PATTERNS AND SHORT-TERM TREATMENT OUTCOMES OF TRAUMATIC HIP DISLOCATIONS IN ADULT PATIENTS AT MOI TEACHING AND REFERRAL HOSPITAL, ELDORET

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A thesis submitted in partial fulfillment of the requirements for award of the degree of Master of Medicine (Orthopaedic Surgery) of Moi University

DECLARATION

Declaration by Candidate

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DISCLOSURE

No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this thesis.

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DEDICATION

This work is dedicated to Esther Akello. My dear wife, you have my unending gratitude for your love, patience, support and encouragement.

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ABBREVIATIONS AND ACRONYMS

AP	Anteroposterior
AVN	Avascular Necrosis
CT	Computerized Tomography
HHS	Harris Hip Score
IREC	Institutional Research and Ethics Committee
MCFA	Medial Circumflex Femoral Artery
MTRH	Moi Teaching and Referral Hospital
N	Newton
OA	Osteoarthritis
ROM	Range of Motion
RTA	Road Traffic Accidents
SPSS	Statistical Packages for Social Sciences
THD	Traumatic Hip Dislocations
THR	Total Hip Replacement
USA	United States of America

OPERATIONAL DEFINITIONS OF VARIABLES AND KEY CONCEPTS

Adult – a person who is aged 18 or more years.

Patient – an injured person seeking treatment; used interchangeably with participant

Short-term outcomes – these are functional outcomes assessed clinically using a tool (Harris hip score) within 9 months of hip dislocation. Categorised as excellent, good, fair, and poor. Satisfactory outcomes include both excellent and good outcomes, while unsatisfactory outcomes include the fair and poor outcomes.

Traumatic hip dislocation – traumatic injury of the hip joint that causes the head of the femur to get out of the acetabulum.

Treatment – how to achieve stable concentric reduction.

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ABSTRACT

BACKGROUND: Traumatic hip dislocations (THD) accounts for about 5% of traumatic joint dislocations. Due to the inherent stability of the hip joint a lot of force is required to dislocate it. This excessive force often causes associated injuries that may delay the diagnosis and treatment of the hip dislocations, resulting in poor outcomes on long term follow up. At MTRH, there is paucity of information on patterns of traumatic hip dislocations and their treatment outcomes in adult patients. This study therefore seeks to bridge that information gap.

OBJECTIVE: To determine the patterns of traumatic hip dislocations and their short-term treatment outcomes in adult patients at MTRH.

METHODS: This prospective descriptive study was conducted at MTRH (Accident and Emergency Department, Orthopaedic wards, and Outpatient clinics). Formal approval to conduct the study was provided by IREC and MTRH administration. The study population included adult patients who presented with traumatic hip dislocations. Consecutive sampling was done. An interviewer administered questionnaire was used to collect data. More data was obtained by reviewing the patients' radiographs and file notes. The patients were then reassessed using a Harris Hip Score three times at an interval of three months. Obtained data was analysed using SPSS version 20, and presented in prose, graphs and frequency tables.

RESULTS: A total of 53 patients with traumatic hip dislocations were enrolled in this study. Five of the participants were lost to follow up at various stages of the study. The mean age at the time of dislocation was 36.1±SD 12.7 years (range 19 – 63 years). There were 45 (84.9%) males and 8 (15.1%) females. Thirty-eight (71.7%) of the patients had sustained the dislocations due to road traffic accidents. The other causes of THD were falls from heights (17%) and assault (11.3%). Forty-nine (92.5%) of the patients had posterior THD while 4 patients (7.5%) had anterior dislocations. Associated injuries were present in 29 (54.7%) of the patients, with fractures of the acetabulum accounting for majority of these associated injuries (30.2%). Craniofacial soft tissue injuries accounted for 13.2% of the associated injuries. In 38 (71.7%) of the participants closed reduction was achieved while open reduction was performed in the other 15 (28.3%) patients. Thirty-five (66%) of the dislocations were reduced within 24 hours of injury. At nine months follow up 96% of the patients had good and excellent functional outcomes, while 4% had poor and fair outcomes.

CONCLUSION: Most of the traumatic hip dislocations were due to road traffic accidents. Majority of them were posterior dislocations. Most of the dislocations were treated by closed reduction. Short-term functional outcome at 9 months after injury was satisfactory in majority of patients.

RECOMMENDATION: Emphasis on road safety to reduce road traffic accidents and consequently numbers of traumatic hip dislocations. More efforts to be put in for timely reductions of THD by creating awareness among healthcare workers in peripheral health facilities.

CHAPTER ONE: INTRODUCTION

1.1: Background Information

Traumatic hip dislocations (THD) encompass a spectrum of injuries with considerable potential for long term disability and rapidly progressive joint disease (Sanders, Tejwani, & Egol, 2010). They result from high energy forces acting along the long axis of the shaft of the femur (Obakponovwe, Morell, Ahmad, Nunn, & Giannoudis, 2011; Tornetta & Mostafavi, 1997). These usually occur in the setting of road traffic accidents (RTA) but may also result from falls from a height, and high impact sports like soccer. Based on the direction of the force and the position of head of the femur in relation to the acetabulum, THD are classified into posterior, anterior, and central (Obakponovwe et al., 2011; Sanders et al., 2010). The posterior dislocations constitute 85% to 90% of THD.

Although THD is uncommon injury, accounting for about 5% of all traumatic joint dislocations (Obakponovwe et al., 2011), its incidence is thought to be on the rise (Clegg, Roberts, Greene, & Prather, 2010). It poses a challenge to orthopaedic surgeons in that it has to be diagnosed and reduced within 24 hours (preferably within 6 hours) to minimise risks of patients developing long-term debilitating complications (Pietrafesa & Hoffman, 1983; Tornetta & Mostafavi, 1997). This is not always possible. The large amounts of energy that produce THD also cause associated injuries, some of which are very severe and take precedence in the management of the patient (Hak & Goulet, 1999; Pietrafesa & Hoffman, 1983; Suraci, 1986). This may delay the diagnosis and management of the dislocations. Sometimes the dislocations may be missed altogether (Upadhyay, Moulton, & Srikrishnamurthy, 1983).

1.2: Problem statement

An average of 45 patients with THD receive treatment at the Moi Teaching and Referral Hospital (MTRH) every year. Some of these patients are referred from the neighbouring health facilities. The patterns and short-term treatment outcomes of these patients remain largely unknown.

1.3: Justification for the study

Most of the published studies on THD have been conducted in developed parts of the world. In Africa, studies on THD have mainly been published in West Africa. Therefore, the etiology and types of THD, associated injuries, and treatment given to patients with THD it is not known at MTRH. Furthermore, literature search does not show functional status of patients with THD within 1 year of injury. This study aims at bridging this information gap on the patterns and short-term treatment outcomes of traumatic hip dislocations at MTRH. It will also form a basis for further studies in the region, especially on the long-term outcomes of these injuries.

1.4: Research question

What are the patterns and short-term treatment outcomes of traumatic hip dislocations in adult patients at Moi Teaching and Referral Hospital, Eldoret?

1.5: Study objectives

1.5.1: Broad objective

To describe the patterns and short-term treatment outcomes of traumatic hip dislocations in adult patients at MTRH.

1.5.2: Specific objectives

1. To identify the etiology and describe types of traumatic hip dislocations in adult patients at MTRH.
2. To identify injuries associated with traumatic hip dislocations in adult patients at MTRH.
3. To describe the treatment of traumatic hip dislocations in adult patients at MTRH.
4. To assess the short-term functional outcomes of traumatic hip dislocations in adult patients at MTRH.

CHAPTER TWO: LITERATURE REVIEW

2.1: Introduction

Traumatic hip dislocation (THD) occurs when the femoral head is forced out of its normal position in the acetabulum as a result of trauma. This leads to loss of articular congruence between the femoral head and the acetabulum. It is uncommon injury, accounting for about 5% of traumatic joint dislocations (Obakponovwe et al., 2011). In a normal adult hip joint this injury is almost always caused by high energy mechanisms (Sanders et al., 2010; Tornetta & Mostafavi, 1997). There is a high incidence of associated injuries in these patients (Clegg et al., 2010; Tornetta & Mostafavi, 1997). These injuries may be more severe and take precedence in the management of the patients. In such cases the diagnosis and treatment of THD may be missed leading to worse outcomes.

2.2: Relevant anatomy of the hip joint

2.2.1: Articular surfaces

The hip joint is a ball- and- socket joint with large arc of rotation (Browner, Jupiter, Levine, Trafton, & Krettek, 2009; Obakponovwe et al., 2011). The head of the femur articulates with the acetabulum. The articular surface of the acetabulum has a deficiency that is filled by the transverse ligament inferiorly (Browner et al., 2009). The depth of acetabulum is increased by the acetabular labrum, which is attached to the margin of the acetabulum and the transverse ligament (Obakponovwe et al., 2011; Sanders et al., 2010). The increased acetabular depth enhanced by the labrum ensures that at least 50% of the femoral head is covered by osteocartilaginous labral-acetabular complex in any position of hip motion (Ongeti, Pulei, Maru, Kigera, & Gakuya, 2017).

The diameter of the acetabular cavity is constricted by the labral rim which embraces the femoral head, maintaining joint stability as a static restraint (Jaskulka, Fischer, & Fenzl, 1991). The articular surface on the femoral head is spheroidal and is covered by articular cartilage. The cartilage has its maximal thickness anterolaterally, where the weight of the body is transmitted to the lower limb (Grey, Williams, & Bannister, 1995; Jaskulka et al., 1991). The articular surface of the acetabulum is broadest anterosuperiorly where the pressure of body weight falls in an erect posture. It is also covered by articular cartilage that is thickest anterosuperiorly (Grey et al., 1995; Jaskulka et al., 1991).

2.2.2: Capsule and ligaments of the joint

The ligamentous support of the hip joint is provided by the strong capsule and ligaments that run from the margin of acetabulum to the femoral neck and the intertrochanteric region. The joint capsule is strong and dense. It is attached superiorly to the acetabular margin and the transverse acetabular ligament. It then extends inferolaterally to surround the femoral head and neck. Anteriorly many fibres ascend along the neck as longitudinal retinacula which contain blood vessels for both the femoral head and neck (Browner et al., 2009; Grey et al., 1995).

The iliofemoral ligament (of Bigelow) is the strongest of the ligaments. It is located anteriorly and is intimately blended with the capsule (Grey et al., 1995; Obakponovwe et al., 2011). It supports the anterior capsule of the joint and prevents hyperextension of the hip (Jaskulka et al., 1991; Obakponovwe et al., 2011). It acts as a fulcrum for relocation of the hip since it is rarely disrupted even in cases of trauma.

The pubofemoral ligament is triangular in shape. Its base is attached to the iliopubic eminence and superior pubic ramus while its apex blends distally with the capsule and deep surface of the medial part of iliofemoral ligament. It restricts abduction of the hip (Obakponovwe et al., 2011). The ischiofemoral ligament thickens the capsule posteriorly between the ischial border of acetabulum and base of the neck of the femur (Obakponovwe et al., 2011). It limits internal hip rotation.

