# AETIOLOGY AND OUTCOMES OF OPERATIVELY MANAGED ACUTE ABDOMEN IN ADULTS, AT MOI TEACHING AND REFERRAL HOSPITAL.

**BY**

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**A RESEARCH DISSERTATION SUBMITTED, IN PARTIAL FULFILLMENT FOR THE AWARD OF A MASTER OF MEDICINE DEGREE IN GENERAL SURGERY AT MOI UNIVERSITY.**

## DECLARATION

This dissertation is my own work and has not been presented in any other institution for academic credit. All sources of information used in this work have been acknowledged.

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## DEDICATION

This study is dedicated to my family and colleagues for their unwavering encouragement and support, and to all doctors pushing to ease patient's suffering.

**ACKNOWLEDGEMENT**

I wish to sincerely thank my supervisors for their continued support and guidance in the development of this research work. I would also like to thank my friends, family, and colleagues for their continued support during the course of this work.

## LIST OF ABBREVIATIONS

| | |
|---|---|
| **CT** scan | Computed Tomography scan |
| **DVT** | Deep Venous Thrombosis |
| **HIC** | High-income countries |
| **IREC** | Institutional Research and Ethics Committee |
| **KNH** | Kenyatta National Hospital |
| **LMIC** | Low and middle-income countries |
| **MODS** | Multiple Organ Dysfunction Syndrome |
| **MTRH** | Moi Teaching and Referral Hospital |
| **PC** | Personal Computer |
| **PPUD** | Perforated Peptic Ulcer Disease |
| **SIRS** | Systemic Inflammatory Response Syndrome |
| **SPSS 24** | Statistical Package for Social Sciences version 24 |
| **U.K** | United Kingdom |
| **U.S** | United States of America |

## DEFINITION OF TERMS.

- Acute abdomen- emergent abdominal conditions requiring surgery to resolve them, excluding trauma.
- Abdominal pain- nociceptive response to pathology within the abdomen; it may be visceral or somatic.
- Peritonitis- Inflammation of the peritoneal cavity; occurring due to irritation by infective or non-infective irritants.
- Laparotomy- a surgical incision into the abdominal cavity which involves using the traditional full-size incision. It is sometimes referred to as a coeliotomy.
- Laparoscopy- a surgical procedure performed in the abdomen or pelvis using small incisions with the aid of a camera. It is also referred to as keyhole or minimally invasive surgery
- Complication- any undesirable and unexpected result of an operation or the pathology, affecting the patient
- Duration of stay- from the time of admission to the time the patient is discharged by a doctor.
- Surgical Mortality- from the time of surgery, death within the same admission resulting from the offending pathology, or complications arising from it or its management.
- Surgical site infection- an infection that occurs after the surgery in the part of the body where the surgery took place. Determined by purulent discharge of the wound and localized pain.

- Wound dehiscence- separation of the layers of a surgical wound which may be partial/ superficial or complete (separation of all the layers with total disruption).
- Pneumonia- infection of the lung tissue that is a serious complication that sometimes occurs after surgery. Diagnosed by presence of cough, dyspnea, and positive x-ray findings (consolidations or interstitial opacities).
- Sepsis (*septic shock*)- infection plus two or more of; tachypnea (*RR>20*), tachycardia (*>90*), hypotension(SBP*<100*), fever (*>38.0 degrees Celsius*), and altered level of consciousness
- Deep venous thrombosis- refers to the formation of one or more blood clots (thrombi) in the large veins of the body.
- Enterocutaneous fistula- an abnormal connection that develops between the epithelial lined surfaces of the gastrointestinal tract and skin; as a result, gastrointestinal contents leak through the skin.

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# AETIOLOGY AND OUTCOMES OF OPERATIVELY MANAGED ACUTE ABDOMEN IN ADULTS, AT MOI TEACHING AND REFERRAL HOSPITAL.

## ABSTRACT

**Background**: Acute abdomen is responsible for up to 50% of surgical emergencies. Its aetiological patterns are thought to be changing in Africa. Despite its frequent occurrence, the aetiology and outcomes of operatively managed acute abdomen, in adults, is yet to be described at Moi Teaching and Referral Hospital (MTRH). This description of will be informative to clinical practitioners and improve care of patients

**Objective:** To determine the aetiology and outcomes of operatively managed acute abdominal conditions, in adults at Moi Teaching and Referral Hospital MTRH.

**Methods***:* A prospective descriptive study was carried out in the general surgical and gynaecology wards. Fischer's statistical formula was used to determine sample size, and consecutive sampling was done until the sample size was achieved. A sample of 203 adult patients, 18 years and older, operated on for an acute abdomen between 29th March 2018 to 29th March 2019, were studied. Patients with abdominal trauma causing acute abdomen were excluded. A data sheet was used to record the aetiology and outcomes (early complications, mortality and duration of stay). Descriptive statistical analysis such as frequencies and percentages were used for categorical variables. Measures of central tendency such as mean and interquartile ranges were used for continuous variables. Univariate analysis was used to assess association between the outcome and the aetiology.

**Results**: 203 patients with a median age of 29 years (IQR 23, 35.5) were studied. One hundred and twenty-one (59.6%) were female and eighty-two (40.4%) were male. The most common causes of operative acute abdomen included: ectopic pregnancy 72(35.5%), intestinal obstruction 46(22.7%) and appendicitis 37(18. 7%). Three (1.5%) patients died. Postoperative complication rate was 20.7%. Wound dehiscence (8.4%), surgical site infection (7.9%), pneumonia (3.4%), then sepsis (2.5%) were the most encountered complications. A majority of patients 124(63.5%) were discharged within a week of admission. Aetiology was found to be associated with likelihood of developing wound dehiscence (p 0.003) and surgical site infection (p 0.004) post-operatively.

**Conclusion**: Ectopic pregnancy is the most frequently encountered cause of operative acute abdomen at MTRH. It is followed by intestinal obstruction, appendicitis, then bowel perforations in that order. Wound complications, pneumonia then sepsis are the commonly encountered complications.

**Recommendation:** A 5-10 yearly review of acute abdominal aetiology should be carried out at MTRH to allow us to monitor for any future changes. Studies should be carried out on perioperative factors affecting wound dehiscence with the aim of reducing its occurrence.

# CHAPTER ONE

## 1.0 Introduction and Background

### 1.1 Introduction

Acute abdomen is defined as a spectrum of surgical, medical, and gynaecological conditions that require hospital admission, investigations, and treatment (Garden, 2012). It presents with abdominal pain and tenderness. It's clinical course can ranges from minutes to weeks (Koshy Zachariah, Fenn, Jacob, Alias Arthungal, & Anna Zachariah, 2019). The wide spectrum of associated conditions poses formidable diagnostic and therapeutic challenges.

### 1.2 Background

Acute abdomen is common accounting for on average 50% of all general surgical emergencies. Studies carried out across multiple accident and emergency units in the United Kingdom found it accounted for 50 % of all general surgical emergency admissions (Paterson-Brown, 2009). A look at the non-traumatic acute abdomen in Saudi Arabian facilities found that it represented 54% of general surgical admissions (Abdulmohsen, 2006).

Studies on the clinical spectrum of the acute abdomen show geographical disparities. There is thought to be a change in the frequency of its causative conditions, over time. This is often subtly observed in clinical practice but sparsely documented, especially by surgeons practicing in low and middle-income countries (LMICs) (Rose et al., 2015). An example of this change in epidemiological pattern is best highlighted by Trowell,1959 and Ajao,1981. Trowell, a physician at Mullago Hospital, compiled a variety of studies from across the African continent highlighting the prevalence of operatively managed acute abdominal conditions. He noted that by 1952, appendicitis accounted for 3/4ths of acute abdominal surgeries in Europeans while it was rare in

studies from Africa. A study by Joly and Thomas in 1954 observed that in Ibabdan Nigeria, intestinal obstruction accounted for 85.9% of acute abdominal surgeries while appendicitis was only responsible for 14.1% (H.C., 1959). Two decades later in 1981, Ajao at a facility in Ibadan observed that acute appendicitis (40.3%) had surpassed intestinal obstruction (34.2%) as the most common cause of operatively managed acute abdomen (Ajao, 1981). This observation as per Ajao constituted a clear change overtime in the aetiological causes of the operative acute abdomen. He believed that this change was likely occurring in other areas and was yet to be documented. He thus concluded that as surgeons in Africa we were at a unique point in being able to document these changes and possibly reveal the factors resulting in them. These sentiments are echoed by medical researchers who recommend gaining knowledge of the most common causes of acute abdominal conditions. Familiarity with the special circumstances that make particular causes more likely than others will allow health workers to play the odds (Nega, 2009). As the profile of acute abdomen is changing, it is important to document it from time to time in order to update the information in this area (Zahid, Raza, Mohan, Agrawal, & Kumar, 2018).

An example of Loco regional differences in the causes of operatively managed acute abdomen is best highlighted by studies from Ethiopia that have been conducted in facilities across different regions. Bizuaheyu at Goba Referral Hospital, 446 km from Addis Ababa in the South Eastern part of Ethiopia, observed that acute appendicitis (49.2%), then intestinal obstruction (39.1%) and perforated peptic ulcer disease(5.7%) were the most commonly encountered aetiologies (Tassew et al., 2017). This differs from what was observed by Mequanint at Wolaita Sodo Teaching and referral hospital in the South Central part of Ethiopia, 396 km from Addis Ababa; where intestinal obstruction (49.3%), then acute appendicitis (26.9%) and peroration peritonitis

(25.0%) were the most commonly encountered cases (Negash, 2017). Nega at a rural primary hospital in Butajira, Central Ethiopia, 138 km from Addis Ababa, also observed that intestinal obstruction (34.9%) followed by acute appendicitis (24.5%) were the most commonly encountered causes (Nega, 2009). Each author recognized that regional aetiological differences may exist and studies across different facilities on the African continent should be carried out to better highlight this.

Over the course of the last century, it has been reported that in western nations and increasingly in Africa, appendicitis is the leading cause of acute abdomen (Stewart et al., 2014). Adhesions now exceed incarcerated/obstructed hernias as the leading cause of bowel obstruction (Attard & Maclean, 2007; Drozdz & Budzyński, 2012). Complicated peptic ulcer disease, and colorectal malignancies, are on the rise across the globe even among populations in which they were once thought to be infrequent (Archampong et al., 2019; Yusuf, Iqbal, Sarfraz, Sohail, & Imran, 2014).

Stewart in his meta-analysis of studies between 1990-2010 noted that globally, by volume, 70% of deaths from diseases requiring emergency surgery occur in LMICs. Despite this, the burden of surgical emergencies is insufficiently described though the bare estimates indicate a tremendous health burden. This data is especially important for surgical and public health planning in LMICs (Stewart et al., 2014)..

