was the commonest form of joint injury, haemarthrosis followed with 14 (28%) patients injured. 13 (26%) and 8 (14%) patients had dislocations and subluxations respectively. Only two cases of open dislocations were recorded in this study, both were severe (G-3A & G-3B) and both involved the wrist joint.

Investigations

Packed cell volume (PCV) was checked in 112 of the 115 patients, 17 (15.2%) of these were less than 30%. Plain x-ray was done in 104 patients; 77% of these films showed positive pathology, but the positive rate of the plain radiology of the head was only 17% (3 of 17 patients). 65 patients had grouping and cross matching done while microscopy, culture and sensitivity was done in 19 patients, Staphylococcus aureus,
isolated in 5 patients, was the commonest isolate. Two patients went for abdominal ultrasound, one for both pelvic and abdominal ultrasound. This same patient, who had urethral injury, also had a sinogram and a retrograde cystourethrogram.

**Treatment**

In this study only 8 of the 115 patients (6.9%) had any form of first aid treatment at the accident sites. These treatments were directed in most cases at stopping haemorrhage, and this was accomplished most often with strips of torn clothing and tourniquet. But the vast majority of these patients had their first form of treatment only when they got to the hospital. A patient brought in by “good Samaritans” was almost exsanguinated by an actively bleeding leg wound. This patient was eventually transfused with six pints of blood – the highest in the study.

Thirty-one of the patients were referred to this hospital after the initial resuscitation at the referral hospitals. 15 out of these 31 patients were referred from out of town while the remaining 16 sustained their injuries in either Ile-Ife or Ilesa but were initially taken to other hospitals within the town and were subsequently referred. Thus, 84 out of the 100 patients that sustained their injuries in both Ilesa and Ile-Ife were brought directly to the teaching hospital. Of these, 65 (77.4%) were brought to the hospital within 2 hours, 11 or 13.1% at 3-4 hours, 2 (2.4%) between 5 and 6 hours, and 4 (3.6%) between 7 and 24 hours. Only 2 were seen after 24 hours, one coming 12 weeks after sustaining the injury.

Five hundred and forty four different forms of treatment were offered the patients. These were made up of surgery in 61 patients (11.3% of the treatments given), manipulation under anaesthesia (MUA) in 47 patients (8.6% of the treatments given). 89 patients (16.4% of the treatments given) had anaesthesia, 86 patients (15.8% of the treatments given) had one form of external splinting or the other, 85 patients (15.6% of
the treatments given) had tetanus immunoprophylaxis and 79 patients (14.5% of the treatments given) antibiotics while wound dressing was offered to 78 patients (14.3% of the treatments given) and 19 patients (3.5% of the treatments given) were transfused with blood. The average number of treatments given per patient is 4.7 but these ranged from one to eight.

(1) Reduction: Reduction of fractures was achieved by either manipulation under anaesthesia (MUA) or by open reduction. 18 patients had open reduction while 45 had MUA.

(2) Splinting: A total of 92 splints were offered the 86 patients who had external immobilization as part of their treatment. The majority of these patients (53, 57.6%) had POP applied, 28 patients (30.4%) were put on tractions, 5 (5.4%) patients had external fixation while 6 (6.6%) had figure of eight bandaging. Of the 28 patients who had traction, 7 were skeletal while 21 were skin tractions. 6 of the 86 patients had more than one form of external splint applied. 25 patients also had collar & cuff for supplementary upper limb support.

The mean duration of immobilization in splints was 53.5 ± 41.6 days while it ranged from 7 to 257 days. Table 7 shows the long duration of immobilization associated with open fractures when compared with closed fractures and of lower limb fractures when compared with upper limb fractures. It also highlights the duration of immobilization for fractures of the bines shown.
Table 7: The means and the range of duration of immobilization of the different types of fractures.

