REPUBLIC OF CAMEROON
Peace – Work – Fatherland

MINISTRY OF HIGHER EDUCATION

UNIVERSITY OF YAOUNDE I

FACULTY OF MEDICINE AND BIOMEDICAL SCIENCES

REPUBLIQUE DU CAMEROUN
Paix - Travail –Patrie

MINISTÈRE DE L'ENSEIGNEMENT SUPERIEUR

UNIVERSITÉ DE YAOUNDÉ

FACULTE DE MÉDÉCINE ET DES SCIENCES BIOMEDICALES

Department of Surgery and Specialties

POLYTRAUMA PATIENTS WITH FEMORAL FRACTURES: INJURY SEVERITY, SURGICAL MANAGEMENTS AND SHORT TERM OUTCOMES IN YAOUNDE

A Dissertation presented for the award of a specialization Diploma in Clinical Sciences (DES): Option, General Surgery by;

ACHA FONGANG ROGER
Registration Number: 20S1912

SUPERVISOR:

Pr. GUIFO Marc Leroy
Associate Professor of General Surgery
FMBS/CHUY

CO-SUPERVISOR:

Dr. FONKOUE Loic
Senior Lecturer of Orthopedic/Trauma Surgery
FMBS/HGY

2023/2024 School Year

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Date of defense: 24th September, 2024

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Supervisor:
Pr. GUIFO Marc Leroy

Co-Supervisor:
Dr. FONKOUE Loic

2023/2024 School Year

TABLE OF CONTENTS

DEDICATION

This work is dedicated to the **Almighty God** to whom my life and my all belong.

To all those that have been: disabled, widowed and orphaned by polytrauma.

CERTIFICATION

I certify that this work entitled **"POLYTRAUMA PATIENTS WITH FEMORAL FRACTURES: INJURY SEVERITY, SURGICAL MANAGEMENTS AND SHORT TERM OUTCOMES IN YAOUNDE"**, submitted to the Department of Surgery and Specialties, Faculty of Medicine and Biomedical Sciences of the University of Yaounde I by **ACHA FONGANG ROGER, MD (20S1912)**, in partial fulfilment of the requirements for the award of a specialization diploma (DES) in General Surgery, was carried out under our supervision.

_____ Date _____

Pr. Guifo Marc Leroy

Associate Professor

General Surgery

(Supervisor)

_____ Date _____

Dr. Fonkoue Loic

Senior Lecturer

Orthopedic/Trauma Surgery

(Co-supervisor)

ACKNOWLEDGMENT

I wish to express my heartfelt gratitude to everybody who contributed in one way or another to the success of this piece of work especially to:

The head of department of Surgery and Specialties, **Professor ESSOMBA ARTHUR** for giving us the opportunity to train in your department and for your quest for excellence which has been a driving force during our training.

Professor GUIFO MARC Leroy, Associate Professor of General Surgery and supervisor of this thesis. For the commitment you portrayed in making sure I was on the right track. Do accept my sincere gratitude Sir.

Dr. FONKOUE Loic, Senior Lecture in department of Surgery and Specialties, equally co – supervisor of this work. For sacrificially giving your time and help for the realization of this work; I remain infinitely grateful to you.

To all the staff of the Department of Surgery and Specialties for your enormous effort in training us throughout these four years.

To my beloved wife; **Fongang Claudette Mam,** for always being there throughout these four challenging years as a source of encouragement, support and prayer partner. You always saw the possibility even when I could not see.

To my wonderful children (**Fongang Jotham, Fongang Phanuel, Fongang Eliana, Bah Casmile, Bright)** for being a source of inspiration for me to work harder.

To my parents (**Acha Batholomew and Acha Esther)** for haven laid the solid foundation on which we are currently constructing on.

To my: siblings, in – laws, friends and brethren for the support in one way or the other.

Immense gratitude to all the Surgeons and Mentors who guided me throughout these years of specialization in General Surgery. I will remain indebted to you.

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255	MBOLE Jeanne Mauricette née MVONDO M.	L	Quality management, Quality control of healthcare products and foodstuffs
256	SOPPO LOBE Charlotte Vanessa	L	Drug quality control
257	ABA'A Marthe Dereine	AS	Drug Analysis
258	FOUMANE MANIEPI NGOUOPIHO Jacqueline Saurelle	AS	Pharmacology
259	MINYEM NGOMBI Aude Périne épse AFUH	AS	Pharmaceutical regulations

Key

P= Professor

AP= Associate Professor

SL= Senior lecturer

L= Lecturer

AS = Assistant

HoD= Head of Department

LIST OF ABBREVIATION

AIS: Abbreviated injury score

RTS: Revised trauma score

ISS: Injury severity score

NISS: New injury severity score

EDC: Early definitive care

ETC: Early total care

EAC: Early appropriate care

SDS: Safe definitive surgery

DCO: Damage control orthopedic

LFFF: Late first fracture fixation

ORIF: Open reduction and internal fixation

ICU: Intensive care unit

GCS: Glasgow coma score

RTA: Road traffic accident

ATLS: Advance trauma life support

CT scanning: Computer tomography scanning

FAST: Focused Assessment with Sonography in Trauma

DPL: Diagnostic peritoneal lavage

APACHE: Acute physiology and chronic health evaluation

ICISS: International classification of disease injury severity score

TRISS: Trauma and injury severity score

ASCOT: A severity characterization of trauma

SBP: Systolic blood pressure

RR: Respiratory rate

SBPc: Coded systolic blood pressure

RRc: Coded respiratory rate

GCSc: Coded Glasgow Coma Score

RTSc: Coded revised trauma score

mmHg: Millimeters of mercury

cm: Centimeter

AP: Anterioposterior

CHU: Yaounde University Teaching Hospital

CURY: Yaounde Emergency Center

HCY: Yaounde Central Hospital

HGY: Yaounde General Hospital

SSI: Surgical site infection

IMN: Intramedullary nail

GA: Gustillo Anderson

SIRS: Systemic inflammatory response syndrome

ARDS: Acute respiratory distress syndrome

MOF: Multiple organ failure

PFN: Proximal femoral nail

DCP: Dynamic compression plate

DFN: Distal femoral nail

IBM: International Business Machine

SPSS: Statistical Package for Social Sciences

USA: United States of America

SD: Standard Deviation

HoD: Head of Department

UY1: University of Yaounde 1

FMBS: Faculty of Medicine and Biomedical Sciences

P: Professor

AP: Associate Professor

SL: Senior Lecturer

L: Lecturer

AL: Assistant Lecturer

ENT: Ear, nose and throat

LOS: Length of stay

WHO: World Health Organization

HIV: Human Immunodeficiency Virus

ECG: Electrocardiogram

LC – DCP: Limited contact dynamic compression plate

MIPPO: Minimally invasive perentaneon plate osteosynthesis

AO: Association of Osteosynthesis

IQR: Interquartile range

ANOVA: Analysis of Variance

PTT: Partial Thromboplastin Time

INR: International normalized ratio

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDIX

SUMMARY

Background: Polytrauma is a patient having an injury severity score ≥ 16. It is generally used to describe trauma patients whose injuries involve multiple body regions, compromise the patient physiology and potentially cause dysfunction of uninjured organs. Femoral fracture is one of the injuries frequently sustained in polytrauma patients. There are different surgical treatment strategies that could be implemented in the management of femoral fractures in polytrauma patients which includes: early definitive care, damage control orthopedics or early appropriate care. In our setting, we also have late first fracture fixation.

Objectives: Our main objective was to contribute in ameliorating the surgical management of femoral fractures in polytrauma patients in Yaounde. Specifically, we sought to: assess the overall injury severity of polytrauma patients with femoral fractures using revised trauma score, injury severity score and new injury severity score; describe the different surgical management strategies used in femoral fractures in polytrauma patients; compare the short term outcomes of these different surgical management strategies.

Method: A descriptive, cross – sectional, hospital based prospective study was carried out for a period of 7 months using the convenient non – probability sampling method. After an informed consent was obtained, a data collection sheet was filled. Data was managed with statistical package for social sciences version 25.

Results: Out of the 19 participants, 68.4% were males while 31.6% were females. The age group 21 – 30 years had the highest number of participants (26.3%). Most of them had primary level of education (42.1%) and were bike riders (52.6%). The injuries were mostly caused by road traffic accidents (94.7%). 31.6% of the patients had hypotension, 26.3% had tachypnea. Maximum number of patients (57.9%) had Glasgow coma score in the range 13 – 15. After the limbs, the other anatomical regions mostly affected were the skin (52.6%) and head/neck (42.1%). The mean injury scores were as follows: injury severity score – 26.0, revised trauma score – 10.6, new injury severity score – 30.6. Patients mostly had right (52.6%) closed (73.7%) transverse (42.1%) femoral shaft (90%) fractures. 73.7% of patients underwent at least 1 surgical intervention to fix the femoral fracture and the maximum surgical treatment strategy

used was damage control orthopedics (42.9%). General anesthesia was used in 42.9% of cases and the most common actual technique was intramedullary nailing (36.8%). 42.9% of operated patients had no complications and we had a general mortality of 31.6% (indicating how severe femoral fracture is in polytrauma patients). Average length of stay in hospital – 17.0 days, length of stay in intensive care unit – 1.2 days. There was no statistical significant difference in the short term outcome of the different treatment strategies.

Conclusion: Polytrauma with femoral fracture is a public health problem in Yaounde mostly affecting young male motorbike riders who comes to the hospital seriously injured with abnormalities in their physiological parameters and more than 30% of them end up dying. Those that undergo surgical intervention mostly benefit from damage control orthopedics with no relevant in the short term outcomes between the different surgical management strategies.

Keywords: Polytrauma, femoral fracture, injury severity, surgical management strategy, short term outcome.

RÉSUMÉ

Contexte: Un polytraumatisé est un patient dont l'ISS est ≥ 16. Ce terme est généralement utilisé pour décrire les patients traumatisés dont les lésions touchent plusieurs régions du corps, compromettent la physiologie du patient et peuvent entraîner un dysfonctionnement des organes non blessés. La fracture du fémur est l'une des lésions fréquemment subies par les patients polytraumatisés. Il existe différentes stratégies de traitement chirurgical pouvant être mises en œuvre dans la gestion des fractures fémorales chez les patients polytraumatisés : EDC, DCO ou EAC. Dans notre contexte, nous avons également des LFFF.

Objectifs: Notre objectif principal était de contribuer à l'amélioration de la prise en charge chirurgicale des fractures fémorales chez les patients polytraumatisés à Yaoundé. Plus précisément, nous avons cherché à: évaluer la gravité globale des lésions des patients polytraumatisés souffrant de fractures fémorales en utilisant RTS, ISS et NISS; décrire les différentes stratégies de gestion chirurgicale utilisées dans les fractures fémorales chez les patients polytraumatisés; comparer les résultats à court terme de ces différentes stratégies de gestion chirurgicale.

Méthode: Une étude descriptive, transversale et hospitalière a été menée sur une période de 7 mois en utilisant la méthode d'échantillonnage non probabiliste. Après l'obtention d'un consentement éclairé, une feuille de collecte de données a été remplie. Les données ont été gérées avec SPSS version 25.

Résultats: Sur les 19 participants, 68,4 % étaient des hommes et 31,6 % des femmes. La tranche d'âge 21-30 ans était la plus représentée (26,3 %). La plupart d'entre eux avaient un niveau d'éducation primaire (42,1 %) et étaient des cyclistes (52,6 %). Les blessures étaient principalement causées par des accidents de la route (94,7 %). 31,6 % des patients présentaient une hypotension, 26,3 % une tachypnée. Le plus grand nombre de patients (57,9 %) avaient un SCG compris entre 13 et 15. Après les membres, les autres régions anatomiques les plus touchées étaient la peau (52,6 %) et la tête/cou (42,1 %). Les scores moyens des blessures étaient les suivants : ISS - 26,0, RTS - 10,6, NISS - 30,6. Les patients présentaient principalement des

fractures droites (52,6 %), fermées (73,7 %), transversales (42,1 %) et de la diaphyse fémorale (90 %). 73,7% des patients ont subi au moins une intervention chirurgicale pour fixer la fracture fémorale et la stratégie de traitement chirurgical maximale utilisée a été le DCO (42,9%). L'anesthésie générale a été utilisée dans 42,9 % des cas et la technique actuelle la plus courante était l'IMN (36,8 %). 42,9 % des patients opérés n'ont pas eu de complications et la mortalité générale a été de 31,6 % (indique la gravité de la fracture fémorale chez les patients polytraumatisés). La durée moyenne de séjour à l'hôpital était de 17 jours, et de 1,2 jour en unité de soins intensifs. Il n'y a pas eu de différence statistiquement significative dans les résultats à court terme des différentes stratégies de traitement.

Conclusion: Le polytraumatisme avec fracture du fémur est un problème de santé publique à Yaoundé qui affecte principalement les jeunes motocyclistes masculins qui arrivent à l'hôpital gravement blessés avec des anomalies dans leurs paramètres physiologiques et plus de 30% d'entre eux finissent par mourir. Ceux qui subissent une intervention chirurgicale bénéficient le plus souvent de la DCO, sans que les résultats à court terme ne varient entre les différentes stratégies de prise en charge chirurgicale.

Mots-clés: Polytraumatisme, fracture fémorale, gravité des lésions, stratégie de prise en charge chirurgicale, résultats à court terme.

CHAPTER ONE: INTRODUCTION

1.1 BACKGROUND

Polytrauma is generally used to describe trauma patients whose injuries involve multiple body regions, compromise the patient physiology and potentially cause dysfunction of uninjured organs (1) (2). Trauma is a common public health problem in the world today(3). Injuries (both unintentional and violence related) take the lives of 4.4 million people around the world each year and constitute nearly 8% of all death(4). Injuries and violence are responsible for an estimated 10% of all years lived with disability(4). Injury related conditions represented 27% of all registered admissions in the Emergency Department of Limbe Regional Hospital in 2013(5). Injuries associated with femoral fractures are the major cause of morbidity in polytrauma patients(6) (7) (8). Femur is the most fractured long bone in the body that often necessitates surgical fixation(6) (9). Femoral fracture is one of the injuries frequently sustained by polytrauma patients(10) (11) (12). A typical patient is a young healthy male injured in a motor vehicle accident(10). It has a frequency of about 11% in trauma patients(6) (13) and an annual incidence between 1.0 and 2.9 million worldwide(6) (14). The most frequently injured site of the femur is the midshaft, particularly among adult population following road traffic collisions(6) (15). There are various treatment options for femoral fractures, such as: fixation with screws and plate, intramedullary nailing (IMN) and external fixators(6). Reduction of femoral fracture can be open or closed. About 75% of femoral shaft fractures are treated with reamed intramedullary nailing(6) (11). An external fixator construct is mostly used to stabilize hemodynamically unstable patients or those with severe open fractures(6).

In the management of femoral fractures in polytrauma patients, there is a choice to be made between: early definitive care (EDC) or early total care (ETC), damage control orthopedics (DCO) and early appropriate care (EAC) or safe definitive surgery (SDS). In a study carried out in Finland, the majority of the patients (78%) underwent EDC compared to 22% that had DCO(16). Patients who undergo DCO are significantly more severely injured(10). Patients with DCO have more intensive care unit (ICU) stay and hospital stay compared to EDC(10). In EDC, definitive fracture stabilization occurs within 48 hours from the injury(10). DCO involves primary external fixation within the first 48 hours of injury followed by delayed definitive fracture fixation some days later(10). It is widely accepted that patients who are deemed “stable” benefits from EDC while “unstable” patient need DCO(10). Treatment of borderline patients and

those with other particular concomitant injuries however remains controversial(10). Traumatic brain injury is the most commonly stated reason for choosing DCO(10). Other reasons include; hemodynamic instability, respiratory failure secondary to chest trauma, multiple lower extremity fractures and open fractures(10). Four clinically significant factors suggested by Pape et al to decide the patient management protocol between EDC versus DCO were: acidosis, coagulation profile, temperature and soft tissue injuries(17) (18). Pape classified the patients into four groups based on these parameters: patients in extremis, unstable patients, borderline patients, and stable patients(17).

Femoral fractures may be associated with severe complications, such as: bleeding, pneumonia, pulmonary embolism, acute renal failure (ARF), acute respiratory distress syndrome (ARDS), multiple organ failure (MOF), sepsis, deep vein thrombosis and wound infection(6) (19) (20). Polytrauma patients are expected to have a higher risk of morbidity and mortality than that obtained by the summation of expected mortality owing to their individual injuries(1) (21). Polytrauma patients have a 1.9 – fold higher odds of mortality than non – polytrauma patients(1). Also, they have longer hospital and ICU stay(1). The expected higher risk of mortality of polytrauma patients is based on the assumption that the underlying pathophysiological response of the injured person would aggravate the clinical outcome(1). The injured person's pathophysiological response to the injury load, however, makes a differentiation between 'polytrauma and 'multitrauma'(1) (22). For example, hypovolemic shock and massive blood transfusion are often associated with coagulopathy and imbalance in acid – base homeostasis(1) (23). A combination of injury severity, relevant pathophysiologic change, or physiologic changes seemed to be useful for mortality prediction(1) (2). The dysregulation of the immune system after trauma presents one of the greatest threats to life(1) (24) (25).

Delay femoral fracture fixation in multiple injured patients has been shown to increase the hospital morbidity and adverse outcome(10). Surgical delay beyond 48 hours is associated with nearly five times greater mortality compared with those undergoing surgery within 12 hours(10).

The treatment strategy of femoral fractures in polytraumatised patients has evolved over the years and led to improved outcomes for these patients. However, there is still controversy regarding the optimal treatment strategy and surgical care can differ markedly from one country to another. We

aimed to investigate the different surgical strategies used in the management of femoral fractures in polytraumatised patients and their outcomes in this study. This is going to help us to have a better understanding of the best treatment strategy to adapt in our local setting.

1.2 RESEARCH OBJECTIVES

1.2.1 MAIN OBJECTIVE

- To contribute in ameliorating the surgical management of femoral fractures in polytrauma patients in Yaounde.

1.2.1 SPECIFIC OBJECTIVES

- To assess the overall injury severity of polytrauma patients with femoral fractures using: revised trauma score (RTS), injury severity score (ISS) and new injury severity score (NISS).
- To describe the different surgical management strategies used in femoral fractures in polytrauma patients.
- To compare the short term outcomes of these different surgical management strategies.

1.3 RESEARCH QUESTION

- What is the best surgical management strategy for femoral fractures in polytrauma patients in Yaounde?

1.4 RESEARCH SCOPE

The study was limited to polytrauma patients with femoral fractures presenting in the major hospitals in the city of Yaounde between January 1st, 2024 and July 31th, 2024.

1.5 DEFINITION OF TERMS AND CONCEPTS

Polytrauma: An injury severity score (ISS) $\geq$ 16.

Femoral fracture: An x-ray confirmed breech of continuity of a living femur.

Early definitive care: This is when a permanent fixation (usually with plates or intramedullary nail) of the femoral fracture is carried out within the first 48 hours from the injury during the first surgical intervention.

Damage control orthopedic: This is when the patient first benefit from a temporal fixation (usually with an external fixator) of the femoral fracture within 48 hours from the injury before benefitting from a delayed permanent fixation of the fracture.

Early appropriate care: This is when the patient initially received a multidisciplinary resuscitation for 2 – 5 days and gets stable before benefitting from a permanent fixation of the fracture. The fracture fixation takes place within day 2 to 5 from the injury.

Late first fracture fixation (LFFF): This is when the first surgical intervention to fix the femoral fracture is carried out after 5 days from the injury. This is a concept adapted for this study based on our local setting realities.

Short term outcome: Follow up 30 days after surgery including postoperative complications, mortalities and length of hospital/ICU stay.

Injury severity: How severe the injury is based on ISS, NISS and RTS.

CHAPTER TWO: LITERATURE REVIEW

2.1 KNOWLEDGE REVIEW

2.1.1 General Overview on Polytrauma

2.1.1.1 Introduction

Trauma is the leading cause of death for people aged 1-44 years and is exceeded only by cancer and atherosclerotic disease in all age group(26). The injured person's pathophysiological response to the injury load makes a differentiation between polytrauma and multitrauma(1). The major causes of polytrauma are: road traffic accidents (RTA), falls from height, occupational injury, assault, domestic injuries, gunshot, sport injuries, blast, and natural disaster. Motor vehicle accidents remain the principle mode of injury in severely injured patients with femoral fractures(10). Management of polytrauma patients follows a team approach including so many members such as; emergency medicine physician, trauma surgeons, orthopedic surgeons, general surgeons, neurosurgeons, vascular surgeons, visceral surgeons, anesthesiologist etc. Each member of the team should be familiar with trauma resuscitation.

Nearly 50% of all trauma deaths are due to the immediate injury, often lethal head injuries or exsanguinating trauma due to rupture of major vasculature. Approximately another 10% occur within hours after the initial trauma secondary to hypovolemic shock, hypoxia or head injury. Lastly, the remaining 40% of trauma death occur weeks later, secondary to acute respiratory distress syndrome, renal failure or some combination of multiple organ failure(27) (28) (29) (30).

2.1.1.2 Definitions

Polytrauma is generally used to describe trauma patients whose injuries are severe and involved multiple body regions. The term polytrauma lacks a universally accepted definition(21) (31) (32) (33) (34). The term polytrauma has been frequently defined in terms of a high injury severity score (ISS) and has been generally used interchangeably with terms such as 'severely injured' or 'multiple trauma'(1). Polytrauma has different definitions. Polytrauma is a short verbal equivalent used for severely injured patients usually with associated injury(35).

- Two or more severe injuries in at least two areas of the body(35). At least one out of two or more injuries or the sum total of all injuries endangers the life of the injured person

with polytrauma(35) (31) (36) (37). The term polytrauma cannot be used as a final diagnosis without an objective quantification of the extent of the severity of the injury(35).

- A second definition of polytrauma is based on injury severity score (ISS). The internationally accepted threshold is ISS ≥ 16(1) (3) (10) (38) (31). This internationally accepted threshold is based on the description as being predictive of a mortality risk above 10%(1). Other ISS values frequently used are: > 15, > 16, > 18, ≥ 18, > 25(1).
- The New Berlin definition of polytrauma is: "A patient with abbreviated injury score (AIS) ≥ 3 for two or more different body regions with additional one or more variables from the five physiologic parameters"(1) (31). The New Berlin definition of polytrauma is feasible and applicable for trauma patients(1). The physiologic parameters are: systolic blood pressure ≤ 90mmHg (hypotension), Glasgow coma score (GCS) ≤ 8 (unconsciousness), base excess ≤ 6.0 (acidosis), international normalized ratio ≥ 1.4 or partial thromboplastin time ≥ 40 seconds (coagulopathy), age ≥ 70 years (age)(1) (31). Age, systolic blood pressure and Glasgow coma score have been reported to have good predictive power for mortality(1) (39).
- A patient with AIS ≥ 3 in two or more different body regions(1) (21) (31) (40) (22) (41).

2.1.1.3 Advanced Trauma Life Support (ATLS)

Advanced trauma life support (ATLS) is the guideline used in the resuscitation of polytrauma patients(3). There are two approaches to the ATLS. For the individual physician, assessment of the polytraumatized patient is performed using a stepwise longitudinal approach, in which the airway is handled first and no procedures are initiated until the airway is secured. Then breathing and circulation are addressed. In the trauma team approach, each team member should be assigned a specific task or tasks so that each of these can be performed simultaneously to ensure the most rapid treatment possible.

Primary survey

ATLS starts with the primary survey consisting of:

A – Airway with cervical spine protection.

B – Breathing.

C – Circulation and hemorrhage control.

D – Disability.

E – Exposure/environmental control.

Immediate life threatening problems must be diagnosed and treated. It usually takes no longer than a few minutes unless procedures are required. The primary survey is repeated anytime the patient status changes.

Summary of the primary survey is as follows:

- Airway with cervical spine protection – Airway opened, airway obstruction treated, possible definitive airway placed, cervical stabilisation.
- Breathing – Breathing assessed, tension pneumothorax and massive hemothorax treated, oxygen and assisted ventilation provided as needed.
- Circulation – Blood circulation and tissue perfusion assessed, intravascular volume loss replaced with fluid and blood, cardiac tamponade and cardiac arrest treated, emergency thoracotomy performed if indicated, external hemorrhage controlled.
- Disability – Neurologic status assessed.
- Exposure/environment – Patient fully undressed and environment controlled to protect from hypothermia or hyperthermia.

