SPINE INJURIES; PATTERN, MECHANISMS OF INJURY AND MANAGEMENT OUTCOMES AMONG PATIENTS ADMITTED AT MUHIMBILI ORTHOPAEDIC INSTITUTE.

Abubakar Ramadhan Hamis, MD

MMed (Orthopedics and Traumatology) Dissertation
Muhimbili University of Health and Allied Sciences
October, 2014

SPINE INJURIES; PATTERN, MECHANISM OF INJURY AND MANAGEMENT OUTCOMES AMONG PATIENTS ADMITTED AT MUHIMBILI ORTHOPAEDIC INSTITUTE

By,

Abubakar H. Ramadhan, MD

A Dissertation Submitted in (Partial) Fulfillment of the Requirement for the Degree of Masters of Medicine in Orthopedics and Traumatology of the Muhimbili University of Health and Allied Sciences.

Muhimbili University of Health and Allied Sciences
October, 2014

CERTIFICATION

The undersigned certifies that, he has read and hereby recommend for acceptance by Muhimbili University of Health and Allied Sciences a dissertation entitled: "**Spine injuries; pattern, mechanisms of injury and management outcomes among patients admitted at Muhimbili Orthopaedic Institute (MOI)**" submitted in partial fulfillment of requirement for degree of Master of medicine in Orthopaedics and Trauma surgery of Muhimbili University of Health and Allied Sciences

_____

Prof. L. M. Museru

Supervisor

_____

Date

DECLARATION AND COPYRIGHT

I, **Abubakar Ramadhan Hamis** declared that this **dissertation** is my own original work and that it has not been presented and will not be presented to any other University for a similar or any other degree award

Signature: …….. Date: ……..

This dissertation is copyright material protected under the Berne Convention, the copyright Act 1999 and national enactments, in that behalf, on intellectual property. It may not be reproduced by any means, in fully or in part, except for short extracts in fair dealings, for research or private study, critical scholarly review and disclosure with acknowledgement, without the written permission of the Directorate of Postgraduate Studies, on behalf of both the author and Muhimbili University of Health and Allied Sciences.

ACKNOWLEDGEMENTS

I would like to express the deepest appreciation to my supervisor, Professor L.M Museru who has the attitude and the substance of a genius: he continually and convincingly conveyed a spirit of adventure in regard to research and an excitement in regard to teaching. Without his guidance and persistent help, this dissertation would not have been possible.

Am also grateful to Drs. Respicious Boniface, Felix Mrita for spending time to read and provide useful suggestions about this dissertation.

During the period of three years, many friends were helpful to colour my life. I have to acknowledge all my colleagues for their assistances in many aspects that I can not list them all because of limited space.

Furthermore I would also like to acknowledge with much appreciation the crucial role of the staff of MOI and MUHAS for the cooperation they offered me during study period.

I would like to thank my parents, Ramadhan Hamis, My late Mother Orlice M. Martin, my Maternal Aunt Mariam M. Martin for providing me with unfailing support and continuous encouragement throughout my years of education.

I am extremely fortunate to have my wife, Janeth, my daughter Shani and my son Salim who have given me nothing but unconditional love and support throughout my study period.

DEDICATIONS

To my late Mother, Orlice M. Martin,

And

My beloved wife Janeth, my daughter Shani and my son Salim have never left my side and are very special.

ABSRTACT

Spine injury is trauma to the cord and/or its surrounding structures including the vertebral bones, ligaments and blood vessels as a result of an externally applied mechanical force. Some etiologic factors include road traffic accident, fall, missile, assault, domestic / industrial accident and sport / recreational activity.

Acute injuries of the spine and spinal cord are among the most cause of severe disability and death after trauma.

Acute management includes medical agents and surgical treatment that usually includes either all or a combination of reduction, decompression, and stabilization.

In our settings very little is known regarding the prevalence, age, gender, anatomical levels, mechanism of injuries and management outcomes among patient with SCI. This study have helped us to understand the pattern, mechanism, management outcomes and the burden of spine injured patients admitted at MOI, thus will help to plan on care of these patients and improve rehabilitation services.

Objective: To determine patterns, mechanism of injury and management outcomes among patients with spine injuries treated at MOI.

Methodology: Hospital based descriptive cross sectional study was conducted at MOI.

Forty five patients with spine injuries admitted at Muhimbili Orthopedic Institute were enrolled in this study from March 2013 to February 2014. Structured questioners were used to interview the patients.

Results: Forty five patients were interviewed, two patients died during the course of study. Male were 42(93.3%) and Female 3(6.7%). Male to Female ratio (14:1). With a mean age of 34.5 ± 9.4years. The most affected individuals were in the age group 26 – 45 years (68.9%). MVC were the leading cause of spine injury and it occurred in 29 patients (64.4%).

The cervical spine was most affected segment of the spine (53.3%), followed by thoracic spine (28.9%) and lumber spine (17.8%).

Neurological deficit was observed in 31 patients (ASIA A-D) and 14 patients had no neurological deficit, (ASIA E), compression fracture (type A) and distraction injury (type B) account 91.1% and rotational injury (type C) occurred in 8.9% of patients. Among nonsurgical treated patients, 3(30.0%) patients neurologically improved. Surgical treatment was done in twenty one patients of which, 9(42.9%) patients neurologically improved. P-value: 0.72.

Conclusion

Young adult males are majority of patients who sustained spine injuries follows MVC. The cervical spine was the most common level of injury with complete neurologic deficit predominating.

TABLE OF CONTENTS

CERTIFICATION ii
DECLARATION AND COPYRIGHT iii
DEDICATIONS v
ABSRTACT vi
TABLE OF CONTENTS viii
LIST OF TABLES x
LIST OF FIGURES x
ABBREVIATIONS xi
CHAPTER ONE 1
1.0 INTRODUCTION AND BACKGROUND 1
1.1 LITERATURE REVIEW 7
1.2 PROBLEM STATEMENT 11
1.3 RATIONALE 12
1.4 RESEARCH QUESTIONS 12
1.5 OBJECTIVES 13
1.5.1 Broad Objective 13
1.5.2 Specific Objectives 13
CHAPTER TWO 14
2.0 METHODOLOGY 14
2.1 Study Design 14
2.2 Study Area 14
2.3 Study Population 14
2.4 Study Period 14

2.5 Inclusion Criteria....14
2.6 Exclusion Criteria....14
2.7 Sample size estimation and sampling technique....15
2.8 Patients' enrollment and Data collection....15
2.9 Data Management and Analysis....16
2.10 Ethical consideration....16
CHAPTER THREE....17
3.0 RESULTS....17
CHAPTER FOUR....21
4.0 DISCUSSION....21
CHAPTER FIVE....24
5.0 CONCLUSION....24
5.1 STUDY LIMITATIONS....24
5.2 RECOMMENDATIONS....24
APPENDICES....33
Appendix I: Questionnaire (English Version)....33
Appendix II: Questionnaire (Swahili Version)....36
Appendix III: Consent Form (English Version)....39
Appendix IV: Consent Form (Kiswahili Version)....41
Appendix V: ASIA Impairment Scale....43

LIST OF TABLES

Table 1: Social Demographic……..17

Table 2: Distribution of Neurological deficit among spine injury patients……20

Table 3: Management outcomes among spine injured patients……..20

LIST OF FIGURES

Figure 1: Neurologic examination recommended by the American Spinal Injury Association (ASIA)……...3

Figure 2: Mechanism of spine injury……18

Figure 3: Distribution of sample by Radiological level of spine injury……...19

ABBREVIATIONS

AO	-	Arbeitsgemeinschaft fur Osteosynthesefragen.
ASIA	-	American Spine Injury Association
CT scan	-	Computer Tomography Scan
EMD	-	Emergency Medical Department
FFH	-	Fall From Height
GSW	-	Gun Short Wound
MMED	-	Masters of Medicine
MRI	-	Magnetic Resonance Imaging
MOI	-	Muhimbili Orthopedics Institute
MUHAS	-	Muhimbili University of Health and Allied Sciences
OPD	-	Outpatient Department
MVC	-	Motor Vehicle Crash
SCI	-	Spinal Cord Injury
SD	-	Standard Deviation
SPSS	-	Statistical Program Software for Social Sciences
USA	-	United States of America
US	-	United States

CHAPTER ONE

1.0 INTRODUCTION AND BACKGROUND

Spine injury is trauma to the cord and / or its surrounding structures including the vertebral bones, ligaments and blood vessels as a result of an externally applied mechanical force. The etiologic factors of spine injury include road traffic accident, FFH, missile, assault, domestic / industrial accident and sport / recreational activity (1,2,3,4).