<table>
<thead>
<tr>
<th>Fracture</th>
<th>Number</th>
<th>Means (Days)</th>
<th>Range (Days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall</td>
<td>69</td>
<td>53.5 ± 41.6</td>
<td>7-257</td>
</tr>
<tr>
<td>Open</td>
<td>21</td>
<td>103 ± 62.7</td>
<td>24-257</td>
</tr>
<tr>
<td>Closed</td>
<td>38</td>
<td>47.4 ± 40</td>
<td>7-240</td>
</tr>
<tr>
<td>Upper limb</td>
<td>19</td>
<td>36.7 ± 36.7</td>
<td>14-77</td>
</tr>
<tr>
<td>Lower limb</td>
<td>55</td>
<td>66.8 ± 51.7</td>
<td>7-257</td>
</tr>
<tr>
<td>Femur</td>
<td>13</td>
<td>46.5 ± 46.5</td>
<td>7-156</td>
</tr>
<tr>
<td>Tibia</td>
<td>16</td>
<td>87.6 ± 52.3</td>
<td>42-257</td>
</tr>
<tr>
<td>Humerus</td>
<td>4</td>
<td>49.0 ± 28.5</td>
<td>21-77</td>
</tr>
<tr>
<td>Radius &amp; ulna</td>
<td>6</td>
<td>41.5 ± 14.8</td>
<td>14-56</td>
</tr>
</tbody>
</table>

A further breakdown of surgical procedures offered the patients is shown in table 8, and it shows that debridement and primary wound closure each carried out in 30 (29.4%) patients were the two commonest surgical procedures offered the patients while open reduction and internal fixation (ORIF) was the procedure of choice in 18 (17.6%) patients. These procedures were carried out under anaesthesia. Local anaesthetic was offered to 31 patients, general anaesthesia to 50 patients while 15 patients had their procedure under analgesia and sedation.

Table 8: The choice of surgical procedures done for the patients.

<table>
<thead>
<tr>
<th>Choice of Procedure</th>
<th>Number of Patients</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Debridement</td>
<td>30</td>
<td>29.4%</td>
</tr>
<tr>
<td>Primary closure</td>
<td>30</td>
<td>29.4%</td>
</tr>
<tr>
<td>ORIF</td>
<td>18</td>
<td>17.6%</td>
</tr>
<tr>
<td>Secondary closure</td>
<td>8</td>
<td>6.9%</td>
</tr>
<tr>
<td>Tendon repair</td>
<td>5</td>
<td>4.9%</td>
</tr>
<tr>
<td>Skin grafting</td>
<td>3</td>
<td>2.9%</td>
</tr>
<tr>
<td>Patelllectomy</td>
<td>2</td>
<td>2.0%</td>
</tr>
<tr>
<td>Above knee Amputation</td>
<td>1</td>
<td>1.0%</td>
</tr>
<tr>
<td>Other surgeries</td>
<td>7</td>
<td>5.9%</td>
</tr>
<tr>
<td>Total</td>
<td>104</td>
<td>100.0%</td>
</tr>
</tbody>
</table>
Many patients had surgery on more than one occasion: the maximum number of times a patient had to have surgery was four in two patients. Three patients went for surgery thrice, 11 for two times while 50 went for surgery only once. Many patients had more than one type of surgical procedures: 2 had 4 different procedures, 6 had 3 procedures, and 20 had 2 procedures while the remaining 38 had just one procedure for a total of 104 procedures.

The femur accounted for 11 out of the 18 cases of ORIF, the tibia and the humerus for 2 each. The wrist, pelvis and the ulna each accounted for just one case. 5 patients had ORIF with K-nails, 3 with condylar blade plates while 2 each had Austen-Moore prosthesis, dynamic compression plates (DCP), Steimann’s pins and Kirchner wires. The last two had either a Jewett plate or lag screws.

Other treatments: 79 of the 115 patients were given antibiotics. The commonest antibiotics used were ampicillin and cloxacillin. But cefuroxime was the commonest peri-operative antibiotic used.

19 of the 115 patients were transfused with blood (all were given whole blood), of these, 11 were transfused with 2 units of blood, 6 with 3 units while one patient each was transfused with 4 and 6 units of blood.

Complications of treatment

Of the 115 motorcycle accident victims with limb injuries treated in the hospital within the study period, only 94 were followed up for one year. The remainders discharged themselves against medical advice, died or were referred to other hospitals for treatment. 67 (71.3%) of these patients had complications.