Secondary survey

The secondary survey is performed only after the primary survey has been finished and all immediate threats to life have been addressed. It is a head to toe examination designed to identify any injuries that might have been missed. It can be accompanied by specialized diagnostic tests such as; computer tomography (CT) scanning, extremity radiography, endoscopy, formal ultrasonography. The history in the secondary examination is focused on the trauma and pertinent information if the patient is to be sent to surgery. The mnemonic SAMPLE covers the basics:

- Symptoms – Pain, shortness of breath, other symptoms.

- Allergies to medications
- Medications taken
- Past medical/surgical history
- Last meal – Important to determine risk of aspiration.
- Events leading up to trauma.

Summary of the secondary survey is as follows:

- Focused patient history - symptoms, allergies, medications, past medical/surgical history, last meal, events leading up to trauma.
- Head/skull – Eyes, skull, tympanic membrane, pupils evaluation.
- Neck – Midline position of the trachea.
- Chest – Chest inspection, palpation and auscultation.
- Abdomen – Inspection, auscultation, palpation and percussion. Consider focused assessment with sonography in trauma (FAST) and/or diagnostic peritoneal lavage (DPL).
- Spine/vertebrae – Palpation of the spinal column, neurologic examination, clearing the cervical spine.
- Genitourinary – Perineal examination, rectal examination, genital/vaginal examination.
- Musculoskeletal – Palpation of the pelvis, extremities, and splint fractures (consider immediate reduction of dislocations).

Tertiary survey

A tertiary trauma survey, including a detailed history and physical examination, and a review of written radiology reports on all studies ordered has been recommended. The tertiary survey is performed 24 hours after the polytrauma patient has been admitted to the ward or ICU or 24 hours after the initial surgery.

2.1.1.4 Trauma Scoring System

Characterization of injury severity is crucial to the scientific study of trauma; the actual measurement of injury severity began about 50 years ago(42). In 1969, researchers developed the abbreviated injury scale (AIS) to grade the severity of individual injuries(42). It was modified in

2005. It is the basis for the injury severity score (ISS) which is the most widely used measure of injury severity in patients with trauma. Multiple alternative scoring systems have been proposed, each with its own merits, problems and limitations. There is none that is ideal for all the cases. The ideal trauma scoring system would provide an accurate, reliable and reproducible description of injuries and prediction of morbidity and mortality outcomes in any setting.

The uses of the trauma scoring system are:

- Injury description.
- Predict outcome/mortality- resource allocation, end of life decisions.
- Triage- transfer to trauma center, use of helicopter transport.
- Quality assurance- evaluation of trauma care within and between trauma centers.
- Trauma care research.

An accurate method for quantitatively summarizing injury severity has many potential applications. The ability to predict outcome from trauma (mortality) is perhaps the most fundamental use of injury severity scoring system(42). Trauma mortality prediction in individual patients by any scoring system is limited and is in general no better than good clinical judgment. There are various systems available for scoring trauma severity. Some are based on anatomical descriptions of injuries, some on physiological parameters and other use combined data. They can be divided as follows:

Physiological scoring system:

- Revised trauma score (RTS).
- Acute physiology and chronic health evaluation (APACHE I, II, III).
- Glasgow coma scale and paediatric Glasgow coma scale.
- Prognostic index.
- Trauma score.
- Acute trauma index.
- Triage index.

Anatomical scoring system:

- Abbreviated injury score (AIS).
- Injury severity score (ISS).
- New injury severity score (NISS).
- Anatomic profile
- International classification of diseases (ICISS)

Combined scoring system:

- Trauma and injury severity score (TRISS).
- Polytrauma-Schussel.
- Trauma index.
- A severity characterization of trauma (ASCOT).

Revised Trauma Score

The RTS is one of the most common physiologic scores used. It combines three specific, commonly assessed clinical parameters as follows: Glasgow coma scale, systolic blood pressure (SBP) and respiratory rate (RR). The magnitude of derangement in each parameter is scored from 0-4 as in the table below.

Coded value	GCS	SBP(mmHg)	RR(breaths/min)
0	3	0	0
1	4-5	<50	<5
2	6-8	50-75	5-9
3	9-12	76-90	>30
4	13-15	>90	10-30

Table 1: Revised Trauma Score (42).

The RTS has two forms depending on its use. When used for field triage, the RTS is determined adding each of the coded values together. Thus the RTS ranges from 0-12 and is easily calculated. An RTS of less than 11 is used to indicate the need for transport to a designated trauma center. The coded form of RTS is used more frequently for quality assurance and outcome

prediction. The coded RTS is calculated as follows, in which SBPc, RRc and GCSc represent the coded values of each variable.

$$RTSc = 0.9368GCSc + 0.7326SBPc + 0.2908RRc$$

Obviously this value is more complicated to compute, which limits its usefulness in the field. The main advantage of the coded RTS is that the weighting of the individual components emphasizes the significant impact of traumatic brain injury on outcome. RTS has the following limitations:

- Difficulty in estimating the Glasgow coma scale in certain situations such as: ventilated patients, intoxicated patients and children.
- May underscore rapidly resuscitated patients.
- Does not account for duration of physiological derangement.

Abbreviated Injury Score (AIS)

The AIS is a simple numerical method for grading and comparing injuries by severity. Although originally intended for use with vehicular injuries, its scope is increasingly expanded to include other injuries. It is the basis of injury severity score. It was developed and published in 1971 and has undergone regular revision. Every injury is assigned a code based on anatomical site, nature and severity. Injuries are grouped by body regions. It is scored as follows:

AIS code	Description
1	Minor
2	Moderate
3	Serious (non-life threatening)
4	Severe (life threatening, survival probable)
5	Critical (survival uncertain)
6	Maximal (currently untreatable)

Table 2 : Abbreviated Injury Score

It enables ranking of injury severity and correlates with patient outcome. The predictive validity and reliability of the AIS and its derivatives have been demonstrated, but their widespread use in population based research is hindered by the cost of AIS coding. It does not reflect the combined effects of multiple injuries.

Injury Severity Score (ISS)

Baker et al introduced the ISS in 1974 as a means of summarizing multiple injuries in a single patient(43). The ISS is defined as the sum of squares of the highest AIS grade in the three most severely injured body regions. It is derived from AIS. Only one injury per body region is allowed. The ISS ranges from 1-75, and an ISS of 75 is assigned to anyone with AIS of 6. The ISS can be used to predict mortality, morbidity from trauma and length of hospital stay. Six body regions are defined which are:

- Thorax: Include all lesions to internal organs, drowning and inhalation injury. Chest injury also includes those to the diaphragm, rib cage and thoracic spine.
- Abdomen and visceral pelvis: Includes all lesions to internal organs of the abdomen and pelvis. Lumbar spines are included.
- Head and neck: Include injury to the brain or cervical spine, skull or cervical spine fractures and asphyxia/suffocation.
- Maxillofacial: Include those involving mouth, ears, nose and facial bones.
- Extremities and bony pelvis: Include sprains, fractures, dislocation and amputation.
- External structures: Include lacerations, contusions, abrasions and burns, independent of their location on the body surface.

ISS has the following limitations:

- Inability to account for multiple injuries to the same body region.
- Limit the number of contributing injuries to only three.
- Impairs usefulness of ISS in penetrating injuries- multiple injuries common.
- Weights injuries to each body region equally.
- Ignores importance of head injuries to mortality from trauma.
- Mortality is not strictly an increasing function of ISS.
- Makes the ISS a heterogeneous score and reduces its predictive ability.

The ISS can be classified as follows(6) (44):

- ISS of 1 to 8 is minor injury.
- ISS of 9 to 15 is moderate injury.

- ISS of 16 to 24 is serious injury.
- ISS of 50 to 74 is critical injury.
- ISS of 75 is non – survivable.

In conclusion, despite its imperfection, trauma severity scoring remains important for many reasons.

2.1.2 General Overview on Femoral Fractures

2.1.2.1 Introduction

Femoral fracture is a serious injury. It is often caused by severe injury such as trauma sustained from motor vehicle accident or fall. It is typically sustained in high impact trauma, due to large amount of force needed to break the bone (because of the strength of the femur). The femur is very vascular and fractures can result in significant blood loss into the thigh resulting in anemia.

2.1.2.2 Definition

Femoral fracture is a breech in the continuity of a living femur. The femur is the longest bone in the human body and is located on the thigh. It starts from the hip joint to the knee joint.

2.1.2.3 Anatomy Review

The femur or thigh bone is the longest and the strongest bone of the body. Like any other long bone, it has two ends upper and lower, and a shaft.

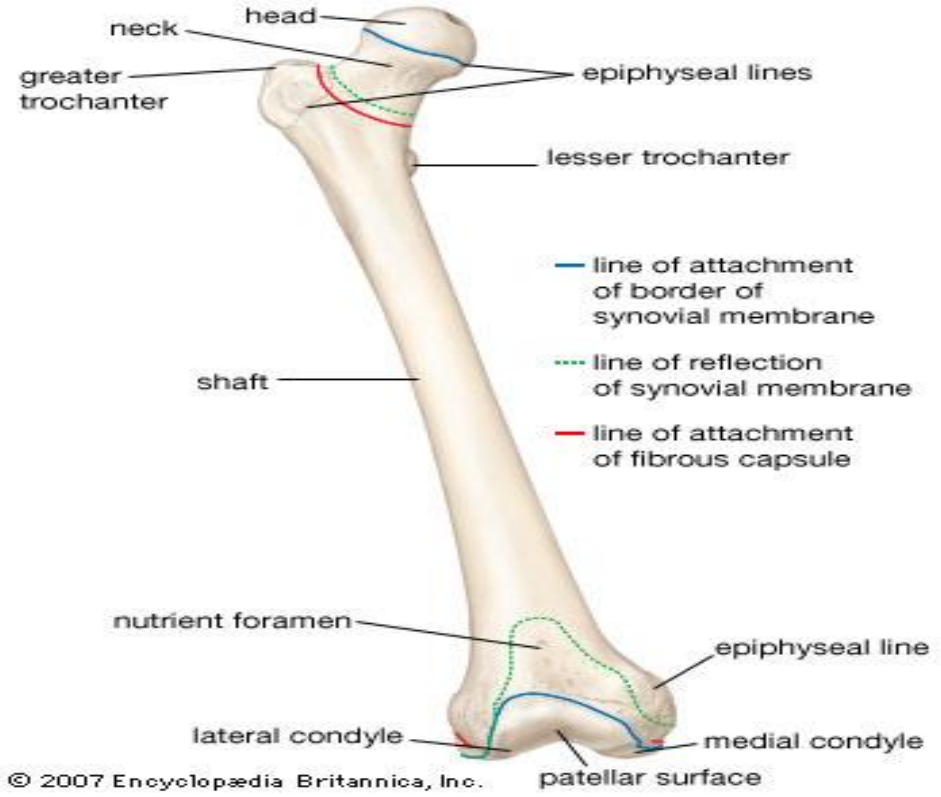


Figure 1: Femoral bone (front view) (45)

Anatomy position

The head is directed medially upwards and slightly forwards. The shaft is directed obliquely downwards and medially so that the lower surfaces of the two condyles of the femur lie in the same horizontal plane(45) (46).

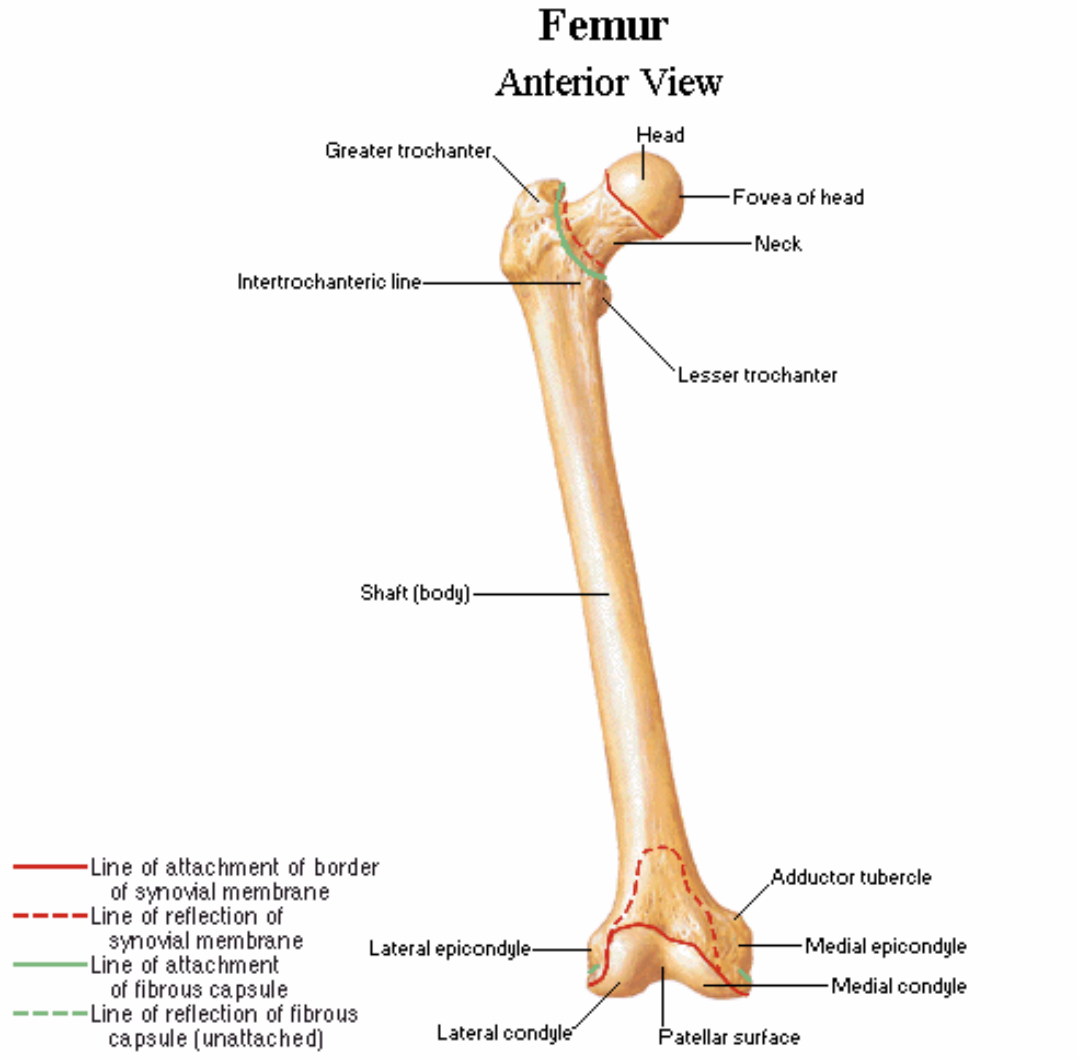


Figure 2: Anterior view of femoral shaft (45)

Upper end: The upper end of the femur includes the head, the neck, the greater trochanter, the lesser trochanter, the intertrochanteric line, and the intertrochanteric crest. These are described as follows.

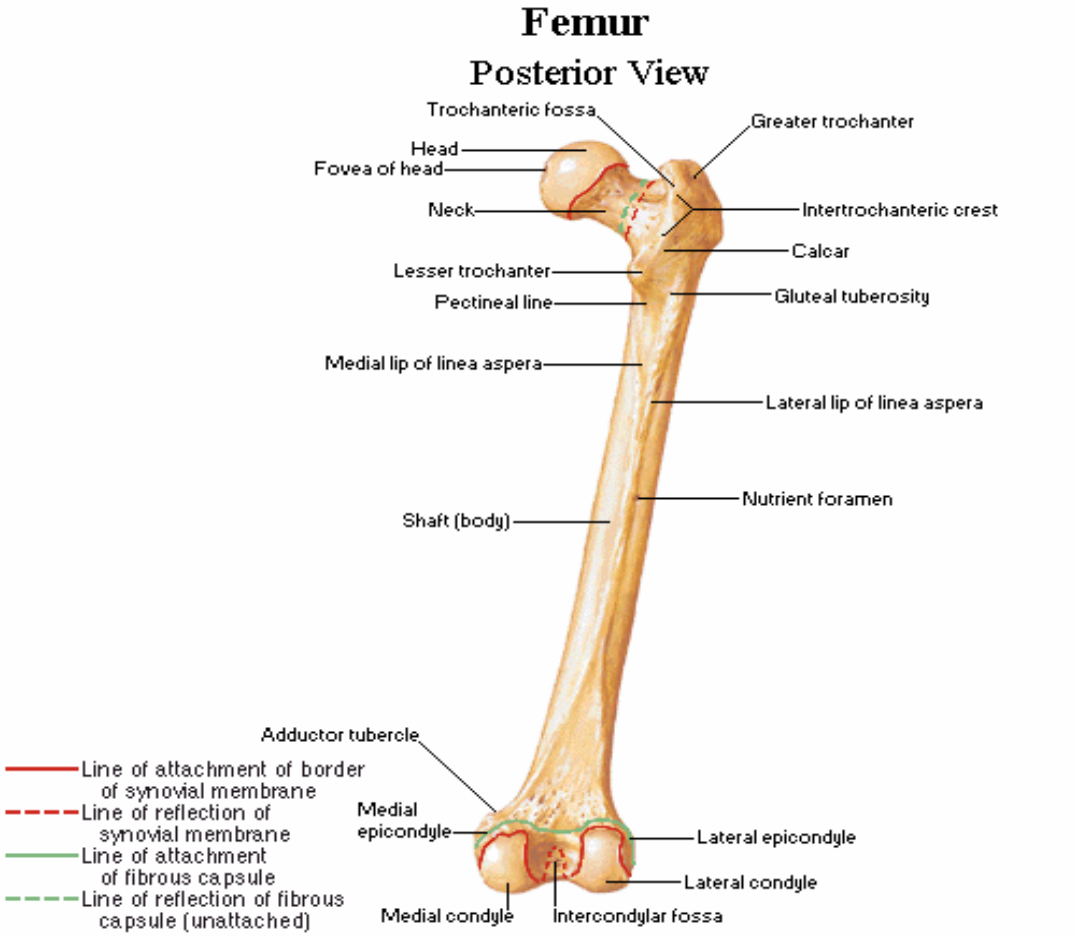


Figure 3: Posterior view of femoral shaft (45)

Head

The head forms more than half a sphere, and is directed medially, upwards and slightly forwards.

It articulates with the acetabulum to form the hip joint. A roughened pit is situated just below and behind the center of the head. This pit is called the fovea.

Neck

It connects the head with the shaft and is about 3.7 cm long. It makes an angle with the shaft. The neck - shaft angle is about 125° in adults. It is less in females due to their wider pelvis. The angle

facilitates movements of the hip joint. It is strengthened by a thickening of bone called the calcar femorale present along its concavity.

Greater trochanter

This is large quadrangular prominence located at the upper part of the junction of the neck with the shaft. The upper border of the trochanter lies at the level of the center of the head.

Lesser trochanter

It is a conical eminence directed medially and backwards from the junction of the posteroinferior part of the neck with the shaft.

Shaft

The shaft is more or less cylindrical. It is narrowest in the middle, and is more expanded inferiorly than superiorly. It is convex forwards and is directed obliquely downwards and medially, because the upper ends of two femora are separated by the width the pelvis, and their lower ends are close together. In the middle one-third, the shaft has three borders, medial, lateral and posterior and three surfaces, anterior, medial and lateral. The medial and lateral borders are rounded and ill-defined, but the posterior border is in the form of a broad roughened ridge, called the linea aspera. The medial and lateral surfaces directed more backwards than towards the sides. In the upper one-third of the shaft, the two lips of the linea aspera diverge to enclose an additional posterior surface. Thus it has four borders, medial, lateral, spiral line and the lateral lip of the gluteal tuberosity and four surfaces anterior, medial, lateral and posterior. The gluteal tuberosity is a broad roughened ridge on the lateral part of the posterior surface. In the lower one-third of the shaft also, the two lips of the linea aspera diverge as supracondylar lines to-enclose an additional, popliteal surface. Thus, this part of the shaft has four borders, medial, lateral, medial supracondylar line and lateral supracondylar line and four surfaces, anterior, medial, lateral and popliteal. The medial border and medial supracondylar line meet inferiorly to obliterate the medial surface(45) (46).

Lower end

The lower end of the femur is widely expanded to form two large condyles, one medial and one lateral. Anteriorly, the two condyles are united and are in line with the front of the shaft. Posteriorly, they are separated by a deep gap, termed the intercondylar fossa or intercondylar notch, and project backwards much beyond the plane of the popliteal surface.

Attachment of the femur

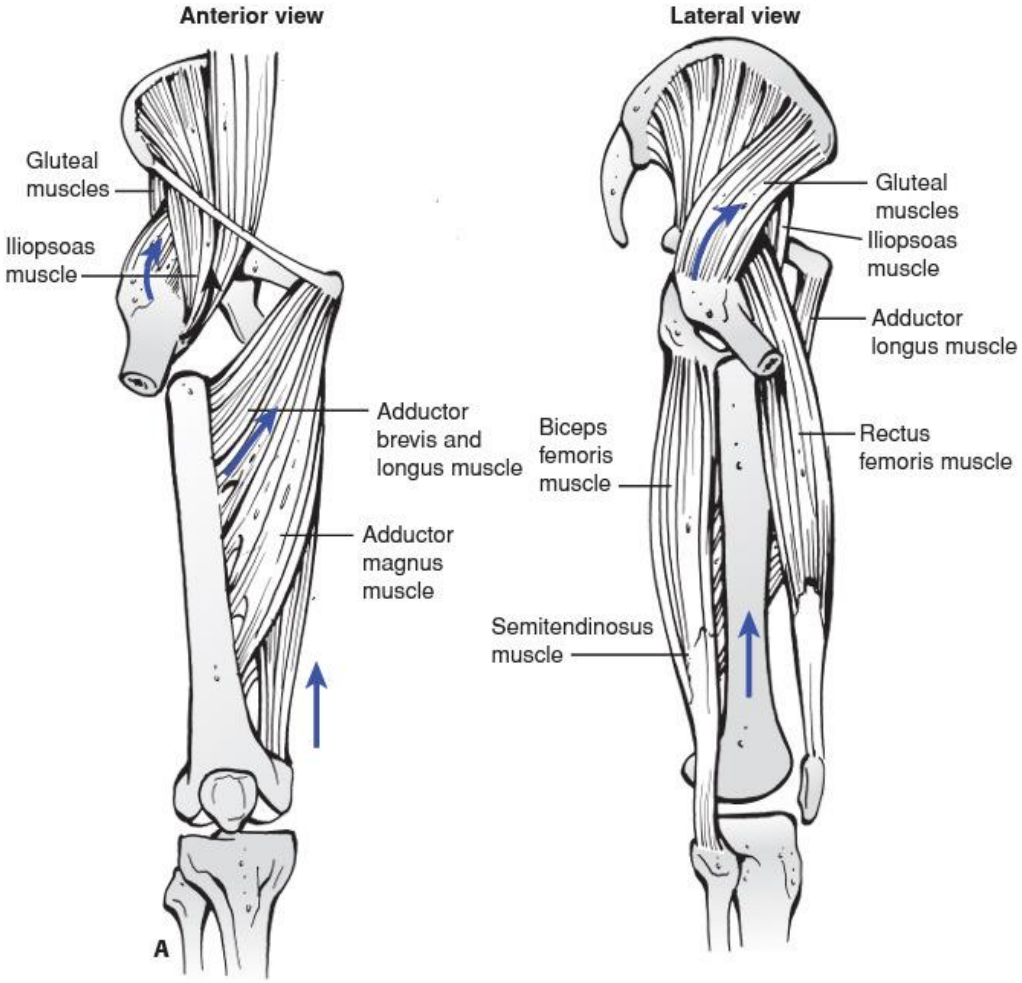
The fovea on the head of the femur provides attachment to the ligament of the head of femur or ligamentum teres.