Acute injuries of the spine and spinal cord are among the most cause of severe disability and death after trauma (5).

Spine Injury

Spinal cord injury occurs predominantly in young males (6, 7). The gender ratio is 4:1 males to females. The mean age is 30 years. The median age is 25 years, indicating half of all the patients who sustain a spinal cord injury are younger than 25 years of age.

The prevalence of traumatic spinal cord injury in the United States is estimated to be 525 to1124 persons per million populations (8, 9).

The most common cause of traumatic spinal cord injury is a motor vehicle crash, which accounts for more than half of all trauma-related cord injuries. Other common causes are falls (25%), gunshot injuries (15%), and sports injuries (10%) (10,11). Older individuals are more likely to sustain a cord injury from a minor fall, such as a fall from a standing height. Falls in persons aged more than 65 years are 2.8 times more likely to be associated with a spinal cord injury than similar falls in patients aged less than 65 years (12).

The most common site of spinal cord injury is the cervical region, accounting for 50% to 64% of traumatic spinal cord injuries (13).Neurologic injury is localized to the lumbar region (conus medullaris or cauda equina) in 20% to 24% of patients and to the thoracic cord in 17% to 19% of patients (13).Approximately half of the patients with an acute spinal cord injury have a complete injury on initial evaluation. Cervical injuries (tetraplegia) are more often incomplete neurologic deficits than complete, whereas thoracic injuries are more often complete.

Children account for 1% to 5% of acute spinal cord injury admissions (6, 7). Patients with an immature skeleton can sustain a spinal cord injury without overtly disrupting the structural components of the vertebral column. This type of a cord injury, labeled as spinal cord injury without radiographic abnormality in the publications preceding the use of magnetic resonance imaging (MRI), may occur in nearly half of very young patients with spinal cord injuries (in
42% of patients aged <9 years) (13).It is present much less frequently in older patients with immature skeleton (in 8% of patients aged 15 to 17 years) (13).Most of the younger patients (70%) had an incomplete injury (13).

Spinal cord injury without structural disruption of the vertebral column can also occur in older patients who have a narrow spinal canal, either a congenitally narrow spinal canal (spinal canal diameter <80% of the midbody vertebral body diameter) or a pathologically narrow canal from osteophytes and degenerative changes (14).These patients also typically have an incomplete cord injury, usually of a central cord injury pattern (15).

PRINCIPLES OF EVALUATION

Initial evaluation and management of patients with a spine injury can be complex, but priorities of Advanced Trauma Life Support still apply (16). Each subsequent event in the patient's triage is influenced by the findings of the initial evaluation, for both management of the spinal injury and other potential injuries.

Emergency Department Care

Spinal evaluation is concurrent with resuscitative measures. Spine evaluation within the first few minutes of arrival in the emergency department includes assessment of gross neurologic function by report from field personnel, direct observation, or initial gross examination during primary survey, diagnosis of severely unstable injuries such as
fracture-dislocations or distractive injuries on trauma x-rays which includes lateral cervical spine x-ray and anteroposterior (AP) chest x-ray, and assessment of hemodynamic parameters for potential neurogenic shock.

Spinal cord injury can complicate resuscitation (16). Spinal cord injury itself increases the risk for multiple organ system failure in polytrauma patients (18). The presence of severe hemodynamic parameter abnormalities in the initial phases of resuscitation is associated with a poor prognosis for neurologic recovery (17). Normal hemodynamic, on the other hand, does not predict neurologic recovery.

Awake and cooperative patients require a complete neurologic examination. The American Spinal Injury Association (ASIA) has identified essential minimal elements of neurologic assessment recommended for all patients with a spinal injury (Fig. 1) (19).

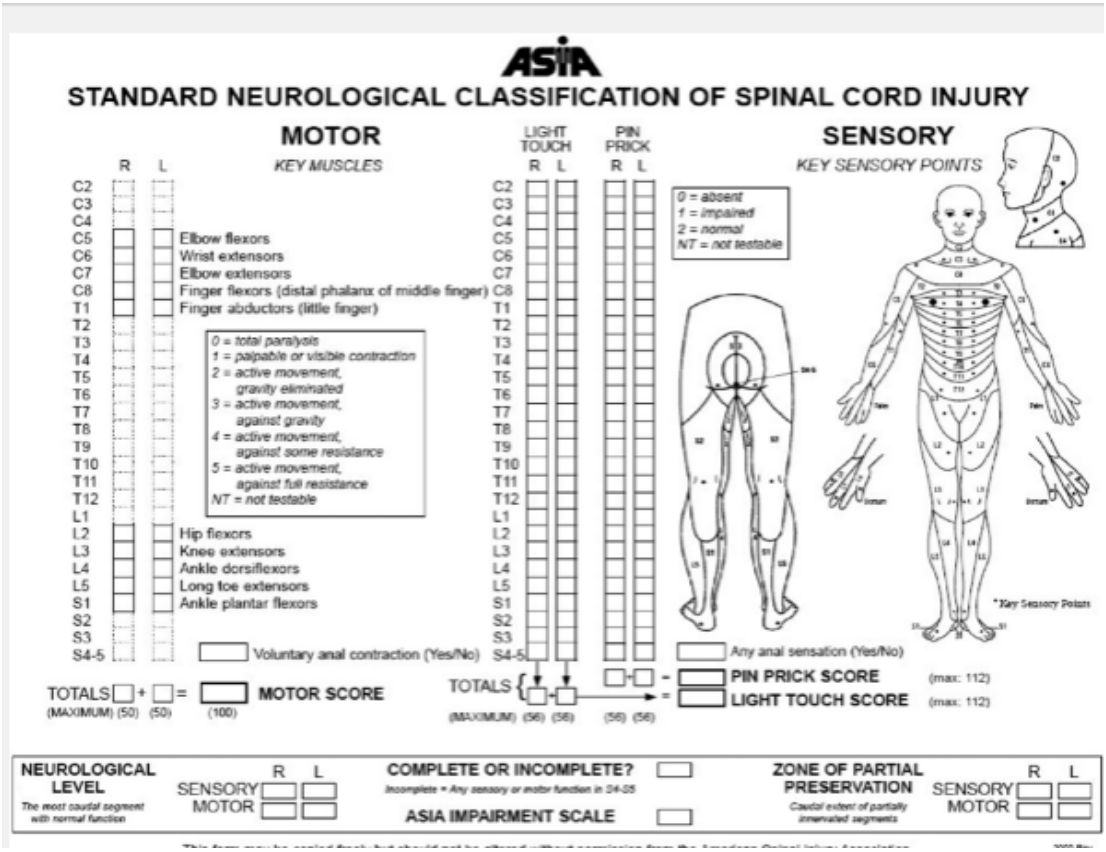


Figure 1: Neurologic examination recommended by the American Spinal Injury

Association (ASIA).

The American Spinal Injury Association (ASIA) Impairment Scale A – E. (19)

ASIA A – No motor or sensory function is preserved below the level of injury (and in the sacral segments S4 – S5)

ASIA B – Sensory but not motor function is preserved below the neurological level (includes the sacral segments S4 – S5)

ASIA C – Motor function is preserved below the neurological level, but too little to represent a practically usable function (more than half of key muscles below the neurological level have a muscle grade less than 3)

ASIA D – Motor function is preserved below the neurological level, to an extent that provides practically usable function (at least half of key muscles below the neurological level have a muscle grade of 3 or more on a scale from 0 to 5)

ASIA E – Motor and sensory functions are normal, ASIA A implies a complete injury, ASIA B – D describes incomplete injuries.

The essential elements of neurologic function are strength assessment of five specific muscles in each limb and pinprick discrimination assessment at 28 specific sensory locations on each side of the body.

The spine examination includes inspection and palpation of the spine. The patient must be rolled on his or her side by using a log-rolling maneuver. The patient's head and neck are supported by one assistant, and the patient's trunk is supported by two to three other assistants. The head and trunk are then rolled by the assistants in unison while the examiner inspects and palpates the spine to check for hemorrhage, abrasion, laceration, malalignment, or palpable gap in the spinous processes. The chest and abdomen are also examined for contusions or abrasions suggestive of an injury induced by a seat belt or steering wheel.

Diagnostic Imaging

Plain Radiography

Plain x-rays, if they show complete lateral visualization of the cervical spine and include an open mouth view, are fairly sensitive in identifying cervical spine fractures. The risk of missing significant fractures is less than 1% of patients (20). The sensitivity of the lateral x-ray alone is 83% and specificity is 97% (21). The addition of open-mouth and AP views increases the sensitivity to approximately 100% (21).

Cervical x-rays in a trauma patient are performed with the patient supine and secure on a backboard.