With the increasing emphasis on universal health care, global health bodies have been paying more attention to accessible surgical care, tailored toward community needs. This is due to the fact that emergent surgical conditions cause significant morbidity and mortality in LMICs. To this end, vehicles such as the Global Initiative for Emergency and Essential Surgical Care as well as the Lancet Commission on Global Surgery have been set up. They aim to determine the global burden of surgical

conditions ( clinical spectrum, regional differences, morbidity, mortality, and cost) and influence policy to make surgical care accessible to all (Bergström, McPake, Pereira, & Dovlo, 2015). Emphasis is being laid on addressing crucial gaps in knowledge, policy, and action. Reducing morbidity and mortality from surgical disease, especially from the acute abdomen will require better knowledge of their epidemiology (Dare et al., 2015; Rose et al., 2017). A paucity of data is noted especially in LMICs, on the pattern of disease categories encountered (Meara et al., 2015; Weiser et al., 2008).

As the spectrum of conditions causing acute abdomen is very wide, there is no substitute for general knowledge on its loco-regional pattern (Nega, 2009). Demonstrable needs should primarily dictate decisions regarding the provision of surgical care and training. Hospital based data helps identify these problems. Blanchard, in 1987 while looking at the epidemiology and spectrum of surgical care in district hospitals in Pakistan, noted that undergraduate medical education should concentrate on producing doctors who understand surgical conditions they'll have to manage within community hospitals and data on the various conditions is imperative. This data is important for policy formulation, surgical training and resource allocation (Blanchard, Blanchard, Toussignant, Ahmed, & Smythe, 1987).

The last comparable study in our Kenyan set up looking into operatively managed acute abdominal conditions and their outcomes was conducted at the Kenyatta National Hospital (KNH) over 18 years ago (Awori M.N, 2002), and before that, at the same facility, 30 years ago (Ngugi, 1991). There is a real need to fill the knowledge gap on region/facility-specific patterns, of operatively managed acute abdomen, with more recent data.

Assumption of awareness in our practice, has led to neglect in describing the broader local disease incidence. Many studies none the less have, and are being done on varied individual causes of acute abdomen. Conducting this study was to raise our awareness of our local epidemiological pattern. This description of will inform clinical practitioners and improve care of patients. This will also allow us to disprove assumptions, compare our findings with other institutions and open an avenue for further in-depth research.

### 1.3 Problem Statement

The epidemiology of acute abdominal surgical emergencies in adults, in Africa, is thought to be changing. Regional differences are thought to be present, as well as changes in dominant aetiologies overtime. A paucity of data on this is observed from a number of low and middle-income countries, though subtly observed in clinical practice. A lack of information regarding the local disease incidence means that both our management and teaching skills are yet to be tailored towards the community's needs. The broad clinical range on operatively managed surgical acute abdominal conditions in adults, and their outcomes, are yet to be described at Moi Teaching and Referral Hospital (MTRH).

### 1.4 Justification/rationale

Acute abdominal emergencies are commonly handled at MTRH, Eldoret. They appear directly (non-referrals) or as referrals, with varied pathology requiring urgent management. No study has been conducted at Moi Teaching and Referral Hospital (MTRH), on the pattern of operatively managed acute abdominal disease in adult patients. This is despite studies being present on individual conditions, and on the patterns of surgical acute abdomen in paediatric patients (Harunani, Imbaya, & Kuremu, 2016). This means we have not identified some of our areas of need, and as

researchers are not fully contributing to the global discourse on this matter. This makes this study imperative in our set up.

### 1.5 Research question

What is the aetiology, and outcome of operatively managed acute abdomen in adult patients at MTRH?

### 1.6 Objectives

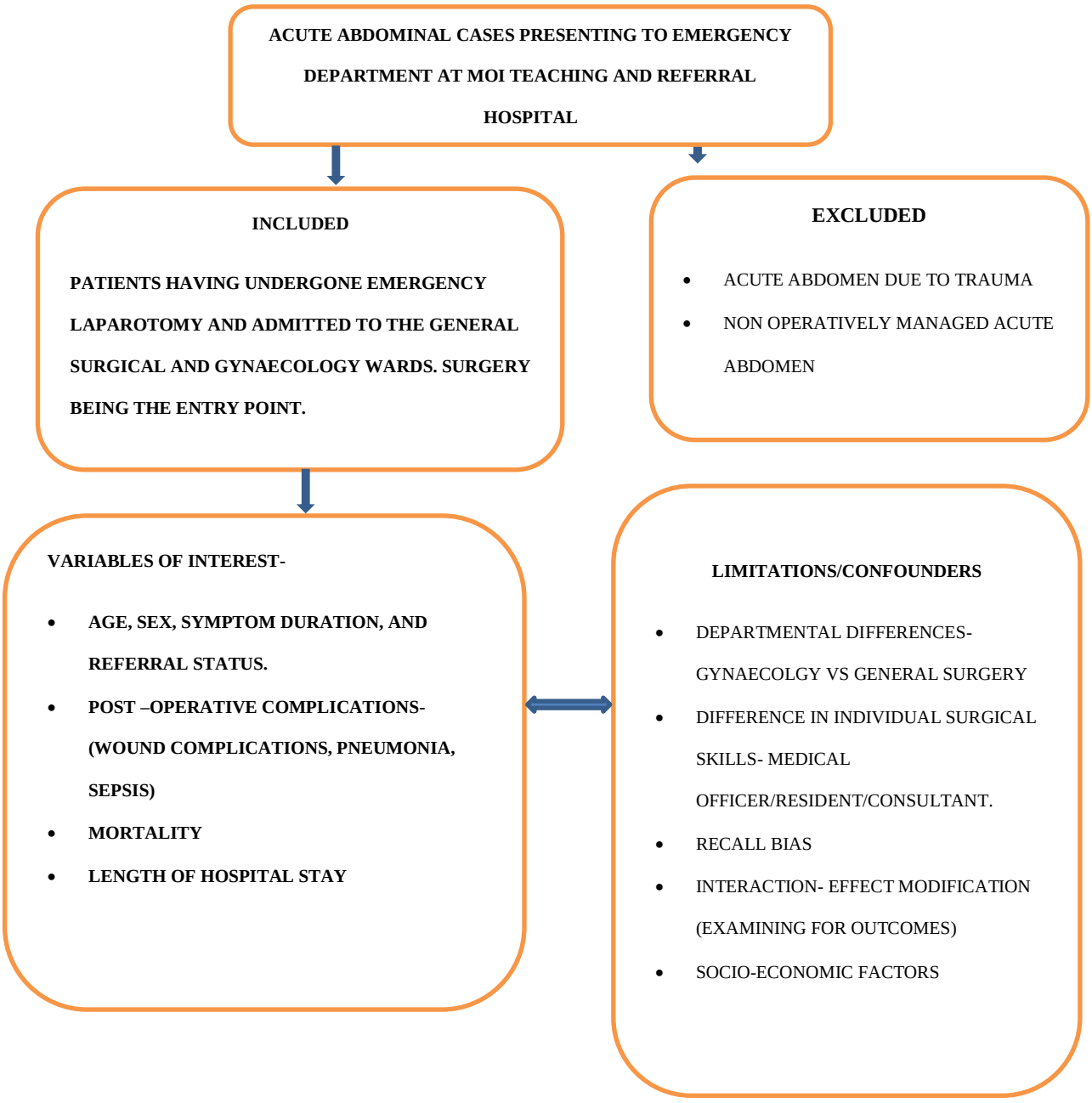
#### 1.6.1 Broad objectives

- To establish the aetiology and outcomes of operatively managed acute abdomen in adults, at MTRH.

#### 1.6.2 Specific objectives

1. To describe the aetiology of operatively managed acute abdomen in adults, at MTRH.
2. To describe the outcome of operatively managed acute abdomen in adults, at MTRH.
3. To determine the association between aetiology and likelihood of the observed post-operative outcome.

## 1.7 Conceptual framework



# CHAPTER TWO

## 2.0 LITERATURE REVIEW

### 2.1 Introduction

This review entailed a look into the background of operatively managed acute abdomen, it's pathogenesis and a broad summary on its clinical diagnosis. It employed both chronological and thematic descriptions from prior published research. Studies reviewed were broadly divided into those published in the 20th and 21st century, to highlight changing epidemiological trends. A look into the commonly encountered postoperative complications and mortality then followed. A case is made for the necessity of this study, highlighting the global economic burden, and the call to study the pattern of operatively managed acute abdomen.

### 2.2 Pathogenesis

Acute abdomen may arise from many aetiological factors and can be classified in various ways. The causes of acute abdomen may be divided into five large categories (Inflammatory, Mechanical, Neoplastic, Vascular, and Congenital) (The Acute Abdomen MODULE 2 - Diseases and Malfunctions, 2017):

Inflammatory: Acute inflammation of intra- abdominal organs or the peritoneum may occur as a result of irritants, broadly classified as infective or non-infective (Garden, 2012).The pathological process is the same no matter the trigger (reactive hyperaemia of affected tissue, fluid exudation into tissues from capillary dilatation, and finally leucocyte migration into the inflamed tissues). The clinical consequence depends on many factors, most importantly, the patient's age, the underlying condition, its severity and duration, the organ involved, and comorbidity. Examples of inflammatory causes include acute appendicitis, diverticulitis, pelvic inflammatory diseases and peptic ulcer disease.

Mechanical: Obstruction refers to impedance of the normal flow of material through a hollow viscus (Garden, 2012). It may be due to abnormality of the viscus wall, lesions within the viscus's lumen or outside the viscus causing extrinsic compression. Smooth muscles in the viscus wall reflexively contract to overcome the obstruction causing colicky abdominal pain. Failure to overcome the obstruction leads to increased intraluminal pressure, proximal dilatation and compromised blood supply to the viscus. End outcomes vary with anatomical location, whether the obstruction is partial or complete and whether blood supply to the organ is compromised. Obstructive causes include post-operative adhesions, incarcerated hernias, intussusception, volvulus, congenital atresia, gut stenosis and colonic carcinomas resulting in acute abdomen.

Vascular: Blood supply is cut off leading to tissue ischaemia and tissue necrosis. Infarction leads to ischaemic coagulative necrosis prompting an inflammatory reaction to develop along the margins of an infarct due to presence of necrotic tissue. Infarctions can be due to arterial occlusion (embolism, thrombosis, extrinsic compression), venous occlusion, non-occlusive causes (shock- hypovolaemic, cardiogenic, septic) or from vasoconstrictor drug administration.

Congenital: Defects such as duodenal atresia, diaphragmatic hernias and mal rotation of the gut can lead to acute abdomen.

## 2.3 Clinical Evaluation

It is important to emphasize that despite the fact that “acute abdominal pain” is often used synonymously with “acute abdomen”, they are different terms (Grundmann RT, 2010). Acute abdomen is time sensitive and often leads to emergency surgery. Acute abdominal pain on the other hand refers to a broader nociceptive response from both benign processes and emergent acute abdominal aetiology.