The following are attached to the greater trochanter:

- The piriformis is inserted into the apex.
- The gluteus minimus is inserted into the rough lateral part of the anterior surface.
- The obturator internus and the two gemelli are inserted into the upper rough impression on the medial surface.
- The obturator externus is inserted into the trochanteric fossa.
- The gluteus medius is inserted into the ridge on the lateral surface. The trochanteric bursa of the gluteus medius lies in front of the ridge, and the trochanteric bursa of the gluteus maximum lies behind the ridge.

The attachments on the lesser trochanter are as follows:

- The psoas major is inserted on the apex and medial part of the rough anterior surface.
- The illacus is inserted on the anterior surface of the base of the trochanter and on the area below it.
- The smooth posterior surface of the lesser trochanter is covered by a bursa that lies deep to the upper horizontal fibres of the adductor magnus.


Anterior view
Gluteal muscles
Iliopsoas muscle
Adductor brevis and longus muscle
Adductor magnus muscle
A
Lateral view
Gluteal muscles
Iliopsoas muscle
Adductor longus muscle
Biceps femoris muscle
Rectus femoris muscle
Semitendinosus muscle

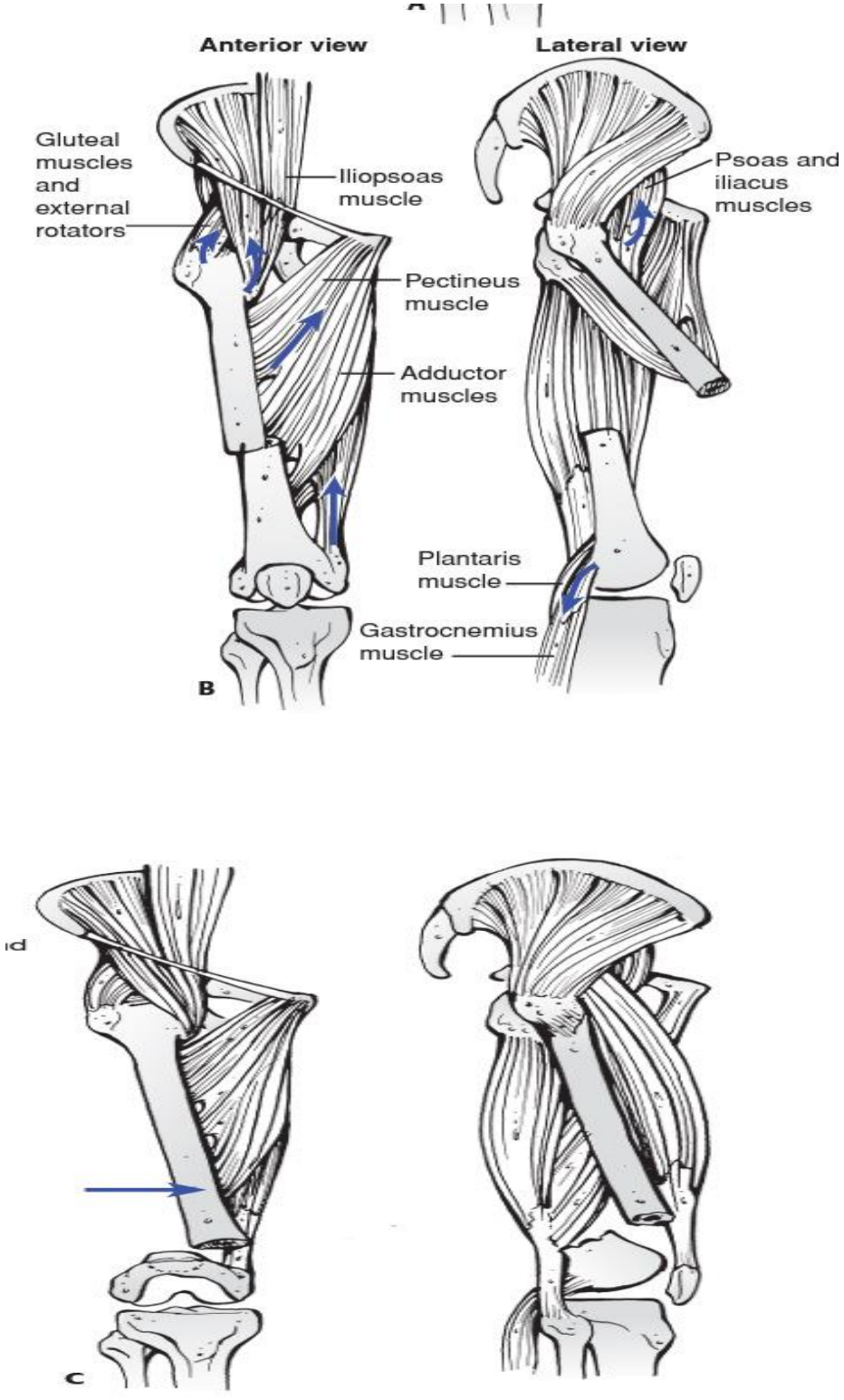


Figure 4: Muscular attachments and fracture location determine the observed deformities and displacements (45).

The intertrochanteric line provides:

- Attachment to the capsular ligament of the hip joint.
- Attachment to the upper band of the iliofemoral ligament in its upper part.
- Attachment to the lower band of the iliofemoral ligament in its upper part.
- Origin to the highest fibres of the vastus lateralis from the upper end.
- Origin to the highest fibres of the vastus medialis from the lower end of the line.

The quadrate tubercle receives the insertion of the quadratus femoris.

The attachments on the shaft are as follows:

- The medial and popliteal surfaces are bare, except for a little extension of the origin of the medial head of the gastronemius to the popliteal surface.
- The vastus intermedius arises from the upper three-fourths of the anterior and lateral surfaces.
- The articularis genu arises just below the vastus intermedius.
- The lower 5 cm of the anterior surface are related to suprapatellar bursa.
- The vastus lateralis arises from the upper part of the intertrochanteric line, anterior and inferior borders of the greater trochanter, the lateral lip of the gluteal tuberosity, and the upper half of the lateral lip of the linea aspera.
- The vastus medialis arises from the lower part of the intertrochanteric line, the spiral line, the medial lip of the linea aspera, and the upper one-fourth of the medial supracondylar line.
- The deeper fibres of the lower half of the gluteus maximus are inserted into the gluteal tuberosity.
- The adductor longus is inserted along the medial lip of the linea aspera between the vastus medialis and the adductors brevis and magnus.
- The adductor brevis is inserted into a line extending from the lesser trochanter to the upper part of the linea aspera, behind the pectineus and the upper part of the adductor longus.

- The adductor magnus is inserted into the medial margin of the gluteal tuberosity, the linea aspera, the medial supracondylar line, and the adductor tubercle, leaving a gap for the popliteal vessels.
- The pectineus is inserted on a line extending from the lesser trochanter to the linea aspera.
- The short head of the biceps tendons arises from the lateral lip of the linea aspera between the vastus lateralis and the adductor magnus, and from the upper two-thirds of the lateral supracondylar line.
- The medial and lateral intermuscular septa are attached to the lips of the linea aspera and to the supracondylar lines. They separate the extensor muscles from the adductors medially, and from the flexors laterally.
- The lower end of the lateral supracondylar line gives origin to the plantaris above and the upper part of the lateral head of the gastronemius below.
- The popliteal surface is covered with fat and forms the floor of the popliteal fossa. The origin of the medial head of the gastronemius extends to the popliteal surface just above the medial condyle(45) (46).

Nutrient artery to the femur

Femur is supplied by femoral artery. The nutrient artery is derived from the second perforating artery. In case it is absent, it is replaced by two nutrient arteries derived from the first and third perforating arteries. The nutrient foramen is located on the medial side of the linea aspera, and is directed upwards(47).

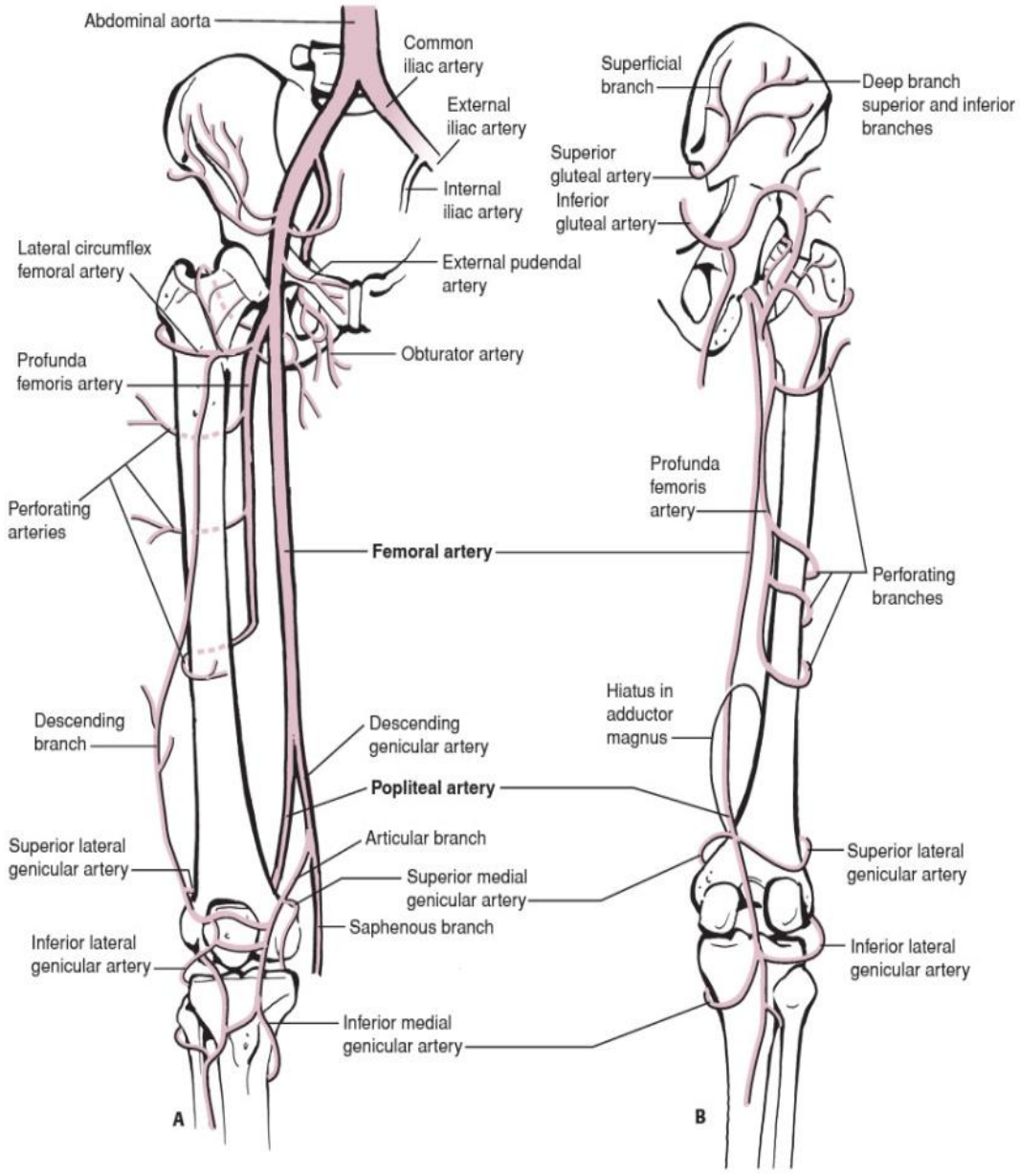


Figure 5: Schematic diagram of arterial supply of femoral shaft (47)

Biomechanics of fracture

Biomechanics is defined as mechanics applied to biology. Mechanics is the analysis of any dynamic system be it relative motion of quanta and subatomic particles or motion of galaxies(48). The effect of a force sustained in an accident depends on its magnitude, direction and nature of load; the nature of the bone including bone microarchitecture with mineral content**,**

bone density and geometrical shape and the counteraction of soft tissues(48). The material strength of bone varies with age, sex, and species of animal. It also varies with the location of bone such as femur versus humerus. The directions of forces on bone are tension, compression, shear, bending and torsion. The force that caused fracture can be direct or indirect (rotation, axial, compression, and bending without a direct impact)(49). Bone breaks when deformed before other musculoskeletal materials because of its brittleness attributed to mineral content(16).

Thus a fracture is a failure of bone as a material and as a structure(50). Under tension and compression loads, bone strength is proportional to the bone cross – sectional area and to the square of the apparent density; small reduction in bone density may be associated with large reductions in bone strength.

2.1.2.4 Epidemiology

Femoral fractures occur in a bimodal distribution, whereby they are most commonly seen in males age 15 – 24 years (due to high energy trauma) and females aged 75 years and older (pathologic fractures due to osteoporosis, low energy fall). It is the most common traumatic orthopedic injuries requiring hospitalization.

2.1.2.5 Mechanism of Injury

The mechanism of injury will depends on the anatomical location of the fracture. It is usually due to direct trauma due to RTA or falls. For femoral neck fracture, majority are due to trivial fall because of direct blow over the greater trochanter. Lateral rotation of the extremity, which cause marked posterior comminution of the neck. Cyclical loading due to muscle force and tension also cause femoral neck fractures.

Femoral shaft fracture is usually due to major violence and is common in young adults because the strong metaphyseal areas transmit the force to the shaft causing fracture. Supracondylar femoral fracture is due to severe varus or valgus forces with axial loading and rotation due to RTA, falls, etc.

2.1.2.6 Classifications and Types

Femoral fractures can be classified based on location into: proximal femoral fractures, femoral shaft fractures and distal femoral fractures. Proximal femoral fractures include the following: femoral neck fractures, pertrochanteric fractures and subtrochanteric fractures(38). Distal femoral fractures can be classified into supracondylar fractures, intercondylar fractures, unicondylar fractures and comminuted fractures.

Femoral fractures can be classified based on the fractured line as: transverse fractures, oblique fractures, spiral fractures, comminuted fractures. They can also be classified as open or closed fractures. Open fractures can be classified based on Gustillo – Anderson classification as: I, II, IIIA, IIIB, and IIIC.

2.1.2.7 Clinical Features

The patient present with pain and tenderness, swelling, shortening, complete external rotation deformity such that the lateral border of the foot touches the bed, inability to move. It might present with features of shock such as unconsciousness, pallor, cold nose, tachycardia, cold and clammy skin, and hypotension. For supracondylar femoral fracture, there is a flexion deformity caused by the pull of the gastrocnemius muscle. Hemarthrosis is commonly seen, especially with fractures extending into the joints.

2.1.2.8 Investigations

The main investigation to confirm the diagnosis of femoral fracture is an x – ray of the femur. We have the anteroposterior (AP) and lateral view. Both the hip and knee joints should be included to rule out the possibility of injury to these joints. Radiograph helps to study the level and pattern of fracture and thereby plan the treatment.

For femoral neck fracture, the required investigation is x – ray of the hip (AP and lateral views). For supracondylar femoral fractures; AP, lateral and oblique views are required for the x – ray. Arteriography should be performed in suspected vascular damage or in associated dislocation of the knee joint. Preoperative investigations to prepare the patient for surgery should also be carried out. These preoperative workups include the following: full blood count, blood group and rhesus,

bleeding and clotting time, urea and creatinine, electrolytes, human immunodeficiency virus (HIV) serology, blood glucose level, electrocardiogram (ECG) and cardiac ultrasound.

Figure 6: Radiograph showing right femoral shaft fracture (From Yaounde University Teaching Hospital).

Anterioposterior radiograph of the pelvis have to be done also to rule out pelvic fracture which is common in patients with femoral fractures.

2.1.2.9 Management

Management of femoral fractures in general consists of three main general aspects. These are: medical treatment, temporal fracture stabilization and permanent fracture stabilization.

The medical treatment consists of the immediate medications administered to these patients immediately the fracture is sustained. This is made up of the immediate resuscitation and

stabilization of the patient. It consists of: intravenous fluid, analgesic and anticoagulant administration. For open fractures, antibiotics and antitetanus have to be added. The patient can be administered blood if necessary. Other medications can be added depending on the particular situation of the patient.

For the temporal fracture stabilization, it concerns the temporal immobilization of the fractured limb while awaiting the permanent stabilization of the fracture. For femoral fractures, traction is the choice for temporal immobilization. There are two types of traction which are; skin traction and skeletal traction. A choice can be made between the two on which to use.

The permanent stabilization of femoral fractures consisting of the reduction and fixation of the fracture can either be by conservative method (orthopedic method) or surgical method. Fracture reduction can be open reduction or closed reduction. The fixation can either be external fixation or internal fixation.

2.1.2.10 Surgical Techniques (51) (52)

Intramedullary fixation for subtrochanteric fractures using a proximal femoral nail (PFN)

Indications

- Low and extended subtrochanteric fractures.
- Ipsilateral femoral neck and shaft fracture.
- Unstable inter – trochanteric fractures.
- Failed plate fixation of subtrochanteric fractures.
- Pathological fractures.

Anesthesia

- General anesthesia
- Prophylactic antibiotics according to the hospital protocol.

Table and equipment

- PFN set

- Standard osteosynthesis set as per local hospital protocol.
- An image intensifier.

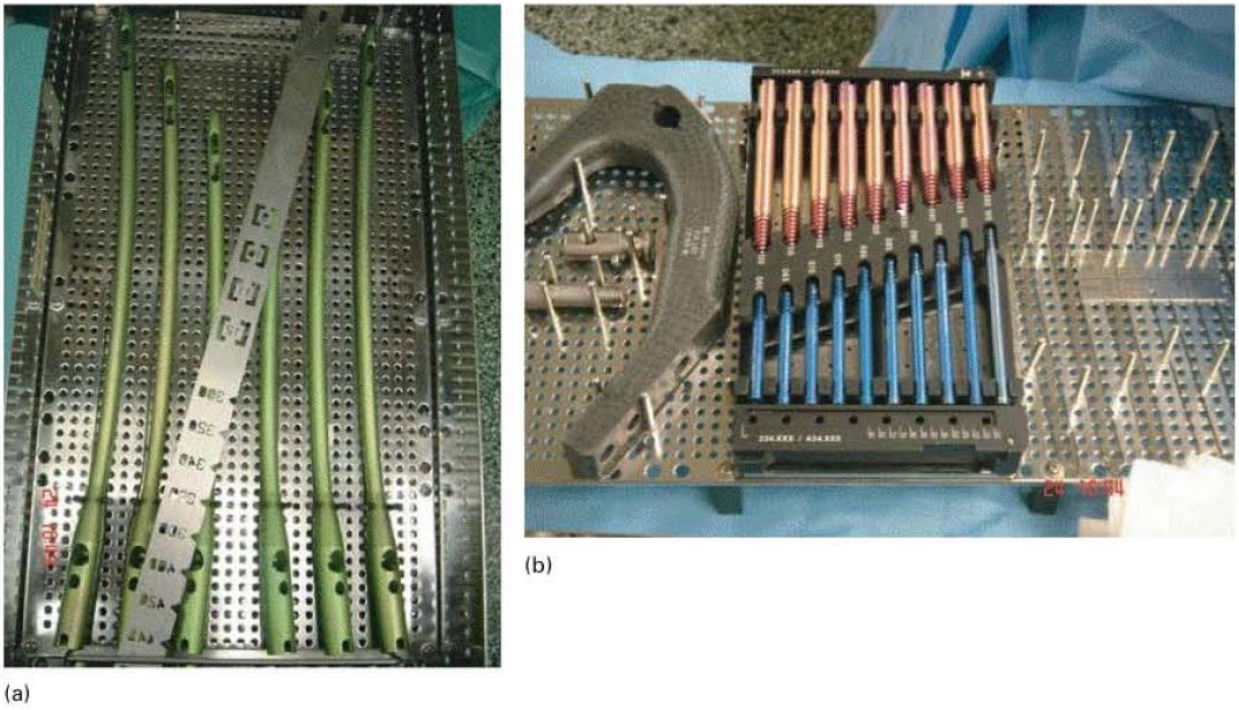


Figure 7: PFN intramedullary osteosynthesis set (51)

Table set up

- The instrumentation is set up on the side of the operation.
- Image intensifier is from the contralateral side.
- Position the table diagonally across the operating room so that the operating area lies in the clean air field.

Patient positioning

- The patient is supine on the fracture table with traction applied on the affected leg through a skeletal pin in the proximal tibia or a foot holder attached to the fracture table.
- The affected leg is adducted about 10 – 15 degree to facilitate the nail's entrance.
- The unaffected leg is place in a lithotomy position.
- The arm of the affected side is draped over the body.

- Beware of maintenance of rotational mal – alignment.

Draping and surgical approach

- Prepare and drape the skin from the iliac crest together with the lateral thigh to the tibial tubercle with usual antiseptic solution.
- Obtain fluoroscopic AP and lateral images of the fracture site.
- Using a marker pen, draw the fracture plane over the skin.
- Make a 5cm incision, 5 – 8 cm proximal from the tip of the greater trochanter.
- Incise the gluteus maximus fascia and split the muscle in line with its fibres.
- Palpate the tip of the trochanter and the piriformis fossa.
- Introduce a curved awl to the tip of the greater trochanter and drive it in gently in line with the femoral shaft of the proximal fragment.
- An alternative technique is the use of a 2.8mm guide wire inserted laterally at an angle of 6 degree to the shaft, up to a depth of 15cm.
- Obtain a radiograph to verify the exact determination of the entry point.
- Insert the guide wire in line with the proximal fragment and forward it down the medullary canal.
- Acquire AP and lateral fluoroscopic images to ensure correct insertion of the wire.
- Use the cannulated drill bit to ream as far as the stop on the protection sleeve.
- Using a rule, calculate the appropriate nail length.
- Attach and assemble the appropriate nail to the insertion jig.
- Insert the nail over the guide wire into the medullary canal using manual force under fluoroscopic control.
- The nail is passed until the proximal locking screw hole allows for placement of the screw in the inferior to central portion of the neck.
- Once the nail is inserted, abduct the limb to correct any varus deformity.
- Once the nail is at its proper depth, a true lateral radiograph most be obtained.
- With the nail centered within the jig and both centered within the head and neck, the screw must be in the center of the head when placed. This rotation must be maintained while the guide wire for the screw is advanced.

- Insert the stacked drill sleeves and push them to the bone.
- Advance the guide wire to the subchondral area of the bone.
- Confirm correct guide placement with image intensifier views.
- Perform appropriate length reaming and place the appropriate length femoral neck screw into the dense subchondral bone of the femoral head.
- Verify that the femoral neck screw threads are within the subchondral bone.
- Confirm correct screw placement with the image intensifier.
- For distal locking a freehand perfect circle technique is used.
- Insert the end cap.
- Obtain AP and true lateral radiographs of the whole femur.

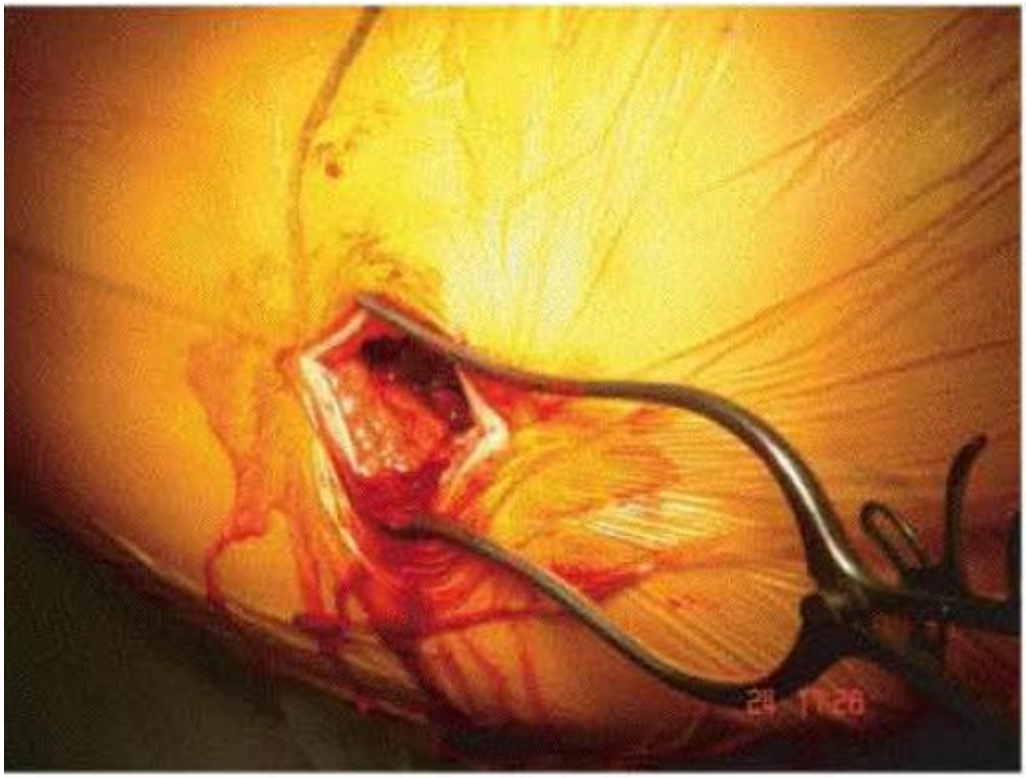


Figure 8: Incision for PFN (51)

Closure

- Irrigate the wound thoroughly and achieve hemostasis.
- Close fascia and subcutaneous fat with absorbable suture.
- Close skin with non – absorbable suture.