Two hundred and fifty six complications were seen after treatment, a frequency of 2.2 complications per patient, it however ranged from 0 to 8 per patient. Furthermore some of these complications overlapped considerably e.g. many patients with
muscle weakness also had muscle atrophy. As table 9 shows, joint stiffness was the commonest of the complications (60; 63.8% of the patients). Muscle weakness was next with 47 (50.0%) patients affected. Wound infection occurred 15 (16.0%) of the patients. Delayed union, malunion and non-union were seen in 15 (16.0%), 8 (8.5%), and 4 (4.3%) of the patients respectively. Limb deformity and osteomyelitis developed in 13 (13.8%) and 4 (4.3%) patients respectively. One of the patients who sustained multiple fractures and was treated conservatively refractured the femur while ambulating on crutches in the ward just before discharge. The tibia and the fibula have the highest rate of complications (85 of 239 bone and joint complications). If the 13 complications recorded in the 5 patients with fracture of the tibia alone are taken into consideration, then the tibia becomes the bone with the most complications.

Table 9: Complications of treatments.

<table>
<thead>
<tr>
<th>Complications</th>
<th>Number of Patients</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>% of patients</td>
</tr>
<tr>
<td>Joint stiffness</td>
<td>60</td>
<td>63.8</td>
</tr>
<tr>
<td>Muscle weakness</td>
<td>47</td>
<td>50.0</td>
</tr>
<tr>
<td>Limb oedema</td>
<td>31</td>
<td>33.0</td>
</tr>
<tr>
<td>Muscle atrophy</td>
<td>25</td>
<td>26.6</td>
</tr>
<tr>
<td>Wound infection</td>
<td>15</td>
<td>16.0</td>
</tr>
<tr>
<td>Delayed union</td>
<td>15</td>
<td>15.0</td>
</tr>
<tr>
<td>Deformity</td>
<td>13</td>
<td>13.8</td>
</tr>
<tr>
<td>Shortening</td>
<td>11</td>
<td>11.7</td>
</tr>
<tr>
<td>Malunion</td>
<td>8</td>
<td>8.5</td>
</tr>
<tr>
<td>Nerve palsy</td>
<td>5</td>
<td>5.3</td>
</tr>
<tr>
<td>Hypertrophic scar</td>
<td>5</td>
<td>5.3</td>
</tr>
<tr>
<td>Non union</td>
<td>4</td>
<td>4.3</td>
</tr>
<tr>
<td>Osteomyelitis</td>
<td>4</td>
<td>4.3</td>
</tr>
<tr>
<td>Tendon lesion</td>
<td>4</td>
<td>4.3</td>
</tr>
<tr>
<td>Plaster sore</td>
<td>3</td>
<td>3.2</td>
</tr>
<tr>
<td>Reaction to skin traction</td>
<td>2</td>
<td>2.1</td>
</tr>
<tr>
<td>Wound breakdown</td>
<td>2</td>
<td>2.1</td>
</tr>
</tbody>
</table>
The knee joint developed stiffness in 36 of 74 patients while the ankle was stiff in 21 of them. The most commonly involved joint in the upper limb was the wrist with 6 patients involved. Other involved joints were the elbows (5 patients), the hips and the shoulders (3 patients each).

**Duration of hospitalisation**

Ninety out of the 115 patients were offered admission, 14 of these eventually discharged themselves against medical advice leaving 76 patients who were admitted for an average of 30.2 days. The duration of admission ranged from 1 to 154 days.

**Outcome**

After one year of follow-up, 59 or 51.3 % of the patients had a satisfactory outcome while 26 or 22.6 % of the patients’ outcome were not satisfactory based on persistence of complications at one year of follow-up. 14 (12.2%) of them discharge themselves against medical advice, 9 (7.8%) were lost to follow-up, 4 (3.5%) died, and the remaining three (2.6%) were referred to other hospitals. One of these had a head injury that needed neurosurgical care and was referred to UCH, Ibadan. The other two requested referral to the National Orthopaedic Hospital, Igbobi and Enugu for nearness to their family.

The patients who discharged themselves against medical advice gave various reasons for doing so. These ranged from inability to afford the cost of treatment given by 11 of the 14 patients to preference for traditional bonesetter treatment by two
patients. One patient actually discharged himself against medical advice rather than accept surgery.