A complete history of the patient’s condition is important and should be obtained as soon as possible. It should include a complete description of the patient’s pain and associated symptoms. Surgical, medical and social history should be sought. Considering multiple diagnoses is encouraged especially with life threatening conditions that require timely intervention to limit morbidity and mortality. Assessment of pain is considered in terms of location, character (visceral versus somatic pain), onset (acute versus gradual), intensity (severe versus mild on the pain scale), and patterns of radiation and pain referral. Duration and progression of pain are considered, with persistent pain being troubling while improving or lessening pain being favourable. Exercabations and relieving factors should be considered. Factors that obscure the presentation of pain may delay or prevent correct diagnosis with eventual adverse patient outcomes (Malacuso, 2012). Enquiries about previous episodes are made as recurrent episodes generally point to a medical cause, with the exceptions of mesenteric ischemia (intestinal angina), gallstones, or partial bowel obstruction. Life-threatening causes should always be ruled out before focusing on less serious diagnoses. In seriously ill patients with severe abdominal pain, the most important diagnostic measure may be expeditious surgical exploration.

Assessment of associated symptoms should be placed in the clinical context, including the patient's age and the current point in the course of the illness. Anorexia may be reported. Vomiting may occur in almost any abdominal disease with pain generally preceding it in surgical conditions. It is usually present in small bowel obstruction unless the presentation is early in its course or the obstruction is partial. Other serious pathologies like large bowel obstruction may not present with vomiting except in their later stages. Contents and character (bilious, blood streaked, coffee ground or feculent) of the vomitus should be noted. Bowel symptoms such as diarrhoea may occur. It is common with mesenteric ischaemia and is frequently reported in conditions such as appendicitis (Wagner, 1996). Diarrhoea can also present itself in some patients with colonic obstruction or early in small bowel obstruction as reflexively hyperactive bowel distal to the obstruction point. Bloody stool with significant abdominal pain should raise a flag for ischaemia causing mucosal compromise. Absence of flatus is more reliable than constipation in bowel obstruction as bowel clears gas more rapidly than fluid. Dysuria or pyuria may occur when any inflammatory process happens close to the genitourinary tract (this includes appendicitis, cholecystitis, pancreatitis, or any inflammatory process involving bowel)

Physical examination of the patient is important. The general appearance is noted. An "anxious, ill looking" patient with acute abdomen is of serious concern, but clinicians must take care not ignore a calm or "well looking" patient who might still have serious underlying pathology. Vital signs are necessary and alert the clinician to the state of the patient and need for resuscitative measures.

An abdominal examination is a key element in diagnosing an acute abdomen. It is important to understand the limitation of these techniques as they may yield false negatives and false positive results. Inspection, auscultation and percussion are performed. Palpation is done to primarily localize tenderness, identify peritonitis (guarding, rebound tenderness) and detection of organ enlargements. It normally progresses from non-painful areas to more painful ones. Traditional rebound testing is performed by gentle depression of the abdominal wall for approximately 15–30 seconds with sudden release. The patient is asked whether the pain was greater with downward pressure or with release (Malacuso, 2012). Guarding is defined as increased abdominal wall muscular tone and is only of significance as an involuntary reflex when it reflects a physiological attempt to minimize movement of the intra peritoneal structures. True guarding is identified by gently assessing muscle tone through the respiratory cycle, preferably with the knees and hips flexed to further relax the abdomen. In true guarding, the examiner will be able to detect continued abdominal wall tension throughout the respiratory cycle while with "voluntary guarding," the tone decreases with inspiration.

Rectal and pelvic examinations are of value in assessment of acute abdomen but this may be limited (Malacuso, 2012). A rectal examination may be of use in detecting intestinal ischemia, late intussusception, or colon cancer. The exam's usefulness is likely to increase with the patient's age (the elderly). Its use in other age groups should be targeted to diagnoses in which it may yield important information. A pelvic examination presents an opportunity to assess the pelvic peritoneum directly for signs of inflammation, through the assessment of cervical motion tenderness. The groin and femoral triangle are assessed for hernias. Male patients must be inspected for testicular pathology including torsion and infection.

An acute abdomen patient may be unstable at presentation and requires immediate attention. The usual sequence of resuscitation is applied by securing the airway, concurrent treatment of hypotension and assessment for life threatening conditions requiring emergent surgical intervention. Older people, immune compromised patients, and pregnant women and children need extra attention when dealing with acute abdomen due to their propensity for atypical presentation, co morbidities, compromised immune systems, sensitivity to medication and sometimes impaired ability to mount characteristic physiological response.

Standard tests such as complete blood counts, arterial blood gases, blood chemistry and urinalysis are carried out. Abnormal results are often not specific to a single cause.

Imaging modalities such as Computed Tomography (CT) are frequently used in evaluation of the patient with abdominal pain. Plain abdominal radiographs are helpful in evaluating acute abdomen however their limitations must be appreciated (Maull, 1984).

Preoperative diagnosis of acute abdomen with limited facilities is very crucial to minimize morbidity and mortality in the developing countries (Rk & Ml, 2005). Clinical acumen plays a key role in diagnosis and management of acute abdomen. There is always a need to improve diagnostic acumen and decision making. The axiom of “treat the patient, not the test” applies in the patient with acute abdominal pain. If the history and physical examination show a high pre-test likelihood of a disease, a negative test cannot exclude the diagnosis. Definitive management will depend on the cause of acute abdomen.

## 2.4 Definition

Acute abdomen is a term used to encompass a spectrum of surgical, medical and gynaecological conditions ranging from trivial to life-threatening conditions, which require hospital admission, investigation, and treatment (Garden, 2012). It typically presents with abdominal pain. Often the terms acute abdomen and acute abdominal pain are used synonymously, however, they are different. Acute abdomen encompasses a spectrum of conditions that often lead to emergency surgery. Acute abdominal pain, on the other hand, refers to a broader nociceptive response from both benign processes and emergent abdominal aetiology (Grundmann RT, 2010).

Studies conducted on operatively managed acute abdomen are hospital based, descriptive, cross sectional studies in both retrospective (Kotiso & Abdurahman, 2007), (Gebre, n.d.), prospective (Ajao, 1981; Agboola et al., 2014), or mixed (Ngugi,1991) manner.

The definition of acute abdomen used in studies is not standardized. It is agreed in every definition that it is of sudden nature, abdominal pain is a key symptom, and it may require surgical intervention. No clear temporal aspect to the definition is noted. Traumatic causes of acute abdomen are included in some studies (Agboola, Olatoke, & Rahman, 2014), while others exclude it, even going further to qualify their scope of study as ‘non- traumatic acute abdomen’ (Ayenew, Gizaw, Workneh, & Fentahun, 2017; Gebre, 2016; Negash, 2017). Gebre defined acute abdomen in his study as any serious intra-abdominal condition (such as appendicitis) attended by pain, tenderness, and muscular rigidity, and for which emergency surgery may be considered. He excluded trauma and obstetric and gynaecological causes from his study. Agboola in his study which included trauma as an acute abdomen cause, defined acute abdomen

as an abnormal condition characterized by sudden onset of severe pain within the abdominal cavity which requires immediate evaluation, diagnosis and may require surgical intervention (Agboola, Olatoke, & Rahman, 2014). Acute abdomen is simply defined as a sudden onset abdominal disease condition which often requires an immediate surgical intervention by Kotiso in his study (Kotiso & Abdurahman, 2007). His study included operative and non-operative cases, and also patients with protracted illness with acute exercabations realizing the acute on chronic process of their condition.

Gynaecological causes are looked at with the broader entity in very few studies, despite being a major contributor to the surgical acute abdomen (Awori & Jani, 2005; Doumi El Bushra Ahmed, 2018; Nega, 2009). No reason was given for exclusion of gynaecological conditions in the studies it was missing from. Exclusion of gynaecological causes from the studies paints an incomplete picture of the operatively managed acute abdomen. An absence of uniformly used methods to monitor surgical conditions or delivery of care results in a gap in reliable data. This hinders knowledge on the burden of these conditions and the ability to monitor change, track interventions or build robust advocacy and funding platforms (Meara et al., 2015). This study thus included gynaecological conditions to paint a more complete picture on all acute abdominal conditions resulting in an emergency laparotomy.

For the purpose of this study, the acute abdomen is defined as a spectrum of abdominal conditions excluding trauma, requiring operative management(laparotomy) to resolve them.

**2.5 Operatively managed acute abdomen in the 20th century- 1900's to 2000.**

A marked difference was present in the socio-cultural aspects and health capabilities of different areas of the globe at the beginning of this century. The west was well into the industrial age while Africa was in the grip of colonial control with the westernization of our health systems in its infancy. Thus, when data on acute abdominal aetiological spectrums and outcomes already existed in Europe and the United States of America, barely any data was present on this issue in Africa. This may be due to the fact that at that time in Africa, resources were being channelled towards the setup of a standardized health system. Large swaths of the population lacked access to basic health care. Large health care centres mostly relied on foreign specialists and medical training in Africa was in it's infancy. Through the collaborative effort of health care workers and improvement in our health systems, studies began emerging notably in the 1940s and 1950s (H.C., 1959).

The pattern of acute abdomen in Africans in tropical counties was observed to differ greatly from that of Europe and America. Europe and America, then considered advanced groups, largely had inflammatory conditions especially appendicitis which accounted for three-fourths of emergency laparotomies. In Africans, considered a less advanced group at the time, obstructive disease groups such as external hernias, volvulus, and intussusception in adults formed nine-tenths of cases. Colonic carcinomas were exceedingly rare among Africans and peptic ulcer disease was more common in Europeans (H.C., 1959).

Appendicitis at the time was very low among Africans as indicated by findings in general practice. An increase in its occurrence was noted with the emergence of towns. No data existed to support this but infrequency was inferred from autopsies performed in Nairobi and Lagos. A rise in incidence was reported in surgeries done in

large towns at the time which included Ibadan (Nigeria), Brazzaville (Congo) and Rhodesia (South Africa). It was postulated at the time that an increasingly European diet consisting of bread, rice and potatoes was leading to this increase. These foods were thought to encourage pathogenic organisms in the caecum and studies on the influence of these foods were advised. The approximately equal incidence of appendicitis in black and white Americans further served to strengthen this theory(H.C., 1959).

Obstructive disease groups were observed to be predominant in most areas of Africa. Strangulated hernias were the chief cause of obstruction and incidence was suggested to vary among ethnic groups. Volvulus was the 2nd most encountered cause of intestinal obstruction. Vick in 1932 observed that in one year more cases were encountered in 2 facilities in Kisumu and Nairobi, Kenya than seen in 21 teaching hospitals in Britain within the same period. Intussusception in adults was a rare condition to find outside Africa(H.C., 1959). In Ibadan, it was observed to be so frequent as to almost equal the incidence of infantile intussusception. Adhesions and bands were reported to be infrequent in both Africans and Europeans at the time. The fact that that colonic carcinoma was exceedingly rare among Africans struck the European practitioners at the time as it was on the rise in Europe and America(H.C., 1959).

Typhoid perforation rather than perforated peptic ulcer disease was the most common cause of perforation peritonitis. Diverticulitis in Africans was practically unheard of at that time. Gynaecological conditions and trauma were considered major causes of abdominal emergencies in the African setup(H.C., 1959).