The AP cervical spine view is less helpful in diagnosing acute injuries. The open mouth view is essential for excluding a C1 arch or C2 odontoid process fractures. Tomograms or a CT scan may be necessary to substitute for the open mouth view in unresponsive patients. Oblique views can identify injuries of the facet joints, pedicles, and lateral masses, particularly at the cervico-thoracic junction. For this reason, oblique views in the trauma setting can increase the diagnostic sensitivity of cervical x-rays.

Harris measurements based on the distance between the dens and the basin is probably the simplest and most reliable measurements for identifying cranio-cervical dissociation (22).

Computed Tomography and Magnetic Resonance Imaging

CT and MRI may be useful together in determining the presence and extent of spinal column injury (23). MRI is superior in demonstrating spinal cord pathology and intervertebral disc herniation. CT is superior to MRI in demonstrating osseous injury. However, injuries purely localized to the transverse plane, such as odontoid fracture, can be missed on axial CT images. For these types of injuries, direct coronal CT can provide superior demonstration of skeletal features in the upper cervical spine (24).

MRI can show edema and hemorrhage associated with acute spinal cord injury. Increased cord signal and parenchymal cord hemorrhage indicate poor prognosis for neurologic recovery (25,26).

Definitive Treatment

Nonsurgical Options

Closed treatment remains the standard of care for most spinal injuries.

Closed treatment options are bed rest, halo apparatus, external orthosis, or cast (27). Bed rest as definitive treatment may be indicated in rare cases of patients unable or unwilling to undergo bracing or surgery because of a severe preexisting deformity, morbid obesity, medical co morbidity, or personal preference. Bed rest for the initial few weeks preceding bracing is an option for severely unstable injuries. The level of injury serves as a guide for the category of external orthosis. Custom-molded trunk orthosis provides added rotational control. Casts can be applied in hyperextension to improve kyphosis. Bracing is continued until bone healing is sufficient for load bearing: 8 weeks in cervical injuries and 12 weeks in thoracolumbar injuries.

Surgical Options

Surgical stabilization of the spinal column can prevent further mechanical injury to the damaged cord tissue. Removing residual compressive mass effect may in addition allow better neurologic recovery. Closed treatment of unreduced injuries may lead to chronic pain requiring later surgical treatment (28).

The critical role of time is increasingly being recognized as potentially pivotal in affecting neurologic recovery. Early intervention in this setting is not defined in days after the injury, but rather in minutes and hours. Animal studies have suggested a potential window of opportunity in the first 3 to 6 hours after injury in which significant neurologic recovery may be possible (30, 31, and 29).

1.1 LITERATURE REVIEW

Epidemiology

Large variations in incidence, prevalence, gender distribution, mechanism of injury, level of injury, and completeness of injury have been reported from various parts of the world with regard to spinal injuries (32, 33).

The lowest prevalence is found in India, /with 236 per million (36), and the highest in US, with 1 800 (35). Dahlberg et al. found a prevalence of 280 per million in Helsinki in 2002 (34).

In the National Spinal Cord Injury Statistical Centre Database (US), the average age at the time of injury was 29 years in 1970 and 37 years in 2005 (37, 38). The proportion of people who are injured after the age of 60 increased from 5 % to 13 % during the same period (38).

In a study done in Western Norway, it was found that the average age increased from 40.2 years in the period 1994 – 96 to 48.9 years in the period1997 – 2001, for women from 24.7 years to 57.7 years, and for men from 41.5 years to 46.3 years (39).

In studies from Taiwan and Iran, spinal injuries occur with equal frequency among both genders (41, 43). The largest preponderance of men is found in studies from Sierra Leone and Nigeria (ratio 11 – 12: 1) (42, 44). The three studies from Norway show a male/female ratio of 4.7 – 5.0: 1 (39 – 40).

In Dar es salaam, Tanzania, Mhina et al studied a total of 54 patients who sustained spine injuries, their ages ranged between 12 and 69 years with mean of 35.5 years. The 21-30 year group formed the majority of the patients. Common causes of spine injuries were MVC counting for 38.9% and FFH 46.3% (77).

In Iran, Taghippor M. *et al* and Fakharian E. *et al* had notified 4:1, 3.7:1 for male/female ratio (45, 46). The peak of male injury occurs in 25-44 year-olds

Mechanisms of injury and anatomical level of spine injury

Different subdivisions of mechanisms of injury have therefore been applied in international literature, although most studies have classified mechanisms of injury as traffic accidents, falls, sports accidents and other accidents (47 – 48).

In most countries, traffic accidents are the most common mechanism (47 – 48). The largest proportion has been observed in West Africa, at 89 % (49). The lowest proportions are found in Greenland, at 4 % (50), as well as in Pakistan and Nepal, both at 7 % (51, 52). Falls account for the other main mechanism of traumatic spinal cord injuries (47 – 48).

In Pakistan and Nepal, falls account for 82 % (51, 52). In Western Norway, the most frequent mechanisms of injury were falls (45.5 %) and traffic accidents (34.2 %) (54). Violence is a frequent cause of traumatic spinal cord injuries in South Africa, where it accounts for 61 – 62% (55,53) of the cases, whereas all studies from Europe report less than 5% – with the exception of Greenland, where violence was the cause in 11 % of the cases (50).

The anatomical level of injury in the spinal cord is divided into high (cervical) and low injuries (thoracic, lumbar and sacral) (56, 57).

Approximately, 160000 patients / year sustain an injury of the spinal column in the United States.

The majority of these injuries comprise cervical and lumbar (L3–L5) spine fractures. However, between 15%and 20%of traumatic fractures occur at the thoracolumbar junction (T11–L2), whereas 9–16% occur in the thoracic spine (T1–T10) (61).

Study by Mhina et al, in Dar es Salaam Tanzania, has notified that the vertebra in the C3-C5 and T11-L3 regions were most frequently fractured. Neurological deficits were observed in 33% patients with paraplegia and quadriplegia dominating the neurological pathology (67). About 50–60% of thoracolumbar fractures affect the transition T11–L2, 25–40% the thoracic spine and 10–14% the lower lumbar spine and sacrum (62, 63). In a study by Magerl and Engelhardt (59) on 1446 thoracolumbar fractures, most injuries concerned the first lumbar vertebra, i.e., 28 %(*n*=402), followed by T12 (17%, *n*=246) and L2 (14%, *n*=208).

The epidemiologic multicenter study on fractures of the thoracolumbar transition (T10–L2) by the German Trauma Society studied 682 patients and revealed 50% (*n*=336) L1 fractures, 25 %(*n*=170) T12 fractures, and 21 %(*n*=141) L2 fractures. (50). In the series by Michael Heinzelmann and Guido A Wanner at the University Hospital in Zürich demonstrated a very similar distribution for operated spine fractures (1992–2004, *n*=1744): 20%cervical spine (*n*=350), 8%thoracic spine T1–T10 (*n*=142), 62% thoracolumbar spine T11–L2 (*n*=1075), and 10% lumbosacral spine L3-sacrum (*n*=176). (54).

The susceptibility of the thoracolumbar transition is attributed mainly to the following anatomical reasons:

1. The transition from a relatively rigid thoracic kyphosis to a more mobile lumbar lordosis occurs at T11–12.
2. The lowest thoracic ribs (T11 and T12) provide less stability at the thoracolumbar junction region compared to the rostra thoracic region, because they do not connect to the sternum and are free floating.
3. The facet joints of the thoracic region are oriented in the coronal (frontal) plane, limiting flexion and extension while providing substantial resistance to anteroposterior translation. (51) In the lumbosacral region, the facet joints are oriented in a more sagittal alignment, which increases the degree of potential flexion and extension at the expense of limiting lateral bending and rotation.
4. The cervical spine, being the most mobile part of the spine, is susceptible to injury than other parts of the spine.

In thoracolumbar spine fractures (T1–L5), Gertzbein (48) and Magerl et al. (49) reported 35.8% and 22% neurological deficiencies, respectively.

The epidemiologic multicenter study on fractures of the thoracolumbar transition (T10–L2) by the German Society of Traumatology, revealed neurological deficiencies in 22–51%, depending on the fracture type (22% in Type A fractures, 28%in Type B fractures, and 51% in Type C fractures, according to the AO classification).

Complete paraplegia was found in 5% of the patients with fractures of the thoracolumbar transition.

Operative Treatment

General Principles

Operative treatment of unstable fractures allows for: (65)

i) Early mobilization of the patient

ii) Diminishing pain

iii) Facilitating nursing care (polytraumatized patients)

iv) Early return to work

v) Avoidance of late neurological complications

However, evidence suggests that there is no difference as regards neurological recovery (Frankel score or ASIA score) and no substantial difference in functional long-term outcome between the operative and non-operative treatment (65).