**Mortality analysis (Table 10)**

Four out of the 115 patients died during treatment. 3 of them were involved as passengers while the last one was a rider. (There were more than one person on the bike in all the fatal accident cases). All the accidents occurred on highways and were collisions with moving vehicles, all their co-passengers were injured, three of them fatally. Two had Glasgow Coma Scale score below six, they both died within 5 hours of admission in the casualty; the other two’s score were fifteen, one of them died two days after admission in the casualty recovery room from respiratory failure from phrenic nerve paralysis while the remaining one died 10 days after admission in the ward. All of them had multiple injuries involving more than one region of the body; three had cervical spine injury, two had head injuries and one had chest injuries as associated injuries.
### Table 10: Mortality analysis

<table>
<thead>
<tr>
<th>Age</th>
<th>Sex</th>
<th>Duration of admission</th>
<th>Injury</th>
<th>No of Regions</th>
<th>Limb</th>
<th>GCS</th>
<th>Accident site</th>
<th>Mode involved</th>
<th>Collision type</th>
<th>Cause of death</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not Known</td>
<td>M</td>
<td>5Hrs</td>
<td>Cervical #, Intra cranial injury, # femur, open wrist dislocation, scalp avulsion.</td>
<td>5</td>
<td>Both</td>
<td>5</td>
<td>Highway</td>
<td>Passenger</td>
<td>Moving vehicle</td>
<td>Massive intracranial injury</td>
</tr>
<tr>
<td>70</td>
<td>M</td>
<td>10days</td>
<td>Flail chest, Haemothorax, Upper limb contusion.</td>
<td>2</td>
<td>Lower</td>
<td>15</td>
<td>Highway</td>
<td>Passenger</td>
<td>Moving vehicle</td>
<td>Post mortem not done</td>
</tr>
<tr>
<td>35</td>
<td>F</td>
<td>&lt;1Hr</td>
<td>Head injury, C 4 cervical #, humeral #</td>
<td>2</td>
<td>Upper</td>
<td>3</td>
<td>Highway</td>
<td>Passenger</td>
<td>Moving vehicle</td>
<td>Respiratory paralysis due to cervical spine injury</td>
</tr>
<tr>
<td>42</td>
<td>M</td>
<td>2days</td>
<td>C5-6 Cervical subluxations, Quadriplegia, Forearm #.</td>
<td>2</td>
<td>Upper</td>
<td>15</td>
<td>Highway</td>
<td>Rider</td>
<td>Moving vehicle</td>
<td>Respiratory paralysis</td>
</tr>
</tbody>
</table>
SUMMARY OF FINDINGS

Lower limbs were injured more than the upper limbs in this study. They also have a higher percentage of open fractures.

When Pedestrians and motorcycle occupants (riders and passengers) are compared, the following facts emerged: (1) Pedestrians are younger, (2) They have a more evenly distributed left/right side involvement, in contrast, motorcycle occupants predominantly injured their left lower limbs and their right upper limbs. The injuries sustained in this study appear to be less severe than reported in studies from the technologically advanced countries. This is evidenced by the absence of traumatic amputation involving long bones, the lower rate of surgical amputation and the fact that no patient sustained any major arterial injury.

Motorcycle accident is a significant health problem in this country. Because it often present as an emergency, the demand it places on the available health care facility may be more than can be provided by most primary, secondary and private hospitals.

5) Motorcycle accidents predominantly affect people in the prime of life.

6) Only a small percentage of the patients were using protective devices at the time of accident. None were wearing helmets at the time of accidents. Driving practices was also bad in some of the patients – some were carrying more than two passengers or their headlights were not put on at night when the accidents occurred. The driving conditions were also less than ideal when the accident occurred; potholes and stray animals were the causes of some of the accidents.

7) Treatment is prolonged and morbidity high.
8) A disproportionately large proportion of the fatal cases had head and cervical injuries.
DISCUSSION

Traditionally, the pattern of injuries in Africa has always been as a result of such natural causes as falls, mauling by wild animals and injuries from tribal warfare such as head injuries from hauled stones, stab wounds from daggers and penetrating wounds from arrows. But a different pattern of accident has emerged with the advent of western education and technology. One of the chief causes of this changing pattern is the road traffic accident of which motorcycle accident is an important component.

In this study, road traffic accidents constitute 5.9% of all accident and emergency attendance. 1.3% of these were injured victims of motorcycle accidents. This small percentage of total accident and emergency that is made up of motorcycle accidents agrees with the 1.69% reported by Ross in England. Motorcycle accidents also made up 21.5% of all cases of road traffic accidents in the study. The proportion of road traffic accident victims made up of motorcycle accidents published in literature ranges between 9.36% and 35%.