Perforated peptic ulcers occur as a complication of peptic ulcer disease. Though initially thought to be uncommon in Africans (H.C., 1959), perforated peptic ulcer disease ( PPUD) was observed to be on the rise across the continent. This was revealed in a study in 1975 on the geographical distribution of peptic ulcer disease (Tovey & Tunstall, 1975). A 58 bed, one- doctor hospital at Matana in Burundi, reported 780 operations for peptic ulcers were done in 10 years (79% of all major surgery). A rise of peptic ulcer disease in increasingly urbanized areas was attributed to increased alcohol consumption, an increase in refined carbohydrate consumption, smoking and the use of spices. In Kenya, a rise was reported among the populace of Nairobi and Mombasa. The disease was reported at the time to be rare among the Pokot and Maasai, rural, nomadic, Kenyan tribes (Tovey & Tunstall, 1975).

A study by Ajao years later in Ibadan reported that the epidemiology of acute abdomen was changing. Acute appendicitis had superseded intestinal obstruction as the leading cause of operatively managed acute abdomen. Intestinal obstruction was still majorly as a result of strangulated hernias and intussusceptions. Adhesions and colorectal carcinomas as causes of obstruction had begun to equal and even exceed the number of cases due to volvulus. Perforated peptic ulcers and gall bladder disease were still rarely encountered in clinical practice at the time. He postulated that these epidemiological changes were likely due to urbanization and dietary changes but further study needed to be done to link this (Ajao, 1981).

Ten years later a study at Kenyatta national hospital, in Nairobi, Kenya, observed a change in our prior described disease pattern. Appendicitis (32.3%), intestinal obstruction (28.3%), then perforated peptic ulcer disease (6.6%), in that order, were the commonly encountered causes of operatively managed acute abdomen. Adhesions

were observed to have increased as a cause of intestinal obstruction, while strangulated hernias decreased. The incidence of colorectal tumours was observed to be low (Ngugi, 1991). It is important to note that over the course of this period, male predominance was observed in patients presenting with acute abdomen requiring surgery.

These studies indicate a probable change in epidemiology of operatively managed acute abdomen over time. Over the course of the 20$^{th}$ century, appendicitis became the most common cause of acute abdomen in Africans studied. Intestinal obstruction due to hernias was on a steady decline with adhesions on the rise. PPUD and colorectal carcinomas were also observed to be on the rise in populations where they were thought to be a rare occurrence. The paucity of studies on the operative acute abdomen from many regions/facilities across the continent was observed at the time. This made generalizing these changes to all Africans difficult. It is also important to note that these studies were conducted in urban centres, largely believed to be contributing to these epidemiological changes.

The paucity of these studies may also have been due to practitioners' assumption of awareness on their disease patterns. The needs of many communities especially in low and middle-income countries were largely unknown and training was often biased towards what professors of surgery found interesting or challenging (Blanchard et al., 1987). A need to generate hospital-based data as an approximation of community needs was advocated for in these studies. The data on epidemiological and spectrums of surgical disease would be essential for resource allocation and curriculum design.

**2.6 Operatively managed acute abdomen in the 21st century- 2001 to present.**

This century has seen an upsurge in studies on acute abdomen in adults. Surgery is increasingly being seen as an essential component of health systems and a key means to achieve universal health coverage (Meara et al., 2015). The biggest contributors to the knowledge on epidemiological trends are from West Africa (Nigeria, Ghana) and Ethiopia. Kenya still falls behind in this area with data only emerging from Kenyatta national hospital; the last comparable study having been conducted 18 years ago in 2002 (Awori MN, 2005). The predominant causes of acute abdominal conditions requiring surgical management are appendicitis, intestinal obstruction, and various other aetiologies (including peptic ulcer disease, bowel perforations, and gynaecological conditions) thought to occur in lower frequency. Findings from the studies over the course of these last 20 years were reviewed in these broad categories.

**2.7 Acute appendicitis**

This is the most common cause of operatively managed acute abdomen in a majority of the reviewed studies emerging from the African continent. Agboola conducted a prospective study at a Nigerian Teaching Hospital on 267 patients, a majority of whom were male (71.4%). He observed acute appendicitis (30.3%), followed by intestinal obstruction (27.9%), then typhoid perforation (14.9%) and perforated peptic ulcer disease (7.6%) were the most commonly encountered aetiologies (Agboola, Olatoke, & Rahman, 2014). Hanks study at Tikur Anbessa Specialized Hospital in Ethiopia found appendicitis was the predominant aetiology at 28.0%, followed by intestinal obstruction (17%)(Hanks, Lin C.P., Tefera G., 2014). Ohene at the Komfo Anokye Teaching hospital in Kumasi, Ghana, found appendicitis (22.4%), typhoid perforation (16.2%) and intestinal obstruction (12.6%) were the most encountered aetiologies (Ohene-Yeboah, 2006). Bizuayehu at Goba Referral Hosptal found

appendicitis (49.2%), intestinal obstruction( 39.1%) and perforated peptic ulcer disease (5.7%) were the most commonly encountered aetiologies (Tassew et al., 2017). Ayenew at Nekemte Referral Hospital in Ethiopia found that appendicitis (47.4%), then bowel obstruction (40.0%), and peritonitis from other causes (12.2%) were the most commonly encountered aetiology. Acute appendicitis (52.8%), then appendiceal abscess (27.1%) and perforated appendicitis (20.0%) were the most common pathology encountered intraoperatively for appendicitis cases (Ayenew, Gizaw, Workneh, & Fentahun, 2017).

This pattern of acute appendicitis as the predominant operatively managed acute abdominal cause is reflected in majority of the reviewed literature. This reflects a clear epidemiological change across the continent from half a century ago. Acutely inflamed appendices, perforated appendicitis, and appendiceal abscesses are encountered intraoperatively (Edino, Mohammed, Ochicha, & Anumah, 2004). The high incidence of appendicitis is still thought to be due to urbanization and dietary changes but no study could be found linking this. It is postulated that urban populations consume lower fibre diets than rural communities, and this may be predisposing them to appendicitis (Hanks, Lin C.P., Tefera G., 2014).

### 2.8 Intestinal obstruction

This is the second most commonly encountered cause of operatively managed acute abdomen in the majority of the studies across the continent. It is important to note that some studies that claim a large rural catchment found it occurred more frequently than appendicitis (Nega, 2009; Negash, 2017). Mequanint at the Wolaita Sodo Teaching and referral Hospital in Ethiopia found that intestinal obstruction (49.3%), then appendicitis (26.9%) and perforation peritonitis (25.0%) were the most common cause

of operatively managed acute abdomen. The intestinal obstruction cases were largely due to volvulus, intussusception, and adhesions (Negash, 2017). Berhanu, at a Primary Rural Hospital in Butajira, Ethiopia found that intestinal obstruction (34.9%), appendicitis (24.5%), and intusucception (16.1%) then bowel perforation (11.2%) were the most common aetiologies. Intestinal obstruction was largely due to volvulus, hernia and adhesions (Nega, 2009).

Loco-regional differences are well highlighted in studies conducted across varied regions of Ethiopia. Appendicitis (Ayenew et al., 2017; Gebre, 2016; Tassew et al., 2017) or intestinal obstruction (Nega, 2009; Negash, 2017) were observed as the leading aetiology in different facilities across different regions. No studies have been conducted to determine why this difference is observed but urbanization, access to surgical services, and dietary change is believed to be behind this. Multiple studies from Ethiopia, Kenya, and Nigeria show that compared to 50 years ago intestinal obstruction is no longer the most encountered cause of the surgical acute abdomen (Agboola et al., 2014; Nwashilli, Okobia, Osime, & Agbugui, 2017 (Awori MN, 2005)).

Small bowel obstruction is still observed to occur more frequently than large bowel obstruction. Adhesions rather than incarcerated/obstructed hernias are now the leading cause of intestinal obstruction in many studies emanating from the African continent (Kotiso & Abdurahman, 2007; Nwashilli et al., 2017; Ooko, Sirera, Saruni, Topazian, & White, 2015; Tekalign Admasu, Tilahun Beyene, & Shemsu Nuriye, 2019). A study at MTRH, in 2004 also observed adhesions to be the leading intestinal obstruction cause with many(>60%) of the patients having had prior abdominal or pelvic surgery (Kuremu & Jumbi, 2006). Primary small bowel volvulus and adult

intussusceptions are noted to be dominant aetiologies some studies emanating from Ethiopia (Ayenew et al., 2017; Negash, 2017) but are observed to be on the decline in studies from other regions of the continent (Nigeria and Ghana) with few cases reported as compared to decades prior (Kotiso & Abdurahman, 2007; Nwashilli et al., 2017; Ohene-Yeboah, 2006).

Large bowel obstructions are a result of sigmoid volvulus, in the majority of reviewed studies arising from the African setup. This shows that over the past century this observation has not changed for the African populace. Bahaty (Bahaty, 2013) and Ooko (Ooko et al., 2015) observed that sigmoid volvulus was the leading cause of intestinal obstruction at their facilities of Kisii level 5 (30%) and Tenwek Mission Hospital (25.6%), in Kenya. Colorectal carcinoma though reported in every study as a cause of large bowel obstruction still occurs in relatively low frequency. Awori (3.0%), Agboola (6.5%) and Nnamdi (4.8%) all observed this low frequency in their studies (Agboola et al., 2014; Awori & Jani, 2005; Nwashilli et al., 2017). These findings differ from those emanating from Europe where a Polish study found large bowel obstructions are mostly due to colonic carcinomas (80.4%) (Drozdz & Budzyński, 2012). Sigmoid volvulus accounts for only 2-5% of colonic obstructions in western countries (Selvaraj & Palaniswamy, 2010).

### 2.9 Other causes of operative acute abdomen

Recent studies into perforation peptic ulcer disease show heterogeneity with male predominance over female, and duodenal ulcers occurring more than gastric. No clear geographical patterns are discernible and it is believed that the increase in incidence across the continent results from; improved health-seeking behaviour, improved diagnostic services, urbanization and diet change (Archampong et al., 2019). The

incidence of perforated peptic ulcer disease in the reviewed studies from Africa ranged from 5-11% of operatively managed acute abdomen (Ohene-Yeboah, 2006; Tassew et al., 2017). The increased incidence in these more recent studies proves an epidemiological change over the course of the past century, with perforations from peptic ulcers increasingly causing acute abdomen.

Typhoid perforations are considered an important cause of operatively managed acute abdomen in tropical Africa and Asian countries. A falling trend in typhoid intestinal perforations is evident in studies emanating from developing countries. This is believed to be due to improved diagnosis and access to effective treatment. One study in India observed a 29.5% fall in typhoid perforations over a 30 year period (Mogasale et al., 2014). Despite the fall in perforations over this period, a study by Zahid found that intestinal perforation at 57% was the most common cause of operatively managed acute abdomen, followed by acute appendicitis (14.89%) and intestinal obstruction (9.34%) (Zahid, Raza, Mohan, Agrawal, & Kumar, 2018). A study by Rajiv at a tertiary care hospital in central India found that perforation peritonitis at 39.7% was the most common operatively managed acute abdominal aetiology, followed by acute appendicitis at 37.7% and intestinal obstruction at 14.2% (Jain & Gupta, 2016). Only one study by Nyundo in Rwanda at Kigali University Teaching Hospital found perforation peritonitis at 28.4% to be the leading cause of operatively managed acute abdomen (Nyundo M., Rugwizangoga E, Ntakiyiruta G., 2013).