Postoperative rehabilitation

- Partial weight – bearing is allowed from the second postoperative day with the use of walkers or crutches.
- Routine blood and radiograph of the whole femur in 24 hours.

Outpatients follow up

- Review in clinic with x – ray every 3 – 4 weeks.
- Allow progressive full weight bearing after radiographic callus detection usually 4 – 8 weeks after the surgery.

Implant removal

- Rarely before one year after the operation.
- Ensure the radiographic existence of mature callus bridging the fracture ends in both AP and lateral radiographs.

Open reduction and internal fixation (ORIF): plating

Indications

- Fractures involving the metaphyseal and diaphyseal area.
- Technical contraindication to intramedullary nailing (very small or sclerotic medullary canal).
- Complex shaft fractures in young adults with open growth plates.

Anesthesia

- General anesthesia
- Prophylactic antibiotics according to the hospital protocol.

Table and equipment

- Instrumentation set and set of implants (e.g. broad limited contact dynamic compression plate (LC – DCP) 4.5mm, 4.5mm cortex screw/ 6.5mm cancellous bone screws).
- Image intensifier.

Table set up

- Instrumentation is set up on the side of the operation.
- Image intensifier is set up on the contralateral side.

Patient positioning

- Supine position on a radiolucent table.
- Lift the buttocks to expose posteriolateral aspect of the thigh and buttocks.

Draping and surgical approach

- Clean the skin from the hip to the foot with antiseptic solutions.
- Make a longitudinal lateral incision of the appropriate length in a line from the greater trochanter to the lateral femoral condyle.
- Incise the fascia lata longitudinally.
- Elevate the vastus lateralis off the lateral intermuscular septum, or incise the vastus lateralis muscle alone its fibres.
- Ligate perforating branches of the profunda femoris artery perpendicular to the femur.
- For minimally invasive perentaneons plate osteosynthesis (MIPPO), make a small incision at the lateral femur over the lateral femoral condyle, tunnel the vastus lateralis muscle at the lateral femoral condyle and push the plate proximally, without opening of the fracture site.

Fracture reduction

- External manual traction.
- A distraction device (e.g. the AO distractor) can be helpful to restore length and resist major muscle forces.
- Pointed bone forceps for exact fracture reduction.
- Minimise soft tissue damage. Extensive deporiostation affects blood supply and bone healing.

Implant positioning

- Position the plate on the posteriolateral aspect of the femur alongside the linea aspera.
- Use at least 3 bicortical screws on each side of the main fragments.
- Depending on the fracture localization, the plate need contouring by a bending press or hand held bending pliers to fit the individual anatomical shape of the bone.
- Predrill holes perpendicular to the bone. Minimise heat production by using sharp reamers and cool water irrigation.
- The screws are correctly positioned, when they penetrate the opposite cortex fully and protrude by at least one rotation of the screw.

Conventional plating

- Simple fractures, association of osteosynthesis (AO) type A and B can be reduced precisely and fixed rigidly by interfragmentary compression. This can be achieved by lag screws, by overbending of the plate or by a combination of both.
- To fix simple oblique or spiral diaphyseal fractures, use lag screws combined with a plate.
- Wedge fragments can be reduced with the aid of a pointed reduction clamp and fixed by a lag screw.
- To compress transverse fractures, use a dynamic compression plate (DCP), and drilled eccentrical holes with a DCP – drill guide. The design of the screw hole allows compression of 1.0mm.

Closure

- Irrigate the wound thoroughly and achieve hemostasis.
- Subfascial drainage in conventional plating.
- Close lata fascial over the subfascial drainage and close subcutaneous fat with absorbable suture.
- Close the skin with monofilament non – absorbable suture.

Postoperative care

- Postoperative radiograph in 2 planes.
- Routine postoperative blood laboratory control.
- Physiotherapy on the first postoperative day with active range of motion exercise.
- Remove drain within 48 hours.
- Partial weight bearing (15kg).

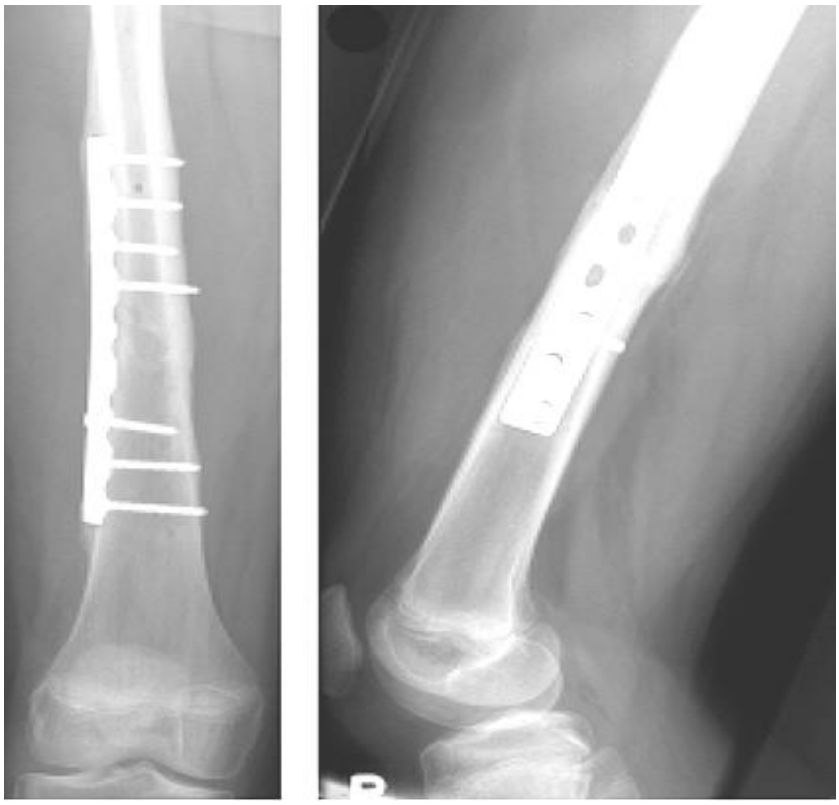


Figure 9: Femoral fracture fixation by plating (From the Yaounde Military Hospital)

Outpatients follow up

- Serial radiograph at 6 weeks, 3 months, 6 and 12 months postoperatively.
- Full weight bearing usually after 6 – 12 weeks, depending on the fracture pattern and radiographic signs of fracture healing.
- Routine implant removal is not mandatory.
- Earliest implant removal 1.5 – 2 years postoperatively.

Intramedullary nailing

Preoperative planning

- Selection of the nail can be based on intraoperative measurements.

Anesthesia

- General anesthesia is preferable especially in the case of multiple injuries and operations.
- Regional (spinal or epidural) anesthesia is possible in case of single injury.
- Preoperative prophylactic single shot antibiotics.

Table and equipment

- Nail instrumentation set including a complete set of implants.
- Standard radiolucent operating table.
- Image intensifier.

Table set up

- Instrumentation is set up on the side of the patient.
- Image intensifier is set up on the contralateral side.

Patient positioning

- Patient can be in the supine or lateral position.

Implant selection

- A sterile radiolucent ruler permits measurement of correct implant diameter and nail length.
- Alternatively, landmarks can be drawn on the skin using a sterile pen. To determine nail length, the distance is measured by a ruler.
- Optimal nail length can also be determined by a guide wire, which is introduced into perfect intramedullary position at the distal femur.

Draping and surgical approach

- Prepare the skin from the gluteal area down to the foot using antiseptic solution.
- For unreamed nailing, make a 2cm long stab incision 10 – 15 cm proximal to the tip of the greater trochanter, exactly in line with the medullary canal, under the control of the image intensifier.
- For reamed femoral nailing, the incision has to be a bit larger, in order to protect the soft tissue from the reamer with a protection sleeve.
- Split the fascia lata longitudinally and divide the fibres of the gluteus maximus muscle.

Fracture reduction

- Manual reduction is usually sufficient to reduce fresh fracture.
- Delayed fracture reduction or fractures in patients with a very thick soft tissue envelop may require reduction aid.
- Open reduction is reserved for very rare fractures which cannot be reduced.

Implant positioning

- Under the control of the image intensifier, identify the interval between the greater trochanter and the piriformis fossa.
- The entry point varies according to the nail design. The entry point for unreamed femoral nail is slightly anterior and lateral to the base of the piriformis fossa. For reamed femoral nails, the insertion is slightly more lateral at the anterior aspect of the medial greater trochanter.
- Open the medullary canal with a 3.5mm guide pin and drive it into the centre of the medullary canal.
- For unreamed femoral nails, cut a cylinder of corticocancerous bone with a cannulated cutter. For solid nail, the guide wire has to be extracted.
- If a cannulated nail is used, insert a long center guide wire and drive it through the fracture into the distal fragment.
- In reamed femoral nailing, use low pressure and sharp reamer heads.
- Down – size the nail diameter 1.0 to 1.5 mm to the size of the last reamer head.

- The implant is assembled with the insertion handle and the connection screw.
- Insert the nail manually into the medullary canal by twisting movement or with slight blow with the hammer.
- Drive the nail through the fracture and place the tip of the nail directly into the center of the intercondylar notch.
- Control alignment, rotation and bone length.
- With a measuring gauge, determine the bolt length.
- The locking screws have to pass both cortices.
- For insertion of the proximal locking screws, screw the aiming device tightly into the internal thread at the proximal tip of the interlocking nail and drill the hole for the screws.
- Perform proximal and distal locking in case of unreamed nailing. We can have dynamic locking or static locking.
- Remove the aiming device.

A

B

Figure 10: A – Joystick placement, B – Reduction of fracture with joystick with passage of guide wire (From Yaounde Emergency Hospital Center)

Closure

- Irrigate the wound thoroughly.
- Achieve hemostasis.
- Close fascia lata and the subcutaneous fat with absorbable sutures.
- Close the skin with non – absorbable sutures.

Postoperative care

- Post-operative radiograph in two standard directions.
- Routine postoperative blood laboratory control.
- Physiotherapy on the first postoperative day with free active and passive range of motion exercises.

Outpatient follow up

- Serial radiograph at 6 weeks, 3months, 6 and 12 months to document fracture healing and remodeling.

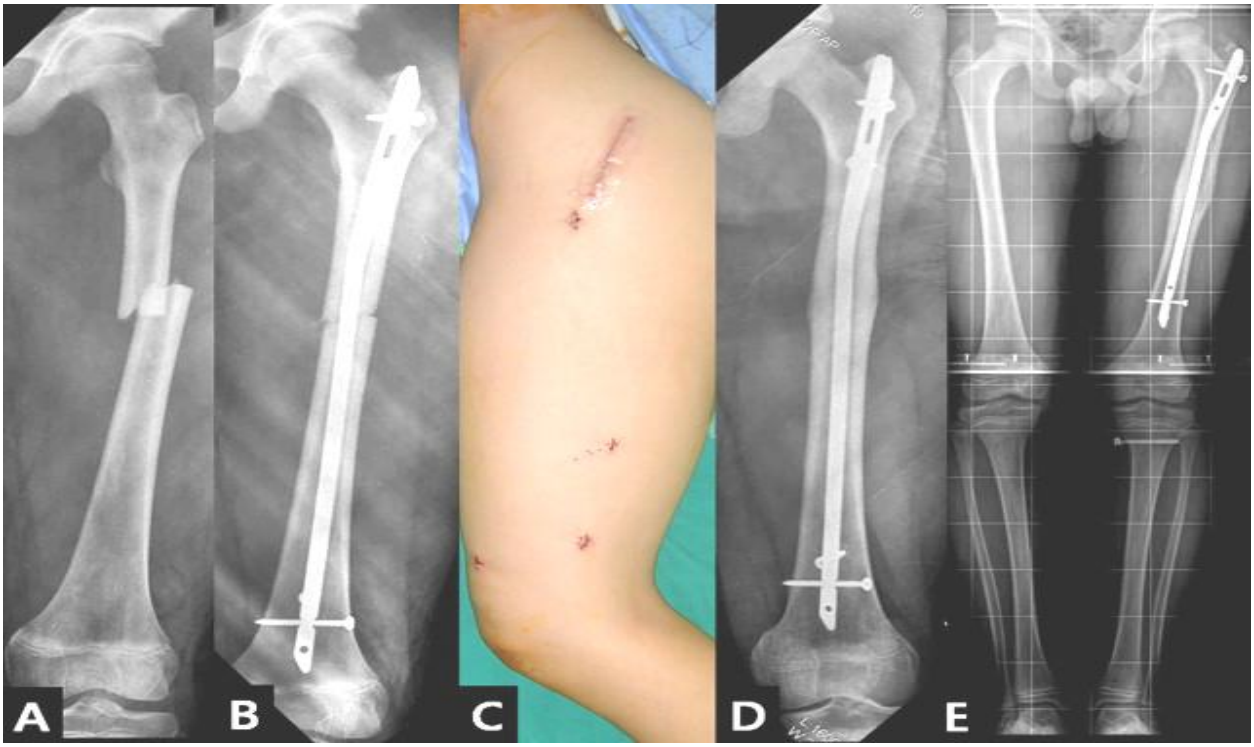


Figure 11: Intramedullary nailing of femoral shaft fracture (From Yaounde Central Yaounde)

Application of an external fixator

Indications

- Damage control orthopedics.
- Transfixation of unstable, intra – articular knee fractures, which are not stabilized as the definite treatment in the primary operation.
- Severe soft tissue damage in open or closed femoral fractures.
- Children femoral shaft fractures.

Anesthesia

- General anesthesia is preferable in multiple injured patients.
- Regional (epidural/spinal) anesthesia is possible in isolated operation of the femur.
- Provide preoperative prophylactic single shot antibiotics.

Table and equipment

- Monolateral external fixator set including: 5.0 and 6.0 mm diameter Schanz screws.
- Carbon fibre rods or metal tubes.
- Tube – to – tube clamps and pin – to – tube clamps.
- Standard radiolucent operating table.
- Image intensifier.

Table set up

- Instrumentation is set up on the side of the operation.
- Image intensifier is set up on the contralateral side.

Patient positioning

- Supine position.

Draping and surgical approach

- Prepare the skin from the gluteal region down to the knee using antiseptic solution.
- Via stab incisions, insert the Schanz screws in a posterolateral direction in the plane of the lateral intermuscular septum.
- For better orientation, the femoral surface is palpated through the stab incision with a small clamp before drilling.

Implant positioning

- Drill holes for the Schanz screws perpendicular to the bone.
- The Schanz screws have to penetrate the full opposite cortex and to protrude some millimeters pass it.
- Insert a pair of Schanz screws into each main fragment and connect them with a short tube.

Fracture reduction

- 'Tube – to – tube' technique: after insertion of a pair of pins in each main fragment, which are each joined by a short tube, the fracture can be manipulated using the two tubes as 'handles'. Fix the two tubes by a short third tube with 2 'tube – to – tube' clamps in the desired fragment position.

Figure 12: Primary rapid stabilization of a femoral shaft fracture in a 21 years old polytraumatised patient (From Yaounde Emergency Hospital Center).

Postoperative care

- Postoperative radiographs in 2 directions.
- Routine postoperative blood control.

Outpatient follow up

- Serial radiographs in 2 standard directions.
- Intense physiotherapy to maintain knee motion.
- Intense care of the pin sites.

Retrograde nailing

Implants

- All types of femoral nails.
- Special retrograde nails preferred.

Indications

- Type A, C1 and C2 fractures of the distal femur.
- Periprosthetic fractures.

Table and equipment

- Basic fracture set with 4.5 mm cortical screws and 6.5 mm cancellous screws.
- Distal femoral nail (DFN) instruments.
- T – handle, Schanz screws.
- Image intensifier.

Patient positioning

- Supine position.
- Examine knee joint stability under anesthesia.
- Leave the region from the iliac crest to the middle of the tibial shaft free from draping.

Approach, reduction and fixation

- In case of an intra – articular fracture start with the percutaneous reduction and lag screws fixation from lateral to medial. Use at least two 6.5 mm cancellous screws.
- Check the nail length and diameter with the ruler. The nail end should be at least 2 mm underneath the subchondrial bone.
- Support the distal part of the fracture with several towels until you have a flexion of the knee joint between 25 and 30 degree. Choose your incision in line with the middle of the femur, which is usually slightly medial to the patellar ligament.
- Incise the joint capsule in line with the skin incision.

- Insert the guide wire under fluoroscopic control. The entry point is slightly medial on the AP in extension of the midline of the femur.
- Open the femur by passing the drill over the guide wire.
- Push the nail forward until the tip is just distal to the fracture.
- Reduce the fracture. Use the nail to manipulate the distal fragment.
- Check axial alignment.
- If mal – alignment is present slash the nail back and insert poller screws.
- If alignment is achieved, start locking in the distal part using the attached aiming device.
- Check the rotation now using the minor trochanter technique.
- If there is no comminution of the fracture, check the fracture site under fluoroscopy and push the nail gently forward until the distal and proximal fragments get under slight compression.
- In comminuted fracture, check the femoral length. Slash the nail forward or backward to achieve the length measured for the contralateral femur.
- Proximal locking is best perform with a radiolucent drill.

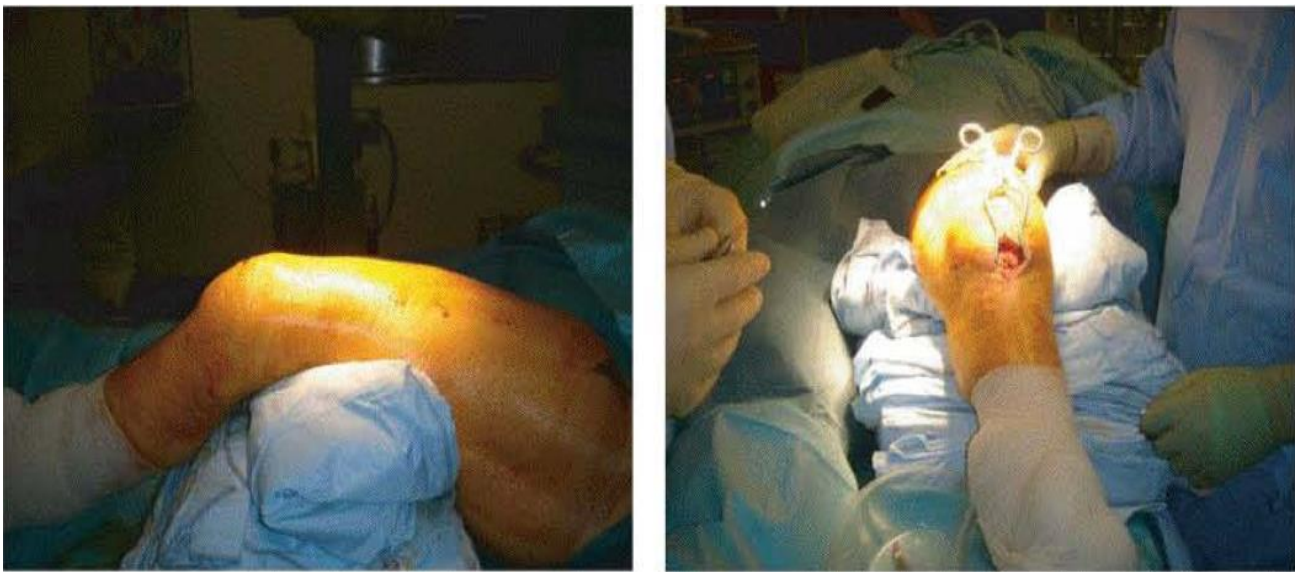


Figure 13: Length and position of incision in retrograde nailing (51).

Closure

- Do a thorough irrigation.
- Do not use drains routinely.

- Only skin closure is necessary.

Postoperative care

- Perform AP and lateral radiograph with the patella centered.
- Start mobilization on the second day with partial weight bearing.

Outpatient follow up

- Clinical and radiologic follow up at 6 weeks, 3 months, 6 and 12 months after the operation.
- Partial weight bearing for at least 6 weeks for extra – articular fracture and 12 weeks in intra – articular fractures depending on radiographic.

2.1.2.11 Complications

Femoral fractures have some possible complications. These complications can be immediate or delayed complications. We also have some complications that are general to all femoral fractures and some that are particular to the anatomical location of the fracture. For the immediate complications, we can have the following:

- Hemorrhagic shock
- Fat embolism
- Neurovascular injury (femoral artery, popliteal artery, sciatic nerve, etc).

For the delayed complications, we can have the following:

- Refracture
- Complications of fixation device (breaking, loosening, proximal or distal migration, jamming, bending, infection, etc).
- Malunion
- Nonunion
- Joint stiffness

We can also have early complications such as:

- Deep vein thrombosis

- Pressure ulcers
- Infections

For femoral neck fracture in particular, we can have avascular necrosis of the femoral head.

2.1.3 Femoral Fractures in Polytrauma Patients

Femoral fractures are common lesions in polytrauma patients. The management of femoral fractures in polytrauma patients differs from the management of isolated femoral fractures. Look for signs of femoral fracture in a polytraumatised patient during secondary survery. Better healing is observed in cases in which early surgical immobilsation of femoral fractures is perform, but this intervention can actually be harmful if performed too early on unstable trauma patients. Patients, who are underresuscitated as evidenced by increased serum lactate level or base deficit, should have early traction until adequately resuscitated. If the patient is in the theatre for life saving procedure, temporal external fixation also may be used. Definitive surgical repair is delayed until the patient is stable and adequately resuscitated. Early definitive stabilization can be used after ensuring optimal resuscitation and the absence of impending life threatening conditions. A retrospective study of 750 femoral fractures treated from 1999 – 2006 in Cleveland, Ohio found 656 definitive stabilizations were safely used within 24 hours of injury(53). Fracture fixation can be immediate (24 hours from injury), early (48 hours from injury) or late (above 48 hours from injury)(28).

Generally, there are three different approaches to femoral fracture care in polytrauma patients: EDC, DCO and EAC. The management protocol has evolved from conservative treatment to early total care to damage control orthopedic and recently to early appropriate care(17). The concept of ETC arose from the realization that early definitive fixation of femoral fractures provided pulmonary and systemic benefits to most patients. DCO is to minimize surgical insult. More recently, iterative assessment of response to resuscitation using EAC guidelines, suggest definitive fixation of most axial and femoral fractures within 36 hours after injury appears safe in resuscitated patients(27). Femoral fracture fixation in the polytrauma patient, whether provisional or definitive plays a key role in minimizing morbidity and mortality in the acute setting(27).

Early total care (early definitive care) evolved as a concept during the late 1980s, primarily based on benefits of early fixation of femoral fractures. It was believed the patient was too "sick not to have femoral fractures fixed" in the acute setting(27) (29) (30) (54) (17) (55) (56) (57). Prior to 1950s, a polytraumatised patient with significant musculoskeletal injuries was considered physiologically too sick to undergo major orthopedic surgical interventions to stabilize the fractures(17) (58) (59). In a randomized trial, it was shown that patients who had delayed (>48 hours after injury) femoral fracture fixation had more respiratory and other morbidity, including acute respiratory distress syndrome, fat embolism and pneumonia when compared with those that had early fixation. Yet, in distinct patient subgroups with severe thoracic injuries and very high ISS, this concept has been associated with adverse outcomes(28).