These different values may be due to the varied inclusion criteria employed by the authors, whereas some included pedestrian accidents due to motorcycle in the motorcycle accident category, others made a different category for all pedestrian injuries including those due to motorcycle accidents, while a few others were silent on this. Both Ross in England and Asogwa in Nigeria separated the two categories reporting 9.36% and 11.51% respectively. In contrast, Oyemade in Ibadan and Norman in England reported 18.0 and 17.3% respectively; both considered the two causes together.

Motorcycle accidents can occur at any age, but mostly the young adult is involved. In this study, the peak age was 20-29 years. This is in agreement with the 18-30 years peak period reported by Odelowo and the 25-29 years by Asogwa, both in Nigeria.
However, this is slightly higher than those published from the technologically advanced countries. Haddad reported a 16-25-peak age-group while Kumar reported 10-19 years as the peak years. The reason for the older age of peak occurrence in this environment may be due to a delayed access to motorcycle.

All over the world, women and children form a disproportionately large proportion of pedestrian victims. This is borne out in this study; 50% of the pedestrians in this study were females and 45.9% were children below fourteen years. It is worthy of note that the only age group in which females outranked males is the 0-9 year age group, a finding that agreed with similar findings by Oyemade in Ibadan in the age group 5-14 years. Female children mature earlier than their male counterparts, and hence are wont to be active earlier. In addition, girls are more likely to be hawking food on the streets while boys are playing football.

When two or more persons are on the motorcycle, passengers are injured more commonly as shown by the fact that a lower percentage of passengers reported a simultaneous injury to their co-rider than riders. This higher risk of sustaining injuries by the passenger agrees with Bothwell’s published result.

Most published result of daily occurrence of road traffic accidents reported Saturdays and Sundays as days with the highest incidence. However a few authors reported Sunday with a much lower incidence. This study agrees with the last one. A rising trend in daily occurrence started on Thursday and peaked on Saturday. Sundays had a lower incidence. The reason may be because many of the bikes involved are used for commercial commuter services. Therefore on Sundays, the traditional day of rest in this environment, the bikes would not be ridden. More accidents occurred in the afternoon/evening period than at any other time in agreement with most published works. These are the hours of the highest traffic volume when workers will be returning...
from works and students from schools. It is particularly noteworthy that there were no accidents between 10.00pm and 5.00am. This may be because, in the towns where the study took place, people hardly venture out at night unlike the case in more cosmopolitan cities with more lively social night activities. It is also remarkable that more than 70% of collisions between two motorcycles occurred between 6 and 8 pm, a time of the day when the visibility although getting poorer, may still have been bright enough for some of the riders to be tempted not to turn on their headlights. In fact, in four of the seven collisions between two motorcycles, one of the motorcycles involved was without headlight; and in two of the cases involving automobiles; the automobiles had only one headlight on.

In South Western Nigeria, the rainy seasons extend from April to September while the dry seasons are from October to March\textsuperscript{14}. This study confirms Odelowo’s findings that even though the difference was not statistically significant, still more motorcycle accidents occur in the rainy season than in the dry season\textsuperscript{14}. The combination of a wet driving surface, reduced visibility and exposure to the elements makes motorcycle riding when it is raining very hazardous. In this study, there was a dip in the incidence of motorcycle accidents in August; this was also reflected to a lesser extent in the incidence of road traffic accidents but not in the total casualty attendance. An explanation may be that there was a period of intense fuel scarcity in Osun State at that time and this hampered the use of vehicles with consequent reduction in the rate of accidents.

The distribution of the types of collisions in which the motorcycle were involved is comparable with those observed in studies from other countries\textsuperscript{9, 15}. Majority of the accidents in this study were due to collisions with automobiles. In this study, 10 cases of collisions between motorcycles occurred. It is noteworthy that almost all these inter – motorcycle – collisions occurred at dusk when one of them was without headlights. These
episodes highlight the cavalier attitude of the motorcycle riders to the use of various accidents preventing devices on their motorbike.

Alcohol use in these accidents was not very important (15.9%), a fact, which agrees with results of investigation of other authors from this environment\textsuperscript{8, 14} but is at variance with those from developed countries\textsuperscript{5, 12, 16}. This difference may be due to under reporting in Africa and of course lack of basic equipment to do on the spot assessment\textsuperscript{14, 54}.