The incidence of typhoid perforations in other studies emanating from Africa ranged from 2.2- 16.2% (Gebre, 2016; Ohene-Yeboah, 2006). Typhoid perforations are no longer the leading cause of perforation peritonitis in the majority of these studies thus

clearly demonstrating a change in its epidemiology in Africa. It is important to note that there is a stark paucity of data concerning typhoid perforation trends in our region as revealed by literature search (Mogasale et al., 2014).

Other causes of acute abdomen mentioned requiring operative management included primary peritonitis, Meckel's diverticulitis, gall bladder disease, and tuberculous peritonitis. Their incidences were, and are still exceedingly low in comparison to the other major causes encountered in the reviewed studies (Agboola et al., 2014; Ajao, 1981; Kotiso & Abdurahman, 2007; Nwashilli et al., 2017).

### 2.10 Gynaecological causes of operatively managed acute abdomen

Gynaecological causes of the operatively managed acute abdomen are frequently encountered in clinical practice. Up to 13% of women presenting to the general surgeon have a gynaecological problem. Around 10% of women diagnosed with appendicitis actually having a gynaecological issue (SARDAR, NAUSHEEN, ZAHID, & KHALID, 2009). Despite them being a significant acute abdomen cause, they are often examined separately from the broader entity. This is most likely as a result of sub-specialization with conditions being split between general surgery and gynaecology. The medical officer/surgeon working in a rural facility, will sometimes lack the luxury to choose which condition to attend to; as per where it falls in this categorization. Inclusion of gynaecological causes of the acute abdomen was only noted in a few of the studies on the operatively managed acute abdomen from the various facilities in Africa (Awori & Jani, 2005; Doumi El Bushra Ahmed, 2018; Nega, 2009). The most commonly encountered gynaecological conditions include ectopic pregnancy, ovarian cysts (functional/torsed), pelvic inflammatory disease and pelvic abscesses.

Ectopic pregnancy accounted for 5.6% of the operatively managed acute abdominal cases as observed by Berhanu at a primary rural hospital in Ethiopia (Nega, 2009). Awori, at the Kenyatta National Hospital casualty looking at the surgical implications of abdominal pain found that in women, ectopic pregnancy cases at 65.3% eclipsed appendicitis (16.3%) cases (Awori & Jani, 2005). Other gynaecological causes are exceedingly few in comparison to ectopic pregnancy. Ovarian cysts and pelvic inflammatory disease are sometimes incidental findings in women diagnosed with appendicitis. Gynaecological conditions are thought to account for the higher negative laparotomy rate in women as compared with men (SARDAR et al., 2009).

Ectopic pregnancy is observed to be increasing worldwide. In northern Europe, an incidence increase from 11.2 to 18.8 per 1000 pregnancies was observed between 1976 and 1993. In the United Kingdom ( UK), about 11000 cases occur per year (Tay, Moore, & Walker, 2000). A review of ectopic pregnancies in developing countries placed it between 0.5% to 2.3% of live births (Thonneau, Hijazi, Goyaux, Calvez, & Keita, 2002). The observed rise in ectopic pregnancy has been attributed to increased pelvic inflammatory disease and increased use of levonorgestrel only oral contraception. A study was done at MTRH, Eldoret, Kenya, and found an increase of up to nine times with emergency oral contraception use (Shurie, Were, Orang'o, & Keter, 2018). Data on ectopic pregnancy is observed to often be rare, and out of date in developing countries. Time trend studies on the incidence of ectopic pregnancy and how much it contributes to the burden of operatively managed acute abdomen in our region is at best sparse.

**2.11 The outcome of operatively managed acute abdomen.**

Postoperatively, patient care can be considered in 3 phases; immediately postoperatively in a recovery room, surgical ward care to discharge, and post-discharge rehabilitation and convalescence (Garden, 2012). The greatest emphasis on outcomes in this study shall be laid on those encountered in the second phase. This is because the surgeon interacts most frequently with the patient at this point following surgery. Outcomes encountered in this period include recovery with or without complications, leading to discharge, or mortality. The length of stay is also affected by this second phase of patient care, either lengthening or shortening the surgeon's interaction with his/her patient. Complications shall be broadly viewed as pulmonary, cardiac, urinary, cerebral, vascular/venous thromboembolism, wound complications and sepsis.

**2.12 Pulmonary complications**

This is noted to be the largest single cause of postoperative morbidity and 2nd most common cause of deaths in patients> 60 years of age (Garden, 2012). It is also observed to occur more commonly after emergency procedures. The main problems encountered following recovery from anaesthesia are pulmonary collapse and infection. Pulmonary collapse results from the inability to breathe deeply and cough up bronchial secretions after surgery. Pulmonary infections often follow the collapse or aspiration of gastric content. Patients may present with cough chest pain, absent or diminished breath sounds and crepitations. Patchy opacities are observed on a chest x-ray.

Preventative measures against collapse and subsequent infection entail, deep breathing, cough and early mobilization postoperatively, as well as adequate analgesic

administration. Treatment entails the use of antibiotics which should ideally be prescribed after sputum is sent for a bacteriological exam.

Post-operative pneumonia incidence ranges from 0.7-2.2% in studies reviewed originating from African facilities (Negash, 2017; Nyundo M., Rugwizangoga E, Ntakiyiruta G., 2013). A global look at its frequency places the incident between 0.5-28% of postoperative complications (Chughtai et al., 2017).

Risk factors for developing postoperative pneumonia include nasogastric tube use, blood transfusions, diabetes, smoking, poor lung function, bacterial presence in sputum, duration of mechanical ventilation, age >75 years, procedural duration >30 minutes and pre-operative hospitalization (Chughtai et al., 2017). Other pulmonary complications such as pleural effusion and pneumothorax occur infrequently, as evidenced by their lack of mention in the studies reviewed on the operatively managed acute abdomen.

**2.13 Cardiac complications**

Risks of cardiac complications are increased in patients suffering from cardiovascular disease. Myocardial ischemia/infarction, cardiac failure, arrhythmias, and cardiogenic shock are exceedingly rare in the reviewed studies from African facilities.

**2.14 Urinary complications**

The most frequently encountered include post-operative urinary retention and urinary tract infections. Retention results from a combination of post-operative pain, effects of anaesthesia and drugs plus difficulties initiating urination while sitting or lying in bed (Garden, 2012). Infections occur following contamination of the urinary tract on instrumentation. Treatment for retention involves catheterization, while giving antibiotics, adequate hydration, and proper bladder drainage to control infections.

Acute renal failure occurs when there is protracted hypo-perfusion of the kidneys. Early recognition and adequate post-operative fluid replacement prevent its progression to an irreversible state. Patients who develop post-operative renal failure reportedly have a mortality rate of 50% (Garden, 2012). Urinary complications are noticeably absent in the studies reviewed in the African setting. This is likely due to the under-reporting of these conditions.

**2.15Cerebral complications**

Cerebrovascular accidents may result from sudden hypotension in hypertensive, elderly patients with atherosclerosis. Neuropsychiatric disturbances occur frequently with delirium being experienced especially in the elderly. Delirium is worsened by the use of sedative or hypnotic drugs. Factors such as hypoxia, sepsis, sleep deprivation, and metabolic disturbances contribute to acute confusional states (Garden, 2012). Alcoholics upon withdrawal may experience delirium tremens presenting with agitation, confusion and sometimes hallucinations and hyperthermia. Cerebral complications are possibly under-reported as they incidences are few in the studies reviewed.

**2.16 Venous thromboembolism**

Venous stasis, increased blood coagulability and blood vessel damage predispose towards thrombi formation. Deep venous thrombosis (DVT) risk is increased with obesity, increasing age, prolonged surgery, malignant disease, previous DVT or pulmonary embolism, varicose veins, pregnancy and use of oral contraceptive pills. Prevention measures entail the use of compression leg stockings, encouraging ambulation and the use of low molecular weight heparin. DVTs may present with painful, tender, swollen calf but is often asymptomatic. Pulmonary embolism presents

with severe chest pain, pallor, and shock. Prompt cardiopulmonary resuscitation, CT pulmonary angiography and heparinization (Garden, 2012).

One study in Uganda observed a DVT prevalence of 5% following major abdominal surgery, citing cancer diagnosis and increased BMI as the two most important risks identified (Muleledhu et al., 2013). It is noticeably absent in the complications reported in the studies reviewed originating from African facilities. This is possibly due to low prevalence or under-reporting.

**2.17 Wound complications**

Infection is the most commonly encountered complication in surgery and often results from inoculation into the incision during surgery. Studies in the United states of America note it ranges from 3-5% for clean surgery to more than 20% for emergency colon surgery (Barie, 2012). Numerous factors influence its development and include both patient (age, nutritional status, comorbidities) and environmental factors. Studies from African facilities found its incidence ranged from 5.9-21.7% following surgery on acute abdominal conditions (Nega, 2009; Negash, 2017).

Wound dehiscence involves the partial or complete separation of wound layers. Surgical literature mentions it as a rare complication noting it occurs in less than 1% of cases ( (Garden, 2012). Risk factors include respiratory disease, nutritional deficiencies, diabetes, malignancy, smoking, and steroid use. These are broadly ascribed to technical issues, mechanical stress or disrupted healing (Ousey et al., 2018). Its prevalence in studies reviewed from African facilities ranged from 0.8-4.9%, following laparotomy (Nega, 2009; Ooko et al., 2015). Following laparotomy, the incidence of wound dehiscence globally is placed at 0.4-3.8%. It can rise up to 12% when dealing with clean-contaminated wounds (Ousey et al., 2018).

**2.18 Sepsis**

This is a life-threatening organ dysfunction caused by the dysregulated host response to infection (Rhodes et al., 2017). Initially, localized infection leading to it, mostly affects the lungs (50-70%), abdomen (20-25%), urinary tract (7-10%) and skin (Garden, 2012). Both Gram-positive and negative pathogens are involved in its development. Cytokine mediated inflammation results in peripheral vasodilatation, blood flow redistribution with increased fluid third spacing and micro thrombi formation within the microcirculation. The result is a disturbance in oxygen delivery and utilization by body tissues.

Multiple organ dysfunction syndrome (MODS) is the presence of altered organ function in an acutely ill patient such that homeostasis can't be maintained without intervention. Primary MODS results from a well-defined insult in which organ dysfunction occurs early and can be directly attributable to the insult itself. Secondary MODS develops as a consequence of a host response and is identified within the context of SIRS.