Damage control orthopedic began as a concept in the 1990s. It was first practice by Trauma Surgeons in Germany. It recommends early (initial) temporary stabilization followed by secondary definitive osteosynthesis of major fractures in patients at high risk of developing systemic complications(28). In general, the clinical course after severe blunt trauma is determined by three principal factors: the initial degree of injury (first hit, trauma load), the individual biological response and the type of treatment (second hit, surgical load)(28). DCO currently appears to be the treatment of choice for patients with severe polytrauma who are at high risk to develop systemic complications such as multiple organ failure(28) (60). This approach reduces the impact of the second hit. DCO approach consists of three stages: The first stage involves only the life – saving procedures during the acute phase; the temporal external fixation of the major skeletal fractures, hemorrhage control and management of soft tissue injuries. The second stage focuses on the resuscitation of the patient in the ICU with monitoring and optimization of patient physiology. The third and final stage entails definitive fracture fixation in a stable and optimized patient(17) (56). The 'golden period' for definitive fracture fixations in patients managed with the DCO is between 5 and 14 days in the majority of cases(17). It appears that the posttrauma days 2 to 4 are not ideal to perform secondary definitive operations. At this time, sustained immunologic changes are ongoing and fluid shifts (increased generalized tissue edema) have not yet normalized(28) (61) (62).

Early appropriate care resulted from a multidisciplinary group of trauma providers proposing to define optimal type and timing of fixation in multiply – injured patients with these types of

fractures. An insight into the immunological processes at a molecular level evoked in a polytraumatised patient led to the evolution of the 'two – hit theory'. The 'first hit' being the injury itself while the 'second hit' caused by the surgical trauma. As the 'two hit' theory gained popularity, it led to a delay of definitive surgery for 2 – 5 days following trauma, since a higher complication rate was observed following definitive surgery within the first 5 days of the injury(17). It offers the benefits of ETC and safety of DCO(17) (63). EAC is best suited for borderline patients(17). Early appropriate care describes expeditious definitive management of said fractures once acidosis has improved; EAC has been shown to reduce complications, length of stay and costs(27).

Polytrauma and shock incite an inflammatory response in the body. This inflammatory response may be generalized and uncontrolled in cases of massive injuries resulting in systemic inflammatory response syndrome (SIRS) and generalized tissue damage predisposing to multiple organ failure and early death(17). The body mounts a counter – regulatory anti – inflammatory response to balance SIRS via cellular mediators resulting in immunosuppression.

2.2 STATE OF THE ART

Here, we looked at results of studies conducted in recent 10 years on femoral fractures in polytrauma patients focusing on the surgical management outcomes.

2.2.1 In The World

The mean age of patients with femoral fractures is 30.7 +/- 16.2 years(6). Majority of fractures are unilateral (96.7%) and closed fractures (91%)(6). The frequency of femoral fracture is 11% among trauma patients(6). The common complication in the surgical management of femoral fractures and their percentages is as follows: wound infection (12.6%), pulmonary complications (9.7%), pneumonia (7.3%), pulmonary embolism (1.2%), acute respiratory distress syndrome (1.2%), sepsis (4.0%), and acute renal failure (2.1%)(6). The median length of hospital stay for patients with femoral fractures is 10 days while ICU stay is 7 days(6). Overall hospital mortality rate is 2.1%(6). The incidence of multiple organ failure decreased significantly from ETC to the DCO period regardless of the type of treatment of the femoral fracture(60).

CHAPTER THREE: METHODOLOGY

3.1 STUDY DESIGN

A hospital based prospective longitudinal observational descriptive and analytic study was carried out in the City of Yaounde, Cameroon between January 1st, 2024 and July 31st, 2024.

3.2 STUDY AREA AND SETTING

The participants in the study were recruited from five hospitals in Yaounde. These hospitals are: Yaounde University Teaching Hospital (CHU), Yaounde Emergency Center (CURY), Yaounde Central Hospital (HCY), Yaounde General Hospital (HGY) and Yaounde Military Hospital.

Yaounde is a city in Cameroon. It is the political capital of Cameroon and the regional capital of the Center Region. It is the second largest city of Cameroon after Douala with a population of more than 2.8 million people.

- ***The Yaoundé University Teaching Hospital (CHU)***

The Yaounde University Teaching Hospital was created on the 28th of October, 1965. It is situated in Yaounde town, Center Region of Cameroon, in the Yaounde 6 Sub Division. It's a first category hospital with respect to the Health Pyramid in Cameroon, and harbors all of the main medical specialties. Its surgical unit has 30 beds, headed by a chief of service, assisted by 05 surgeons in specialties such as; general surgery, visceral surgery, thoracic surgery, urologic surgery, trauma and orthopedic surgery. There are 12 nursing staffs, including a ward charge. The theatre has 05 operating rooms with a theatre staff consisting of 09 nurses headed by a ward charge. There are 03 anesthesiologists and 07 anesthesia nursing staff.

- ***The Yaoundé General Hospital***

Established in 1985, the Yaounde General Hospital is a first category hospital in the town of Yaounde. It is found in Ngousso neighborhood, in the Yaounde V Sub Division. Comprises several specialties equipped with state of the art equipment to carry out diagnostic and interventional procedures. The surgical department comprises two units of 30 admission beds each. Neurosurgery, visceral surgery, urology, orthopedics and trauma, cardiothoracic and

vascular surgery are the different surgical specialties. The theatre comprises six operating rooms with two anesthesiologists and reanimators being assisted by several anesthesia and theatre staff.

-***The Yaounde Emergency Center***

The Yaounde Emergency Center, a 50 bed capacity, second category hospital created in 2014, located in the Yaounde 2 Sub Division, precisely at Messa. It is the first of its kind emergency structure in the sub region with main role to receive and manage patients with medical and surgical emergencies where the vital prognoses are threatened. Its emergency surgical department is made up of a several specialties, among which, neurosurgery, general and visceral surgery, thoracic and cardiovascular surgery, trauma and orthopedic surgery with state of the art operating rooms and reanimation departments for management of life threatening emergencies.

- ***The Yaoundé Central Hospital***

It is a second category health structures located in the Yaounde 2 Sub Division. Created in 1933, it is the largest health facility in Yaounde serving too as a referral structure for patients from everywhere. A capacity of 650 beds with all medical specialties. The hospital has an emergency surgical unit with a capacity of 12 admission beds and two operating rooms for emergency surgical procedures. A team of surgeons in various surgical specialties take group turns of calls at the unit. The main theatre comprises seven operating rooms; each having anesthetic machines where elective surgical procedures are conducted.

- ***Yaounde Military Hospital***

The Yaounde Military Hospital is a hospital owned by the Ministry of Defense. It is located within the City of Yaounde. The hospital has the Surgical Department with 2 orthopedic surgeons.

3.3 STUDY POPULATION AND SAMPLING

Subjects for the study included all polytrauma patients with femoral fractures of all age groups and gender presenting at the chosen hospitals in the city of Yaounde during the study period and who gave consent for the study. Patients who failed to give proper information and unconscious

patient who had no relative to consent for the study were excluded from the study. Recruitment of patients to participate in the study was done at the Emergency Departments, Theatre, Surgical Service and Intensive Care Unit of the various hospitals. A convenience non-probability sampling method was used.

3.3.1 INCLUSION CRITERIA

- All polytrauma patients with femoral fractures presenting in the chosen hospitals who accepted to participate in the study during the study period.

3.3.2 EXCLUSION CRITERIA

- Patients who had incomplete data.
- Those brought in dead.
- Patients transferred to other facilities or travelled abroad for treatment before any surgical intervention.
- Patients discharged against medical advice.
- Patients lost to follow up.

3.3.3 SAMPLE SIZE

All polytrauma patients with femoral fractures who presented in the recruiting hospitals between January 1st, 2024 and July 31st, 2024 constituted the sample size.

3.3.4 SAMPLING METHOD

Convenience non probability sampling method was used.

3.4 STUDY PROCEDURES

We first obtained ethical clearance from the Institutional Ethical Review Board of the Faculty of Medicine and Biomedical Sciences of the University of Yaounde 1. Institutional authorizations were then obtained from the various hospitals of recruitment.

We then proceeded to the five hospitals and started recruitment. The first thing was to obtain the patient written consent before recruiting him or her. For unconscious patients, we obtained consent from their relatives.

A data collection sheet designed in the form of a questionnaire was used for information collection. It was interviewer – administered. The data collection sheet contained information on the patient demographic, mechanism of injury, physiological parameters, injury sustained, injury severity, femoral fracture, surgical management strategies and short term outcomes.

Patients were considered as having polytrauma when the ISS was ≥ 16. A femoral fracture was diagnosed only after confirmation by x-ray. Four main surgical management strategies for femoral fractures were considered: EDC, DCO, EAC and LFFF.

The patients were followed up for 30 days after the surgical intervention. We checked the following under short term outcomes within these 30 days: mortality, length of ICU stay, length of hospital stay, post-surgical morbidity (surgical site infection (SSI), thromboembolism, pressure ulcer, pulmonary complications, sepsis, acute renal failure, pin tract infection, hemorrhage etc).

3.5 STATISTICS

Exploratory analysis and data cleaning was done on Excel and exported to SPSS version 25 where data analysis was performed. Missing data was coded as missing before any analysis was done. Descriptive statistics of patient's epidemiological, physiological parameters, injury sustained, femoral fracture characteristics and short term outcomes were explored. Mean and Standard Deviation, or Median and interquartile range (IQR) was used to summarize continuous variables while frequencies and percentages were used to calculate categorical variables.

Chi-square test or fischer exact test was used to compare 2 groups of categorical variables .Independent t – test was used to compare means of continuous variables within two groups while analysis of variance (ANOVA) test was used to compare means of continuous variables within more than 2 groups. P-values <0.05 was considered statistically significant.

3.6 ETHICAL CONSIDERATION

The ethical clearance was obtained from the Institutional Ethical Review Board of the Faculty of Medicine and Biomedical Sciences of the University of Yaounde 1. Authorizations were obtained from the administrations of the five hospitals where we did the recruitment. The following were explained to the participants:

- The clinical and public health benefits of the study.
- Their right to refuse to participate in the study.
- Any risk resulting from the study.

3.7 TIMELINE

Year	2023		2024								
Month	N	D	J	F	M	A	M	J	J	A	S
Writing and defense of protocol											
Data collection											
Data analysis											
Writing of thesis											
Public defense											

Table 3: Gantt chart

3.8 RESOURCES NEEDED

3.8.1 HUMAN RESOURCES

I needed five research assistants who were junior residents. They helped me in the filling of the data collection sheets; history taking, physical examination and investigation interpretation.

3.8.2 MATERIAL RESOURCES

ITEM	COST (FCFA)
Production and multiplication of questionnaires and consent form	50 000
Production and multiplication of protocol	6 000
Motivation of research assistants	50 000
Printing and multiplication of thesis	50 000
Gloves and other examination tools	25 000
Transport fare	75 000
Internet services and communication credit	60 000
Miscellaneous	103 200
Total	419 200

Table 4: Itemised budget

CHAPTER FOUR: DATA PRESENTATION AND ANALYSIS

4.1 INTRODUCTION

A total of 27 polytrauma patients with femoral fractures presented in the recruiting hospital within the 7 months of the recruitment. Out of this number, 8(29.6%) were excluded (discharge home against medical advice). Nineteen polytrauma patients with femoral fractures were included in the study.

4.2 SOCIO – DEMOGRAPHIC CHARACTERISTICS

The polytrauma patients with femoral fractures were of different age groups with the majority of them being in the age group 21 – 30 years (26.3%). The least number of patients was in the age group 61 – 70 years (5.3%). The other age groups were as follows: 0 – 10 years (15.8%), 11 – 20 years (10.5%), 31 – 40 years (21.1%), 41 – 50 years (10.5%), and 51 – 60 years (10.5%).

Thirteen (68.4%) were males while six (31.6%) were female. Majority of the patients had primary level of education (42.1%) while 36.8% had secondary level of education as the maximum level of education. Just 21.1% of the patient went to tertiary education.

Ten (52.6%) of the patients were motorbike riders while three (15.8%) were pupils. Other occupations had one (5.3%) each and were: agricultural engineer, agriculture, driver, mechanic, student and retired.

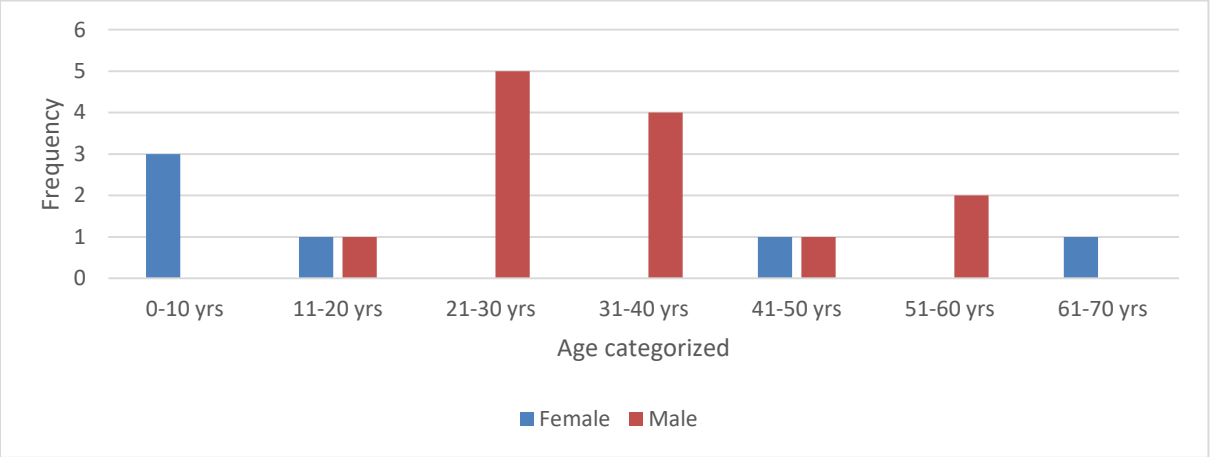


Figure 14: Age and Sex

Table 5: Socio – Demographic Characteristics

Variable	Category	Frequency N=19	Percent (%)
Age (Years)	0-10	3	15.8
	11-20	2	10.5
	21-30	5	26.3
	31-40	4	21.1
	41-50	2	10.5
	51-60	2	10.5
	61-70	1	5.3
Sex	Female	6	31.6
	Male	13	68.4
Level of education	Primary education	8	42.1
	Secondary education	7	36.8
	Tertiary education	4	21.1
Occupation	Agricultural engineer	1	5.3
	Agriculture	1	5.3
	Bike rider	10	52.6
	Driver	1	5.3
	Mechanic	1	5.3
	Pupil	3	15.8
	Retired	1	5.3
	Student	1	5.3

4.3 MECHANISM OF INJURY

There were actually 2 mechanism of injuries within these patients which were; road traffic accident and fall of a tree. Eighteen (94.7%) had road traffic accident as their mechanism of injury while one (5.3%) had fall of a tree as the mechanism of injury.

Table 6 : Trauma Mechanism

Variable	Category	Frequency N=19	Percent (%)
Trauma mechanism	RTA	18	94.7
	Tree fell on her	1	5.3

4.4 PHYSIOLOGICAL PARAMETERS

A greater majority 12(63.2%) of patients included in the study had systolic blood pressure between 90-139 mmHg) and 14(73.7%) had respiratory rate 10-30, 11(57.9%) had Glasgow coma score between 13 – 15, all had clotting time <40s and 18(94.7%) had INR less than 1.40 (Table 7).

Table 7: Physiological Parameters

Variable	Category	Frequency N=19	Percent (%)
SBP(mmHg)	>140	1	5.3
	90-139	12	63.2
	60-89	6	31.6
RR	10-30	14	73.7
	>30	5	26.3
GCS	3	1	5.3
	4-5	1	5.3
	6-8	3	15.8
	9-12	3	15.8
	13-15	11	57.9
Clotting time	PTT<40s	19	100
INR	<1.40	18	94.7
	>1.40	1	5.3

4.5 ANATOMICAL LOCATION OF INJURY

All patients included in the study (100%) sustained injury on their limbs, 68.4% on their skin, 52.6% on their head and neck, 42.1% on their chest (thorax), 21.1% on their maxillofacial area and 15.8% sustained injuries on their abdomen (Figure 15).

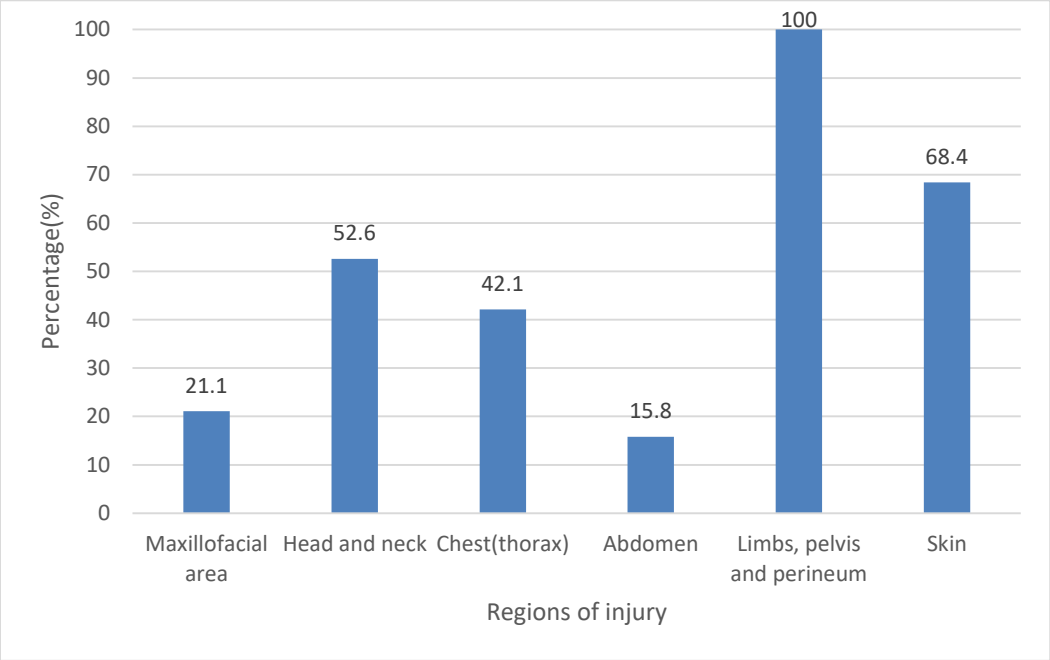


Figure 15: Regions of injury

4.6 INJURY SEVERITY

Overall mean ISS was 26.0±8.7, mean RTS was 10.6±1.3 and mean NISS was 30.6±6.9 (Table 8).

Table 8: Injury Scores

Variable	Mean	Std. Deviation
Injury Severity Score	26.0	8.7
Revised Trauma Score	10.6	1.3
New Injury Severity Score	30.6	6.9

Majority of patients 9 (47.4%) each had ISS in the categories 16 – 24 (seriously injured) and 25 – 49. One patient had ISS in the category 50 - 74 (critically injured) (Table 9).

Table 9: ISS score categorized

Variable	Category	Frequency	Percent (%)
ISS category	16 – 24 (Serious injury)	9	47.4
	25 – 49	9	47.4
	50 – 74 (Critical injury)	1	5.3
	Total	19	100

4.7 FEMORAL FRACTURE CHARACTERISTICS

Among the 19 patients included, 10(52.6%) patients had femoral fracture to the left while 9(47.4%) were on the right (Figure 4.3). In total, there were 20 femoral fractures sustained as one patient had a bifocal fracture (femoral shaft and neck fractures). Most of the fractures 18(90%) were femoral shaft fractures (Figure 4.4). Fourteen patients (73.7%) had a closed fractures while 5 (26.3%) had open fractures. Amongst patients with an open fracture, 2(40%) had GA classification of 1 while 1 (20%) patient each had GA classification of 2, 3B, 3C. Eight (42.1%) patients had a transverse fraction line and 6(31.6%) had a communited fracture line (Table 10).

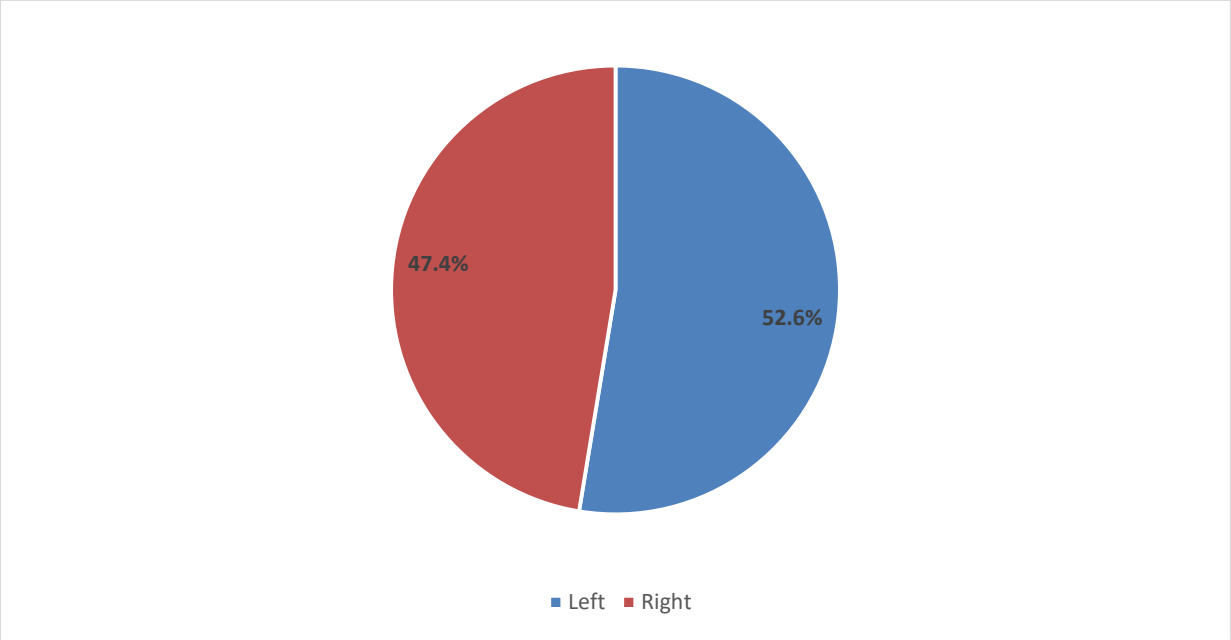


Figure 16: Femur Involved

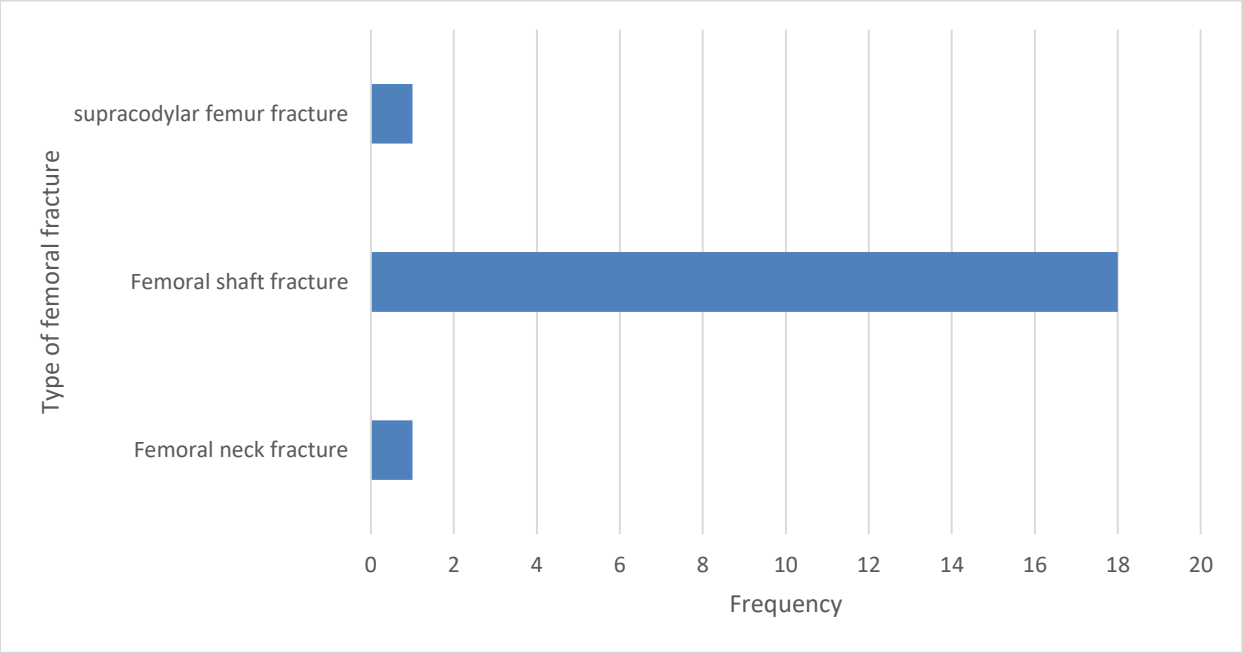


Figure 17: Type of femoral fracture

Table 10: Femoral fracture characteristics.