In literature, the pattern of injuries sustained in motorcycle accidents varied, it depends on the place where the study was done and the inclusion criteria employed. While many authors showed a preponderance of limb injuries\textsuperscript{9, 12, 13, 14, 50}, the proportion differed. It ranged from 40.3\%\textsuperscript{12} to 64\%\textsuperscript{50}. In this study, 79.20\% of the patient had injury to the limbs. This was higher than reported in the literature because all injuries to the limbs, skeletal and soft tissues alike, were included. When patients with fractures alone (i.e. 79) were considered and it was based on all motorcycle accidents injuries that were seen in the casualty (i.e. 145), and not only on those with limb injuries, then the proportion fell to 54.5\% which falls within the range as reported in literature.

There is paucity of studies in the literature reporting on the laterality of limb trauma resulting from motorcycle accidents. Alabi reported 61.4\% and Oguachuba 77.8\% (21 out of 27 patients) right-sided dominance of tibia fractures sustained by the patients in their studies.\textsuperscript{30-42} 30-42\% of these patients were victims of motorcycle accidents\textsuperscript{46, 46}. The reason for such dominance as given by Alabi was that the motorcyclist puts the right leg down after applying the break, which is on the left side\textsuperscript{47}. But in this study, most patient’s injury were on the left side. When the patients were stratified on the bases of their mode of involvement, the left side still predominated in riders (56.3\%), and
passengers (56.1%) of motorcycles but in pedestrians, it fell to 38.5% as against 46.2% for the right side

Most of the accidents were as a result of motor vehicle collisions, majority of which, were from moving vehicles. Many of these may have been due to direct impact bumper injury to the leg of the patient. The cyclist who normally rides close to the edge of the road would have been hit on the left side in the right hand side driving system that is in use in Nigeria. In certain situations however, he may sustain injuries to both limbs – a bumper injury on the left and another injury to the right limb, when the cycle topples to that side. Pedestrians on the other hand may walk on any side of the road depending on their whims, furthermore, they can move across the road in either direction hence, the distribution of fractures in their own case is more evenly spread out among the sides than was obtained among passengers or riders.

In the upper limb, the right side was injured 60% of the time and the left, 40%. In this case the motorcyclist, having been hit by the motor vehicle on the left side, toppled over on to the right, breaking his fall with the upper extremity of that side, thereby injuring it. It is worth mentioning, that none of the patients with upper limb trauma injured both sides together.

Apart from the skin, fractures were the commonest injuries seen. 79 of the patients had fractures. The tibia 40.5% either alone or together with the fibula was most frequently involved, this compares with most reported series in the literature\textsuperscript{9, 12}. The majority of the fractures sustained by the patients were closed (65.8%). This agrees with the 66.9% (107 of 160) reported by Zettas\textsuperscript{13}, but is much less than the 86% (207 of 240) reported by Deaner\textsuperscript{9}. However, Deaner’s series was done on military personnel who by regulation may have been wearing protective clothing with consequently reduced tendency
to injure the skin. 72% of the tibia fractures were open, the highest such proportion among the long bones and is in keeping with most reported series in the literature\textsuperscript{13}.

In this study, the chest and the abdomen were not frequently injured. This confirmed Zettas’ hypothesis that the lack of confining space such as the interior of an automobile alleviated the compressive forces to these resilient structures\textsuperscript{13}.