Sepsis is estimated to kill one in every four patients it affects, and emergency surgery is a recognized risk for it (Moore, Moore, Jones, Xu, & Bass, 2009). In the studies emanating from the African continent, its incidence ranges from 0.6-12% (Gebre, 2016; Kotiso & Abdurahman, 2007). There are limited reports on sepsis epidemiology and management outcomes in Africa (Otu, Elston, & Nsutebu, 2015).

The Surviving Sepsis Campaign is a global initiative aimed at reducing the mortality from sepsis. It employs a six step approach that involves building awareness of sepsis, improving diagnosis, increasing appropriate treatment use, educating healthcare preofessionals, improving Post-operative intensive care unit care, developing guidelines of care and facilitating data collection for audit and feedback. Various

criteria have been developed to this end. At the time of the development of this study the Sepsis 2 guidelines were in place; Systemic Inflammatory Response Syndrome Criteria. This defined sepsis as the presence of infection with two or more of the following symptoms; tachypnea with a respiratory rate more than 20, tachycardia with a heart rate greater than 90 beats per minute, hypotension with a systolic blood pressure less than 100 millimetres of mercury, fever with a temperature higher than 38.0 degrees Celsius), and an altered level of consciousness.

**2.18 Mortality**

Mortality postoperatively for acute abdomen ranges from 2-14% globally(Stewart et al., 2014). Mortality rates on their own are an inaccurate measure of surgical performance, but rather a surrogate marker, accounting for all confounders (Heeney, Hand, Bates, Mc Cormack, & Mealy, 2014). A range of 4.1-18% was observed in the reviewed studies emanating from the African continent(Hanks, Lin C.P., Tefera G., 2014; Negash, 2017). Sepsis was mentioned as the leading cause of death in studies that reported high mortality(Hanks, Lin C.P., Tefera G., 2014). Studies linked late presentation and referral, increased age, and complications with an increased likelihood of mortality (Negash, 2017; Pearse et al., 2012; Tekalign Admasu et al., 2019; Zahid et al., 2018).

Globally complicated PUD, bowel obstruction, mesenteric ischaemia, abscess, and soft tissue infections and appendicitis, are among the top contributors to surgical mortality. Complicated PUD accounts for 3.5% of deaths per 100,000 per year. It is followed by bowel obstruction ( 2.1), biliary disease (1.3), mesenteric ischaemia (1.0), abscess and soft tissue infections (0.5) and appendicitis (0.5) (Stewart et al., 2014)

### 2.19 Length of stay

This is used as a parameter to assess health care system efficiency and is an indicator of hospital resource utilization. Extended hospital stays are reported to pose a significant economic burden on families and public health systems (Marfil-Garza et al., 2018). In the United States of America, the average cost of patient bills jumped from 12000 to 40000 US dollars when patients had increased length of hospital stay, due to postoperative pneumonia (Chughtai et al., 2017)).

Factors leading to extended hospital stay include; younger age, male gender, lower physician to patient ratio, emergency and weekend admission, surgery, the number of comorbidities, residence in rural areas and low socioeconomic status (Marfil-Garza et al., 2018). The average length of stay in the studies reviewed was 6-14 days with post-operative complications attributed to an extended hospital stay (Nyundo M., Rugwizangoga E, Ntakiyiruta G., 2013).

### 2.20 Economic burden posed by surgical conditions

It is estimated that between 2015 and 2030, surgical conditions will be responsible for a cumulative loss of 20.7 trillion US dollars to the global economy. More than half of these losses will occur in LMICs (12.3 trillion dollars) (Meara et al., 2015). Surgical conditions are financially devastating to individuals and families. This is especially important seeing that emergencies contribute to a big portion of the surgical burden. Scale-up of surgical services to deal with emergent acute abdominal issues is essential to achieve maximum benefits in health and welfare development(Rose et al., 2017). This study did not explore the socio economic aspects affecting the patients studied. It is possible that this would be a confounder as low socioeconomic status is postulated to affect certain outcomes like length of stay, and also may affect access to health care; leading to longer symptom durations before help is sought, resulting in more

adverse outcomes (Marfil-Garza et al., 2018). It could be an important gap to address in future studies.

### 2.21 Conclusion: a case for prevalence data on the operatively managed acute abdomen

Universal health aspirations set out in the post-2015 sustainable development goals cannot be achieved without access to surgical care (Rose et al., 2017). Actual data concerning surgical condition prevalence is scarce, thus the most urgent regional needs, especially in LMICs, are unknown. This compromises the ability to advocate for, and allocate resources, as well as plan services (Meara et al., 2015). Decisions regarding surgical care and training should be based on demonstrable needs. The Lancet Commission on global surgery notes the paucity of prevalence data as a huge set back towards tracking the prevalence of surgical conditions. The absence of uniform coding methods restricts data comparability between different settings (Meara et al., 2015). Basic, social and clinical research on determinants of surgical diseases and barriers to health access is required, as this knowledge has effects at the individual, system, population, and economic levels.

This study is especially important in our Kenyan setting. The last comparable study was conducted 18 years ago, and published data has only been generated from one facility in the whole country; Kenyatta National Hospital. A literature search concluded the pattern of operatively managed acute abdomen, in adult patients at MTRH, has yet to be determined. It is important to note that this facility serves a wide catchment area and is the second-largest referral facility in the country. We cannot claim to be addressing our surgical needs without first describing them. As surgeons, we are in an ideal place to document any change in acute abdominal epidemiological trends in our facility, and this study is a step in this direction.

# CHAPTER THREE

## 3.0 METHODOLOGY

### 3.1 Study site

This study was conducted at Moi Teaching and Referral Hospital (MTRH) situated along Nandi road, in Eldoret. This is the country's fifth-largest town and headquarters of Uasin Gishu County in the North rift of Kenya. It is approximately located 320 kilometres North West of Nairobi, the capital city of Kenya. MTRH was upgraded from Uasin Gishu District Hospital (UGDH) in the late 1990s.

MTRH is currently about a 1000 total bed capacity tertiary health institution. It is the second-largest teaching and referral hospital in the country after Kenyatta National Hospital. It also serves as a referral health institution with a wide catchment area including the western part of Kenya, the eastern part of Uganda and southern Sudan. According to the central statistics of the hospital, MTRH has an average outpatient of 210 000 outpatients per year or an average of 600 outpatients per day, with accident and emergency department receiving over 10 000 outpatients per year. It also has a cumulative 35 000 inpatients per year. As per the hospital records, in the year of 2016-2017, of an average of 800 emergency surgeries were performed by the general surgical and gynaecology teams.

### 3.2 Study design and period

A prospective, descriptive, hospital-based study with data collected between the periods of March 2018 to March 2019. Patients were followed up to either discharge or death on the ward.

### 3.3 Study Population

The target population was adult patients presenting with an acute abdomen at Moi Teaching and Referral Hospital. This study population was adult patients with an acute abdomen requiring emergency laparotomy to resolve the pathology. Patients were recruited from the surgical and gynaecological units at Moi Teaching and Referral Hospital. Only patients that met the inclusion criteria and consented were studied.

### 3.4 Inclusion and exclusion criteria

#### 3.4.1 Inclusion criteria

- Adult patients aged 18 years and above.
- Patients that underwent emergency surgery for an acute abdomen at MTRH.

#### 3.4.2 Exclusion criteria

- Patients with acute abdomen secondary to abdominal trauma.

### 3.5 Sample size determination and technique

An average of 800 emergency surgeries was performed by the Moi Teaching and Referral general surgical and gynaecological teams in the year 2016-2017. Due to time and financial constraints a sample was deemed best to conduct this study. The sample size was determined by the use of Fisher *et al* statistical formula as follows:

$$n = \frac{Z^2pq}{d^2}$$

Where:

n = minimum sample size

Z = the standard normal deviation set at 1.96 which corresponds to a 95% confidence level.

p = Characteristic of the study population; one of the major outcomes of interest in this study is mortality in patients with operatively managed acute abdomen. A similar study conducted by Kotiso showed a mortality rate of 14 % (Kotiso & Abdurahman, 2007). Thus a p of 0.14 was used)

q = 1 – p (1-0.14= 0.86)

d = the level of precision was set at 5% or 0.05 corresponding to 1.96

Therefore, in substitution:

$= \frac{(1.96)^2 \times 0.14 \times 0.86}{(0.05)^2} = 185.2967$

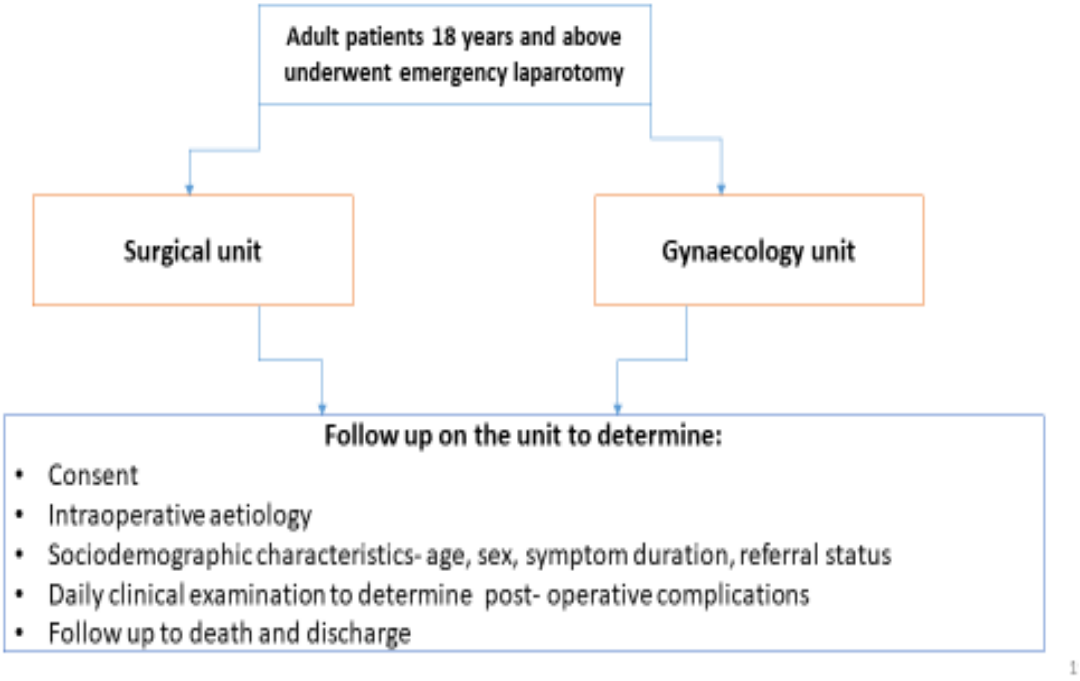
= rounded off to 185 participants

When this was adjusted for non-responders set at 10%, a sample size of 203 patients was determined.

**3.6 Sampling technique**

Consecutive/ snow ball sampling was employed. From the first patient selected at random, each patient was consecutively recruited into the study as they presented to the hospital with an acute abdominal cause requiring emergency surgery.