Variable	Category	Frequency N=19	Percent (%)
Type of femoral fracture	Femoral neck fracture	1	5
	Femoral shaft fracture	18	90
	supracondylar fracture	1	5
Open/closed fracture	Closed	14	73.7
	Open	5	26.3
GA Classification N=5	1	2	40
	2	1	20
	3B	1	20
	3C	1	20
Fracture line	Communited	6	31.6
	Oblique	5	26.3
	Transverse	8	42.1

4.8 SURGICAL TREATMENT STRATEGY

Out of the 19 patients recruited, 14 (73.7%) had at least one surgical intervention to stabilised the femoral fractures while 5 (26.3%) died in the hospital before any surgical intervention to stabilised the femoral fractures. Among the 14 patients that underwent surgery, the surgical treatment strategies were as follows: 6 (42.9%) had DCO strategy, 5 (35.7%) had LFFF strategy and 3(21.4%) through EAC strategy (Figure 18). Amongst patients who underwent LFFF, 4 (80%) had this strategy because of lack of finance. The average interval between injury and first surgical intervention was 7±7.7 days and the average interval between DCO and definitive stabilization was 22±16.1 days patients (Table 11).

Three patients that had the DCO strategy did not have the definitive stabilisation. One of them died before the final stabilisation, one had a transfemoral amputation while the third refused the definitive stabilisation.

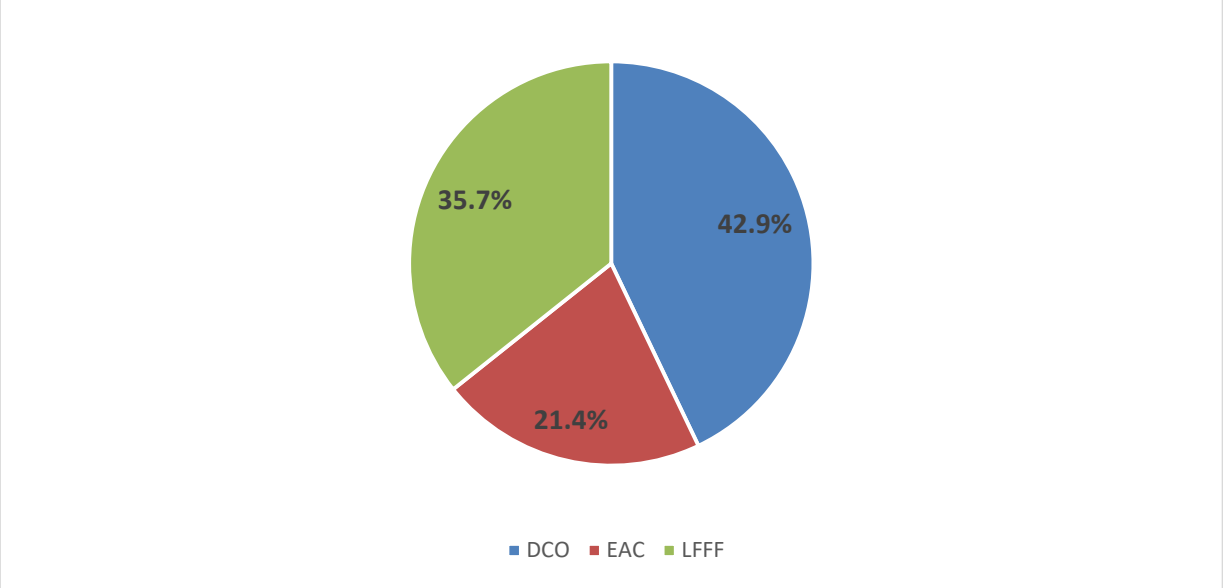


Figure 18: Surgical Treatment Strategy

Table 11: Surgical Treatment Strategies

Variable	Category	Frequency N=19	Percent (%)
If LFFF/Reason n=5	Delay from insurance	1	20
	Lack of finance	4	80
	Late referral	1	20
Interval between injury and 1st surgical intervention n=14		**7±7.7 days**	
	<1	2	14.3
	>=10	5	35.7
	1-3	5	35.7
	4-6	2	14.3
Interval between DCO and definitive stabilization (days) n=6		**22±16.1 days**	
	20	1	16.7
	39	1	16.7
	7	1	16.7
	Not done	3	50

4.9 SURGICAL TECHNIQUE

General anaesthesia was used in 6(42.9%) patients (Figure 19) and supine installation in 13 (92.9%) patients. A large majority had lateral incisions and the most used actual technique was IMN in 7(36.8%) patients (Figure 20). Anterograde IMN was used in all 7 patients and trochanteric point of entry was mostly used in 5(71.4%) (Table 12).

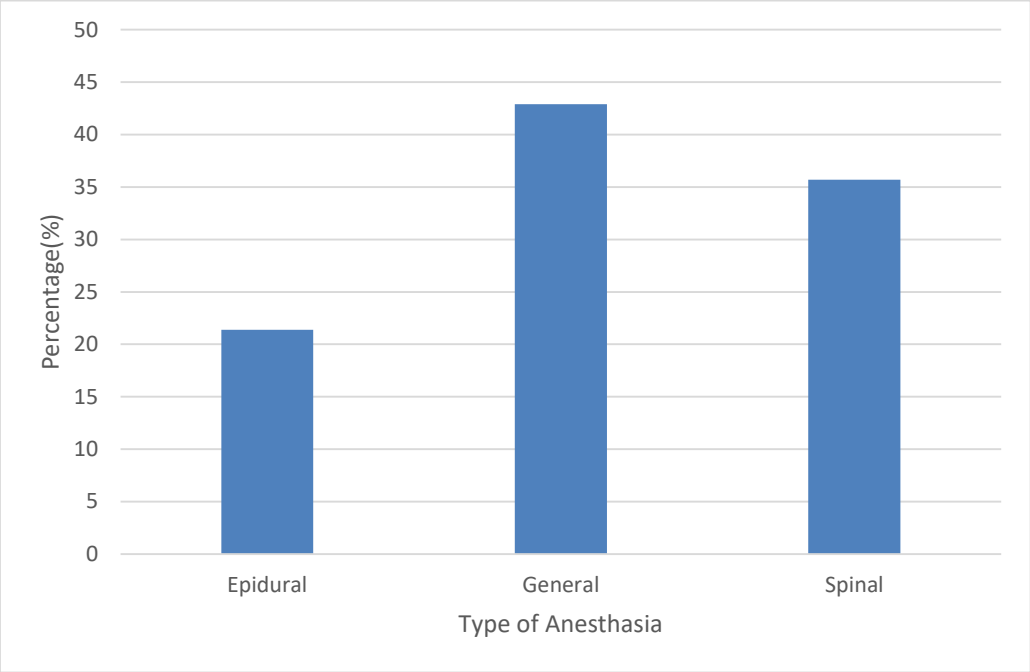


Figure 19: Type of Anaesthesia

Table 12: Surgical Techniques.

Variable	Category	Frequency N=19	Percent (%)
Installation n=14	Left lateral	1	7.1
	Supine	13	92.9
Incision n=14	Circular	1	7.1
	Lateral	11	78.6
	Median	2	14.3
Open/closed reduction(fluoroscopy) n=13	Closed	2	15.4
	Open	11	84.6
Actual technique n=14	IMN	7	36.8
	External fixator	5	26.3
	Amputation	1	5.3
	Plate	4	21.1
Specify if plate	DCP	4	100
If IMN/anterograde or retrogade n=7	Anterograde	7	100
If IMN/point of entering n=7	Pisiform	2	28.6
	Trochanteric	5	71.4

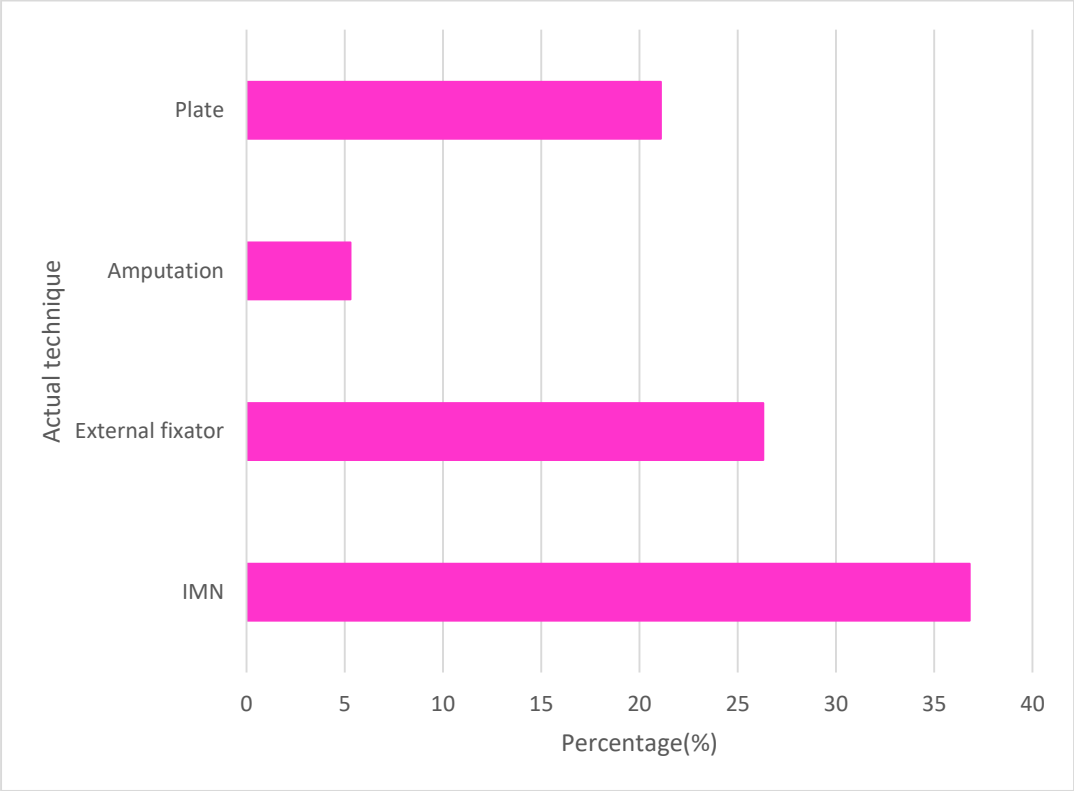


Figure 20: Actual Technique

4.10 SHORT TERM OUTCOMES

4.10.1 POSTOPERATIVE COMPLICATIONS

Amongst the patients who underwent surgery, 42.9% had no complication. One patient (7.1%) each had: bleeding, pressure ulcer, constipation, acute renal failure, thromboembolism and pin tract infection as postoperative complication. Two (14.3%) had anaemia while 3 (21.4%) had sepsis (Figure 21).

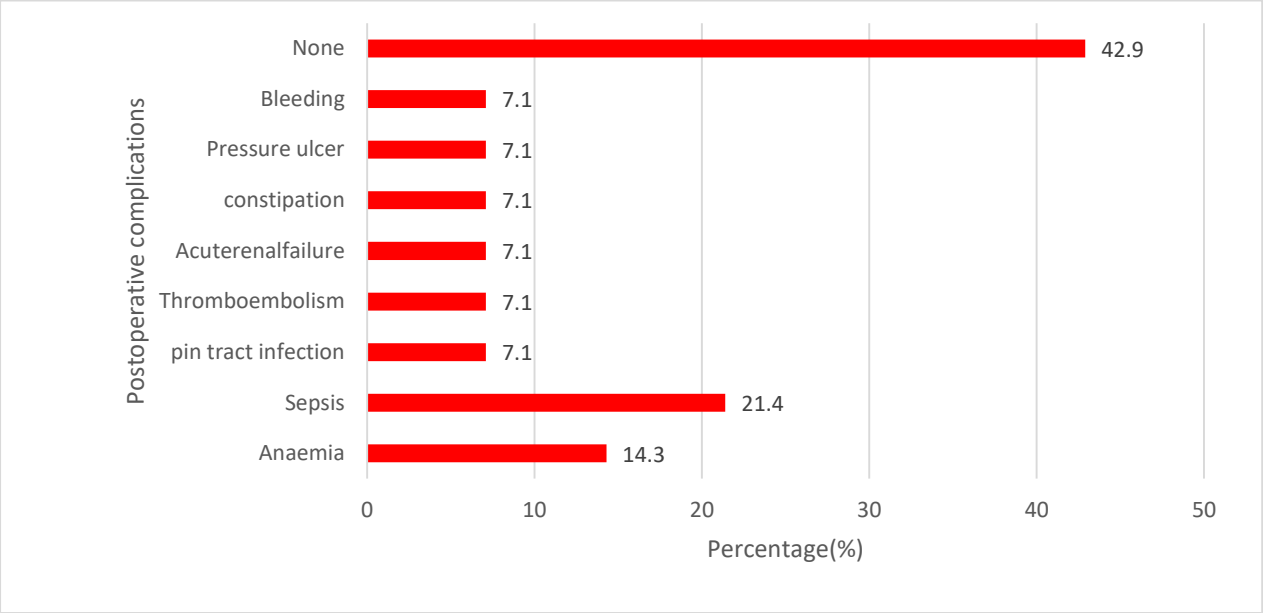


Figure 21: Postoperative complications

4.10.2 HOSPITAL/ICU LENGTH OF STAY

Overall mean hospital length of stay of all patients who underwent surgery was 17.0+14.5days and mean ICU length of stay was 1.2+2.0 days (Table 13).

Table 13: Hospital/ICU length of stay.

Variable	M+SD	Min-Max
Length of hospital stay(days)	17.0+14.5	0-57
length of ICU stay (days)	1.2+2.0	0-7

Below is a pie chart showing the proportion of patients admitted in ICU. Seven (36.8%) patients were admitted into ICU while 12 (63.2%) were not (Figure 22).

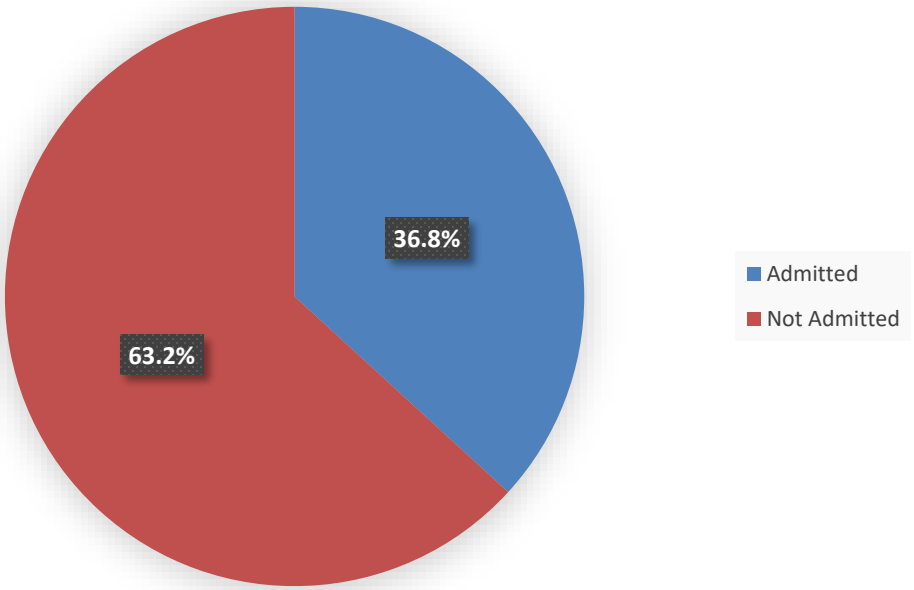


Figure 22: Proportion of those admitted in ICU

4.10.3 MORTALITY

Amongst all the 19 patients included in the study, 6(31.6%) died and 13(68.4%) survived (Figure 23).

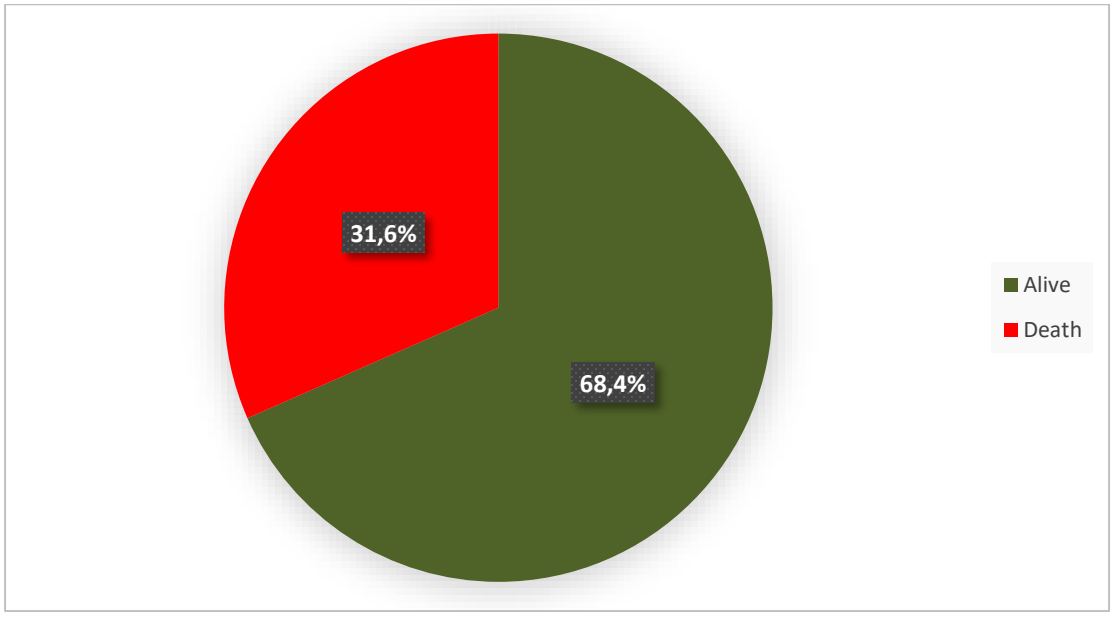


Figure 23: Overall mortality of polytrauma patients with femoral fractures

Out of the 6 patients who died; 2 (33.3%) died within less than one day, 1 (16.7%) each died after 2 days, 3 days , 6 days and 8 days. Out of the 5 patients who died before surgery, 2 (40%) died within less than an hour, 1 (20%) each died after 2 days, 3 days and 8 days (Table 14).

Table 14: Interval between Injury and Death

Variable	Category	Frequency	Percentages (%)
Interval between injury and death	<1	2	33.3
	2	1	16.7
	3	1	16.7
	6	1	16.7
	8	1	16.7
	Total	6	100
Interval between injury and death for death before surgery	<1	2	40
	2	1	20
	3	1	20
	8	1	20
	Total	5	100

4.11 BIVARIATE ANALYSIS

Bivariate analysis of factors associate to patients who underwent surgery or did not undergo surgery

The table below shows the bivariate analysis of physiological parameters associated to patients who underwent surgeries and patients who did not undergo surgery. No physiological parameters was significantly associated to if patient underwent surgery or not (Table 15).

Table 15: Bivariate analysis of physiological parameter associated to patients that died before surgery or underwent surgery.

Variable	Category	Died before surgery	Underwent surgery	p-value
SBP	>140	0(0)	1(7.1)	0.622
	60-89	1(20)	5(35.7)	
	90-139	4(80)	8(57.1)	
RR	>30	1(20)	4(28.6)	0.709
	10-30	4(80)	10(71.4)	
GCS	3	1(20)	0(0)	0.115
	4-5	1(20)	0(0)	
	6-8	1(20)	2(14.3)	
	9-12	1(20)	2(14.3)	
	13-15	1(20)	10(71.4)	
INR	<1.40	5(100)	13(92.9)	0.539
	>1.40	0(0)	1(7.1)	

The table below shows the bivariate analysis of injury scores associated to patients who underwent surgeries and patients who did not undergo surgery. There was a significant mean difference (6.3) in ISS between patients who underwent surgery and patients who did not undergo surgery (95% CI p=0.001). There was a significant mean difference (-2.7) in RTS between patients who underwent surgery and patients who did not undergo surgery (95% CI p=0.041). There was a significant mean difference (9.5) in NISS between patients who underwent surgery and patients who did not undergo surgery (95% CI p=0.004) (Table 16).

Table 16: Bivariate analysis of injury scores associated to patients that underwent or did not undergo surgery.

Injury Severity	Died before surgery	Underwent surgery	Mean difference	95% CI		p-value
				Lower	Upper	
ISS	35.8+9.9	22.43+4.8	13.4	6.3	20.4	**0.001**
RTS	9.6+1.9	11+0.9	-1.4	-2.7	-0.1	**0.041**
NISS	37.6+8.1	28.14+4.5	9.5	3.4	15.6	**0.004**

Figure 24 below shows region of injury categorized by if patients underwent surgery or died before they underwent surgery. The image below show that most of the patients who died before surgery had injuries on the head and neck 5(100%), chest (thorax) 4 (80%) and limbs, pelvis and perineum 5 (100%).

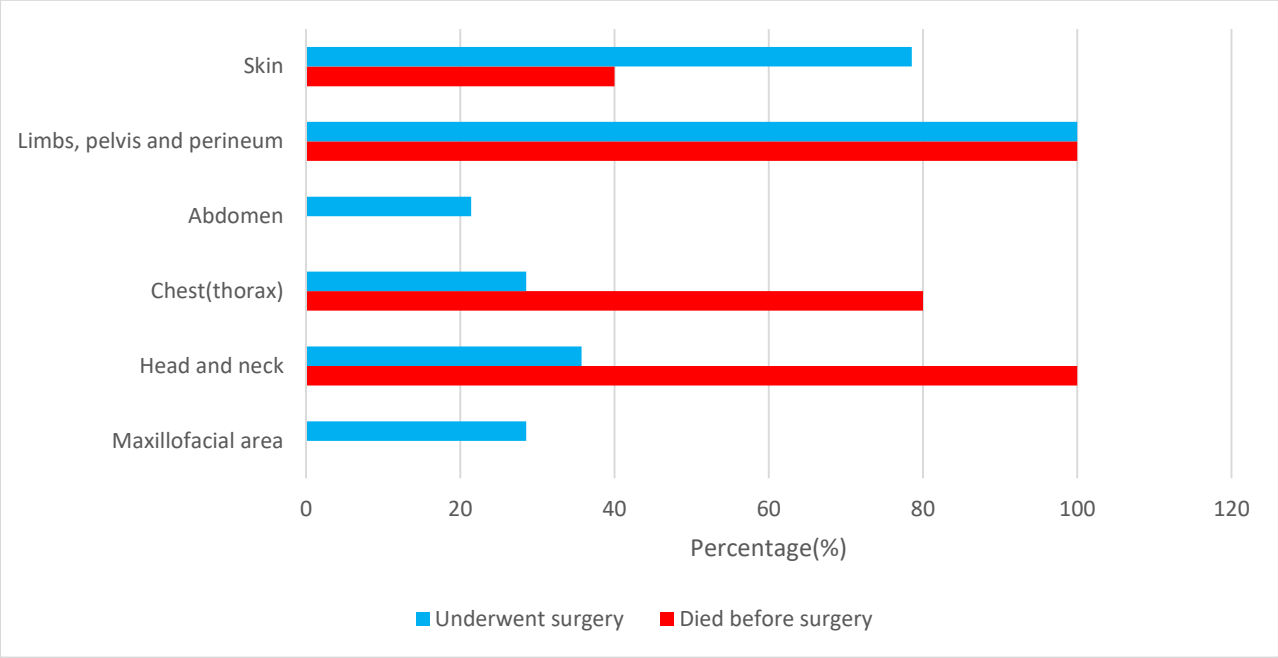


Figure 24: Region of injury categorized by surgery undergone or not

From the table below, there was a significant association between injuries incurred on the head and neck region and if the surgery was performed or not 95% (CI p=0.013). There was a significant association between injuries incurred on the chest (thorax) region and if the surgery was performed or not 95% (CI p=0.046) (Table 17).