The hip joint, therefore, though very mobile, is a very stable joint. The factors responsible for its stability can be summarised as (Browner et al., 2009):

1. The close fitting of femoral head into the acetabulum, and the restrain offered by acetabular labrum.
2. The presence of the vacuum effect.
3. Reinforcement of the capsule by strong ligaments and the surrounding muscles.

2.2.3: Blood supply of the hip

The blood supply to the hip is tenuous and is easily compromised in cases of THD. This can lead to osteonecrosis of the head of the femur or secondary osteoarthritis of the hip joint (Browner et al., 2009; Obakponovwe et al., 2011; Sanders et al., 2010).

The head of the femur derives its arterial blood supply mainly from the medial circumflex femoral artery (MCFA) which is a branch of deep femoral artery (Browner et al., 2009; Tornetta & Mostafavi, 1997). The branches of MCFA form an extracapsular anastomosis (at the base of femoral neck) from which the superior and posterior cervical arteries originate. These cervical branches pass through the capsule close to its insertion to lie on the femoral neck. They then ascend along the neck and enter the femoral head just below its articular surface (Browner et al., 2009; Grey et al., 1995; Sanders et al., 2010). A lesser contribution to arterial blood supply to the femoral head comes from the foveal artery via the ligamentum teres. This artery is present and of sufficient size to make a contribution in about 75% of the hips in children but its contribution in adults is minimal (Browner et al., 2009; Sanders et al., 2010).

2.3: Etiology of THD

Reports of THD in patients were in medical literature as early as the 2^{nd} half of 19^{th} century even before the X- rays were discovered (Browner et al., 2009). During that era cadaveric studies were used to define various anatomic injuries that were associated with THD. Although THD is considered to be a rare injury, its incidence is noted to have escalated due to an increased number of accidents involving all types of motor vehicles, and more so when the safety belts are not won (Pietrafesa & Hoffman, 1983).

Traumatic dislocations of the hip usually result from high-energy forces acting along the long axis of the femur shaft (Clegg et al., 2010; Obakponovwe et al., 2011; Sanders et al., 2010). These high-energy forces are encountered in RTA, falls from a height, as well as in high impact sports like soccer.

Studies on THD have found RTA to be the cause of at least two thirds of these injuries (Pietrafesa & Hoffman, 1983). Road traffic accidents accounted for 96% of causes of dislocations in retrospective study that was conducted at Vendarbilt University Medical Centre (Rosenthal & Coker, 1979).

In Mansfield (England) at a time when textile and coal mining industries were thriving, pit accidents and falls or falling objects significantly contributed (33%) to the etiology of THD (Upadhyay et al., 1983). A study conducted in Taiwan found RTA accounted for 78% of these injuries while 13.5% were due to falls from heights (Yang, Tsuang, Hang, & Liu, 1991). At the University of Vienna, Juskulka et al., (1991) recorded 96% of THD were due to RTA, while 4% were as a result of falls. A study conducted in Nigeria found all patients with THD had been involved in RTA (Alonge, Ogunlade, & Idowu, 2002). In Turkey, 83.9% of THD were caused by RTA, 12.9% were due to work place injuries, while sports accounted for 3.2% of the dislocations (Sahin et al., 2003). A study that sought to identify prognostic factors in patients with THD at King Fahd University Hospital found that 81% of the dislocations were due to RTA, 13.7% were caused by falls from a height and 5.1% due to sports (Al-Bahlool, Bubshait, & Sadat-Ali, 2009).

Although most of the cases of THD have been attributed to high energy mechanisms, a number of cases in which less energy was involved have been described. In Massachusetts, case reports of two recreational footballers who sustained hip fracture-dislocations as a result of trivial trauma were described (Giza, Mithofer, Matthews, & Vrahas, 2004). In one case a 24-year old man was struck on the left buttock by opponent player during a match and sustained THD, while in another case a 41-year old woman fell forward while dribbling the ball also sustaining fracture dislocation.

A similar case report of a 28-year-old rugby player, with no prior history of hip joint problems, sustaining a type III Thompson-Epstein fracture dislocation after a colleague landed on his lower back was published in England (Newton & du Plessis, 2014). It had been earlier suggested that hip dislocations caused by low energy mechanisms could be a result of underlying joint instability that need to be identified and corrected to avoid recurrent dislocations (Mofidi, Sankar, Kutty, Kaar, & Curtin, 2002).

2.4: Laterality of the involved hip

Traumatic dislocations of the hip commonly involve one limb (Browner et al., 2009). Findings on laterality of the hip affected have differed in a number of studies, indicating that there could be no predisposing factors on laterality of the involved hip. In analysis of long term effects of THD it was noted that in patients who had been involved in RTA the left hip had been twice as much affected as the right hip, but in other causes the incidence was equal in both limbs (Upadhyay et al., 1983). While the left hip was affected in 60% of the THD in a study in Taiwan (Yang et al., 1991), it was only involved in 40% of the dislocations in a study that was carried out in Nigeria (Alonge et al., 2002).

Bilateral hip dislocations are rarer compared to unilateral dislocations (Pietrafesa & Hoffman, 1983). Nonetheless, a few cases have been documented. In a study by Alonge et al. (2002) in Nigeria, one of the patients had sustained bilateral posterior dislocations. Bilateral anterior dislocations in a young man involved in RTA was documented in Turkey (Duygulu, Karaoglu, Kabak, & Karahan, 2003). Another case report of asymmetrical left hip posterior dislocation and right hip anterior dislocation in a young adult was also made in Turkey (Sahin, Ozturk, Dereboy, & Karaeminogullari, 2007). In Italy, a simultaneous right posterior dislocation and left anterior hip dislocation in a 23-year-old man that had been involved in RTA was described (Pascarella, Maresca, Cappuccio, Reggiani, & Boriani, 2008).

2.5: Mechanisms of dislocation

The main mechanism in THD is axial loading (Browner et al., 2009; Obakponovwe et al., 2011; Rosenthal & Coker, 1979; Sanders et al., 2010). The direction of the dislocation depends on the position of the hip at the time of impact and the direction of the force vector applied. If the leg is straight or the hip and knee are in flexion of less than 90º and the hip is adducted the posterior dislocation of the hip with fracture of the posterior acetabular wall usually occurs (Laorr, Greenspan, Anderson, Moehring, & McKinley, 1995; Obakponovwe et al., 2011; Pietrafesa & Hoffman, 1983). In contrast if the hip is abducted and externally rotated, the medial aspect of the knee is pushed by the steering wheel, dashboard, or front seat, resulting in an anterior dislocation.

2.6: Types of THD

Traumatic dislocations of the hip are broadly classified into three groups: the posterior, the anterior, and the central dislocations. This classification is based on the direction and position of the head of femur in relation to the acetabulum (Obakponovwe et al., 2011; Sanders et al., 2010). The posterior and anterior dislocations are further sub classified using classification system developed by Thompson and Epstein, 1951.

2.6.1: Posterior THD

They account for about 85% to 90% of the THD (Obakponovwe et al., 2011; Sanders et al., 2010). They are sub classified using Thompson-Epstein classification system into 5 types based on severity of associated acetabular fractures and presence of femoral head fracture (Browner et al., 2009; Obakponovwe et al., 2011; Sanders et al., 2010).

This classification system has a prognostic significance in that the prognosis worsens with increasing classification type (Browner et al., 2009; Obakponovwe et al., 2011). This classification is shown in Table 2.6.1.1, and Figure 2.6.1.1 on page 13.

Frequency of various types of posterior THD have varied in different studies. An epidemiologic review of 46 posterior fracture-dislocations of the hip found that 46% were type III injuries, 26% were type IV, 17% were type II and 11% were type V (Rosenthal & Coker, 1979). Out of the 90 cases of posterior THD in a study done in Taiwan, 34% were type I, 20% were type II, 11% were type III, 9% were type IV while 26% were type V (Yang et al., 1991).

In contrast, a study done in Nigeria only had type I (60.6%) and type II (21.4%) injuries (Alonge et al., 2002). In Brazil, type I dislocations were 47.5%, type II were 32.5%, type III were 10%, and each of types IV and V made up 5% (Lima, do Nascimento, de Almeida, & Facanha Filho, 2014).

Table 2.6.1.1: Thompson-Epstein Classification of Posterior THD (Obakponovwe et al., 2011)

Type I	Simple dislocation with or without an insignificant posterior wall fragment
Type II	Dislocation associated with a single large posterior wall fragment
Type III	Dislocation with a comminuted posterior wall fragment
Type IV	Dislocation with fracture of the acetabular floor
Type V	Dislocation with fracture of the femoral head

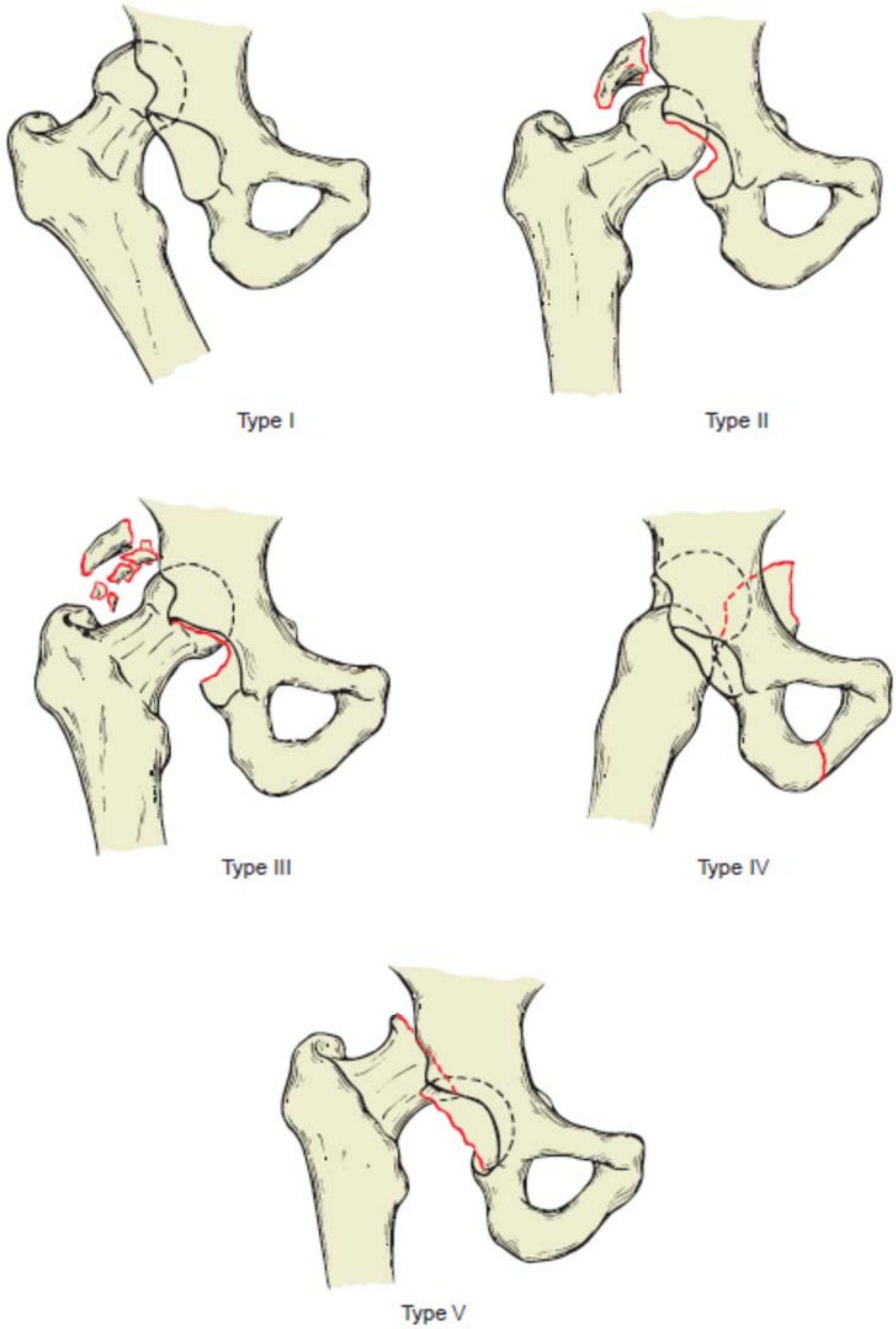

Figure 2.6.1.1: Thompson-Epstein classification of posterior THD (Browner et al., 2009)

2.6.2: Anterior THD

These are much fewer than posterior THD, constituting about 10% of THD (Bastian, Turina, Siebenrock, & Keel, 2011; Laorr et al., 1995; Yang & Cornwall, 2000). They are sub divided into 2 types using Epstein classification (Obakponovwe et al., 2011). This classification is shown in Table 2.6.2.1 below.