### 3.6 Study flow chart




### 3.7 Study execution

Adult patients presenting to the emergency department were assessed and diagnosed with conditions requiring emergency surgery to resolve them. Residents and Surgeons from the general surgical and gynaecological teams conducted the various emergency surgeries. The principle investigator did not interfere in diagnosis or the surgical management. Having undergone the surgeries, the patients were admitted to either the general surgical or gynaecology wards. The criteria for inclusion was met after they had undergone emergency surgery. The principal investigator examined the theatre lists and post-operative books from theatre and tracked these patients down to their units of admission. Patients meeting the criteria were informed about the study and consent sought.

Once consent was give, the patients' demographic features (sex, age, referral status) clinical presentation, diagnoses (intraoperative finings) and outcomes of interest

(post-operative complications, mortality and length of stay) were documented on the data collection sheet.

Following surgery, a review of the surgical notes was used to confirm the aetiology of the acute abdomen. In cases where the diagnosis wasn't clear, the operating surgeon was consulted and consensus reached on the diagnosis based on their intraoperative findings.

Patients were then followed up with daily clinical evaluation (relevant history, examination, and imaging where needed) to identify post-operative progress. Identification of complications encountered was mainly determined by clinical exam and adjunct imaging where needed.

Patient follow up was up to the point of discharge or death. Outcomes of interest included postoperative complications (determined through clinical exam and adjunct laboratory testing and imaging where appropriate), duration of hospital stay, and mortality.

**3.8 Data management and analysis**

Patients were assigned a confidential study identification number during the course of this study to protect their identity.

Data entry: Data was coded and entered using Microsoft excel. Collected data was checked for completeness, correctness, and accuracy by the principal investigator

Data analysis: Analysis was done using SPSS 24 computer program. Descriptive statistics such as mean, median, associated standard deviation and inter-quartile range were used for continuous data while frequency listings and percentage were used for categorical data. Variables of interest included the causes of acute abdomen, the post-operative complications, mortality rate and length of hospital stay. To assess

association between the aetiology and the outcome Chi square was used in cases where the expected cell count was small Fishers' exact test was used.

Data storage: Data collected was digitized and stored on a personal computer (PC) with password protection. Information was backed up on a second hard drive to guard against data loss in case of equipment malfunction.

All Originals and copies of project plans, forms, error lists, and other documentation were and still are, preserved in a secured storage point, throughout the entire study duration.

### 3.9 Ethical Consideration

**Risks**- the major risk present during this study (breach of patient confidentiality) was actively avoided by assigning confidential study identification numbers to patients and limiting individuals with the ability to access the research information.

**Benefits**- This study aimed at contributing to the body of knowledge by describing the pattern and outcome of operatively managed acute abdomen at MTRH.

**Confidentiality**- was maintained by assigning a confidential study identification number to patients. Data is kept in locked, safe storage points, and their electronic backup password secured with limited personnel access.

**Informed consent** -was sought for this study. Patients or patient health proxies were to agree to participate evidenced by the signing of witnessed consent forms.

This study was reviewed and approved by the Institutional Research and Ethics Committee (IREC) FAN: IREC 2091.

### 3.10 Study implications

This study aimed to describe the aetiology and outcomes of the operatively managed acute abdomen at MTRH.

This knowledge was to be useful to health care practitioners when considering differential diagnoses for acute abdomen requiring emergency surgery. It was also to help them and the facility adapt in approach and resource allocation towards acute abdominal surgical emergencies.

### 3.12 Study limitations

- Due to resource limitation and time constraint, only short term outcomes were considered as the endpoint of the study was with the discharge or death of a patient on the ward.
- As the study was done in a single institution setting and based on its design, the results are not generalizable to other settings.
- Confounders such as interdepartmental differences, skill difference among operating surgeons, ward/patient hygiene levels, comorbidities, interaction-effect modification during physical examinations, or socioeconomic differences were not controlled for in this study.

### 3.13 Dissemination of results

Study findings are to be disseminated through an oral defence of this thesis. The results may be presented at relevant seminars/conferences and publication in a peer reviewed scientific journal and a printed thesis.

# CHAPTER FOUR

## 4.0 RESULTS

A total of 203 adult patients were recruited into this study between the period of March 2018 and March 2019. They were managed operatively for causes of emergent acute abdomen. No patients were lost to follow up and none withdrew consent over this period of time.

### 4.1 Socio-demographic and clinical characteristics

One hundred and twenty-one (59.6%) of the study participants were female and 82 (40.4%) were male. The median age was 29 years (IQR 23,35.5). the youngest patient was 18 and the oldest was 94 years with a range of 76. Peak incidence for acute abdomen requiring surgery was observed in the 18-27-year age bracket (Fig1).

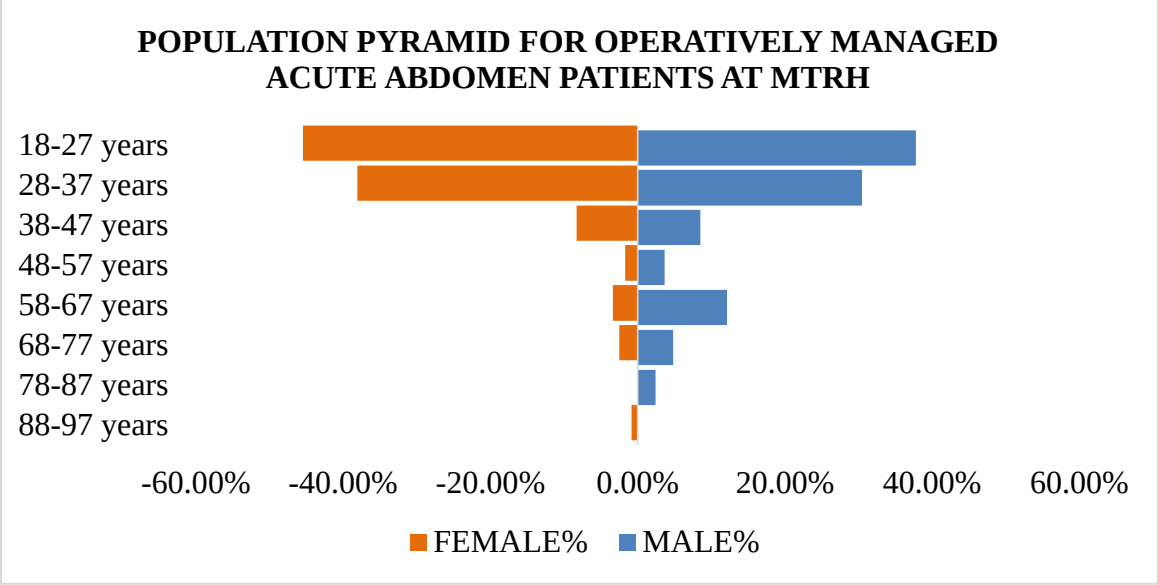



**Figure 1: Population pyramid for acute abdomen patients**

The majority (n=185, 91.1%) of patients presented to the facility within 6 days from the onset of their symptoms (fig2). The most common symptoms and signs were abdominal pain (99.5%), abdominal tenderness (99.5%), nausea (91.1%), vomiting (65.5%), constipation (25.6%) and diarrhoea (6.9%). Abdominal tenderness was

localized in 58.6% of study participants and generalized in 41.4%. Patients referred from other health facilities accounted for 29.1%( n=59) of the sample population. The reasons cited for referral included; lack of resources, lack of a surgeon, and a lack of diagnostic imaging at the referring facility.

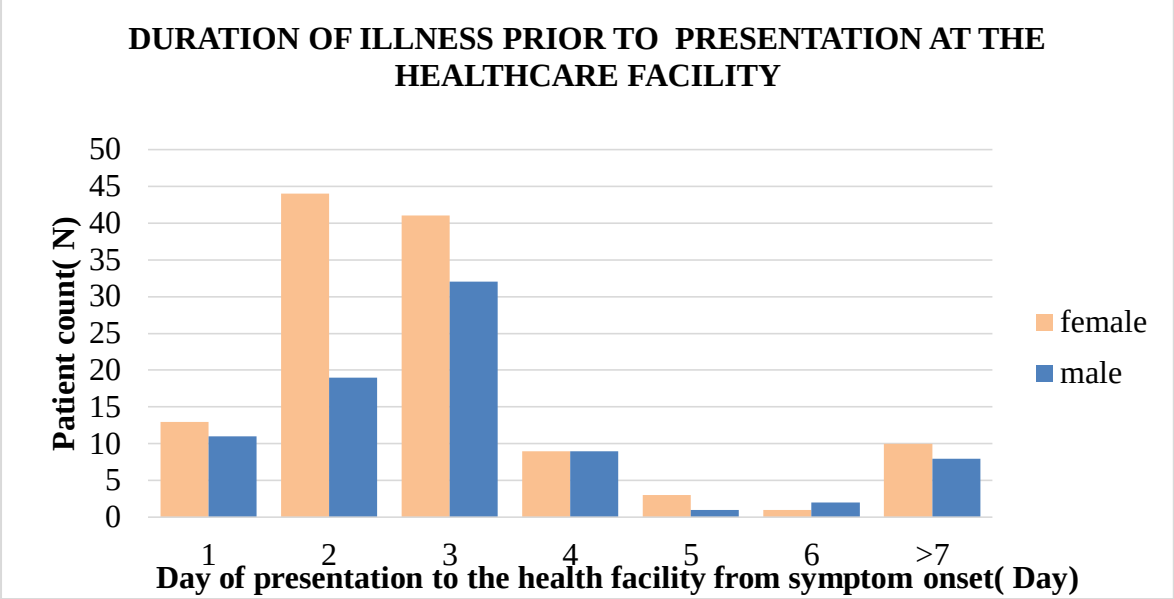



**Figure 2: Duration of illness**

### 4.2 Aetiology and outcomes of operatively managed acute abdomen

#### 4.2.1Aetiology

The aetiology of conditions resulting in operative management of acute abdomen was broadly grouped into two; General surgical and gynaecological. General surgical causes accounted for 58.1% (N=118) of cases and gynaecological causes accounted for 41.9% (N=85). More males (69.5%, N=82) than females (30.5%, N=36) were managed for general surgical causes. The exclusivity of women in the gynaecological data portion resulted overall in a higher number of women (59.6%, N=121) than men (40.4%, N=82) in the study. The most frequently encountered causes of operatively managed acute abdomen in this study were ectopic pregnancy (35.5%, N=72),

intestinal obstruction (22.7%, N= 46), acute appendicitis (18.3%, N=37), and bowel perforations (12.8%, N=26).

A summary of the aetiology of operatively managed acute abdomen within the study period is presented in table 1.