Table 17: Bivariate analysis of region of injury associated to patients that underwent or did not undergo surgery.

Variable	Category	Died before surgery	Underwent surgery	p-value
Maxillofacial area	0	5(100)	10(71.4)	0.179
	1	0(0)	4(28.6)	
Head and neck	0	0(0)	9(64.3)	**0.013**
	1	5(100)	5(35.7)	
Chest(thorax)	0	1(20)	10(71.4)	**0.046**
	1	4(80)	4(28.6)	
Abdomen	0	5(100)	11(78.6)	0.259
	1	0(0)	3(21.4)	
Limbs, pelvis and perineum	0	0(100)	0(100)	….
	1	5(100)	14(100)	
Skin	0	3(60)	3(21.4)	0.111
	1	2(40)	11(78.6)	

Overall injury severity scores categorized by surgical strategies (DCO, EAC and LFFF)

Mean Injury severity score (ISS) was highest in patients who underwent DCO and lowest in patients who underwent EAC. There was a significant mean difference in ISS amongst patients who underwent the different surgical strategies (95% CI p=0.039). Mean revised trauma score was highest amongst patients who underwent LFFF (11.4$\pm$0.9) and lowest among patients who underwent EAC (11$\pm$1). Mean new injury severity score was highest amongst patients who underwent DCO (29.8$\pm$6.7) and lowest among patients who underwent LFFF (26.8$\pm$0.4). There was no significant mean difference in RTS and NISS scores amongst patients who underwent the different surgical strategies (Tabl 18).

Table 18: Injury severity categorized by surgical strategies

Injury severity	Damage Control Orthopedic n=6	Early Appropriate Care N=3	Late first fracture Fixation N=5	p-value
Injury Severity Score (M±SD)	25.8±5	18.3±0.6	20.8±3.3	**0.039**
Revised Trauma Score (M±SD)	10.7±0.8	11±1	11.4±0.9	0.418
New Injury Severity Score (M±SD)	29.8±6.7	27±0	26.8±0.4	0.505

Overall short term postoperative surgical outcomes categorized by surgical strategies

Out of the 14 (73.7%) patients that underwent surgery, 6 (42.9%) underwent DCO, 3 (21.4%) EAC and 5 (35.7%) LFFF. Among those that underwent DCO, a greater proportion 3 (50%) had no surgical complication. Among those that underwent EAC, 2 (66.7%) had sepsis, 1(33.3%) had Anaemia and 1(33.3%) had constipation after surgery. Among those that underwent LFFF, a greater majority of patients had no complication 3(60%). There was no significant difference in postoperative complications amongst the different surgical strategies used in the study. Mean hospital stay was highest among patients who underwent LFFF (26.2±7.9 days) and lowest among patients who underwent EAC (14±4.6 days). Mean ICU stay was highest among patients who underwent LFFF (1.6±3.1days) and lowest among patients who underwent EAC (0±0 days). There was no significant mean different in hospital length of stay and ICU length of stay amongst the different surgeries (Table 19).

Table 19 Postoperative complications categorized by surgical strategies.

Variable	DCO N=6	EAC N=3	LFFF N=5	p-value
Anaemia	1(16.7)	1(33.3)	0(0)	0.417
Sepsis	1(16.7)	2(66.7)	0(0)	0.078
pin tract infection	1(16.7)	0(0)	0(0)	0.488
Thromboembolism	1(16.7)	0(0)	0(0)	0.488
Acute renal failure	1(16.7)	0(0)	0(0)	0.488
constipation	0(0)	1(33.3)	0(0)	0.139
Pressure ulcer	0(0)	0(0)	1(20)	0.379
Bleeding	1(16.7)	0(0)	0(0)	0.488
None	3(50)	0(0)	3(60)	0.226
Mortality				
Alive	5(83.3)	3(100)	5(100)	0.488
Death	1(16.7)	0(0)	0(0)	
Length of hospital stay (days) M±SD	22.7±18.7	14±4.6	26.2±7.9	0.490
Length of ICU stay (days) M±SD	1.5±2	0±0	1.6±3.1	0.593

Figure 25 below shows mortality amongst the 14 patients that underwent surgery categorized by surgical strategies. Among patients that underwent surgery using DCO strategy, 1(16.7%) died and all survived using LFF and EAC.

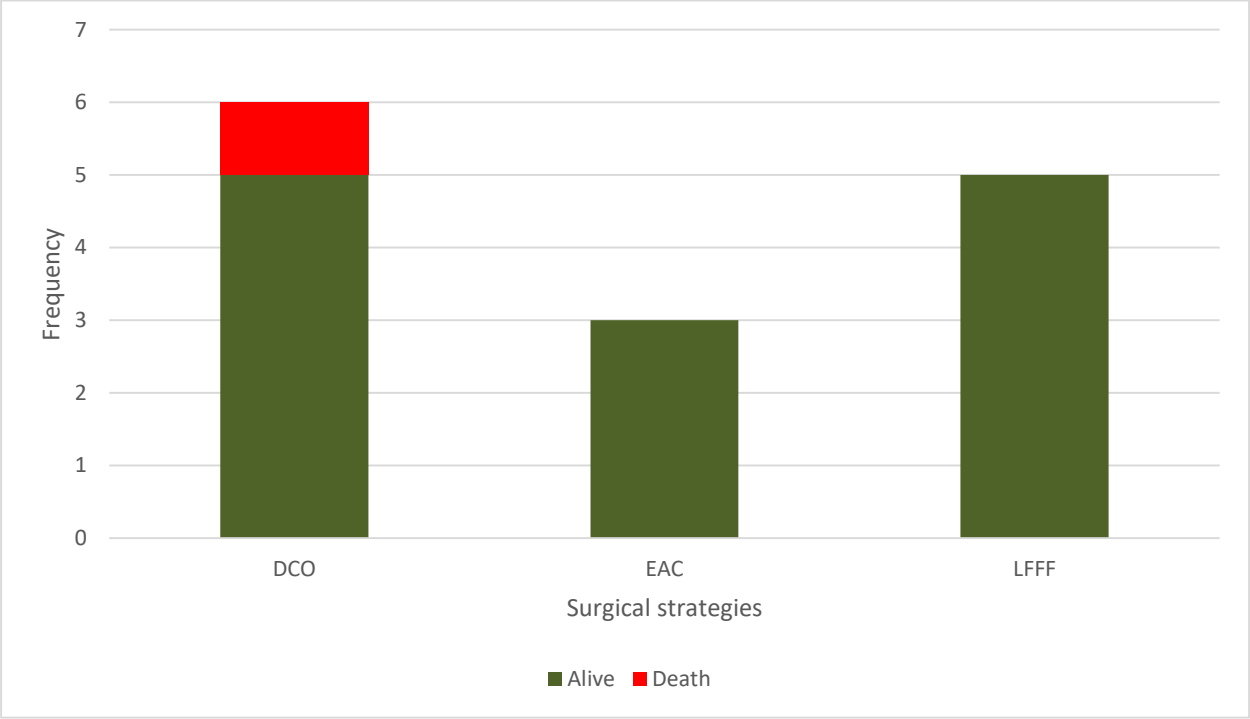


Figure 25: Mortality of patients who underwent surgery categorized by surgical strategies

CHAPTER FIVE: DISCUSSION

5.1 INTRODUCTION

Out of the 27 polytrauma patients with femoral fractures that consulted in general during the recruitment period, 8 were excluded from the study. They were excluded because they seek to be discharge against medical advice before any surgical intervention to stabilize the femoral fracture or before dying. Hence, follow up could not be complete. Some of the reasons for discharge against medical advice were: lack of finance to undergo the surgical intervention and for traditional treatment of the fracture.

5.2 SOCIO – DEMOGRAPHIC CHARACTERISTICS

A total of 19 polytrauma patients having femoral fractures were recruited with a male dominance of 68.4% while female had 31.6%. This was similar to other studies carried out elsewhere: Ching H H et al(21) and Cheng S R et al(1).

Majority of the patients were in the age group 21 – 30 years. The least number of patients were in the age group 61 – 70 years. Dencker H M in a study carried out in Sweden had a similar age group most affected(48).

The greatest number of patients had primary education (42.1%) as the highest level of education and were bike riders (52.6%). This could have affected their exposure to having road traffic accident which was the highest mechanism of injury in our study.

5.3 MECHANISM OF INJURY

Eighteen (94.7%) with the exception of one had as mechanism of injury RTA. The one exception had a tree that fell on her. Other similar studies carried out revealed that in 64 – 65 % of cases, RTA was the mechanism of injury(6) (10). Hence RTA as mechanism of injury was higher in our study. This could be deal to the fact that most of the other mechanisms of injuries in the other studies were not common in our setting.

5.4 PHYSIOLOGICAL PARAMETERS

Physiological parameters are a very important element in polytrauma patients as they contribute greatly to morbidity and mortality. Blood gases which is an important element in polytrauma patients to check for acid – base balance hence acidosis was not done in any patient in our study. This could have contributed to mortality. In our study, we looked at: systolic blood pressure, respiratory rate, Glasgow coma score, coagulation profile (clotting time and INR).

Majority of patients had normal systolic blood pressure (90 – 139 mmHg) (63.2%), normal respiratory rate (10 – 30 c/m) (73.7%) and normal coagulation profile.

31.6% of patients had systolic blood pressure less than 90 mmHg (shock). This was higher compared to other studies that range from 11 – 22%(1) (21). 26.3% of patients had abnormal respiratory rate. This was far higher compared to other studies that reported 5 – 10% of patients with respiratory rate abnormality. Hence we concluded that our patients had more physiological distortion compared to other studies.

Majority of our patients had GCS in the range 13 – 15 (57.9%). This was similar to Ching H H et al who reported 59.5% of his patients in the same GCS range.

Comparing the physiological parameters in patients that died before surgery to those that underwent surgery, there was no statistically significant different in any of the parameters. This could be deal to the fact that blood gases dictating acidosis which is an important physiological parameter contributing in mortality in polytrauma patients was not done by any of our patient.

5.5 ANATOMICAL LOCATIONS OF INJURIES

There are six possible anatomical locations of injuries in a polytrauma patient. There are: maxillofacial, head and neck, thorax, abdomen with visceral pelvis, limbs with bony pelvis and skin.

All our patients had injuries on their limbs. This is because we were recruiting only polytrauma patients with femoral fractures which is located on the limbs. 68.4% of patients had injury on their skin which were mostly minor injuries (abrasions and lacerations) while 52.6% had injuries

on their head and neck. The abdomen was the least affected area of the body injured with just 15.8% of patients having abdominal lesions. This was contrary to a study carried out by Ching et al(21) in which most polytrauma patients had injury in: maxillofacial region followed by thorax and abdomen. This could be deal to the fact that Ching et al recruited polytrauma patients in general while we recruited polytrauma patients with femoral fractures only.

All the five patients that died before any surgical intervention was carried out on them had injuries on their head and neck while 80% of them had thoracic injury. This was in line with Ching et al(21) who reported that fatal patients had a higher rate of head and neck injuries.

5.6 INJURY SEVERITY

The mean ISS was 26.0, mean RTS 10.6 and mean NISS 30.6. In each of these patients, the NISS was equal to or higher than the ISS. Normally, an RTS of 11 and below indicates the referral of the patient to a Trauma Center. Hence our mean RTS being 10.6 which is below 11 mean that most of our patients ought to be referred to a specialized Trauma Center.

Comparing our ISS to other studies, it was lower to that of Cheng S R et al(1), Pape H C et al(3) who had ISS between 28 to 29. NISS was also lower compared to Pape H C et al(3) that had 37.2. RTS was higher compared to Ching et al(21) who had 6.8. We noted that Ching et al had a worst RTS (6.8) but lower mortality (11.4%) compared to our study. This could be deal to the fact that his study was carried out in a specialized Trauma Center were they had better measures to resuscitate the patients despite the poor RTS.

Majority of our patients were seriously injured (ISS: 16 – 24) with one patient who died being critically injured (ISS: 50).

There were statistically significant difference when comparing the injury severity between patients that died before any surgical intervention to stabilize their femoral fractures and those that underwent surgical interventions. Those that died before surgical intervention were more injured with higher ISS, NISS and RTS.

5.7 FEMORAL FRACTURE CHARACTERISTICS

52.5% of our patients had right femoral fractures while 47.4% had left femoral fracture. No patient had bilateral femoral fracture. This was similar to a study carried out in Sweden where they also had more right femoral fractures with right to left ratio of 1.2:1(48). In other studies, unilateral femoral fracture was between 92 – 97%(6) (48) compared to the 100% in our study.

Though we had 19 polytrauma patients having femoral fractures, there were 20 femoral fractures altogether as there was a single patient having a bifocal femoral fracture (femoral neck + shaft fractures). 90% of these fractures were femoral shaft fractures. Other types of fracture present were femoral neck and supracondylar fractures.

73.7% of the patients had closed fractures while 23.7% had open fractures. Syed et al(6) had 91% of closed femoral fractures. The higher percentage of closed fracture is because of the anatomical location of the femur in the thigh which is a region that is richly covered with muscles hence lower risk of open fractures as compared to the legs. The open fractures were mostly GA 1 (40%).

The fracture line was mostly transverse (42.1%) followed by communited (31.6%). This could be deal to the higher forces of injury that caused the polytrauma.

5.8 SURGICAL TREATMENT STRATEGY

There are 3 standard strategies internationally in the management of polytrauma patients with femoral fractures. These are: EDC, DCO and EAC. For the purpose of this study and adapting to our local realities, we came up with a fourth treatment strategy which is LFFF. So, we had four possible treatment strategies (EDC, DCO, EAC and LFFF) that were available for the management of these patients. Of these 4 possible strategies, three were used as EDC was not used for any of the patients. The surgical treatment strategies were used for the 14 patients that underwent surgical interventions to stabilize their femoral fractures.

The most used surgical treatment strategy was DCO (42.9%) followed by LFFF (35.7%). EAC had 21.4%. This was contrary to a study carried out in April 2021(10) in which EDC was mostly used (78%) followed by DCO (22%) for those that were more severely injured. This could be

deal to the facts that: the study was carried out in a Tertiary Trauma Center, Trauma Surgeons were available to readily carry out surgical interventions within 24 hours after injuries and most of the patients were health insured hence no financial limitation to performing surgical interventions.

Patients mostly had LFFF because of lack of finance (80%) to pay for the surgical intervention at the appropriate time.

The average interval between injury and the first surgical intervention was 7 days. This is very late as it exposes the patient to higher risk of complications as studies have shown that the earlier the fixation of the femoral fractures, the lesser the risk of complications. This could be one of the causes of the high rate of mortality (31.6%) in our study compared to other studies.

Out of the 6 patients that underwent DCO, 3 did not undergo the definitive stabilization intervention as: 1 had a transfemoral amputation, 1 died before the definitive stabilization and 1 refused the definitive stabilization to remain with the external fixator. The average interval between DCO and definitive stabilization was 22 days. This was higher than the 4 – 15 days interval that is normally recommendated. This could be deal to the lack of finance for the definitive stabilization to be carried out on time.

Patients that had DCO had the highest ISS while those that had EAC had the lowest ISS with a statistical significance difference. We can deduce from here that the patients were properly attributed to the different surgical strategies as DCO is for extremis and unstable patients who should normally have a higher ISS compared to borderline patients that mostly benefit from EAC(17). There was no statistically significant difference in RTS and NISS between the different strategies.

5.9 SURGICAL TECHNIQUE

General anesthesia was used in 42.9% of cases. This was in line with Babita et al(17) who recommended that general anesthesia should mostly be used in polytrauma patients especially when there is an associated traumatic brain injury.

Patient were mostly installed in the supine position (92.9%) and had a lateral incision (78.6%). Reduction of the fractures were mostly done without fluoroscopy (open reduction) (84.6%).

The most actual technique used in fixation of the femoral fractures was IMN (36.8%), followed by external fixator (26.3%). The external fixators were all used in DCO. Compared to Syed I G et al(6), he had 75% of his patients treated with reamed IMN while only 8.9% treated with external fixator. The reason for the difference could be the fact that EDC was mostly used in Syed I G et al while we had DCO as the most used strategy. We had one patient that had a transfemoral amputation following a crush injury that involved the distal aspect of the femur.

All the patients that had plating as the actual technique(10) had DCP used. Antegrade nailing was used in all the seven patients that had IMN.

The trochanteric point of entry was mostly used (71.4%). This was contrary to Syed I G et al(6) who mostly had the pisiform fossa as the point of entry.

5.10 SHORT TERM OUTCOMES

Among the 14 patients that underwent surgical intervention, 42.9% had no postoperative complications while 57.1% had at least one postoperative complication within the 30 days of follow up after surgical intervention. The most common complication was sepsis (21.4%) followed by anemia (14.3%). The other postoperative complications were: bleeding, pressure ulcer, constipation, acute renal failure, thromboembolism and pin tract infection. Syed I G et al had 4.0% sepsis and 2.1% acute renal failure which were lower.

Overall mean hospital length of stay (LOS) for patients who underwent surgical intervention was 17.0 days. Pape H C et al(3) also had 17.0 days as the LOS in hospital.

LOS in ICU was 1.2 days. This was shorter compared to 8.2 days reported by Pape H C et al(3).

36.8% of patients were admitted in the ICU. This was very small compared to the 84.1% reported by Cheng S R et al(1). This could be deal to the fact that we had a lower tendency to admit patients into the ICU.

We had an overall mortality of 31.6%. This was very high compared to several other studies that reported an overall mortality in polytrauma patients ranging from 2 – 18%(6) (38) (21) (36) (40). One of the reason for this could be the low admission of our patients into the ICU. Also the longer interval between the injury and the first surgical intervention could results to some complications such as pulmonary embolism leading up to death. This could as well be an expression of how serious femoral fracture is in polytrauma patients. Our rate of death before any surgical intervention was 26.3%. This was higher compared to the 2.43% reported by Syed I G et al(6).

66.7% of patients that underwent EAC had sepsis as a postoperative complication while 33.3% each had anemia and constipation. Mean LOS in hospital and ICU was highest in LFFF and lowest among EAC.

Overall, there was no statistical significant difference in both the short term postoperative complications and LOS in hospital and ICU between the different surgical management strategies. So generally, there was no statistical significant difference in the short term outcomes between the different surgical treatment strategies. This could be deal to the fact that the high rate of death prior to surgical intervention has done a natural selection especially for those that underwent LFFF. Hence most of those that ought to have severe complications deal to prolong interval between injury and intervention died even before the intervention. Also, there could have been proper attribution of the patients to the appropriate treatment strategies: Extremis – DCO, Unstable patients – DCO, Borderline patients – EAC and Stable Patients – EDC (or LFFF)(17).

STUDY LIMITATION

The study had the following limitations:

- We used a non – probability sampling method which is not the best.
- Our sample size was 19 which could be small compared to other studies.

CONCLUSION AND RECOMMENDATION

CONCLUSION

Polytrauma with femoral fractures is a major public health problem in Yaounde. Those mostly affected are male bike riders in the age group 21 – 30 years who had as maximum level of education primary education. Road traffic accidents is the highest mechanism of injury leading to associated injuries mostly on the skin and neck. Most of these patients came to the hospital with abnormal physiological parameters and ended up dying with those that died mostly having injuries in the head/neck and thorax.

The patients mostly had right closed transverse femoral shaft fractures and benefitted from damage control orthopedics as the surgical management strategy. It was noticed that there is no statistical significant difference in the short term outcome between the different surgical management strategies that were used.

RECOMMENDATIONS

In line with our results obtained, we humbly recommend the following:

To the Medical Research Teams;

- To carry out a similar study on a larger study population to better access the postoperative outcomes.
- To carry out similar study for a longer duration to assess the late postoperative outcomes.
- To carry out studies on the hospital mortality among polytrauma patients.

To the health practitioners;

- To increase on our rate of admissions of polytrauma patients into the ICU.
- Use biological workups such as blood gases and lactate to better monitor polytrauma patients during the acute phase.

To the Ministry of Public Health;

- Establish emergency kits in Emergency Departments from where trauma patients can be taken care of during the acute phase while the necessary finance is being looked for (pre – finance the management of polytrauma patients).
- Ensure that there are functional blood banks in hospitals receiving polytrauma patients.

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APPENDIX

APPENDIX I: DATA COLLECTION SHEET

I am ACHA FONGANG ROGER, a final year resident of General Surgery of the University of Yaounde 1. I am carrying out a study on the topic 'Polytrauma patients with femoral fractures: injury severity, surgical managements and short term outcomes in Yaounde'

Part 1: Epidemiology

1) Identification number

_____

2) Age

1 O-10 years

2 11-20 years

3 21-30 years

4 31-40 years

5 41-50 years

6 51-60 years

7 61-70 years

8 >70 years

3) Sex

1 Male

2 Female

4) Highest level of education

1 No formal education

2 Primary educations

3 Secondary educations

4 Tertiary educations

5) Occupation

Part 2: Mechanism of injury

6) Trauma mechanism

1 RTA

2 Fall from height

3 Assaults

4 Sport injuries

5 Domestic injuries

6 Occupational injuries

7 Gunshots

8 Others _____

Part 3: Physiological parameters

7) Systolic blood pressure

1 >140

2 90-139

3 60-89

4 <60

8) Respiratory rate (cpm).

1 0

1 <5

2 5 – 9

3 >30

4 10 – 30

9) GCS

1 14-15

2 9-13

3 3-8

10) Coagulopathy

1 PTT > 40s

2 PTT < 40s

11) International normalized ratio

1 INR < 1.4

2 INR > 1.4

12) Age

1 <70 yrs

2 >70 yrs

Part 4: Injury sustained

13) Describe in details the nature of injury on the maxillofacial area if any

_____

_____

14) Describe in details the nature of injury for the head and neck if any

_____

_____

15) Describe in details the nature of injury for the chest (thorax) if any

_____

_____

16) Describe in detail the nature of injury for the abdomen if any

_____

_____

17) Describe in details the nature of injury to the limbs, pelvis and perineum if any

_____

_____

18) Describe in details the nature of injury on the skin if any

_____

_____

Part 5: Injury severity

19) Injury severity score (ISS)

_____

20) Revised trauma score (RTS)

21) New injury severity score (NISS)

_____

Part 5: Femoral Fracture

22) Femur involved

1 Left

2 Right

3 Bilateral

23) Type of femoral fracture

1 Femoral neck fracture

2 Pertrochanteric femur fracture

3 Subtrochanteric femur fracture

4 Femoral shaft fractures

5 Supracondylar fracture

24) Open or closed fracture

1 Closed

2 Open

25) If open fracture, GA classification

---

26) Fracture line

1 Transverse

2 Oblique

3 Spiral

4 Communited

5 Others _____

Part 6: Surgical Management

27) Treatment strategy

1 Early definitive care (EDC)

2 Damage control orthopedic (DCO)

3 Early appropriate care (EAC)

4 Late first fracture fixation (LFFF)

28) If LFFF, reason for the delay

1 Lack of finance

2 Late arrivals in the hospital

3 Late referral

4 Lack of surgeon

5 Surgeon preferences

6 Others _____

29) Interval between injury and first surgical intervention

_____

30) Interval between DCO and definitive stabilization

_____

31) Types of anesthesia

_____

32) Installation

_____

33) Incision

_____

34) Open or closed reduction (fluoroscopy)

1 Open

2 Closed

35) Actual technique

1 Intramedullary nail

2 Plate (specific the type)

_____

3 External fixator

4 Dynamic hip screw (DHS)

5 Proximal femoral nail

6 Gamma nail

36) If IMN, anterograde or retrograde

1 Anterograde

2 Retrograde

37) If IMN, point of entering

1 Trochanteric

2 Pisiform fossa

Part 7: Short term outcome

38) Postoperative complications

1 SSI

2 Thromboembolism

3 Pressure ulcer

4 Pulmonary complications

5 Sepsis

6 Acute renal failure

7 Bleeding

8 Pin tract infections (for external fixators)

9 Others _____

39) Mortality

1 Death

2 Alive

40) Length of hospital stay

_____

41) Length of ICU stay

_____

APPENDIX II: INFORMED CONSENT FORM

A2.1 INFORMED CONSENT

(Modified from: WHO, 20, avenue Appia – CH-1211 Geneva 27 – Switzerland –

http://intranet.who.int/homes/rpc/erchttp://www.who.int/rpc/research_ethics)

Informed Consent form for polytrauma patients with femoral fractures, who we are inviting to participate in a study titled: "*Polytrauma patients with femoral fractures: injury severity, surgical managements and short term outcomes in Yaounde"*

Name of Principal Investigator: **Acha Fongang Roger**

Name of Proposal and version: **Version 4, May 2014**

This Informed Consent Form has two parts:

- **Information Sheet** (to share information about the study with you).
- **Certificate of Consent** (for signature if you agree to take part).