Even in this study, with an exclusion criterion of all accidents not involving the limbs, the head and face region still formed a sizable proportion. This fact agreed with most reported series. However most of the head injuries recorded here were minor scalp and facial lacerations - only 7 of the patients had intracranial injury, along with another who sustained a fracture of the skull. The Glasgow Coma Scale of the patients were as follows:
Despite the fact that this study is limited to limb injuries from motorcycle accidents, the near absence of associated chest or abdominal injuries and the mildness of most of the associated head injuries do suggest a different pattern of injury resulting from motorcycle accidents from those reported from advanced countries. Haddad reported that 6 out of 10 patients with upper extremity fracture had severe associated injuries which included: basal skull fracture - 2 cases, C6-7 fracture dislocation –1, haemothorax – 2 and one flail chest\(^{12}\). Zettas reported 6 lower limb amputations (one at the scene) while Deaner’s series included 15 amputations that were carried out\(^{9, 13}\). Only one traumatic amputation was recorded in this study and that was of a finger, an above knee amputation was also done for a patient who presented with an already gangrenous foot after staying at home for more than a week after sustaining the injury. It appears, therefore that the injuries sustained by the patients in this present study, on the whole may not be as severe as those reported from advanced countries. A number of reasons may account for this. Kraus and Bothwell believed that the severity of patient’s injury increased with the engine power and the speed of the motorcycles at the point of impact\(^{15, 16}\). Odelowo also held that accidents in urban roads are not usually as severe as those on intercity roads\(^{54}\). Most of the bikes in use in this country are Yamaha, Suzuki, Honda, and Kawasaki models all within the 100-120cc ranges. In fact, the latest series, imported second hand from abroad are even smaller, 80cc or less, most of them with top speeds less than 100km/hr are used mainly for urban transit. While, they may be involved as frequently in accident situations as the bigger models that are common in more affluent countries, the severity of injuries from such accidents may not be as severe.
The total number of investigations done in this study revealed the relatively few variety of investigations available in this environment for troubleshooting trauma cases. A study of this size bereft of such armamentarium as CAT scan, MRI, arterial gases measurement, and central venous pressure reading will be had to come across in the more technologically advanced countries. But the basic investigations done here is similar to those reported from similar studies elsewhere in developing countries. It is perhaps then, no small mercy that the injury pattern from motorcycle accidents appears to be relatively benign in this community.

The quality and the quantity of the pre-hospital care given to the patients in this study were low. Many of these patients never had any form of pre-hospital care; one reason may be due to the poor awareness of the resuscitative measures to be taken at accident sites by many people. Perhaps, nothing better illustrates the huge difference in the response to accident site situation between this community and the more technologically advanced countries than the media. In locally produced films, emergency situations are accompanied by much wailing by those around in order to attract the attention of their neighbour, who will rush there only to add to the confusion at the scene. This is quite different from what is portrayed in western films in which mouth-to-mouth resuscitation may be given while someone else sends for the ambulance. In patients with severe injuries unfortunate enough to be taken to hospitals outside the teaching hospital setting, many will not be offered the right kind of treatment at the right time. Many never had adequate care of their wounds; in one of the patients in this study, a wound that had been sutured at another hospital was found to contain much soil particles and devitalised tissues.
Basically, two forms of treatment were directed at the skeletal injury: (1) Manipulation under anaesthetic followed by splinting with POP or external fixation, traction, and (2) surgery.

22.8% of the patients had open reduction and internal fixation, this is a rather small proportion compared to what has been reported abroad\(^9,12\), but actually agreed with some reported series in this environment\(^{16,47,80}\), which fall within 6% and 30% of the cases.

The only amputation done in this series was for a patient with an open tibia fracture who presented in the hospital, more than a week after sustaining his injuries with the limb already gangrenous. This rate (<1%) is very low compared to the 3-4% reported in studies from the more technologically advanced countries\(^12\).

It has been known since the time of Cairn’s study that although head injury may be the commonest cause of the fatality, fractures are the source of the greatest morbidity\(^\text{10,81}\). The complication rate in this series was 2.1 per patient. Many series reported a high complication rate and subsequent morbidity as a result of skeletal injury\(^12,13\). In this study, 67 out of the 115 patients developed complications after treatment. The commonest seen were joint stiffness, muscle weakness and muscle wasting. This so-called fracture disease was also common in Alabi and Oguachuba series\(^{46,46}\). Most of them improved with physiotherapy.

Of the major complications, wound infection occurred in 6.2% is the most common. This rate falls within the 2-20% seen in most developed countries\(^33\). 11.3% of the patients developed chronic osteomyelitis mainly of the tibia. Many of these patients developed the osteomyelitis secondary to open fractures\(^{46}\). The exposure of the motorcyclist to his environment during and after the crash makes contamination of his wounds more likely than in car occupants. Gravels, grass, glass and cinders are frequently found in motorcycle injury wounds. According to Deane, the large force employed
coupled with the exposure lead to devitalisation of skin and bone with its ensuing complications.  

12.2% of the patients had delayed union while 3.5% of them had non-union. 7.0% of the patient had malunion. 11 or 9.6% of the patient developed shortening, however, most of these were less than 2cm, and only two required surgery to correct the shortening.

Over all, the tibia among all bones had the highest rate of complication. This may be because the majority of its fractures were open.

The mean duration of hospitalisation in this series was 30.2 days. This falls within the range of 12.5-39 days in some reported series. The 1-154 days range of hospitalisation also falls within the range reported in these series.