This is clearly valid for compression fractures that are relatively stable, i.e., A1 and A2 fractures, according to the AO classification.

In burst fractures, there is often some degree of canal compromise with a potential risk of neurological injury. Hence, progressive neurological deterioration in the presence of substantial canal compromise is an indication for surgical decompression and stabilization. Importantly, neurological status, spinal stability, degree of deformity of the injured segment, degree of canal compromise, and associated injuries are the most relevant factors that need to be considered when deciding on operative or non-operative treatment for patients with a spine fracture. Most investigators recommend early surgical decompression in cases of an incomplete spinal cord injury and persistent compression of neurogenic structures.

In a study by McKinley w. et al showed no significant differences in changes of neurologic status were noted between surgical and nonsurgical groups, either for neurologic level of injury or ASIA motor changes (68).

1.2 PROBLEM STATEMENT

Spinal cord injury is a devastating injury, resulting in varying degrees of neurological injuries which includes paralysis, sensory loss and sphincter disturbance which may be permanent and irreversible in some patients, It was labeled as "an ailment not to be treated" in the Edwin Smith papyrus 5000 years ago (49).

In developed world, SCI has been well studied with thousands of manuscripts being published in the last few decades.

These include large scale epidemiologic surveys, multicenter research on interventions in acute SCI, reports on complications from acute and chronic SCI, results of rehabilitation interventions and functional outcomes. But all this covers only a part of the world population. The spinal injuries result in serious morbidity, lending the victims motor and sensory useless, hence reduce the workforce to the nation. Also the incapacity poses difficulties to family Members, in taking care of those affected and thus reduces local productivity

Rehabilitation centers for spinal injured persons are scarce, not well staffed, and moreover not specialized enough to take care of victims, and in other countries, or other parts of the Countries are nonexistent, making spinal injury a major social economic problem. In our settings very little is known regarding the prevalence, age, gender, anatomical levels, mechanism of injuries and management outcomes among patient with SCI.

1.3 RATIONALE

Spinal injury is a devastating injury affecting approximately 2.4% of injured patients admitted at MOI monthly (66). The incidence of spine injured patients is anecdotally observed to be increasing among trauma patients see at MOI.

This study will help to develop a pilot spine injury registry which can be used to develop a national spine injury registry

The general demographics of spinal cord injury in the developing world share some similarities with the epidemiological pattern reported from the developed countries, example SCI is primarily a disease of the young males.

but mechanism of SCI differs eg in developed world spine injury victims results from diving and sports, which is really reported at developing countries of which most victims are anecdotally observed to result from MVC and falling from trees or building construction (43, 44, 46, 50, 53,).

This study will help us to understand the pattern, mechanism of injury, management outcomes and the burden of spine injured patients admitted at MOI, thus will help to plan on care of these patients and improve rehabilitation services.

1.4 RESEARCH QUESTIONS

What's the burden of spine injuries at MOI?

What are the etiologies of spine injured patients admitted at MOI?

What are the mechanisms of spine injuries among patients admitted at MOI? What are the management outcomes of spine injured patients admitted at MOI?

1.5 OBJECTIVES

1.5.1 Broad Objective

To determine patterns, mechanism of injury and management outcomes among patients with spine injuries treated at MOI.

1.5.2 Specific Objectives

1. To determine the proportion of spine injuries among patients admitted at MOI between March 2013 and February 2014.

2. To assess the level of spine injuries sustained among patients admitted at MOI between March 2013 and February 2014.

3. To determine the mechanism of spine injury among patients admitted at MOI between March 2013 and February 2014.

4. To determine the distribution of neurological deficit among spine injured patients treated at MOI between March 2013 and February 2014.

5. To determine the treatment outcomes among spine injured patients admitted at MOI between March 2013 and February 2014.

CHAPTER TWO

2.0 METHODOLOGY

2.1 Study Design

This was a hospital based descriptive cross sectional study that was conducted at MOI.

2.2 Study Area

This study was conducted at MOI, with a bed capacity of 165 beds, as the main referral center for patients with skeletal trauma serving both the city of Dar es Salaam and the country at large for patients with complicated injuries.

2.3 Study Population

All patients with spine injuries admitted at Muhimbili Orthopedic institute with spine injuries from March 2013 to February 2014.

2.4 Study Period

This study was conducted from March 2013 to February 2014 at Muhimbili Orthopedic institute, a referral and teaching institution in Dar es Salaam Tanzania.

2.5 Inclusion Criteria

The study included patients aged 13 years and above admitted at MOI with spine injuries from March 2013 to February 2014.

Patients with spine injuries who came unconscious was also enrolled in this study after obtaining consent from their relative or from themselves after gaining conscious in the ward.

2.6 Exclusion Criteria

Patients who refused to consent and patients who were below 13 years old. Patients who had neurological deficit prior to injury, i.e. hemiplegic secondary to CVA.

2.7 Sample size estimation and sampling technique

Sample size was estimated using the formula below and the proportion of spine injury obtained from the previous local data,

$$N=\frac{z^2\ P\ (1-P)}{D^2}$$

Where

N- Is the sample size

Z- 1.96 at 95% confidence interval

P- Proportion of spine injury patients at MOI = 2.4%

(66). D- Is the margin of error which is 5%

Therefore, the estimated minimum study sample size was 36. Plus 10% to increase the internal validity of study got sample size of 40. Therefore minimum of sample size was 40 spine injury patients admitted at MOI in the period of March 2013 to February 2014.

2.8 Patients' enrollment and Data collection

All patients with spine injury were seen by casualty officer at MOI and fulfill all admission requirements by the hospital.

All spine injured patients were lifted like a log, and inspection of the back is done by logroll maneuver, those patients suspected to have cervical spine injury, hard neck collar were applied.

Casualty officer took the history of the patient and examination ie ATLS, General examination, neurological examination and examined other injured system.

Relevant investigations ie spine X rays and ct scan if needed as per requirement were ordered.

Then the patient was reviewed by researcher or research assistant and counseled for consent to be involved in this study.

The patients were interviewed by a structured questionnaire and relevant examination ie neurological examination was re-evaluated by a researcher using ASIA impairment scale.

Spine x rays +/- ct scan of the patient were assessed by a researcher and radiologist and in the presence of vertebral fractures the AO classification was used.

Management of these patients were given as per MOI protocol focus on prevention of bed sores, physiotherapy and urinary and bowel care

These patients were followed in the ward until definitive treatment was decided

Two casualty doctors were trained to assist in the data collection exercise as they met patients on arrival at MOI.

Full participation in the management of the entire patient involved in my study was offered by the principle investigator.

2.9 Data Management and Analysis

Data entry, coding, cleaning and analysis were done by using statistical software (SPSS version 16). Frequency distribution was used to describe categorical variables. Means and SD were used for continuous variables. Chi-Square test was used for categorical variables and t- test for continuous variables. A variable with P-value of equal or less than 0.05 was considered to be statistically significant.

2.10 Ethical consideration

Permission to conduct the study was sort from the Ethics and Research Committee of MUHAS and from the Department of Orthopedics and Traumatology incorporated in MOI. Informed written Consent was obtained from parents/guardian of each individual patient or a patient him/herself before being recruited to the study, research findings and information were not released unless for academic and scientific purposes.

CHAPTER THREE

3.0 RESULTS

Forty five patients with spine injury met study inclusion criteria and were included in this study. Of these, male were 42(93.3%) and female 3(6.7%). Male to Female ratio (M: F 4:1). The age range from 19years to 58years with a mean age of 34.5 ± 9.4years. The most affected individuals were in the age group 26 – 45 years account (68.9%) Table 1 summarizes the results.

Table 1: Social Demographic

Variables	Frequency	Percentage
Age group		
15-25	9	20.0
26-35	16	35.6
36-45	15	33.3
46-55	3	6.7
56 and above	2	4.4
Gender		
Male	42	93.3
Female	3	6.7

MVC were the leading cause of spine injury and it occurred in 29 patients (64.4%). The second cause for spine injury was FFH which constituted 16 patients (35.6%). Figure 2.