Table 2.6.2.1: Epstein Classification of Anterior THD (Obakponovwe et al., 2011)

Type I	Superior dislocations, including pubic and subspinous.
IA	No associated fractures
IB	Associated fracture or impaction of the femoral head
IC	Associated fracture of the acetabulum
Type II	Inferior dislocations, including obturator and perineal
IIA	No associated fractures
IIB	Associated fracture or impaction of the femoral head
IIC	Associated fracture of acetabulum

2.7: Associated injuries

More than 400 Newton (N) of force is required just to distract the femoral head from the acetabulum (Browner et al., 2009). Therefore, because of the high energies involved, associated injuries are common and may delay timely diagnosis and management of THD leading to poor outcomes (Browner et al., 2009; Obakponovwe et al., 2011).

Associated injuries may be in proximity to the affected hip or they may occur in other parts of the body. Their incidence has been reported to vary from 70% to 95% (Clegg et al., 2010; Obakponovwe et al., 2011).

Advances in vehicle restraints should theoretically reduce morbidity and mortality in patients who sustain THD from motor vehicle collisions but studies have not demonstrated this anticipated benefit of passenger restraints (Browner et al., 2009).

Yang et al., (1991) reported incidence of associated injuries to be 70.8% of which 21.9% had single while 48.9% had multiple associated injuries. In their study Jaskulka et al., (1991) found that 96% of patients with traumatic dislocations had associated injuries. Alonge et al., (2002) reported 68.8% incidence of associated injuries in patients with THD, with fractures of posterior wall of the acetabulum being present in 27.3%. Sahin et al., (2003) found 71% of their patients to have sustained associated injuries of which 32.3% had single injuries while 38.7% had multiple associated injuries. Lima et al., (2014) in Brazil had 74.4% of their study participants sustain associated injuries of which the majority (54.8%) were hip fractures. The studies done by Hak and Goulet (1999) and Suraci (1986) on distribution and severity of injuries associated with THD, found that 95% of the participants had associated injuries. Both of these studies were looking at injuries sustained from motor vehicle accidents.

2.8: Radiologic diagnosis of THD

A good quality single anteroposterior (AP) view plain radiograph of the pelvis is usually adequate to confirm the diagnosis of a traumatic hip dislocation (Browner et al., 2009; Clegg et al., 2010). The head of the femur will not be congruent in the acetabulum. In posterior dislocations, the head appears smaller and lies superiorly, overlapping the roof of acetabulum. In anterior dislocations, it appears larger and either lies inferiorly near the obturator foramen or overlaps the medial acetabulum. Abnormal rotation can also be noted on the AP radiograph, based on the position of the trochanters.

Computerized tomography (CT) scanning is useful for the accurate diagnosis of associated acetabular fractures. A study on computerised tomography after posterior THD found that 31.6% of dislocations had fractures which would otherwise have been overlooked based on plain radiographs alone (Hougaard, Lindequist, & Nielsen, 1987). Their routine use is however limited in the developing countries because they are costly and not easily available.

2.9: Treatment of THD

Traumatic hip dislocation is an absolute orthopaedic emergency that requires prompt reduction (Ongeti et al., 2017; Sanders et al., 2010). This initial treatment is important as it has a bearing on the long-term outcome of the injury. An increase in the rate of avascular necrosis (AVN) of femoral head has been observed when reduction is not performed within 12 hours of dislocation (Browner et al., 2009; Yang & Cornwall, 2000). Treatment often is done by closed manipulation methods and in cases where it is not possible or fails then open reduction is done.

In the Rosenthal and Coker (1979) retrospective review of the epidemiology of posterior fracture-dislocations, 89% of the dislocations were treated by closed reduction. Out of 46 patients with THD in a study done in Nigeria only one patient who had multiple ipsilateral lower limb fractures that precluded closed reduction underwent open reduction. The remaining 45 patients (97%) were treated by closed reduction (Alonge et al., 2002). In a study that was done in Turkey, 80.6% of the THD were treated by closed reduction and the remaining 19.4% treated by open reduction (Sahin et al., 2003). A Brazilian study on epidemiology of THD recorded similar trend in that 90.7% of the patients were treated by closed manipulation (Lima et al., 2014).

In closed reduction the principle is to apply steady traction in the direction of the femur. The hip is considered irreducible by closed means if three attempts at closed reduction fail. Multiple attempts are discouraged as they are associated with poor long-term results (Thompson & Epstein, 1951).

There are several methods that can be used for closed reduction (Browner et al., 2009; Clegg et al., 2010; Obakponovwe et al., 2011). These include the Bigelow and reverse Bigelow, the Allis, the Stimson, the Rochester, and the Piggyback methods. There is no literature to demonstrate the superiority of any method over the others. The method chosen, therefore, entirely depends on the preference of the treating surgeon.

Approximately 2% to 15% of the dislocations are irreducible by closed means and thus require open reduction (Clegg et al., 2010). Open reduction is indicated when closed reduction fails, when the hip joint is unstable or when there are loose bodies in the joint (Pietrafesa & Hoffman, 1983). However, Thompson and Epstein (1951) had earlier advocated for primary open reduction of all posterior dislocations from Type II to Type V. This is after they observed that only 12% of patients who had posterior dislocations type II to V had good results when closed reduction was done as compared to 60% good results in patients in whom primary open reduction was done. They found bony fragments and debris in joint during surgery in 91% of the cases and attributed these to the disparity in results between patients who were treated by closed reduction and those treated by open reduction.

The indications for open reduction include:

- If the dislocation is irreducible by closed manipulation.
- A nonconcentric reduction owing to interposed osseous or soft tissues between the femoral head and acetabulum.
- If there is instability of the joint following closed reduction.
- If there are neurological symptoms involving sciatic nerve.
- Ipsilateral femur and tibia fractures.

The choice of surgical approach depends on the direction of the dislocation. Posterior dislocations are approached via the posterior approach while the anterior dislocations are approached via anterior or anterolateral approaches (Clegg et al., 2010).

Timing of the reduction is an important prognostic factor in relation to the development of avascular necrosis of the femoral head (Rosenthal & Coker, 1979; Sahin et al., 2003; Shim, 1979). An experimental study (using rabbits) demonstrated that with a delay in reduction of the hip dislocation, there was irreversible blockage in extraosseus circulation of the hip, and this was thought to contribute to development of AVN (Shim, 1979). Rosenthal and Coker (1979) concluded that reduction of the dislocation within 24 hours was the most important initial treatment of THD after they observed that all the 3 patients who had developed AVN in their study had delayed reduction of more than 24 hours. In an article reviewing the epidemiology of THD, time to reduction, extent of associated injuries, and direction of the dislocation were summarised as important factors influencing outcome (Clegg et al., 2010).

A study by Rosenthal and Coker (1979) that had 46% of patients with type III, 26% type IV, 17% type II and 11% type V posterior THD, 41(95%) of these dislocations were reduced within 24 hours of injury by closed reduction and 2 underwent open reduction. Due to robust physician-equipped ambulance and air rescue services accessible to victims of trauma in German, a study found that all dislocations were reduced within 3 hours of injury (Dreinhofer, Schwarzkopf, Haas, & Tscherne, 1994). Alonge et al., (2002) found that 81% of dislocations were reduced within 24 hours of injury, with gross delay in 18.8% of the patients that was attributed to delayed presentation from referral centres. Sahin et al., (2003) in Turkey, reported that 75.8% of the dislocations were reduced within 24 hours, while 24.2 % were reduced after 24 hours. In Brazil, Lima et al., (2014) reported that about 70% of dislocations were reduced within 12 hours.

2.10: Functional outcomes

The functional outcomes in patients with THD is dependent on development of long-term complications, mainly post-traumatic osteoarthritis (OA), avascular necrosis (AVN), and sciatic nerve palsy (Clegg et al., 2010; Rodriguez-Merchan, 2000). Other potential complications include heterotopic ossification, deep vein thrombosis, and limitation of hip movements.

The development of complications is influenced by the severity and extent of associated injuries, time to reduction, quality of reduction, and direction of the dislocation (Bhandari, Matta, Ferguson, & Matthys, 2006; Dreinhofer et al., 1994; Rodriguez-Merchan, 2000; Rosenthal & Coker, 1979).

Upadhyay et al., (1983) attributed the high incidence of OA in THD to death of chondrocytes as a result of initial energy absorbed by the cartilage at the time of injury. Jaskulka et al., (1991) and Upadhyay et al., (1983) observed that the outcomes of type II dislocations were inevitably poorer than those of type I, regardless of the method of treatment used. Yang et al., (1991) reported poorer results in patients with multiple severe injuries compared to those that had few and less severe injuries. Dreinhofer et al., (1994) in a long-term follow up study of 50 simple THD reduced within 6 hours observed that there was 88% chance of good long term outcome in patients that had no associated injuries as compared to 54% in patients with associated injuries. He concluded that posterior dislocations (in contrast to anterior dislocations) and associated severe injuries were responsible for poor outcomes.

The quality of reduction in posterior fracture dislocations was shown to be an important predictor of clinical and radiological outcomes (Bhandari et al., 2006). Small osseous and cartilaginous fragments that may remain in the joint and prevent congruous reduction may lead to development of severe OA (Rodriguez-Merchan, 2000). Post-reduction management has not been shown to impact on the outcome of THD (Sahin et al., 2003).

Post-traumatic OA is the most common complication seen after THD and has been reported to occur in approximately 20% of cases (Obakponovwe et al., 2011; Sahin et al., 2003; Tornetta & Mostafavi, 1997). It is believed to be a consequence of cellular injury to articular cartilage from the impact causing the dislocation (Clegg et al., 2010; Jaskulka et al., 1991; Tornetta & Mostafavi, 1997; Upadhyay et al., 1983). With increasing length of follow up especially in people who continue to engage in heavy work after injury, the rate of OA has been noted to increase (Upadhyay et al., 1983). Follow-up radiographs for at least 18 months at 3-month intervals are required for early recognition of OA (Upadhyay et al., 1983).