You will be given a copy of the full Informed Consent Form.

PART I: Information Sheet

Introduction

I am Acha Fongang Roger, a 4th year Resident in General Surgery from the University of Yaounde 1. I am doing a study on 'Polytrauma patients with femoral fractures: injury severity, surgical managements and short term outcomes in Yaounde', a very common problem in this country. I am going to give you information and invite you to be part of this study. You do have to decide whether or not you will participate in the study. Before you decide, you can talk to anyone you feel comfortable with about the research. We may have started collecting information about you or not and whether we continue or not, shall be decided by you. Your participation in the study or not will not influence the care you will receive during your stay in this hospital,

however, the team direct involvement in your care as a participant may improve the chances of diagnosing injuries that could have been missed.

There may be some words that you do not understand. Please ask me to stop as we go through the information and I will take time to explain. If you have questions later, you can ask them to me or any other member of the study team.

Purpose of the study

The treatment strategy of femoral fractures in polytraumatised patients has evolved over the years and led to improved outcomes for these patients. However, there is still controversy regarding the optimal treatment strategy and surgical care can differ markedly from one country to another. We aimed to investigate the different surgical strategies used in the management of femoral fractures in polytraumatised patients and their outcomes in this study. This is going to help us to have a better understanding of the best treatment strategy to adapt in our local setting.

Type of Study intervention

This study will involve an interview with you and which will be followed by a physical examination and the results of any investigations you have done will be studied.

Participant selection

We are inviting all polytrauma patients with femoral fractures, both males and females, to participate in this study.

Voluntary participation

Your participation in this study is entirely voluntary. It is your choice whether to participate or not. Whether you choose to participate or not, all the services you receive at this hospital will continue and nothing will change. If you accept to participate and later change your mind, there shall be no consequences withdrawing from the study at any stage.

Procedures and Protocol

This study will entail three parts: we shall ask you some questions, examine your body and study of your medical file for the results of relevant investigations.

Risks

There is negligible risk involved in this study and we are trained professionals and will try as much as possible not to cause you harm. It may be inconveniencing to answer some questions you already answered when you were admitted or to be examined a second time. However, we will try to inquire from you, only information we could not get in your file or when we are in case of doubt.

Benefits

If you participate in this study, many more health workers will be involved in your care but this does not mean you will not receive proper care if you do not participate. This will personally increases your chances for any problems you incurred during the injury to be identified. Your participation is certainly to help us have more data about this common health problem and certainly future generations will benefit from the results of this study.

Confidentiality

With this study, something out of the ordinary is being done in your community. It is possible that if others in the community are aware that you are participating, they may ask you questions. We will not be sharing the identity of those in the study.

The information that we collect from this study will be kept confidential. Information about you that will be collected during the study will be put away and no one but the study team will be able to see it. Any information about you will have a number on it instead of your name. Information about your identification shall not be shared with or given to anyone.

Sharing the results

A copy of the final results that we will get from this study will be kept at the hospital where this study will be carried out. Information that could identify any participant will not be included. Interested participants could come to the hospital and will be given access to the results of the study. This shall last for 6 months after the study is done.

Right to Refuse or Withdraw

You do not have to take part in this study if you do not wish to do so and refusing to participate will not affect your treatment at this hospital in any way. You will still have all the benefits that you would otherwise have at this hospital. You may stop participating in the study at any time that you wish without losing any rights as a patient here. Your treatment at this hospital will not be affected in any way.

Who to contact

If you have any questions you may ask them now or later, even after the study has started. If you wish to ask questions later, you may contact any of the following:

- Pr. Guifo Marc Leroy. Associate Professor in General Surgery. FMBS, University of Yaounde 1/ Yaounde University Teaching Hospital.
- Dr. Fonkoue Loic. Senior Lecturer in Orthopaedic/Trauma Surgery. FMBS, University of Yaounde 1/ Yaounde General Hospital.
- Acha Fongang Roger. Principal Investigator. 4th Year Resident, General Surgery, University of Yaounde 1. Cell: 00(237)692938307, e-mail: fongangroger@yahoo.com.

PART II: Certificate of Consent

If literate

I have read the foregoing information, or it has been read to me. I have had the opportunity to ask questions about it and any questions that I have asked have been answered to my satisfaction. I consent voluntarily to participate in this study.

Print Name of Participant_____

Signature of Participant_____

Date (day/month/year) _____

If illiterate

I have witnessed the accurate reading of the consent form to the potential participant, and the individual has had the opportunity to ask questions. I confirm that the individual has given consent freely.

Print Name of witness_____

Thumb print of Participant:

Signature of witness_____

Date (day/month/year) _____

Statement by the person taking consent

I have accurately read out the information sheet to the potential participant, and to the best of my ability made sure that the participant understands that the following will be done:

1)

2)

3)

I confirm that the participant was given an opportunity to ask questions about the study, and all the questions asked by the participant have been answered correctly and to the best of my ability. I confirm that the individual has not been coerced into giving consent, and the consent has been given freely and voluntarily.

A copy of this Informed Consent Form has been provided to the participant.

Print Name of Person taking the consent: _____

Signature of Person taking the consent: _____

Date (day/month/year):_____

A2.2 Informed Assent for children

(Modified from: WHO, 20, AVENUE APPIA – CH-1211 GENEVA 27 –SWITZERLAND –

HTTP://INTRANET.WHO.INT/HOMES/RPC/ERCHTTP://WWW.WHO.INT/RPC/RESEARCH_ETHICS)

Informed Assent form for children of age 1 – 20 years having polytrauma with femoral fractures, who we are inviting to participate in a study titled: "*Polytrauma patients with femoral fractures: injury severity, surgical managements and short term outcomes in Yaounde".*

Name of Principal Investigator: **Acha Fongang Roger**

Name of Proposal and version: **Version 4, May 2014**

This Informed Assent Form has two parts:

- **Information Sheet** (gives you information about the study)
- **Certificate of Assent** (this is where you sign if you agree to participate)

You will be given a copy of the full Informed Assent Form

PART I: Information Sheet

Introduction

I am Acha Fongang Roger, a 4th year Resident in General Surgery, from the University of Yaounde 1. I am doing a study on 'Polytrauma patients with femoral fractures: injury severity, surgical managements and short term outcomes in Yaounde', a very common problem in this country. I am going to give you information and invite you to be part of this study. Before you decide whether to participate or not, you can talk to anyone you feel comfortable with about the study. We may have started collecting information about you or not and whether we continue or not, shall be decided by you. Your participation in the study or not will not influence the care you will receive during your stay in this hospital.

Purpose of the study

The treatment strategy of femoral fractures in polytraumatised patients has evolved over the years and led to improved outcomes for these patients. However, there is still controversy regarding the optimal treatment strategy and surgical care can differ markedly from one country to another. We aimed to investigate the different surgical strategies used in the management of femoral fractures in polytraumatised patients and their outcomes in this study. This is going to help us to have a better understanding of the best treatment strategy to adapt in our local setting.

Choice of participants: why are you asking me?

We are involving children from 1 year and above because some studies have shown that polytrauma with femoral fracture occurs among children. We therefore see it necessary to include you in this study.

Participation is involuntary: Do I have to do this?

You don't have to be in this study if you don't want to be. It is up to you. If you decide not to be in the study, it is okay and nothing changes. This is still your hospital; everything stays the same as before. Even if you say "yes" now, you can change your mind later and it is still okay.

Procedures: what is going to happen to me?

If you accept to participate in this study, three things will be done: you will be asked questions about yourself and what happened during the accident, if you can remember; your body shall then be examined for any injuries sustained during the accident; and then we shall look into your hospital file for any relevant information. None of these shall be painful and we are well trained to do it well without causing you harm.

Risks: Is this bad or dangerous for me?

There is little or no danger in this study. This is what is normally done for such patients when they come to the hospital. We are well trained and will ensure it is done well.

Discomforts: will it hurt?

It will not hurt because we are just checking your body, but it may hurt a little if you have been injured on a part of your body and that part is moved during the process.

Benefits: Is there anything good that happens to me?

You will have the opportunity to be cared for by many health personnel and this may increase the chances that some hidden injuries be identified. This does not mean if you do not participate you will not be taken care of properly. There may be no direct good thing for you but this will help in future care of other polytrauma victims by you participating now.

Reimbursements: Do I get anything by being in the study?

You will not be given anything and you will not also spend more than you normally have to spend during your stay in the hospital.

Confidentiality: Is everyone going to know about this

Information about you that will be collected from the research will be put away and no-one but the researchers will be able to see it. Any information about you will have a number on it instead of your name. Only those carrying out the study will know what your number is and they will lock that information up with a lock and key.

Compensation: What happens if I get hurt?

We do not intend it happening because this study is more of caring of your health problems posed by the accident. We will ensure with the help of the hospital to give you the best of care during this period.

Sharing the Findings: Will you tell me the results?

After we have finished with the study, we will explain to you the findings with your parents present. I will also give you a paper with the findings written down on it. Afterwards, we will be telling more people, scientists and others, about the study and what we found. We will do this by writing and sharing reports and by going to meetings with people who are interested in the work we do.

Right to Refuse or Withdraw: Can I choose not to be in the study? Can I change my mind?

No one will be mad at you whether you decide not to take part in the study or not. It is your choice. You can think about it and tell us later if you want. You can say "yes" now and change your mind later and it will still be okay.

Who to contact: Who can I talk to or ask questions to?

You can ask me questions now or later. You can ask the nurse questions. I have a written number and address where you can reach us.

If you choose to be part of this study, I will also give you a copy of this paper to keep for yourself. You can ask your parents to look after it if you want.

PART II: Certificate of Assent

Participant:

If literate

I have read this information (or had the information read to me) I have had my questions answered and know that I can ask questions later if I have them.

I agree to take part in the research.

OR

I do not wish to take part in the research and I have **not** signed the assent below.

_____ (initialled by child/minor)

Only if child assents:

Print name of participant/child_____

Signature of child_____

Date (day/month/year):_____

If illiterate

I have witnessed the accurate reading of the assent form to the participant/child, and the individual has had the opportunity to ask questions. I confirm that the individual has given consent freely.

Print name of witness (not a parent) _____

Signature of witness_____

Thumb print of participant/child

Date (day/month/year) _____

I have accurately read or witnessed the accurate reading of the assent form to the potential participant, and the individual has had the opportunity to ask questions. I confirm that the individual has given assent freely.

Print name of researcher_____

Signature of researcher_____

Date (day/date/year) _____

Statement by the researcher/person taking the consent

I have accurately read out the information sheet to the potential participant, and to the best of my ability made sure that the child understands that the following will be done.

1)

2)

3)

I confirm that the child was given an opportunity to ask questions about the study, and all the questions asked by him/her have been answered correctly and to the best of my ability. I confirm that the individual has not been coerced into giving consent, and the consent has been given freely and voluntarily.

A copy of this assent form has been provided to the participant.

Print Name of Researcher/person taking the

assent_____

Signature of Researcher/person taking the

assent_____

Date (day/month/year) _____

Copy provided to the participant _____ (initialed by researcher/assistant)

Parent/Guardian has signed an informed consent ___yes ___No ___ (initialed by

Researcher/assistant).

APPENDIX III: ETHICAL CLEARANCE

UNIVERSITÉ DE YAOUNDÉ I
FACULTÉ DE MÉDECINE ET DES SCIENCES BIOMÉDICALES
COMITÉ INSTITUTIONNEL D'ÉTHIQUE DE LA RECHERCHE
Tel/ fax : 22 31-05-86 22 311224
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THE UNIVERSITY OF YAOUNDE I
FACULTY OF MEDICINE AND BIOMEDICAL SCIENCES
INSTITUTIONAL ETHICAL REVIEW BOARD

Ref. : N° 1113 /UY1/FMSB/VDRC/DAASR/CSD

CLAIRANCE ÉTHIQUE 19 JUIL 2024

Le COMITÉ INSTITUTIONNEL D'ÉTHIQUE DE LA RECHERCHE (CIER) de la FMSB a examiné

La demande de la clairance éthique soumise par :

M.Mme : ACHA FONGANG ROGER **Matricule: 20S1912**

Travaillant sous la direction de :

- *Pr GUIFO Marc Leroy*
- *Dr FONKOUE Loïc*

Concernant le projet de recherche intitulé : ***Polytrauma patients with femoral fractures: injury severity, surgical managements and short term outcomes in Yaounde***

Les principales observations sont les suivantes

Evaluation scientifique	
Evaluation de la convenance institutionnelle/valeur sociale	
Equilibre des risques et des bénéfices	
Respect du consentement libre et éclairé	
Respect de la vie privée et des renseignements personnels (confidentialité) :	
Respect de la justice dans le choix des sujets	
Respect des personnes vulnérables :	
Réduction des inconvénients/optimalisation des avantages	
Gestion des compensations financières des sujets	
Gestion des conflits d'intérêt impliquant le chercheur	

Pour toutes ces raisons, le **CIER** émet un avis **favorable** sous réserve des modifications recommandées dans la grille d'évaluation scientifique.

L'équipe de recherche est responsable du respect du protocole approuvé et ne devra pas y apporter d'amendement sans avis favorable du **CIER**. Elle devra collaborer avec le **CIER** lorsque nécessaire, pour le suivi de la mise en œuvre dudit protocole.

La clairance éthique peut être retirée en cas de non - respect de la réglementation ou des recommandations sus évoquées.

En foi de quoi la présente clairance éthique est délivrée pour servir et valoir ce que de droit

LE PRESIDENT DU COMITE ETHIQUE

UNIVERSITE DE YAOUNDE I — THE UNIVERSITY OF YAOUNDE I — Faculté de Médecine et des Sciences Biomédicales — Faculty of Medicine and Biomedical Sciences

Mme Abena Ondoa née Obama Marie Thérèse

APPENDIX IV: AUTHORISATION FROM THE HOSPITALS

RÉPUBLIQUE DU CAMEROUN
Paix – Travail – Patrie

MINISTERE DE LA SANTE PUBLIQUE

REPUBLIC OF CAMEROON
Peace – Work – Fatherland

MINISTRY OF PUBLIC HEALTH

CENTRE HOSPITALIER ET UNIVERSITAIRE DE YAOUNDE
YAOUNDE UNIVERSITY TEACHING HOSPITAL

C C H U U YAOUNDE

DIRECTION GENERALE

CELLULE D'APPUI PEDAGOGIQUE, DE LA RECHERCHE ET DE LA COOPERATION

BUREAU DE LA CAPRC

U U T H H YAOUNDE

N°391/AR/CHUY/DG/DGA/DM/CAPRC/CEAAP/CEARC

AUTORISATION DE RECHERCHE

Dans le cadre de la rédaction d'un mémoire de fin d'études, en vue de l'obtention du Diplôme de fin de spécialisation en Chirurgie générale, Monsieur ACHA FONGANG Roger est autorisé à mener une recherche au CHUY sur le thème : « **Polytrauma patients with femoral fractures : injury severity, surgical managements and short term outcomes in Yaoundé** ».

Ces travaux se dérouleront dans le service de Chirurgie sous la supervision de Pr. GUIFO Marc Leroy, Chirurgien.

Toutefois, il devra obligatoirement déposer un exemplaire de mémoire au CHUY (Bureau de la CAPRC).

En foi de quoi la présente autorisation dont la durée de validité est de 03 mois à compter de la date de signature, lui est délivrée pour servir et valoir ce que de droit.

Yaoundé, le 12 JUIN 2024

LE DIRECTEUR GENERAL

Pr. Mone Enyime Félicien

COPIE :
- CAPRC
- BCAPRC
- SUPERVISEUR
- CHRONO

REPUBLIQUE DU CAMEROUN
Paix-Travail-Patrie
****
MINISTERE DE LA SANTE PUBLIQUE
****
SECRETARIAT GENERAL
****
DIRECTION DE L' HOPITAL CENTRAL DE YAOUNDE
****
SECRETARIAT MEDICAL

N° 2061/24 /AMS/DHCY/CM/SM

REPUBLIQUE DU CAMEROUN
Paix-Travail-Patrie
****
MINISTERE DE LA SANTE PUBLIQUE
****
SECRETARIAT GENERAL
****
DIRECTION DE L' HOPITAL CENTRAL DE YAOUNDE
****
SECRETARIAT MEDICAL

Yaoundé, le 10 MAI 2024

ACCORD DE PRINCIPE

Je soussigné **Professeur FOUDA Pierre Joseph**, Directeur de l'Hôpital Central de Yaoundé, marque mon Accord de principe à Monsieur **ACHA FONGANG Roger**, Résident en 4ème Année de Chirurgie Générale à la Faculté de Médecine et des Sciences Biomédicales de l'Université de Yaoundé I, sous le thème « POLYTRAUMA PATIENTS WITH FEMORAL FRACTURE: INJURY SEVERITY, SURGICAL MANAGEMENTS AND SHORT TERM OUTCOMES IN YAOUNDE » à l'Hôpital Central de Yaoundé sous la direction du docteur ATANGANA Désiré.

Pour Le Directeur et par ordre
Le Conseiller Médical,

REPUBLIQUE DU CAMEROUN HOPITAL CENTRAL DE YAOUNDE MINISTERE DE LA SANTE PUBLIQUE
Le Conseiller Médical

Pr. Mgr Pierre Ongolo Zogo

Ampliations :

- Conseiller Médical ;
- Chef service concerné ;
- Intéressé ;
- Archives /Chrono.

REPUBLIQUE DU CAMEROUN
Paix - Travail – Patrie

PRESIDENCE DE LA REPUBLIQUE

MINISTERE DE LA DEFENSE

DIRECTION DE LA SANTE MILITAIRE

REGION DE SANTE MILITAIRE N°1

HÔPITAL MILITAIRE DE REGION N°1

REPUBLIC OF CAMEROON
Peace - Work - Fatherland

PRESIDENCY OF THE REPUBLIC

MINISTRY OF DEFENCE

DEPARTMENT OF MILITARY HEALTH

MILITARY HEALTH REGION N°1

MILITARY REGION HOSPITAL N°1

Yaoundé le 29 AVR 2024 **N°** 240157 **/DV/MINDEF/DSM/RSM1/HMR1/12**

AUTORISATION D'ACCES

Je soussigné, **Colonel-Médecin HAMADOU,** Médecin-Chef de l'Hôpital Militaire de Région n°1 (HMR1) à Yaoundé,

Autorise monsieur **ACHA FONGANG Roger,** étudiante en 4eme année de Medecine Générale à la Faculté de Medecine et des Sciences Biomédicales de l'Université de Yaoundé I, à accéder au Service Spécialisé Chirurgie Orthopédie/Traumatologie de l'HMR1, en vue d'y effectuer une recherche sur le thème **«Polytrauma patients with femoral fractures: injury severity, surgical managements and short term outcomes in yaounde»**

En cas de publication de cet article, les Services d'accueils de l'HMR1 devraient être cités.

En foi de quoi la présente autorisation lui est délivrée pour servir et valoir ce que de droit

Colonel-Médecin **HAMADOU**
Médecin-Chef Hôpital Militaire de Région N°1

REPUBLIQUE DU CAMEROUN
Paix-Travail-Patrie

MINISTERE DE LA SANTE PUBLIQUE

SECRETARIAT GENERAL

CENTRE DES URGENCES DE YAOUNDE

BP : 3911
E-mail : cury_minsanté@Yahoo.fr
Tél : 222 22 25 25/222 22 25 24/222 22 25 22

CURY
Centre des Urgences de Yaoundé

REPUBLIC OF CAMEROON
Peace-Work-Fatherland

MINISTRY OF PUBLIQUE HEALTH

SECRETARIAT GENERAL

YAOUNDÉ EMERGENCY CENTER

N° 02674 /A/MINSANTE/SG/DCURY

Yaoundé le, 06 MAI 2024

AUTORISATION DE RECHERCHE

Je soussigné, **Dr BITANG à MAFOK Louis Joss**, Directeur du Centre des Urgences de Yaoundé (CURY).

Autorise **Madame ACHA FONGANG Roger,** Etudiant en 7e année de Médecine à la Faculté de Médecine et des Sciences Biomédicales de l'Université de Yaoundé I à effectuer ses travaux de recherche dans notre institution hospitalière sous le thème : "***Polytrauma Pateints with pemoral fractures : Injury severity,surgal managements and short term outcomes in Yaounde*** ". Sous la supervision du **Dr FONKOUE Loïc**, Chirurgien Orthopédique.

En foi de quoi la présente autorisation est délivrée à l'intéressé pour servir et faire valoir ce que de droit. /-

RÉPUBLIQUE DU CAMEROUN Republic of Cameroon Ministry of Public Health MINISTÈRE DE LA SANTÉ PUBLIQUE Centre des Urgences de Yaoundé Yaounde Emergency Center Le Directeur

Le Directeur.

Dr. Louis Joss BITANG à MAFOK
Chirurgien
Directeur du Centre des Urgences de Yaoundé (CURY)

REPUBLIQUE DU CAMEROUN
Paix - Travail - Patrie

MINISTERE DE LA SANTE PUBLIQUE

HOPITAL GENERAL DE YAOUNDE

DIRECTION GENERALE

BP 5408 YAOUNDÉ - CAMEROUN
TÉL : (237) 22 21 31 81 FAX : (237) 22 21 20 15.

REPUBLIC OF CAMEROON
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MINISTRY OF PUBLIC HEALTH

YAOUNDE GENERAL HOSPITAL

GENERAL MANAGEMENT DEPARTMENT

N/Réf. : 366-24 /HGY/DG/DPM/APM-TR.

Yaoundé, le 26 AVR 2024

Le Directeur Général

A/TO

Docteur ACHA FONGANG Roger
Résident en 4ème année Chirurgie Générale
Matricule : 20S1912
FMSB – UNIVERSITE DE YAOUNDE I

Objet/subject :
V/demande d'autorisations de recherches.

Docteur,

Faisant suite à votre courrier du 19 avril 2024 dont l'objet est porté en marge.

Nous marquons un avis favorable pour que vous effectuiez vos travaux des recherches au SERVICE CHIRURGIE GENERALE ET VISCERALE dans le cadre de votre mémoire de fin de spécialisation dont le thème porte sur : « ***Polytrauma patients with femoral fractures : Injury severity, surgical managements and short term outcomes in Yaounde***», sous la supervision du Docteur FONKOUE Loïc, chirurgien orthopédiste-Traumatologue.

Pendant la durée des recherches, vous observerez le règlement intérieur de la formation hospitalière. Toutefois, les publications se rapportant à ce travail devraient inclure les médecins de l'Hôpital Général de Yaoundé

Recevez, Docteur, nos salutations distinguées./-

Le Directeur Général,

HOPITAL GENERAL YAOUNDE
H.G.Y
Le Directeur Général Adjoint
YAOUNDE GENERAL HOSPITAL

Prof. EYENGA Victor

Copies :
- DPM
- Chef service Chirurgie Générale et Viscérale
- Archives/chrono.