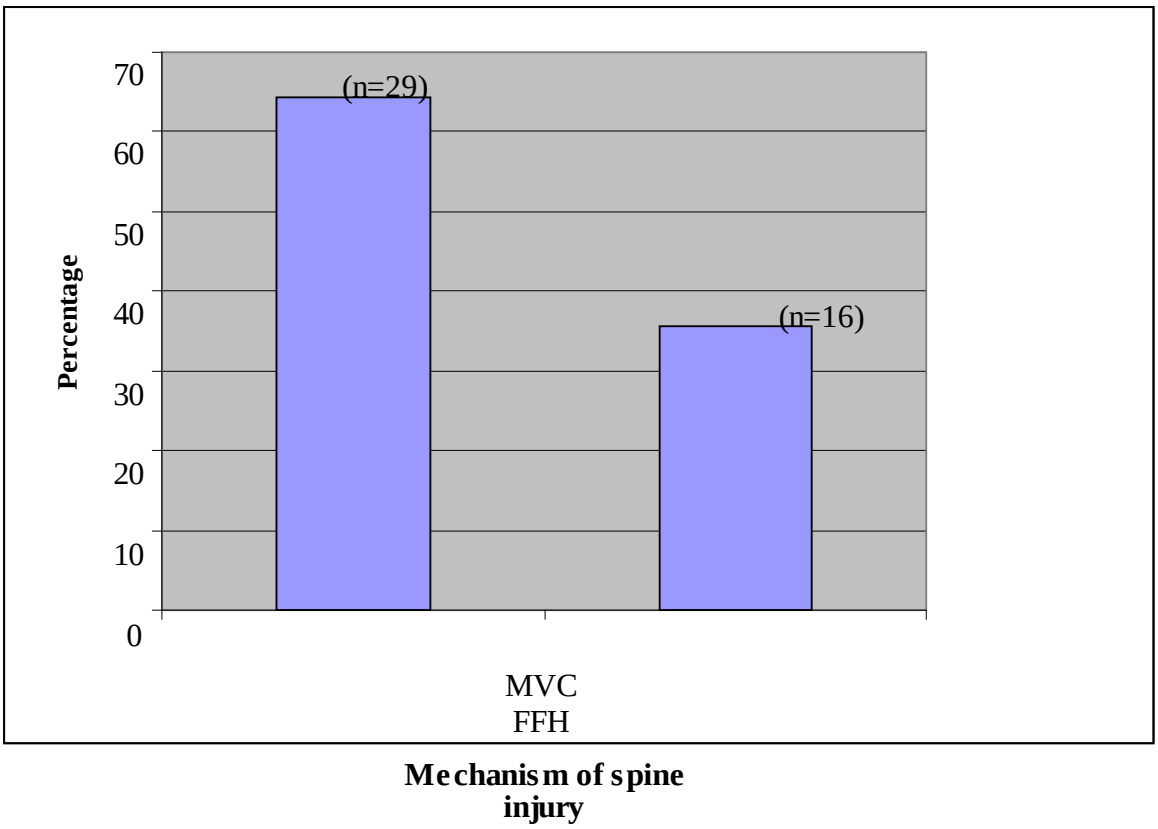


Figure 2: Mechanism of spine injury

Of the studied spine injured patients, cervical spine segment was most affected as it occurred in (53.3%). Thoracic and lumber spine segment were injured in (28.9%) and (17.8%) respectively. Figure 3.

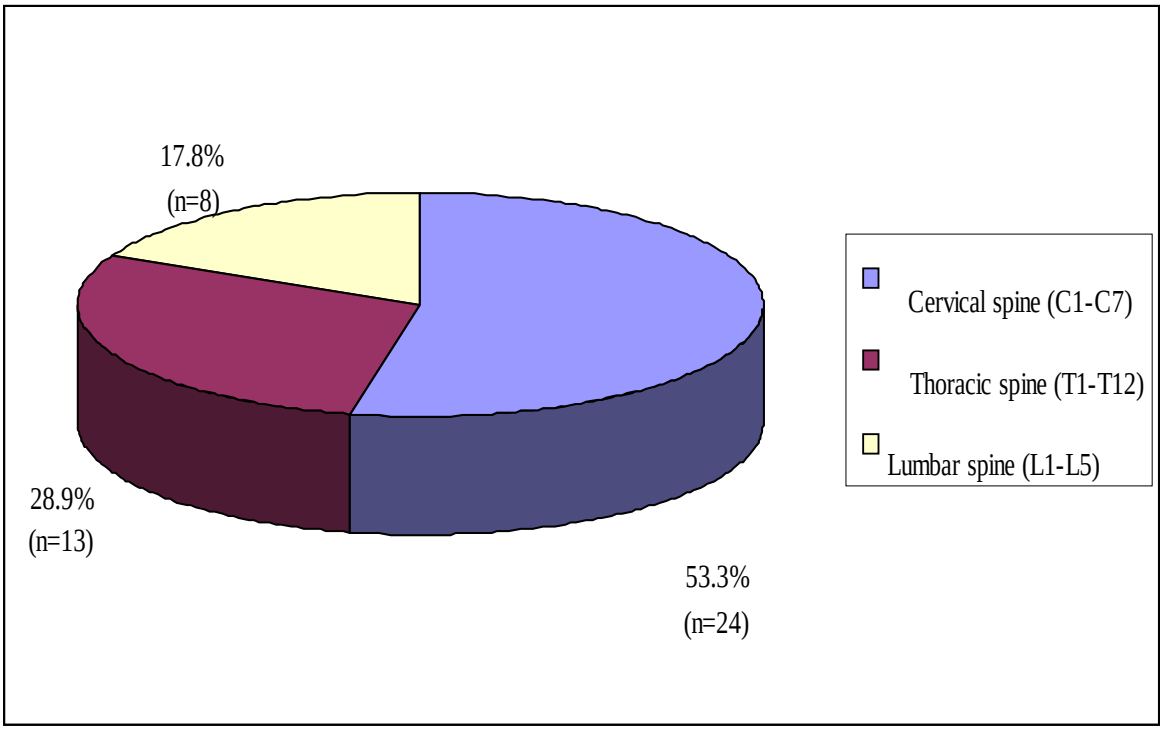


Figure 3: Distribution of sample by Radiological level of spine injury

ASIA grading at presentation showed 27 (60.0%) patients with grade A, 1 (2.2%) patient with grade B, 2 (4.4%) patients with grade C, 1 (2.2%) patient with grade D, 14 (31.1%) patients with grade E. Table 2 shows these.

By Margel/AO Classification to spine injury, 21 (46.7%) patients sustained a compression fracture (type A), 20 (44.4%) patients had distraction injury (type B), 4 (8.9%) patients had rotational injury (type C).

Table 2: Distribution of Neurological deficit among spine injury patients

Variables	Frequency	Percentage
Paraplegia/Quadriplegia (ASIA-A)	27	60.0
Intact sensation (ASIA-B)	1	2.2
Motor useless (ASIA-C)	2	4.4
Motor useful (ASIA-D)	1	2.2
Normal power (ASIA-E)	14	31.1

Among ten nonsurgical treated patients who had neurological deficit, 3(30.0%) neurologically improved while twenty one patients were treated surgically of which 9 (42.9%) neurologically improved. P- value: 0.72. See table 3.

Table 3: Management outcomes among spine injured patients

	Neurologically improved	Remained the same	Died
Non Surgical	3(30.0%)		6(60.0%)
1(10.0%) **Surgical**	9(42.9%)		11(52.4%)
1(4.8%) **Total**	**12(38.7%)**		**17(54.8%)**

2(6.5%) Chi-Square test, P- value: 0.72

CHAPTER FOUR

4.0 DISCUSSION

Large variations in incidence, prevalence, gender distribution, mechanism of injury, level of injury, and completeness of injury have been reported from various parts of the world with regard to spinal injuries (32, 33). Forty five patients with spine injuries have been reported in this study. Spine injuries accounted for 1.17% (n= 3844) of all trauma patients admitted during the study period (66). The cause of spine injury varies with age and particularly sex, with males being three to four times as likely to sustain an injury as females. Epidemiological studies have proved this fact.

This study has shown that males were mostly involved, 42 (93.3%) compared to females 3 (6.7%) with male to female ratio of 14:1, the mean age was 34.5 ± 9.4 and the most affected individuals were in age group of (26-45) 68.9%. Similar findings have been shown in studies by National Spinal Cord Injury Statistical Centre Database (US), the average age at time of injuries was 29 years and 37 years in 1970 and 2005 respectively (37, 38).
Similarly, studies from Sierra Leone and Nigeria have demonstrated the largest preponderance of men, ratio 12:1 (52, 54). Similar findings have been observed by Mhina et al in a study of
54 patients who sustained spine injuries, of which 50 were males and females were 4 with ratio of 13:1 and mean of 35.5 years and majority of the patients were in the age group of 21- 30 years. (67).

In this study Motor Vehicle crashes (MVC) were the most common cause of spine injuries and constituted 29 (64.4%) of all causes.
Falls from a height (FFH) contributed to the causes of spine injuries by 16 (35.6%).