Avascular necrosis of head of femur occurs in 1.7% to 40% of hip dislocations, and the rate increases with delay in reduction and higher injury types (Tornetta & Mostafavi, 1997). If the dislocation is reduced within 6 hours, the incidence rate of AVN is approximately 2% to 10%. The cause is thought to be an ischemic insult to the femoral head. It usually appears within 2 years, but has been seen as long as 5 years after injury (Clegg et al., 2010). Post-reduction management has not been shown to impact on the development of AVN (Sahin et al., 2003) but a non-weight-bearing period may be beneficial in preventing collapse once AVN has developed.

Sciatic nerve injury is more common after fracture-dislocations than after pure dislocations. It occurs in 7% to 19% of patients (Tornetta & Mostafavi, 1997). It is usually partial and most often affects the peroneal division. Resolution after reduction of the dislocation is the rule, and exploration is not required unless nerve function was intact before the reduction and then lost afterward. In the study by Jaskulka et al., (1991), 6.4% of patients had primary lesions of the sciatic nerve.

2.10.1: Harris hip score

Harris hip score (HHS) is a clinician-administered disease-specific outcome measure tool of hip function that was originally developed by William Harris to assess hip function after total hip replacement (THR) surgery (Nilsdotter & Bremander, 2011; Wamper, Sierevelt, Poolman, Bhandari, & Haverkamp, 2010). It is now commonly used to evaluate various hip disabilities and treatments in adults, including OA (Garellick, Herberts, & Malchau, 1999; Shi, Mau, Chang, Wang, & Chiu, 2009).

The score has 4 domains namely, pain, physical function (including activities of daily living and walking ability), absence of hip deformity, and range of motion (ROM) of the hip (Hoeksma et al., 2003; Shi et al., 2009). The score has 10 items with a maximum of 100 points. The pain domain has 1 item with 0-44points while the function domain has seven items with 0-47 points. Absence of deformity has 1 item with 4 points, and ROM has 2 items with 5 points (Hoeksma et al., 2003). The individual domain scores are summed up to get the overall score, which is expressed in descriptive terms as Excellent, Good, Fair, and Poor function (Garellick et al., 1999). The higher the overall score the better the function. A score of less than 70 indicates poor function, 70 to 80 indicates fair function, 80 to 90 is good function and 90 to 100 is excellent function.

The pain and physical function domains are weighted heavily because they were the main indications for surgery in hip pathologies when this tool was developed (Nilsdotter & Bremander, 2011; Shi et al., 2009).

It has excellent reliability and is easy to administer because it does not require formal training (Hoeksma et al., 2003). Its responsiveness was demonstrated by Shi et al. (2009) to be better than that of Short-Form 36 Health Survey for short-term (within 1 year) assessment of hip function. Although Wamper et al., (2010) showed unacceptably high ceiling effects of HHS in their systematic review, the candidate still found this tool appropriate for the study as there were no new treatment trials that were being studied.

CHAPTER THREE: METHODOLOGY

3.1: Study site

This study was carried out at the Accident and Emergency Department, Orthopaedic wards, and Orthopaedic outpatient clinics of the Moi Teaching and Referral Hospital (MTRH), Eldoret. MTRH is a national hospital that is located in Uasin Gishu county. The hospital is about 300 km from Nairobi city in the North-west direction.

The hospital has approximately 1000-bed capacity. It has a catchment area with a population of about 20 million people covering western part of Kenya, eastern Uganda, Rwanda, Democratic Republic of Congo and Southern Sudan. As per the central statistics of the hospital, MTRH has an average attendance of 600 outpatients per day, with the Accidents & Emergency Department receiving over 10,000 outpatients per year. The orthopaedic department attends to over 1300 inpatients per year (AMPATH, 2016).

3.2: Study design

This is a hospital-based prospective descriptive study. Participants were recruited between September 2014 and August 2015. After recruitment, each of the participants was followed for a period of 9 months at 3-monthly intervals. This made the total duration of data collection to span from September 2014 to May 2016.

3.3: Study population

The study population included all adult patients with THD seeking treatment at MTRH during the study period.

3.4 Eligibility criteria

3.4.1 Inclusion criteria

All adult patients with THD who consented to participate in the study during the study period were included.

3.4.2: Exclusion criteria

1. Patients with underlying hip pathology.
2. Patients who did not give consent to participate in the study.
3. Patients with traumatic dislocations reduced in another facility but coming for follow up at MTRH.

3.5: Sampling technique and sample size

All patients with THD who sought treatment at MTRH during the study period and met the inclusion criteria were recruited. The first patient was conveniently recruited after the approval to conduct the study was granted. Thereafter consecutive sampling was done throughout the study duration. Patients were recruited within 24 hours of presentation. A census of 53 patients were recruited in the study.

3.6: Data collection tools and technique

An interviewer administered questionnaire, patients' records (file notes and radiographs), and the Harris Hip Score (HHS) sheets were used to collect data. The questionnaire, and the patients' records were used to collect data at the point of recruitment of participants while the HHS sheets were used as data collection tools in subsequent 3-monthly follow ups.

After obtaining a written informed consent from the patients, the questionnaire was administered by the investigator to collect data on socio-demographic information, the etiology of the dislocation, and the time duration between the injury and arrival to the hospital. Data on the type of dislocation, radiological investigations done, associated injuries, time of reduction, and type of reduction performed was obtained by the investigator reading patients' records.

Radiological diagnosis and categorization into various types and subtypes was done in consultation with qualified pelvic and acetabulum surgeons in the orthopaedic department. The questionnaires were then coded and safely kept.

The HHS sheets were used to collect data on the functional score of the hip in subsequent follow up. Range of motion at the affected joint (compared to the other joint) was measured using a universal orthopaedic goniometer and the follow up radiographs were also reviewed, where necessary. At each follow up visit a sum of all domains of HHS was done to arrive at the total score for each patient. The scores were then categorized into four groups of Excellent, Good, Fair, and Poor.

3.7: Study variables

3.7.1: Socio-demographic characteristics

Age, Sex, Level of education and Occupation

3.7.2: The etiology of the dislocation

These were categorized as RTA, Falls from heights, and Assaults.

3.7.3: Type of dislocation sustained

Categorized as Anterior or Posterior.

3.7.4: Associated injuries

Various associated injuries were enumerated.

3.7.5: Time from injury to reduction of the dislocation

Categorized as reduction done within 6 hours, 6-12 hours, 13-24 hours, and more than 24 hours.

3.7.6: Reduction method

Closed manipulation was attempted in all patients unless it was contraindicated. This was done by the team (orthopaedic registrars and consultants) that was on call when the patients presented. The closed methods used for reduction were entirely the choice of the team that was on call. Patients in whom closed reduction failed or was contraindicated underwent open reduction by the orthopaedic consultants.

3.7.7: Short-term functional outcomes

These were summed up as Excellent, Good, Fair, or Poor.

3.8: Quality control

Validated and accepted instruments (orthopaedic goniometer and Harris Hip Score sheets) were used. Collection of data was done by the candidate with the help of trained assistants.

3.9: Data management

Data was coded and entries made into the Microsoft Excel. This was exported to S.P.S.S version 20 where analysis was done. The results were presented using prose format, graphs and charts, and frequency distribution tables.

3.10: Ethical considerations

The approval (Formal Approval Number: IREC 1271) to conduct the study was granted by Institutional Research Ethics Committee (IREC) of MTRH and Moi University before commencing the study. The patients were informed of the benefits and risks of the study and their written consent sought. Patients were assured that refusal to give consent for the study would not jeopardize their treatment. Patient confidentiality was ensured by assigning each patient a code that was used on the checklist and thus names were not used. Hard copies of the data collected were stored in a secure locker that was only accessible to the investigator. Soft copies were stored in a computer with password protection.

The study findings will be submitted to the Moi University Library in form of a thesis where it would be available for public access. They will also be published and disseminated in other fora a like the Kenya Orthopaedic Association conferences.

3.11: Study limitation

The candidate was not able to administer the HHS before injury to get the baseline scores. This was mitigated by obtaining thorough history to rule out any pre-existing hip pain or pathology. The loss to follow up was mitigated by the investigator calling the patients to remind them about their return visits.

CHAPTER FOUR: RESULTS

4.1: Description of study population

A total of 53 patients with THD were enrolled in the study. There was 9.4 % (5 patients) loss to follow up at various stages leaving 48 patients who completed 9 months of follow up. All these patients that were lost were men. Two patients, 1 with anterior dislocation and another one with type I posterior dislocation were lost to follow up between recruitment and 3-months interval. Another patient with type II posterior dislocation was lost to follow up between 3-months and 6-months interval. Two more patients, 1 with type V posterior dislocation and another one with anterior dislocation were lost to follow up between 6-months and 9-months interval.

4.2: Socio-demographic characteristics

The age of the participants ranged from 19 years to 63 years, with a mean of 36.1 years (Standard deviation ± 12.7). Males were 45 (84.9%) while females were 8 (15.1%), giving a male to female ratio of 5.6 to 1. Twenty-two of the study participants had attained secondary level of education, while 18 had only attained primary education. Only 6 of the study participants had studied up to tertiary levels of education. Twenty-nine of the participants were self-employed, 15 were not employed / or were dependent and 5 were in formal employment. The remaining 4 participants were employed as casual workers. The socio-demographic characteristics are summarised in table 4.2.1 and figures 4.2.1 to 4.2.3 on pages 30-31.