About 51.3% of the patients had a satisfactory outcome while 22.6% of them, the outcome was not satisfactory based on the presence of some persistent complications after one year of follow up. Majority of these persistent lesions (15of 26 patients) involved the joints.

This series has a mortality rate of 3.5% (4 out of the 115 pts). This rate favourably compares with Odelowo series (6.8%) in Ilorin. Some series reported from advanced countries gave similar figures which ranged from Drydale’s 1.4% as quoted by Haddad, through Deaner’s 3.1% to Haddad’s 3.8%. But it should be appreciated that this is not to mean that the quality of medical care given to our patients is in any way close to what obtained abroad; rather, this comparatively low mortality rate may be due to: (i) the less severe pattern of injury seen here and, (ii) most patients who required urgent attention may have died either at the scene of accident or in transit to the hospital because of the poor or non existent pre-hospital care system here. Two of the referred cases said
that their co-passengers (two of three in one case) died at the scene of the accident. The severity of the accidents leading to the fatal cases are borne out by the following facts:

i. All involved more than one region of the body.

ii. All co-riders of the fatal cases also sustained injuries. Three of them also died.

iii. All the accidents were caused by collisions with moving vehicles.

Two of the patients died within 5 hours of arrival in the hospital while one survived for two days and the last one, a 70 yr old patient with fail chest and haemothorax survived for 10 days. Two of the patients had head injury and three had cervical spine injuries. The level of one was not determined while the other two were C4 fracture and C5-6 subluxations. The findings agree with literature series which shows that head injury accounts for majority of deaths in motorcycle accidents\textsuperscript{16}.

One of the golden rules of pre-hospital treatment is that in order to avoid aggravating their injury, patients suspected of having cervical spine fractures must be moved carefully\textsuperscript{72}, preferably with the spine supported on a rigid board\textsuperscript{5, 66}. In this environment, with it’s lack of adequate pre-hospital management, patients are not afforded this care, rather you see a patient with a suspected spinal fracture, bundled up in the back seat of a two door car or worse, carried without stretcher or board, the unsupported head, hanging down. It is thus not surprising that cervical spine fractures were recorded in three out of the four fatal cases. However, one is never sure whether complete neurological impairment was a result of the primary injury or was secondary to the mishandling on the way to the hospital\textsuperscript{72}.
RECOMMENDATIONS

1) Effective ambulance services should be made available for prompt response to accidents. In order to make this easier, the communication networks needs to be good.

2) The public needs to be enlightened about the provision of first aid.

3) The primary and the secondary levels of health care system need urgent improvement if the outcome of treatment is to improve.
REFERENCES:


The practitioner April 1962; 188: 474 - 487.

17. Walt AJ. Initial intrahospital care of the severely injured patient: The early hours.


19. Mc Quilan K, Willes III CE. in Initial assessment. In Cardonna VD, Hurn PD, Batsnagel
Mason PJ, Scanlon Schilpp AM, Trauma nursing. WP Saunders Company, Philadelphia.
106- 107.


21. Sodipo, JOA. in Pre-hospital management of the critically injured. in Adeloye A. ed.
Care of the injured. Ibadan: West Africa College of Surgeons. 1977; 203-216.

22. Cooper, HN. Organization of emergency care with limited facilities in Adeloye A. ed.
Care of the injured. Ibadan: West Africa College of Surgeons. 1977; 229-231.

23. Adjei, A. in The nurse and the injured in Adeloye A. ed. Care of the injured. Ibadan:
West Africa College of Surgeons. 1977; 217-222.

24. Mann CJ and Russell RCG. Bailey and Loves’ Short practice of surgery.. Chapman


27. Apley AG, Solomon L. Apley's system of orthopaedics and fractures.. English Language

28. Al- Fallouji MAR. and Mc Brien MP. Postgraduate Surgery - The Candidate’s guide

Chicago; 1993: Vol. 8: Pg 367.

30. Owosina FAO. The traffic scene in Nigeria - An African example. The
WHO/OBCD/World Bank's Conference on road traffic accidents in Developing Countries.
Mexico City 9 -13 November 1981.

31 Asogwa, SE. Road traffic accidents in Nigeria: A look at the states. Nig. Med J. 1979; 9
(7&8): 771-780.


43. Babarinsa D. in Your leg or your life. in Tell magazine. Lagos: May 15, 2000; Pg 1.