Similar results were observed in most countries, traffic accidents are the most common mechanism (47 – 48). The largest proportion has been observed in West Africa, at 89% (49). However different mechanism of spine injuries have been noted, in Western Norway, the most frequent mechanisms of injury were falls (45.5 %) and traffic accidents (34.2 %) (54).

Studies in Pakistan and Nepal, falls accounted as the common mechanism of spine injuries, both at 82 % (51, 52).

Contrary to this study, Mhina et al observed the common mechanisms of spine injuries were FFH 46.3% and MVC 38.9% (67). This difference might be contributed by increase in the use of motorcycles as means of transport recently.

The current study observed that cervical spine was most affected segment of the spine (53.3%), followed by thoracic spine (28.9%) and lumber spine constituted (17.8%).

Similar results were reported by Mhina et al, that the vertebral in the cervical and thoracolumber regions were most frequently fractured (67).

In United States, studies have shown spine injuries comprise cervical and lumbar spine fractures, however, between 15% and 20% of traumatic fractures occur at the thoracolumbar junction (T11–L2), whereas 9–16% occurs in the thoracic spine (61).

Contrary to this, Heinzelmann and Guido A Wanner at the University Hospital in Zürich demonstrated a distribution for operated spine fractures and noted 20%cervical spine, 8%thoracic spine, 62% thoracolumbar spine and 10% lumbosacral (64).

Current study demonstrated neurological deficit in 31 patients (ASIA A-D) and 14 patients were normal (ASIA E). In this study most of the patients 91.1% sustained compression fracture (type A) and distraction injury (type B), 8.9% sustained rotational injury (type C). These results concurred to what was reported by Mhina et al that neurological deficits were observed in 33 patients with paraplegia and quadriplegia dominating the neurological pathology (67), which is contrary to what reported in study by German Trauma Society (n=682) which has shown findings in terms of type of fractures, whereby type C fractures accounted 51% followed by type B fractures and type A fractures, 28% and 22% respectively (60).

This difference might be due to the fact that motor vehicle speeds are high in German due to good infrastructures compared to our settings, and advance management in German might have served the life of most severe injured patients with type C, compared to our settings where most of these patients might have died before reaching to the hospital.

This study has shown that, there is no difference in neurological improvement among patients treated nonsurgical or surgical, as it has shown among ten patients with neurological deficit treated nonsurgical , 3 (30%) patients improved, and on the other hand twenty patients were treated surgical, of which 9 (42.6%) neurological improved, this difference is not statistically significant. P- value: 0.72.

This results was similar to what reported by McKinley w. et al that, no significant differences in changes of neurologic status were noted between surgical and nonsurgical groups, either for neurologic level of injury or ASIA motor changes (68).

Similarly evidence by Rutabasibwa thesis has reported that there is no difference as regards neurological recovery (Frankel score or ASIA score) and no substantial difference in functional long-term outcome between the operative and non-operative treatment (65).

CHAPTER FIVE

5.0 CONCLUSION

Young adult males are majority of patients sustaining spine injuries following MVC. The cervical spine was the most common level of injury with complete neurologic deficit predominating. However, there were no significant differences in changes of neurological status between non surgical and surgical managed patients.

5.1 STUDY LIMITATIONS

Budget for the study was not adequate to investigate some of the patients with CT scan or MRI. Duration of study was short

5.2 RECOMMENDATIONS

i. Young adult males are majority of patients sustaining spine injuries following MVC. There is a need to conduct another study to see if these groups of patients are aware of road safety measures, like using of seat belts, wearing of helmet and use of speed governor.

ii. Spine injured patients with indications of surgery, should be operated early to reduce the duration of hospital stay and for early rehabilitation.

REFERENCES

1. Centres for Disease Control and Prevention. Spinal Cord Safety, USA 2001, http://www.cdc.gov/safeusa/home/sci.htm.

2. Greenberg MS. Spine Injuries. Handbook of Neurosurgery 5th ed 2001, 25:686-735.

3. Eyster EF, Kelter DB, Porter RW. Think First: The National Head and Spinal Cord Injury Prevention Program; *In* Wilkins RH and Rengachary SS (eds), Neurosurgery1996 vol II; 257:2603-2606.

4. Acton PA, Farley T, Freni LW, Ilegbodu VA, Sniezek JE, Wohlled JC. Traumatic spinal cord injury in Arkansas. *Arch Phys Med Rehabil* 1993; 74:1035-1040.

5. Sonntag VKH, Volmer DG. Spine. In: Winn HR, editor. Youmans Neurological Surgery. 5th ed. Philadelphia: Saunders; 2004. p. 4869-85.

6. Parsons KC. The impact of spinal cord injury on long-term survival. J Insur Med 1991;23(4):227.

7. Parsons KC, Lammertse DP. Rehabilitation in spinal cord disorders. 1. Epidemiology, prevention, and system of care of spinal cord disorders. Arch Phys Med Rehabil
1991;72(4-S):S293 - S294.

8. Banta G. Emergency Care and Transportation of the Sick and Injured. Menasha, WI: American Academy of Orthopaedic Surgeons; 1987.

9. Lasfargues JE, Custis D, Morrone F, et al. A model for estimating spinal cord injury prevalence in the United States. Paraplegia 1995;33(2):62 - 68.

10. Haffner DL, Hoffer MM, Wiedbusch R. Etiology of children's spinal injuries at Rancho Los Amigos. Spine 1993;18(6):679 - 684.

11. Woodruff BA, Baron RC. A description of nonfatal spinal cord injury using a hospital- based registry. Am J Prev Med 1994;10(1):10 - 14.

12. Acton PA, Farley T, Freni LW, et al. Traumatic spinal cord injury in Arkansas, 1980 to 1989. Arch Phys Med Rehabil 1993;74(10):1035 - 1040.

13. Tator CH, Duncan EG, Edmonds VE, et al. Neurological recovery, mortality and length of stay after acute spinal cord injury associated with changes in management. Paraplegia 1995;33(5):254 - 262.

14. Dickman CA, Zabramski JM, Hadley MN, et al. Pediatric spinal cord injury without radiographic abnormalities: report of 26 cases and review of the literature. J Spinal Disord 1991;4(3):296 - 305.

15. Roth EJ, Lovell L, Heinemann AW, et al. The older adult with a spinal cord injury. Paraplegia 1992; 30(7):520 - 526.

16. Advanced Trauma Life Support. Advanced Trauma Life Support Student Manual. Chicago: American College of Surgeons; 1989.

17. Levi L, Wolf A, Belzberg H. Hemodynamic parameters in patients with acute cervical cord trauma: description, intervention, and prediction of outcome. Neurosurgery 1993;33(6):1007 - 1016; discussion 16 - 17.

18. Baker SP, O'Neill B, Haddon W Jr, et al. The injury severity score: a method for describing patients with multiple injuries and evaluating emergency care. J Trauma 1974;14(3):187 - 196.

19. ASIA. Standards for Neurological Classification of Spinal Injury. Chicago: American Spinal Injury Association; 1996.

20. Enderson BL, Reath DB, Meadors J, et al. The tertiary trauma survey: a prospective study of missed injury. J Trauma 1990;30(6):666 - 669; discussion 9-70.

21. MacDonald RL, Schwartz ML, Mirich D, et al. Diagnosis of cervical spine injury in motor vehicle crash victims: how many X-rays are enough? J Trauma 1990;30(4):392 - 397.

22. Harris JH Jr, Carson GC, Wagner LK, et al. Radiologic diagnosis of traumatic occipito-vertebral dissociation: 2. Comparison of three methods of detecting occipitovertebral relationships on lateral radiographs of supine subjects. AJR Am J Roentgenol 1994;162(4):887 - 892.

23. Levitt MA, Flanders AE. Diagnostic capabilities of magnetic resonance imaging and computed tomography in acute cervical spinal column injury. Am J Emerg Med 1991;9(2):131 - 135.

24. Peh WC, Cheng P, Chan FL. Direct coronal computed tomography of the upper cervical spine. Spine 1995;20(8):972 - 974.

25. Schaefer DM, Flanders A, Northrup BE, et al. Magnetic resonance imaging of acute cervical spine trauma. Correlation with severity of neurologic injury. Spine 1989;14(10):1090 - 1095.

26. Schaefer DM, Flanders AE, Osterholm JL, et al. Prognostic significance of magnetic resonance imaging in the acute phase of cervical spine injury. J Neurosurg 1992;76(2):218 - 223.

27. Ersmark H, Dalen N, Kalen R. Cervical spine injuries: a follow-up of 332 patients. Paraplegia 1990;28(1):25 - 40.

28. Beyer CA, Cabanela ME, Berquist TH. Unilateral facet dislocations and fracture- dislocations of the cervical spine. J Bone Joint Surg Br 1991;73(6):977 - 981.