Table 4.2.1: Summary of socio-demographic characteristics

		Frequency	Percentage
Age	Mean	36.1	
	SD	12.7	
Sex	Male	45	84.9
	Female	8	15.1
Occupation	non/dependent	15	28.3
	Self employed	29	54.7
	Informal/Casual	4	7.6
	Formal	5	9.4
Level of education	No formal education	7	13.2
	Primary	18	33.9
	Secondary	22	41.5
	College	6	11.3

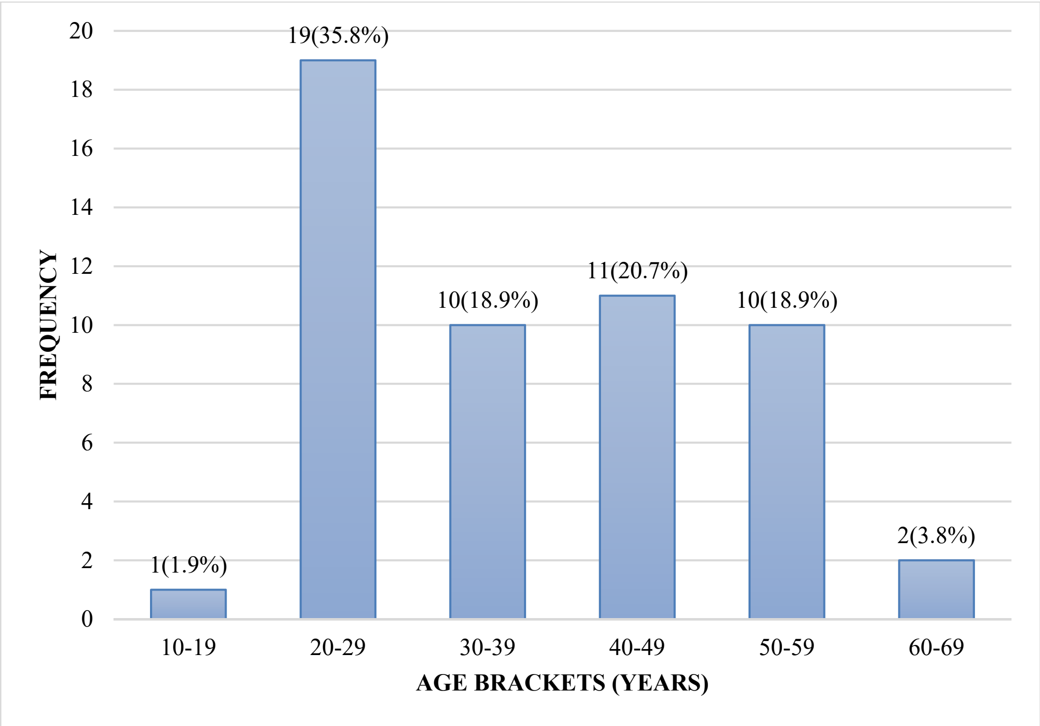

Figure 4.2.1: Age distribution

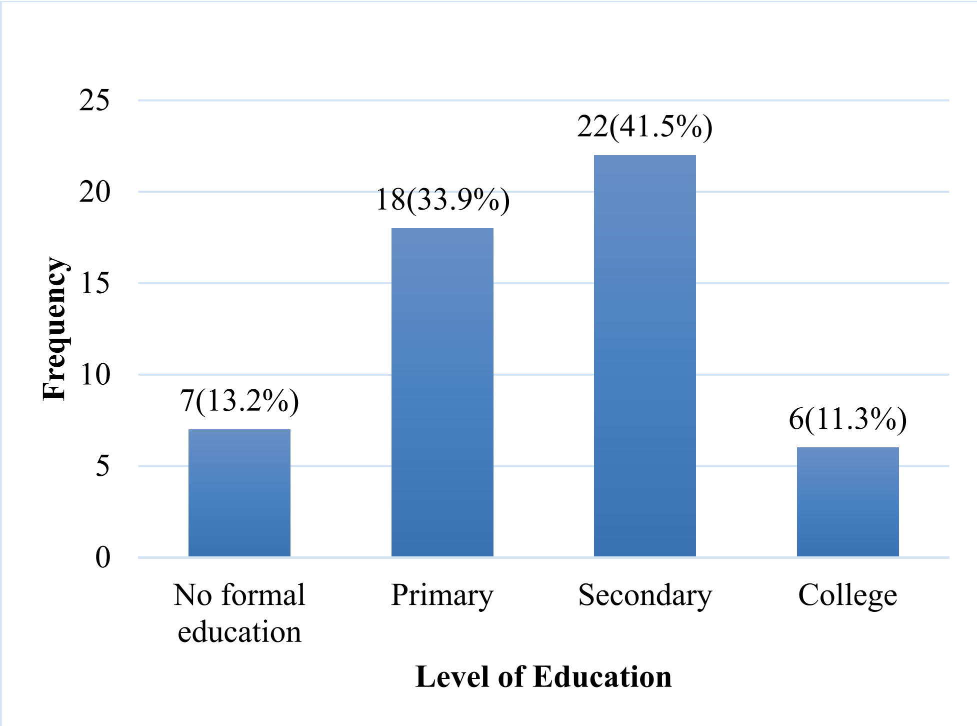

Figure 4.2.2: Level of education

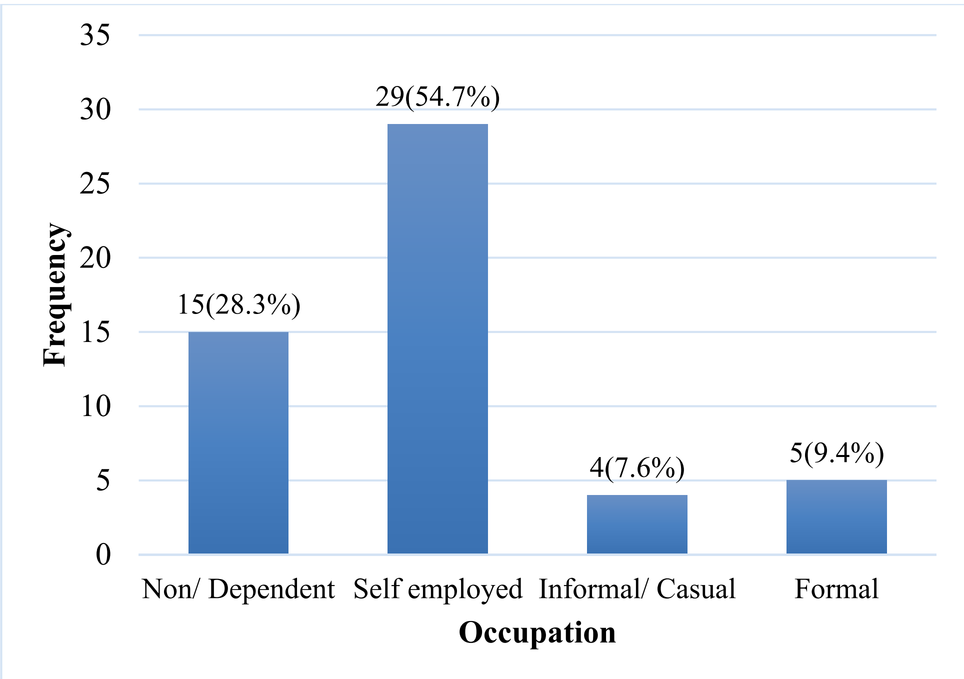

Figure 4.2.3: Occupation of the participants

4.3: Etiology of THD

Road traffic accidents accounted for the 38 (71.7%) of THD. Falls from heights were etiological factor in 9 (17%) of the dislocations while 6 (11.3%) of the patients had sustained their injuries from assaults. This is represented in figure 4.3.1 below.

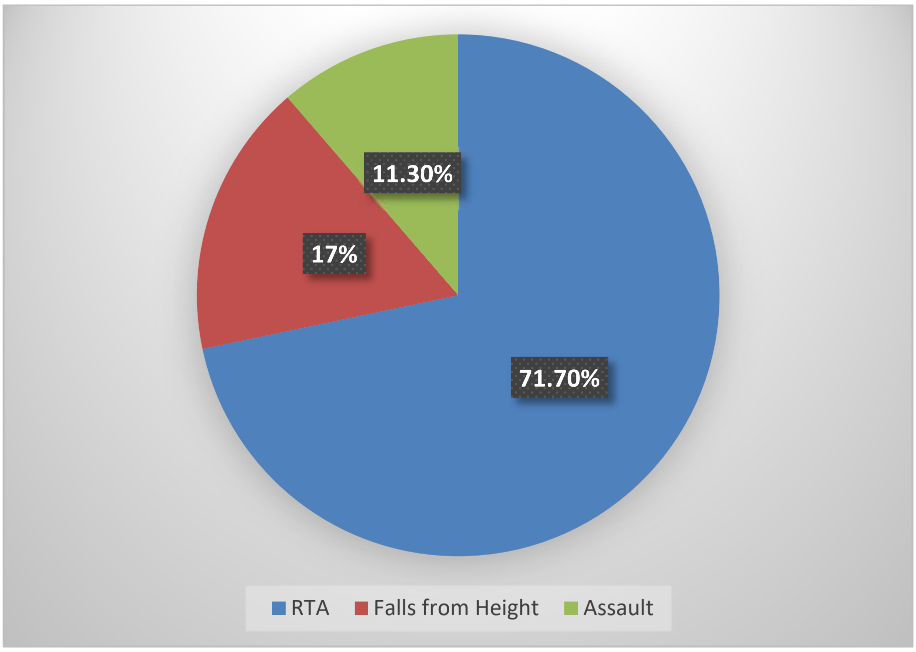

Figure 4.3.1: Etiology of THD

4.4: Types of THD

Forty-nine (92.5%) of the patients had posterior dislocations while 4 (7.5%) had anterior dislocations. The right hip was involved in 29 (54.7 %) of the patients while the left hip was affected in 24 (45.3%) of the cases. There were no participants who had bilateral dislocations.

Majority of posterior dislocations were type I (67.3%) while the minority were types III and V, each comprising of 2 %. Type II constituted 28.6% of posterior THD. There were no type IV dislocations in this study. Three of anterior dislocations were type II and one was type I. The findings on distribution of posterior dislocations is as shown in table 4.4.1 below.

Table 4.4.1: Distribution of posterior THD according to Thompson-Epstein classification

Type	**Frequency (N=49)**	**Percent**
Type I	33	67.3
Type II	14	28.6
Type III	1	2
Type V	1	2
Total	**49**	**100**

4.5: Associated injuries

Twenty-nine (54.7%) of the participants had associated injuries. Fractures of the acetabulum was the commonest, occurring in 16 (30.2%) of the participants. Other associated injuries included craniofacial soft tissue injuries in 7 (13.2%) participants, 5 (9.4%) patients had ligamentous knee injuries, 3 (5.7%) patients had sciatic nerve injury, 2 patients had pneumothorax, and 1 patient had a Lisfranc injury of the foot.

4.6: Treatment

Closed reduction was attempted in all patients except those in whom it was contraindicated (delayed presentation for more than 1 week after injury) and was successful in 38 (71.7%) of the dislocations. The Bigelow technique was commonly used, though the choice of the technique used for reduction entirely depended on the team that was on call. Open reduction was used to achieve stable concentric reduction in 15 (28.3%) patients in whom closed reduction failed and or was not attempted. The most common indication for open reduction was instability of the hip after initial closed reduction in 7 (46.6%) patients. Other indications included delayed presentation in 4 (26.7%) patients and failed closed reduction in other 4 (26.7%) patients. The indications for open reduction are presented in table 4.6.1 below.

Table 4.6.1: Indications for open reduction

Indication	**Frequency (N=15)**	**Percent**
Hip instability	7	46.6
Delayed presentation	4	26.7
Failed closed reduction	4	26.7
Total	**15**	**100**

Reduction was achieved within 6 hours of injury in 12 (22.6%) patients. Those who were treated between 6 hours and 12 hours of injury were 20 (37.7%). Overall, reduction of the dislocations was achieved within 24 hours of injury in 35 (66%) of the patients. In 18 (34%) patients reduction was done after 24 hours of injury. Among these 18 patients, 8 had presented late, 7 delayed to buy implants required for surgery, and 3 had failed closed reduction. Fourteen (77.8%) of the patients in whom reduction was done after 24 hours underwent open reduction while 4 (22.2%) underwent closed reduction. The time taken to reduce the dislocations is presented in figure 4.6.1, and table 4.6.2 compares the time taken to reduce the dislocation and the patient referral status.

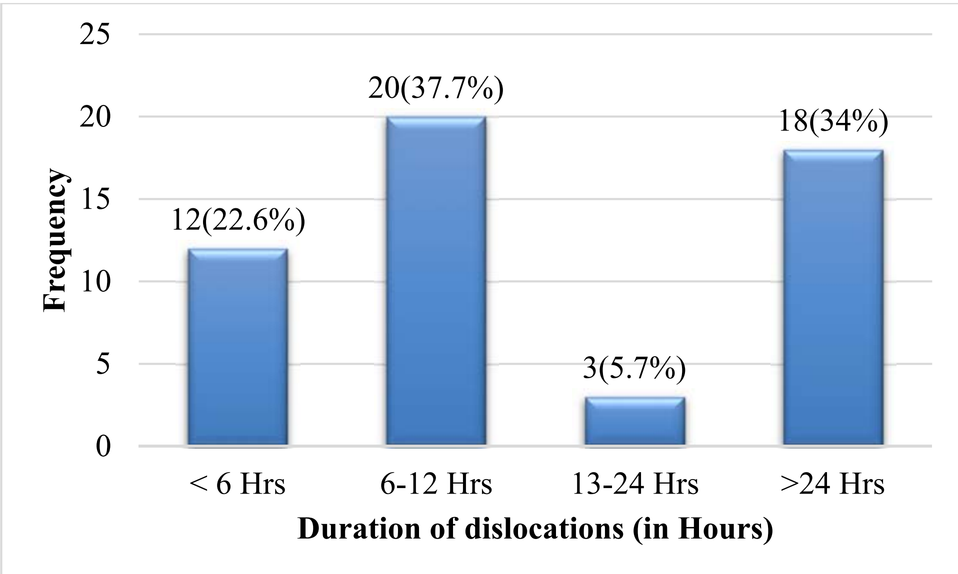

Figure 4.6.1: Time taken to reduce the dislocations

Table 4.6.2: Comparison of duration of dislocation and the referral status

Reduction time	**Non referral**	**Referral**	**Total**
Less than 6 Hours	10	2	**12**
6 Hours – 12 Hours	16	4	**20**
13 Hours – 24 Hours	0	3	**3**
More than 24 Hours	7	11	**18**
Total	**33**	**20**	**53**

4.7: Short-term functional outcomes

Two patients were lost to follow up within the first 3-month interval. One had type I posterior dislocation and could not be reached on the telephone. The other patient had an anterior hip dislocation and had died due to unrelated causes. The functional status of the remaining 51 patients was excellent in 21 (41.2%), good in 22 (43.1%), fair in 6 (11.8%), and poor in 2 (3.9%). Table 4.7.1 below shows the functional status at 3 months.

Table 4.7.1: Functional status at 3 months (n=51)

Type	**Excellent**	**Good**	**Fair**	**Poor**	**Total**
Posterior, Type I	17	11	4	0	**32**
Posterior, Type II	2	10	2	0	**14**
Posterior, Type III	0	0	0	1	**1**
Posterior, Type V	0	0	0	1	**1**
Anterior	2	1	0	0	**3**
Total	**21**	**22**	**6**	**2**	**51**

At 6-month interval another patient (with type II posterior hip dislocation) was lost to follow up. He could not be reached via the telephone number he had provided. Thirty-two (64%) patients had excellent function, 13 (26%) had good function, 3 (6%) had fair function and 2 (4%) had poor function. Table 4.6.2 below shows the functional status at 6 months.

Table 4.7.2: Functional status at 6 months (n=50)

Type	**Excellent**	**Good**	**Fair**	**Poor**	**Total**
Posterior, Type I	26	6	0	0	**32**
Posterior, Type II	3	7	3	0	**13**
Posterior, Type III	0	0	0	1	**1**
Posterior, Type V	0	0	0	1	**1**
Anterior	3	0	0	0	**3**
Total	**32**	**13**	**3**	**2**	**50**

Final follow up was done at 9 months after injury. Two more patients were not reachable at this point for assessment. One of them had type V posterior dislocation while the other one had an anterior dislocation. The function of 48 patients was assessed. Thirty-one (64.6%) had excellent function, 15 (31.3%) had good function, 1 (2.1%) had fair functional score while 1 (2.1%) had poor function as shown by table 4.7.3 below. Figure 4.7.1 below shows the functional scores at 3-monthly intervals.

Table 4.7.3: Functional outcome at 9 months (n=48)

Type	Excellent	Good	Fair	Poor	Total
Posterior, Type I	26	6	0	0	**32**
Posterior, Type II	3	9	1	0	**13**
Posterior, Type III	0	0	0	1	**1**
Anterior	2	0	0	0	**2**
Total	**31**	**15**	**1**	**1**	**48**

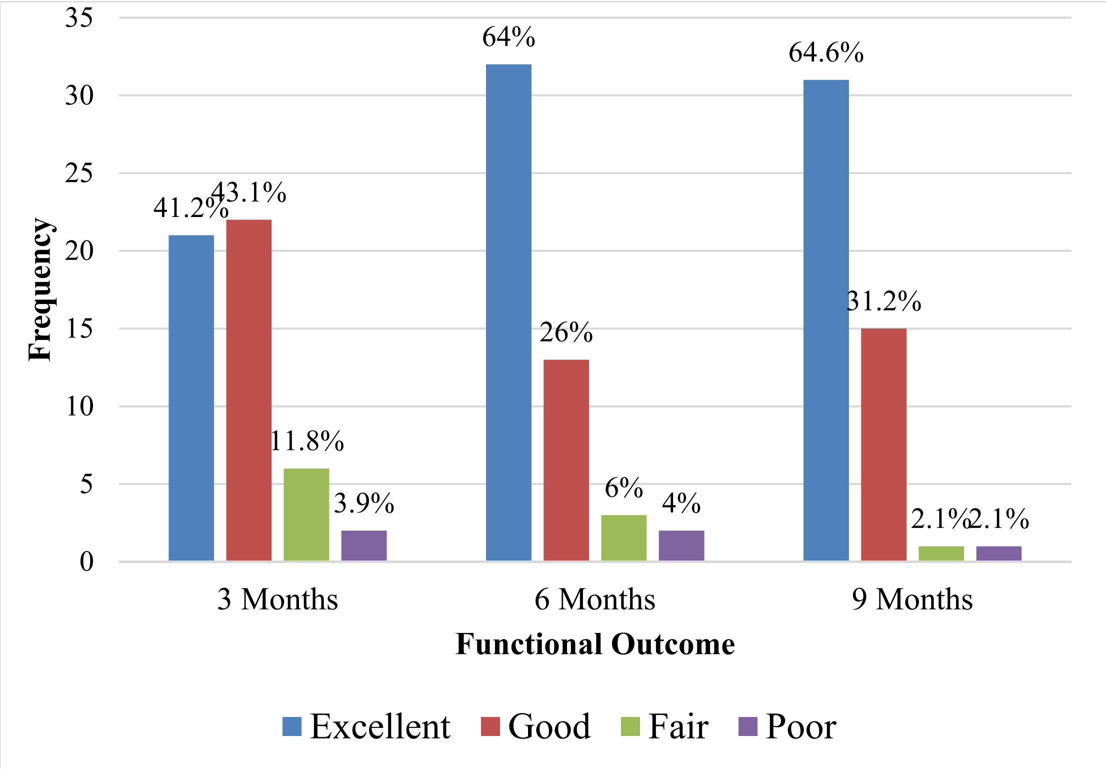

Figure 4.7.1: Functional outcome at various follow up periods

4.8: Associations

There was a positive correlation between the duration of the dislocation and functional outcome at 9 months, as shown in tables 4.8.1 and 4.8.2 below. This correlation was significant (p value 0.042) when excellent and good scores were grouped to form the satisfactory function while fair and poor scores were grouped as unsatisfactory function. The correlation was also significant (p value 0.002) when excellent scores were compared to good scores.

A positive correlation was also noted in the functional scores at 9 months in relation to type I and type II posterior THD. There was a significant difference (p value < 0.001) in the excellent and good scores for patients that sustained type I posterior THD and those that had type II posterior THD. This is shown in table 4.8.3 on page 40.

Table 4.8.1: Association between duration of dislocation and functional outcome at 9 months (Satisfactory and Unsatisfactory)

			Function at 9 Months		Total	P value
			Satisfactory	Unsatisfactory		
Duration	< 24 hrs	Count	32	0	32	0.042
		% within Duration	(100)	(0)	(100)	
	> 24 hrs	Count	14	2	16	
		% within Duration	(87.5)	(12.5)	(100)	
Total		Count	46	2	48	
		% within Duration	(95.8)	(4.2)	(100)	

Table 4.8.2: Association between duration of dislocation and functional outcome at 9 months (Excellent and Good)

			Function at 9 Months			
			Excellent	Good	Total	P value
Duration	< 24 hrs	Count	26	6	32	
		% within Duration	(81.3)	(18.8)	(100)	0.002
	> 24 hrs	Count	5	9	14	
		% within Duration	(35.7)	(64.3)	(100)	
Total		Count	31	15	46	
		% within Duration	(67.4)	(32.6)	(100)	

Table 4.8.3: Association between type I and type II posterior THD and functional score at 9 months (Excellent and Good)

			Function at 9 months			
			Excellent	Good	Total	P value
Type	Type I	Count	26	6	32	
		% within Type	(81.3)	(18.8)	(100)	
	Type II	Count	3	9	12	
		% within Type	(25)	(75)	(100)	< 0.001
Total		Count	29	15	44	
		% within Type	(65.9)	(34.1)	(100)	

CHAPTER FIVE: DISCUSSION

5.1: Socio-demographic characteristics

Age distribution in this study ranged from 19 years to 63 years with a male to female ratio of 5.6:1. The mean age at the time of injury was 36.1 years. This age distribution is associated with increased involvement in energy-demanding and rigorous outdoor activities that predispose to high energy injuries. The age and sex distribution in this study concurs with several other studies done on THD in adults. Upadhyay et al., (1983) found an age range of 12 years to 61 years, with males constituting 78% of their study participants in an analysis of late effects of simple THD in England. In USA, a study by Hak and Goulet (1999) found the age of patients ranged from 16 years to 65 years, with 65% being males. Alonge et al., (2002) in Nigeria reported an age range of 18 years to 69 years with a male to female ratio of 4.3:1. In Brazil, Lima et al., (2014) found a 90.7% male predominance with an age range of 18 to 75 years in a study that was conducted at Ceara Hospital.

5.2: Etiology

Road traffic accidents (RTA) were the major causes of THD, accounting for 71.7%. This can be explained by the fact that the energy involved in RTA is usually high and consistent with the energies required to dislocate the hip joint. Secondly this could be due to the fact that majority of the THD were posterior dislocations which mostly occur when a force is directed along the shaft of the femur with the hip flexed and adducted. This is the position that is usually assumed by most people when they are travelling in motor vehicles.

The findings of this study concur with those of many other studies. Rosenthal and Coker (1979) found that 93% of these injuries had resulted from RTA. Yang et al., (1991) in Taiwan reported that RTA accounted for 78% of the traumatic hip dislocations. Jaskulka et al., (1991) reported that 96% of the cases of THD were due to RTA, while 4% were as a result of falls. In Nigeria, Alonge et al., (2002) found that all the THD were due to RTA. In Turkey, Sahin et al., (2003) recorded that RTA accounted for 83.9% of THD. At King Fahd University Hospital in Saudi Arabia, Al-Bahlool et al., (2009) found that 81% of the injuries had resulted from to RTA, 13.7% were caused by falls from a height and 5.1% due to sports.