29. Delamarter RB, Sherman J, Carr JB. Pathophysiology of spinal cord injury. Recovery after immediate and delayed decompression. J Bone Joint Surg Am 1995;77(7):1042 -1049.

30. Carlson GD, Minato Y, Okada A, et al. Early time-dependent decompression for spinal cord injury: vascular mechanisms of recovery. J Neurotrauma 1997;14(12):951 - 962.

31. Carlson GD, Warden KE, Barbeau JM, et al. Viscoelastic relaxation and regional blood flow response to spinal cord compression and decompression. Spine 1997;22(12):1285- 1291.

32. Cripps RA, Lee BB, Wing P et al. A global map for traumatic spinal cord injury epidemiology: towards a living data repository for injury prevention. Spinal Cord 2011; 49:493 – 501.

33. Ackery A, Tator C, Krassioukov A. A global perspective on spinal cord injury epidemiology. J Neurotrauma 2004; 21: 1355 – 70.

34. Dahlberg A, Kotila M, Leppänen P et al. Prevalence of spinal cord injury in Helsinki.Spinal Cord 2005; 43: 47 – 50.

35. Kurtzke JF. Epidemiology of spinal cord injury. Neurol Neurocir Psiquiatr 1977; 18 (suppl): 157 – 91.

36. Razdan S, Kaul RL, Motta A et al. Prevalence and pattern of major neurological disorders in rural Kashmir (India) in 1986. Neuroepidemiology 1994; 13: 113 – 9.

37. National Spinal Cord Injury Statistical Center. Spinal cord injury facts and figures at a glance. Birmingham, Alabama, USA: The National Spinal Cord Injury Statistical Center, 2010. www.nscisc.uab.edu/public_content/pdf/ Facts%20 and %20 Figures% 20 at % 20 a %20 Glance % 202010.pdf (11.1.2012)

38. DeVivo MJ, Chen Y. Trends in new injuries, prevalent cases, and aging with spinal cord injury. Arch Phys Med Rehabil 2011; 92: 332 – 8.

39. Hagen EM, Eide GE, Rekand T et al. A 50-year follow-up of the incidence of traumatic spinal cord injuries in Western Norway. Spinal Cord 2010; 48: 313 – 8.

40. Gjone R, Nordlie L. Incidence of traumatic paraplegia and tetraplegia in Norway: a statistical survey of the years 1974 and 1975. Paraplegia 1978; 16: 88–93.

41. Yang NP, Deng CY, Lee YH et al. The incidence and characterisation of hospitalised acute spinal trauma in Taiwan–a population-based study. Injury 2008; 39: 443 – 50.

42. Gosselin RA, Coppotelli C. A follow-up study of patients with spinal cord injury in Sierra Leone. Int Orthop 2005; 29: 330 – 2.

43. Rahimi-Movaghar V, Saadat S, Rasouli MR et al. Prevalence of spinal cord injury in Tehran, Iran. J Spinal Cord Med 2009; 32: 428 – 31.

44. Solagberu BA. Spinal cord injuries in Ilorin, Nigeria. West Afr J Med 2002; 21:230–2.

45. Taghippor M, Kazemzadeh SE. Traumatic vertebral column and spinal cord injury in Nemazi hospital, Shiraz: an epidemiological study. Armaghan Danesh J 1384:11(4):55-62.

46. Fakharian E, Tabesh H, Masoud SA. An epidemiologic study of spinal injury in Kashan. J Guilan Uni Med Sci 2004;49:79-85.

47. Cripps RA, Lee BB, Wing P et al. A global map for traumatic spinal cord injury epidemiology: towards a living data repository for injury prevention. Spinal Cord 2011; 49: 493 – 501.

48. Ackery A, Tator C, Krassioukov A. A global perspective on spinal cord injury epidemiology. J Neurotrauma 2004; 21: 1355 – 70.

49. Olasode BJ, Komolafe IE, Komolafe M et al. Traumatic spinal cord injuries in Ile-Ife, Nigeria, and its environs. Trop Doct 2006; 36: 181 – 2.

50. Pedersen V , Müller PG, Biering-Sørensen F. Traumatic spinal cord injuries in Greenland 1965 – 1986. Paraplegia 1989; 27: 345 – 9.

51. Raja IA, Vohra AH, Ahmed M. Neurotrauma in Pakistan. World J Surg 2001;25:1230–7.

52. Lakhey S, Jha N, Shrestha BP et al. Aetioepidemiological profile of spinal injury patients in Eastern Nepal. Trop Doct 2005; 35: 231 – 3.

53. Hart C, Williams E. Epidemiology of spinal cord injuries: a reflection of changes in South African society. Paraplegia 1994; 32: 709 – 14.

54. Hagen EM, Eide GE, Rekand T et al. A 50-year follow-up of the incidence of traumatic spinal cord injuries in Western Norway. Spinal Cord 2010; 48: 313–8.

55. Velmahos GC, Degiannis E, Hart K et al. Changing profiles in spinal cord injuries and risk factors influencing recovery after penetrating injuries. J Trauma 1995; 38: 334 – 7.

56. Maynard FM jr., Bracken MB, Creasey G et al. International standards for neurological and functional classification of spinal cord injury. Spinal Cord 1997; 35: 266 – 74.

57. Ditunno JF jr., Young W, Donovan WH et al. The international standards booklet for neurological and functional classification of spinal cord injury. Paraplegia 1994;32:70–80.

58. Gertzbein SD. Scoliosis Research Society. Multicenter spine fracture study. Spine1992; 17:528–40

59. Magerl F, Engelhardt P. Brust-und Lendenwirbelsäule — Verlaufsformen. In: Witt AN, Rettig H, Schlegel KF (eds) Orthopädie in Praxis und Klinik, Spezielle Orthopädie (Wirbelsäule — Thorax — Becken). Thieme, Stuttgart New York,1994; pp3.82–3.132

60. Knop C, Blauth M, Bühren V, et all. Surgical treatment of injuries of the thoracolumbar transition. I: Epidemiology. Unfallchirurg 1999; 102:924–35

61. Gertzbein SD. Fractures of the thoracic and lumbar spine. Williams & Wilkins, Baltimore. 1992

62. Magerl F, Aebi M, Gertzbein SD, et all. A comprehensive classification of thoracic and lumbar injuries. Eur Spine J 1994; 3:184–201

63. Meyer PR, Heim S. Fractures of the thoracic spine T1-T10. In: Meyer PR (ed) Surgery of spine trauma. Churchill Livingstone, Edinburg,1989; pp 525–72

64. Knop C, Blauth M, Bühren V, et all.Surgical treatment of injuries of the thoracolumbar transition. 2: Operation and roentgenologic findings. Unfallchirurg 2000; 103:1032–47

65. Rutabasibwa N. Spine trauma: Pattern, causes and surgical outcome at Chris Hani Baragwaneth Hospital, in SOWETO, Johannesburg. South Africa 2010. (unpublished)

66. MOI Trauma registry books 2012.

67. Mhina R, Kinasha A, Kinunda SM. The aetiology, pattern and prognosis of fractures of the spine in Dar es salaam, Tanzania. Cent Afr J Med. 1993 Dec;39(12):254-8.

68. McKinley W, Meade MA, Kirshblum S, Barnard B. Outcomes of early surgical management versus late or no surgical intervention after acute spinal cord injury. Arch Phys Med Rehabil 2004;85:1818-25.

APPENDICES

Appendix I: Questionnaire (English Version)

1. Questionnaire no……
2. Patient initials and phone no……
3. Age…….
4. Gender: - 1. Male 2. Female
5. Informant 1.parents 2. Relative
   3. Good Samaritans 4. Patient alone
   5. Others specify……
6. Region of Residence 1.Dar-es-salaam
   2. Coast
   3. Morogoro
   4. Tanga
   5. Others specify……
7. Referring hospital 1.Self referral
   2. Dispensary
   3. Health Centre
   4. District hospital
   5. Regional hospital
   6. Others specify……
8. Mode of transport brought the patient:
   a) Ambulance b) Private car
   c) Taxi
   d) Others: specify…….

9. What was the mechanism of spine injury?

i) MVC (car occupants, pedestrians, motor cyclists)

ii) FFH

iii) GSW spine

iv) Others.....