Falls from heights accounted for 17% of the causes of THD in this study. These occurred in young men who were working in the farms and slid and fell from tractors and lorries that were ferrying farm produce. This concurs with findings of Yang et al., (1991) in which 13.5% of the THD had been due to falls. It, however, contrasts the findings of Upadhyay et al., (1983) in England that had 33% of THD caused by falls. This high percentage of falls in the Upadhyay et al., (1983) study is because it was conducted in Mansfield at a time (1936 – 1976) when coal mining and textile industries were thriving. Thus mining pits accidents and falls or falling objects constituted a significant contribution to the etiology of the hip dislocations in that study.

Assaults formed unusually low energy etiology of THD, accounting for about 11% of hip joint dislocations. These patients had no history of prior trauma to the joint or any hip joint pain that could have pointed to an underlying joint pathology. They all described scenarios in which they had been kicked on their hips leading to injury.

Giza et al., (2004) described similar scenarios in 2 recreational footballers with normal hip joints who sustained hip fracture-dislocations as a result of low energy mechanisms. Newton and du Plessis (2014) also described a similar low energy mechanism in which a 28-year old rugby player with no prior history of hip joint problems sustained a type III Thompson Epstein fracture dislocation after his colleague landed on his lower back while he was prone.

5.3: Type of dislocation

Posterior dislocations were far more common (92.5%) than anterior dislocations in this study. This could be attributable to the fact that most of the injuries had resulted from RTA in which participants were in a seated position at the time of the injury. Biomechanically, as documented by Obakponovwe et al., (2011), it is easier to dislocate the hip joint posteriorly than anteriorly when a force is applied to the longitudinal axis of the femur in a seated position because the joint is flexed and adducted. This could also be explained by the fact that the strong iliofemoral ligament located on the hip anteriorly deflects or impedes progress of anterior dislocations as documented by Pietrafesa and Hoffman 1983.

These findings concur with findings in several other studies. In article reviews on traumatic hip dislocations, both Obakponovwe et al., (2011) and Sanders et al., (2010) noted that 85% to 90% of these dislocations are posterior with rest being anterior and central dislocations. A retrospective study by Yang et al., (1991) in which central fracture-dislocations were excluded, found that 93.7% of the dislocations were posterior while 6.3% were anterior. The study by Alonge et al., (2002) found that 87% of the patients had posterior dislocations while anterior and central dislocations were each making up 6.5%.

A follow up study on traumatic fracture-dislocations of the hip by Sahin et al., (2003) found posterior dislocations in 92% of the participants and anterior dislocations in 8%. They also excluded central fracture-dislocations.

Posterior dislocations are further divided into five types according to Obakponovwe et al., 2011 and Sanders et al., 2010. Various authors have recorded different results in the distribution of these types. In this study most of the posterior dislocations were type I at 67% followed by type II at 28%. This is in agreement with the findings of Alonge et al., (2002) in Nigeria where 60.7% of posterior THD were type I while type II were 21.4%. The findings in this MTRH study, however, contrast with other authors who found a more homogeneous distribution in various types of posterior dislocations. In a study that excluded type I dislocations, Rosenthal and Coker (1979) recorded 46% of posterior dislocations to be type III, 26% type IV, 17% type II and 11% type V. In the study by Yang et al., (1991) 34% of posterior dislocations were type I, 20% were type II, 11% were type III, 9% type IV and 26% were type V. Lima et al., (2014) in Brazil found type I to be 47.5%, type II 32.5%, type III 10%, and type IV and V being 5% each.

There was slightly more involvement of the left hip (54.7%) than the right. Findings on laterality of the affected hip have differed in a number of studies, indicating that there could be no predisposing factors on which side is involved. Yang et al., (1991) found the left hip to have been involved in 60% of the cases while Alonge et al., (2002) found 60% involvement of the right hip. Upadhyay et al., (1983) had made interesting observation. In patients who had been involved in RTAs the left hip was twice as much affected as the right hip, but in other causes the incidence was equal in both limbs.

5.4: Associated injuries

Associated injuries were present in more than half (54.7%) of the patients in this study. Fractures of the acetabulum formed the commonest injury at 30.2%. Others included craniofacial soft tissue injuries, ligamentous knee injuries, sciatic nerve injury, pneumothorax, and a Lisfranc injury of the foot. Inadequate rescue and ambulance services in the country possibly contributed to the lower incidence of associated injuries in this study, in that only patients with less severe injuries could have managed to reach the hospital while those that were seriously injured died before getting to hospital. Another possible explanation is the inconsistent use of seat belts in vehicles in this setting which increases the likelihood of one dying when involved in RTA.

The findings in this study contrast with the findings of Hak and Goulet (1999) and Suraci (1986), who both reported a 95% incidence of associated injuries that were severe enough to warrant an admission on their own. In both studies, the fractures of the acetabulum formed majority of the associated injuries. The very high incidence of associated injuries in these studies could be due to the fact that the study participants were limited to victims of motor vehicle collisions.

5.5: Treatment

Closed reduction was achieved in more than 70% of the dislocations in this study. This was performed under sedation or anaesthesia in the Accident and Emergency Department or in the operating theatre. Patients in whom closed reduction failed to achieve concentric stable reduction or it was contraindicated were treated by open reduction in the operating theatre.

These findings concur with those of other studies. In a retrospective study by Sahin et al., (2003), 80.6% of THD were treated by closed reduction and the remaining 19.4% treated by open reduction. In the Alonge et al., (2002) study, only one patient who had multiple ipsilateral lower limb fractures that precluded closed reduction underwent open reduction. The remaining 45 patients (97%) were treated by closed reduction. In Rosenthal and Coker (1979) review of the epidemiology of posterior fracture-dislocations of the hip 89% of the dislocations were treated by closed reduction. In a study conducted in Brazil by Lima et al., (2014), 90.7% of the patients underwent closed reduction.

As documented by Pietrafesa and Hoffman (1983), open reduction is indicated when closed reduction fails, when the hip joint is unstable or when there are loose bodies in the joint. However, Thompson and Epstein (1951) advocated for primary open reduction of all posterior dislocations from Type II to Type V. After a survey of 204 cases of traumatic dislocation of the hip over a period of 21 years, Thompson and Epstein (1951) noted that of 116 patients who had posterior dislocations type II to V only 12% had good results when closed reduction was done as compared to 60% good results in patients in whom primary open reduction was done. They found bony fragments and debris in joint during surgery in 91% of the cases and attributed these as the cause of disparity in results between patients who were treated by closed reduction and those treated by open reduction. Rosenthal and Coker (1979), however, concluded that the mere presence of intra-articular bone fragments did not necessarily indicate the need for open reduction unless the fragments were trapped between the weight bearing surfaces. This is after they noted that all patients that had undergone exploration had loose bones in the joint, and still a good number of them had good functional results.

Timing of the reduction is an important prognostic factor in relation to the development of avascular necrosis of the femoral head according to Clegg et al., 2010; Sahin et al., 2003; and Shim 1979. In this MTRH study, about 66% of the dislocations were reduced within 24 hours of injury while 34% were reduced after 24 hours of injury. A delay in reduction was because of delayed presentation, a delay by patients to buy implants required for surgery, and failed closed reduction.

This MTRH study findings contrast those of Dreinhofer et al., (1994) in Germany in which all their dislocations were reduced within 3 hours of injury. This was attributable to the robust ambulance and air rescue services accessible to victims of trauma in Germany. Also they only included Type I dislocations that do not require a lot of planning to carry out reduction. In a study by Rosenthal and Coker (1979) that had 46% of patients with type III, 26% type IV, 17% type II and 11% type V posterior THD, 41 (95%) of these dislocations were reduced within 24 hours of injury by closed reduction and 2 underwent open reduction. In Turkey, Sahin et al., (2003) reported that 75.8% of the dislocations were reduced within 24 hours, while 24.2 % were reduced after 24 hours. The reasons for delay in reduction were late transportation of patients to hospital, presence of life-threatening injuries, performing open reduction after insufficient closed reduction, and difficulty in the diagnosis of associated injuries. In Nigeria, Alonge et al., (2002) reported 81% of dislocations were reduced within 24 hours of injury, with gross delay in 18.8% of the patients that was mainly due to delayed presentation from referral centres. Lima et al., (2014) reported that about 70% of dislocations in their study were reduced within 12 hours.

5.6: Short-term functional outcomes

Overall, 95.8% of patients at final assessment had excellent and good function in this short-term follow up study. This can be explained by the fact that most of the patients had type I and II injuries that are not associated with worse outcomes. The incidence of severe associated injuries was also lower and could have contributed to this finding. The short follow up period could also be a factor in this finding because the complications that are associated with poor functional outcomes take more time to develop.

There were significant correlations between the functional outcomes at 9 months the duration of the dislocations, as well as severity of injury (type I and type II posterior THD). In literature search, the candidate did not come across studies assessing short-term functional outcomes of THD. However, in long term studies, both the duration of the dislocation as well as the severity of the injury have been demonstrated to have a significant effect on the functional outcome of THD (Sahin et al., 2003).

CHAPTER SIX: CONCLUSIONS AND RECOMMENDATIONS

6.1: Conclusions

Traumatic hip dislocations were more common in males than females. Most of these men were in the most productive years of life. Most of traumatic hip dislocations were due to road traffic accidents. Assaults formed an unusual low energy etiology in some patients.

Posterior dislocations were more common than the anterior dislocations. Most of the posterior dislocations were type I and II. Associated injuries were present in more than half of the study participants, with fractures of the acetabulum being the commonest.

Most of the dislocations were reduced within 24 hours of injury. Closed manipulation methods were successful in achieving reduction in most of the patients. At final follow up assessment, most of the study participants had good and excellent functional status.

6.2: Recommendations

In view of the fact that RTA accounted for the majority of THD, it is recommended that more emphasis be put on road safety to reduce road traffic accidents and consequently numbers of traumatic hip dislocations.

More efforts should also be put in for timely reductions of THD by creating awareness among healthcare workers in peripheral health facilities, and training of orthopaedic technologists on how to reduce these dislocations.

Further long term studies are recommended to assess the functional status of patients with THD.

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APPENDICES

Appendix I: Questionnaire

(Used while recruiting patients into the study)

A) Demographic Data:

Hospital No. …………… Code No. ……………..

Age. ………….. Sex ……………….

Level of education ……………………………..

Occupation …………………………………….

B) Clinical Aspects:

i) Cause of the dislocation:

- Road traffic accident
- Fall from a height
- Other causes (Specify) …………………………………

ii) Time taken between the injury and arrival to hospital:

- Within 6 hours
- 6 hours to 12 hours
- 12 hours to 24 hours
- More than 24 hours

iii) Type of the dislocation

Anterior dislocation ………………. Posterior dislocation ………………..

a) Anterior dislocation:

Type I………….. Type II…………….

b) Posterior dislocation:

Type I…… Type II…….. Type III…….. Type IV…….. Type V…………

iv) Dislocated hip:

Right ……… Left ……… Both ………

v) Associated injuries:

Abdominal injuries ……….. Head injury and neck .... Chest ……….