10. What was the radiological level of skeletal injury?

i) Cervical spine (C1—C7)

ii) Thoracic (T1—T12)

iii) Lumbar(L3—L5)

11. What was the neurological status of the patient on admission?

i) Paraplegia/ quadriplegia (ASIA –A)

ii) Intact sensation (ASIA - B)

iii) Motor useless (ASIA -C)

iv) Motor useful (ASIA - D)

v) Normal power (ASIA - E)

12. Injury to other body parts 1.Bones of the upper limbs

2. Bones of the lower limbs

3. Head injury

4. Chest injury

5. Visceral injury

6. Others Specify…….

13. Classification of fracture (AO) 1. Type A

2. Type B

3. Type C

14. Duration from injury to 1st admission 1.one day

2. Three days

3. one week

4. Two weeks

5. More than two weeks

15. Treatment modality

i) Non surgical ii) Surgical

16. Post surgery outcome

i) Neurologically improved ii) Remained the same

iii) Died

17. Duration of hospital stay

Appendix II: Questionnaire (Swahili Version)

1. Nambari ya dodoso……

2. Patient initials and phone no.……

3. Umri…….

4. Jinsia: - 1. Mume 2. Mke

5. Mtoa taarifa 1.Wazazi
   2. Ndugu wa karibu
   3. Wasamalia wema
   4. Mgonjwa mwenyewe
   5. Wengine, taja……

6. Mkoa wa makazi1.Dar-es-salaam
   2. Pwani
   3. Morogoro
   4. Tanga
   5. Mkoa mwingine, taja……

7. Hospitali iliyokurifaa; 1.Hana rufaa
   2. Zahanati
   3. Kituo cha afya
   4. Hospitali ya Wilaya
   5. Hospitali ya Mkoa
   6. Nyingine, taja……

8. Usafiri uliotumia kufika hospitali:
   a) Gari la wagonjwa
   b) Usafiri binafsi
   c) Taxi
   d) Usafiri mwingine…….

9. Ni jinsi gani ulivyoumia uti wa mgongo?

i) Ajali ya gari/pikipiki; kama (abiria, mtembea kwa miguu, mwendesha pikipiki)

ii) Kuanguka kutoka kimo kirefu

iii) Kupigwa risasi mgongoni

iv) Njia nyingine, taja.....

10. What was the radiological level of skeletal injury?

i) Mgongo shingo (C1—C7)

ii)Mgongo kifua (T1—T12)

iii) Mgongo tumbo (L1—L5)

11. What was the neurological status of the patient on admission?

i) Paraplegia/ quadriplegia (ASIA –A)

ii) Intact sensation (ASIA - B)

iii) Motor useless (ASIA -C)

iv) Motor useful (ASIA - D)

v) Normal power (ASIA - E)

12. Majeraha sehemu nyingine za mwili

1. Mifupa ya mikono
2. Mifupa ya miguu
3. Majeraha kichwani
4. Majeraha kifuani
5. Majeraha ya matumbo
6. Majeraha mengine, taja……..

13. Classification of fracture (AO) 1. Type A
    2. Type B
    3. Type C

14. Muda uliopata majeraha mpaka kulazwa hospitali kwa mara ya kwanza.
    1. Siku moja
    2. Siku tatu
    3. Wiki moja
    4. Wiki mbili
    5. Zaidi ya wiki mbili

15. Aina ya matibabu iliyotumika
    i) Si upasuaji
    ii) Upasuaji

16. Matokeo baada ya upasuaji
    i) Neurologically improved
    ii) Hali ilibaki vile vile
    iii) Alikufa

17. Umekaa hospitali kwa kipindi gani?

Appendix III: Consent Form (English Version)

CONSENT FORM

Title: Spine injuries; Patterns, Mechanisms injury and management outcomes among patients admitted at Muhimbili Orthopedics Institute 2013 – 2014.

Dear Sir/Madam

Greetings;

My name is Dr Abubakar Ramadhan Hamis, a resident in the department of Orthopaedics and Traumatology at Muhimbili University of Health and Allied Sciences. I would like to conduct the study above as a necessary requirement for fulfillment of my postgraduate studies.

Purpose

The purpose of the study is to determine patterns, mechanisms of injury and management outcomes among patients with spine injuries treated at MOI.

This study requires you to participate so that important information can be obtained from you regarding these injuries.

Confidentiality:

All information collected on questionnaires will be entered into computer with identification number. The questionnaires will be handled with greater secrecy in order to maintain confidentiality.

Risk:

There will be no risk associated with this study.

Participation

Your participation in this study is voluntary and therefore any decision you make will be respected. If you agree to participate in the study, you will be interviewed. If you choose not to participate in the study, you will continue to receive all services that are normally provided in our institute.

If you have any question about the study, you can contact Dr Abubakar Ramadhan Hamis 0715 219175 and Professor L.M Museru 0713334617, Department of Orthopaedics and Traumatology, MUHAS. If you have questions about your rights as a participant, you may contact **Professor M. Mushi**, Director of MUHAS Research and Publications Committee. P.O.BOX 65001 Dar es Salaam.

Do you agree?

Participant agrees……. Participant does NOT agree……

I, _____ have read/been told of the contents of this form and understood its meaning; hence, I do agree to participate in this study.

Signature_____ (Participant), Date_____

Signature_____ (Researcher), Date_____

Appendix IV: Consent Form (Kiswahili Version)

Utafiti kuhusu vitu vinavyosababisha na jinsi sehemu ya uti wa mgongo unavvyovunjika, matibabu na matokeo ya muda mfupi baada ya tiba kwa wagonjwa wanaotibiwa katika taasisi ya mifupa ya Muhimbili.

Salaaam!

Mimi naitwa Dr Abubakar Ramadhan Hamis ni mwanafunzi wa udhamili Chuo Kikuu cha Sayansi za Afya Muhimbili, idara ya magonjwa ya mifupa na majeraha. Ninafanya utafiti huu kama hitaji la lazima ili niweze kumaliza masomo yangu. Pia matokeo ya utafiti huu yatasaidia kufahamu kwa undani zaidi kuhusu tatizo hili ha hivyo kuboresha zaidi tiba yake.

Jinsi ya kushiriki

Kama utakubali kushiriki katika utafiti huu, nitakuhoji maswali machache kuhusu ulivyopata tatizo na maswali mengine yanayohusu jamii kama vile umri, jinsia, kazi na kadhalika. Pia baada ya tiba na kuruhusiwa nyumbani nitakufuatilia katika idara ya wagonjwa wa n je kwa kipindi cha wiki 16 toka ulipopata tiba ili kujua maendeleo yako.

Madhara/usiri

Hakuna madhara yoyote yanayotegemewa kutokana na utafiti huu.Taarifa za ugonjwa wako zitatunzwa kwa kutumia herufi maalum ili kuwa na usiri.

Uhuru wa kushiriki;

Kushiriki kwenye utafiti ni hiari yako.

Unaweza kujitoa wakati wowote. Kama utachagua kutoshiriki, utaendelea kupata huduma kama kawaida hapa hospitalini.

Faida ya utafiti

Ukishiriki kwenye utafiti huu, utapata fursa ya kufahamu kwa undani ukubwa wa tatizo, aina mbalimbali za tiba, pamoja na matokeo baada ya tiba. Pia utapata ushauri wa kitaalamu kwa kipindi chote cha utafiti muda wowote unapohitaji.

Taarifa

Kuna kamati ya kusimamia udhibiti wa utafiti huu.

Endapo unahitaji kupata maelezo kuhusu haki zako au taarifa,wasiliana na Dr Abubakar Ramadhan Hamis 0715 219175 au Professor L.M Museru wa chuo kikuu cha Afya na tiba Muhimbili na taasisi ya mifupa muhimbili. Kama unaswli lolote kuhusu haki yako kama mshiriki wasiliana na **Professor M. Mushi**, ambaye ni mkurugenzi wa bodi ya utafiti chuo kikuu cha Afya na Tiba Muhimbili, kwa S.L.P 65001 Dar es Salaam.

Baada ya maelezo hayo, Je unakubali kushiriki kwenye utafiti? (weka alama) ya vema, Ndiyo.....Hapana.....

Mimi ....., nimeelezwa na nimesoma maelezo haya. Maswali yangu yamejibiwa.

Nimekubali kushiriki katika utafiti huu.

Sahihi ya mtafiti..... Tarehe…….

Sahihi ya Mtafiti ..... Tarehe……..

Appendix V: ASIA Impairment Scale

(A modified Frankel Neurological Performance Scale) Score description

A **Complete;** no motor or sensory function preserved
B **Incomplete;** sensory but no motor function preserved below the neurologic Level (includes sacral segments S4-5)

C **Incomplete;** motor function preserved below the neurologic level (more than half of key muscles below the neurologic level have muscle strength grade<3)
D **Incomplete;** motor function preserved below the neurologic level (more than half of key muscles below the neurologic level have a muscle strength grade >3)

E **Normal;** Sensory and motor function normal.