Associated fractures …………... Sciatic nerve injury ……….. Others ....

vi) Imaging modality:

Plain pelvic x-rays …….. CT scan pelvis …….. Other modality …………

vii) Mode of treatment:

Closed reduction ………….. Open reduction ………..

viii) Reasons for open reduction:

Failed closed reduction …….. Unstable reduction ………..

Delayed presentation ………… Others ………………..

ix) Time of reduction

Within 6 hours ………….. 6 hours to 12 hours …………

12hours to 24 hours ………… More than 24 hours …………

Appendix II: Harris Hip Score
(Used to collect data during follow up of the participants)

Hip ID: **Study Hip:** Left Right

Examination Date (MM/DD/YY): / /

Harris Hip Score

Medical Record Number:

Interval: ______________

Harris Hip Score

Pain *(check one)*

 None or ignores it (44)

 Slight, occasional, no compromise in activities (40)

 Mild pain, no effect on average activities, rarely moderate pain with unusual activity; may take aspirin (30)

 Moderate Pain, tolerable but makes concession to pain. Some limitation of ordinary activity or work. May require occasional pain medication stronger than aspirin (20)

 Marked pain, serious limitation of activities (10)

 Totally disabled, crippled, pain in bed, bedridden (0)

Limp

 None (11) Slight (8) Moderate (5) Severe (0)

Support

 None (11) ` Cane for long walks (7) Cane most of time (5) One crutch (3)

 Two canes (2) Two crutches or not able to walk (0)

Distance Walked

□ Unlimited (11) □ Six blocks (8) □ Two or three blocks (5)

□ Indoors only (2) □ Bed and chair only (0)

Sitting

□ Comfortably in ordinary chair for one hour (5)

□ On a high chair for 30 minutes (3)

□ Unable to sit comfortably in any chair (0)

□ With ease (4) □ With difficulty (2) □ Unable (0)

Absence of Deformity (All yes = 4; Less than 4 =0)

Less than 30° fixed flexion contracture □ Yes □ No

Less than 10° fixed abduction □ Yes □ No

Less than 10° fixed internal **Enter public transportation**

□ Yes (1) □ No (0)

Stairs

□ Normally without using a railing (4) □ Normally using a railing (2)

□ In any manner (1) □ Unable to do stairs (0)

Put on Shoes and Socks

rotation in extension □ Yes □ No

Limb length discrepancy less than 3.2 cm □ Yes □ No

Range of Motion (*indicates normal)*

Flexion (*140°) _______ Abduction (*40°) ________ Adduction (*40°) ________

External Rotation (*40°) ________ Internal Rotation (*40°) ________

Range of Motion Scale

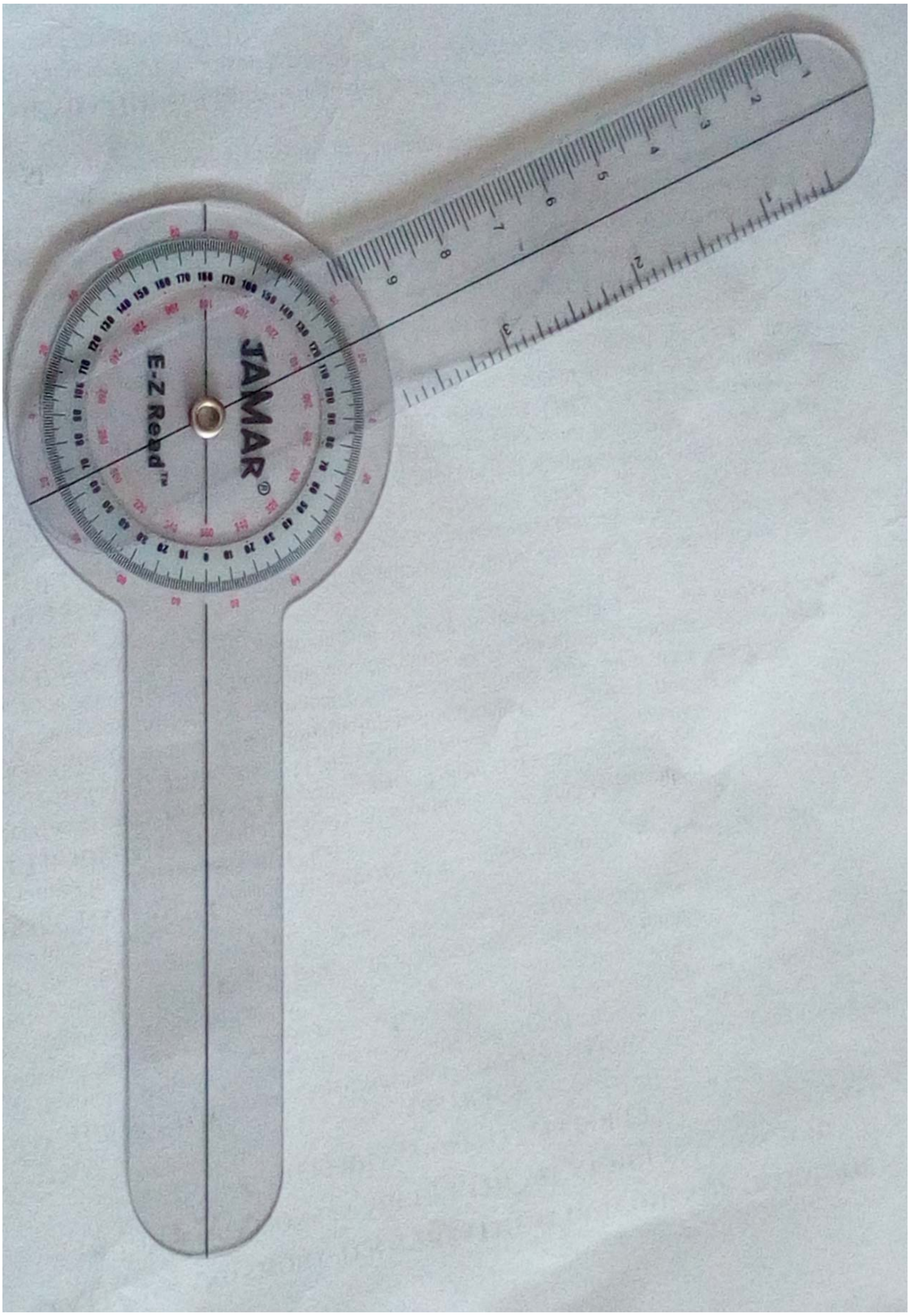
211° - 300° (5) 161° - 210° (4) 101° - 160° (3)

61° - 100 (2) 31° - 60° (1) 0° - 30° (0)

Range of Motion Score ____________

Total Harris Hip Score ____________

Appendix III: Orthopaedic Goniometer



Appendix IV: Consent Form

THE PATTERNS AND TREATMENT OUTCOMES OF TRAUMATIC HIP DISLOCATIONS IN ADULT PATIENTS AT MOI TEACHING AND REFERRAL HOSPITAL, ELDORET

INVESTIGATOR: DR. VINCENT ODUORI MAGERO

P.O. BOX 4606 -30100 ELDORET.

I ………………………………………of P.O. Box ……………………………… Tel ………………………….. hereby give informed consent to participate in this study at MTRH. The study has been explained to me clearly by Dr. Vincent Oduori Magero (or his assistant) of P.O. Box 4606 Eldoret.

I have understood that to participate in this study, I shall volunteer information concerning my injury (traumatic hip dislocation) and undergo medical examination. I am aware that I can withdraw from the study at any time without prejudice to my right of treatment at MTRH now or in the future. I have been assured that the information I give will be handled in confidence. I have not been induced or coerced by the investigator (or his assistant) to append my signature on this form and by extension participate in this study.

Name / Initials of participant ……………………………………………

Signature of participant ……………………… Date ……………………..

Witness ………………………………………………………………………

Signature of witness ……………………… Date ……………………..

Appendix V: IREC approval form

INSTITUTIONAL RESEARCH AND ETHICS COMMITTEE (IREC)

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

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

Reference: IREC/2014/159
Approval Number: 0001271

18th September, 2014

Dr. Magero Vincent Oduori,
College of Health Sciences,
School of Medicine,
P.O. Box 4606-30100,
ELDORET-KENYA.

Dear Dr. Magero,

RE: FORMAL APPROVAL

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

"Patterns of Traumatic Hip Dislocations and their Treatment Outcomes in Adult Patients at Moi Teaching and Referral Hospital."

Your proposal has been granted a Formal Approval Number: ***FAN: IREC 1271*** on 18th September, 2014. You are therefore permitted to begin your investigations.

Note that this approval is for 1 year; it will thus expire on 17th September, 2015. If it is necessary to continue with this research beyond the expiry date, a request for continuation should be made in writing to IREC Secretariat two months prior to the expiry date.

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

Sincerely,

For

INSTITUTIONAL RESEARCH & ETHICS COMMITTEE
18 SEP 2014
APPROVED
P. O. Box 4606-30100 ELDORET

PROF. E. WERE
CHAIRMAN
INSTITUTIONAL RESEARCH AND ETHICS COMMITTEE

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

Appendix VI: MTRH approval form

MOI TEACHING AND REFERRAL HOSPITAL

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

P. O. Box 3
ELDORET

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

18th September, 2014

Dr. Magero Vincent Oduori,
College of Health Sciences,
School of Medicine,
P.O. Box 4606-30100,
ELDORET-KENYA.

RE: APPROVAL TO CONDUCT RESEARCH AT MTRH

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

"Patterns of Traumatic Hip Dislocations and their Treatment Outcomes in Adult Patients at Moi Teaching and Referral Hospital."

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

DR.JOHN KIBOSIA
DIRECTOR
MOI TEACHING AND REFERRAL HOSPITAL

INSTITUTIONAL RESEARCH & ETHICS COMMITTEE
18 SEP 2014
APPROVED
P.O. Box 4606-30100 ELDORET

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

Appendix VII: Budget

Code	Item	Cost (Kshs)
1	Six Reams of plain and ruled paper @ 500	3,000.00
2	Pens, pencils, folder and other stationery	2,000.00
3	Two Computer Flash discs	3,000.00
4	Printing research proposals	10,000.00
5	Printing thesis	15,000.00
6	Binding thesis	3,000.00
7	Research assistants	30,000.00
8	I.R.E.C. fee	1,000.00
9	Data handling	30,000.00
10	Miscellaneous	10,000.00
11	Add 10% contingency	10,700.00
	TOTAL	**117, 700.00**

Appendix VIII: Study timetable

Activity	**Duration**	**Time period**	**Responsible person**
Selection of topic	2 months	February to March 2014	Researcher
Literature review	3 months	March to June 2014	Researcher
Writing proposal	1 month	June 2014	Researcher
Submission to IREC	1 month	July 2014	Researcher and supervisors
Approval by IREC	1 month	September 2014	IREC committee
Data collection including pilot study	18 months	September 2014 to June 2016	Researcher and her assistants
Writing the thesis report/departmental mock defense	9 months	September 2016 to June 2017	Researcher
Submission of thesis	1 month	October2017	Researcher, supervisors and HOD
Oral defense of thesis		August 2018	Researcher