**Table 1: Aetiologies causing the operative acute abdomen**

| DIAGNOSIS | FREQUENCY | % |
|---|---|---|
| | | |
| GYNAECOLOGICAL CAUSES | **N=85** | **41.9%** |
| **Ectopic pregnancy** | 72 | 35.5% |
| **Ovarian cyst** | 5 | 2.5% |
| **Ovarian torsion** | 3 | 1.5% |
| **PID** | 2 | 1.0% |
| **Pelvic abscess** | 2 | 1.0% |
| **Endometriosis** | 1 | 0.5% |
| | | |
| GENERAL SURGICAL CAUSES | **N=118** | **58.1%** |
| | | |
| **Perforated peptic ulcer disease** | 18 | 8.9% |
| **Bowel perforations-other( ileal, jejunal, large bowel)** | 8 | 3.9% |
| **Primary peritonitis** | 5 | 2.5% |
| **Psoas abscess** | 2 | 1.0% |
| **Peritoneal carcinomatosis** | 2 | 1.0% |
| Intestinal obstruction | | |
| Small bowel obstruction | | |
| **Adhesions** | 13 | 6.4% |
| **Hernia** | 10 | 4.9% |
| **Volvulus** | 6 | 3.0% |
| **Intussusception** | 1 | 0.5% |
| **Merckel's diverticulum** | 1 | 0.5% |
| **Unspecified** | 3 | 1.5% |
| Large bowel obstruction | | |
| **Sigmoid volvulus** | 8 | 3.9% |
| **Compound volvulus** | 2 | 1.0% |
| **Colonic carcinoma** | 2 | 1.0% |
| Appendicitis | | |
| **Appendiceal inflammation** | 23 | 11.3% |
| **Appendiceal abscess** | 11 | 5.4% |
| **Appendiceal perforation** | 3 | 1.5% |
| | | |
| TOTAL | **203** | **100%** |

### 4.2.2 General surgical causes

General surgical causes of operatively managed acute abdomen were broadly divided into appendicitis, intestinal obstruction, bowel perforation and peritonitis from other causes (rarer causes). These major groupings were determined by the frequency of occurrence. Intestinal obstruction (40.0%, N=46) was the most common general surgical cause. It was followed by appendicitis (31.4%, N=37), and bowel perforation (22.0%, N=26) respectively.

### 4.2.3 Intestinal obstruction

This was the 2nd most encountered aetiology in this study. It contributed to 22.7% (n=46) of all cases seen. It accounted for 40.0% of all general surgical causes of acute abdomen managed operatively. The median age of presentation was 37 years (IQR 30, 61.75). Referrals from other health facilities amounted to 45.7%( n=21) of cases managed. The number of male patients (n=30, 65.2%) managed for intestinal obstruction was higher than females (n=16, 34.8%). Small bowel obstruction accounted for 73.9%( n=34), while large bowel obstruction for 26.1%( n=12) of cases managed (Table 2).

**Table 2: Aetiologies causing intestinal obstruction**

| **INTESTINAL OBSTRUCTION** | **FREQUENCY** | | | |
|---|---|---|---|---|
| **CAUSES** | **MALE** | **FEMALE** | **TOTAL** | **%** |
| **Small Bowel Obstruction (N=34)** | | | | |
| **ADHESIONS/BANDS** | **9** | **4** | **13** | **28.3%** |
| **HERNIA** | **6** | **4** | **10** | **21.7%** |
| VOLVULUS | 3 | 3 | 6 | 13.0% |
| MECKEL'S DIVERTICULUM | 1 | 0 | 1 | 2.2% |
| INTUSSUSCEPTION | 0 | 1 | 1 | 2.2% |
| UNSPECIFIED | 1 | 2 | 3 | 6.5% |
| **Large Bowel Obstruction( N=12)** | | | | |
| **SIGMOID VOLVULUS** | **6** | **2** | **8** | **17.4%** |
| COMPOUND VOLVULUS | 2 | 0 | 2 | 4.3% |
| COLON CANCER | 2 | 0 | 2 | 4.3% |

Small bowel obstruction resulted from adhesions/bands (n=13, 28.3%), hernias (n=10, 21.7%), small bowel volvulus (n=6, 13.0%), intussusception (n=1, 2.2%), Merckel's diverticulum (n=1, 2.2%), and unspecified causes (n=3, 6.5%). More male patients (58.8%) were treated for small bowel obstruction than female (41.2%).

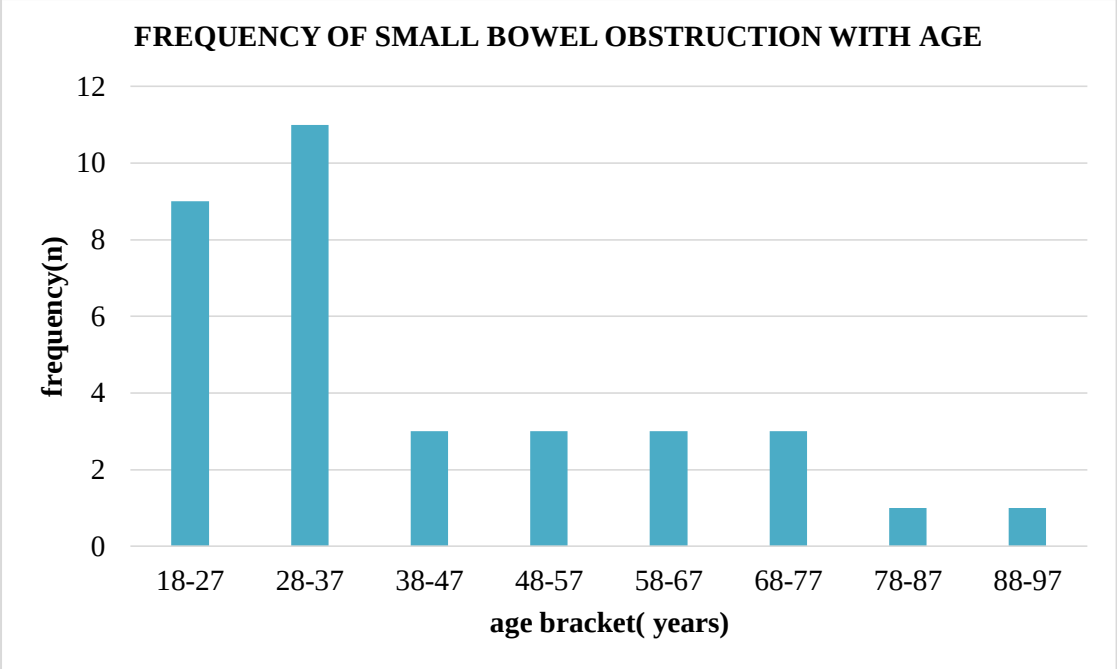



**Figure 3: Small bowel obstruction frequency distribution by age**

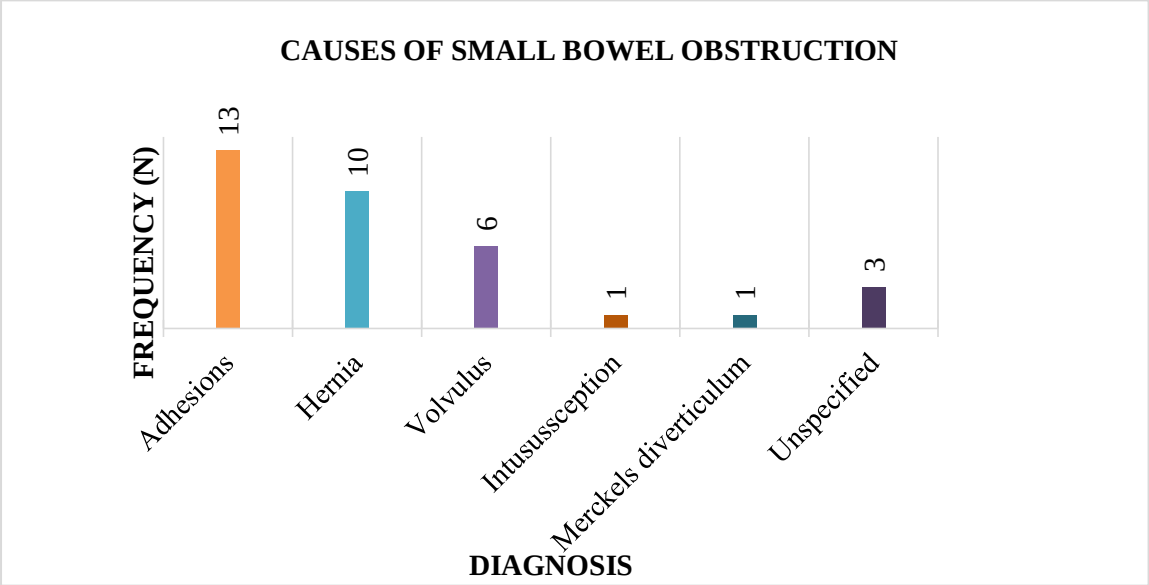



**Figure 4: Causes of small bowel obstruction**

Large bowel obstructions resulted from sigmoid volvulus (n=8, 17.4%), colon cancer (n=2, 4.3%) and compound volvulus (n=2, 4.3%). More male patients (83.3%) were managed for large bowel obstruction than female (16.7%).

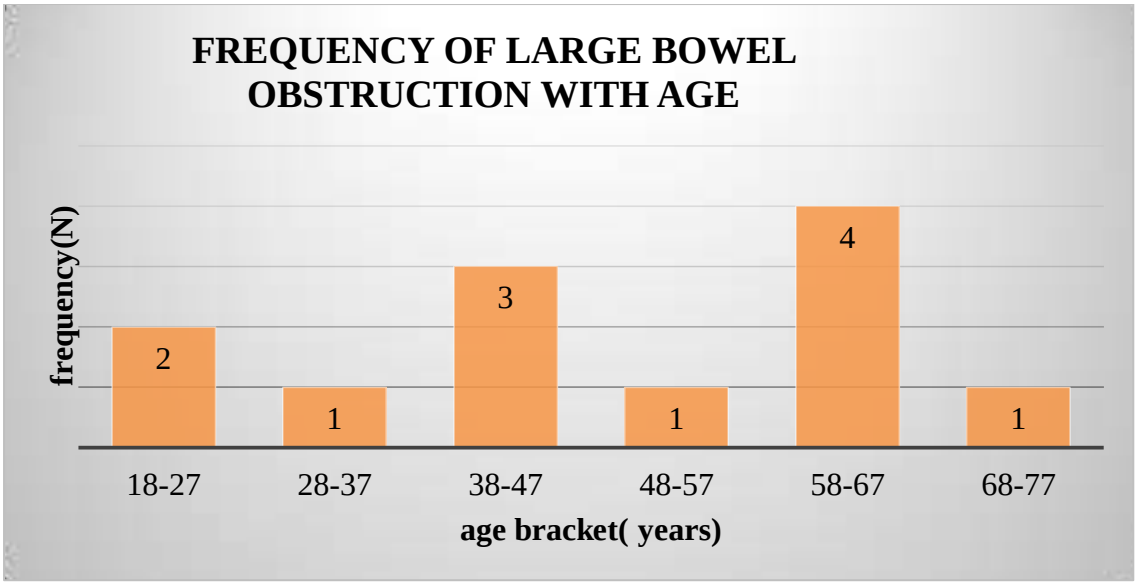



**Figure 5: Large bowel obstruction frequency distribution by age**

### 4.2.4 Appendicitis

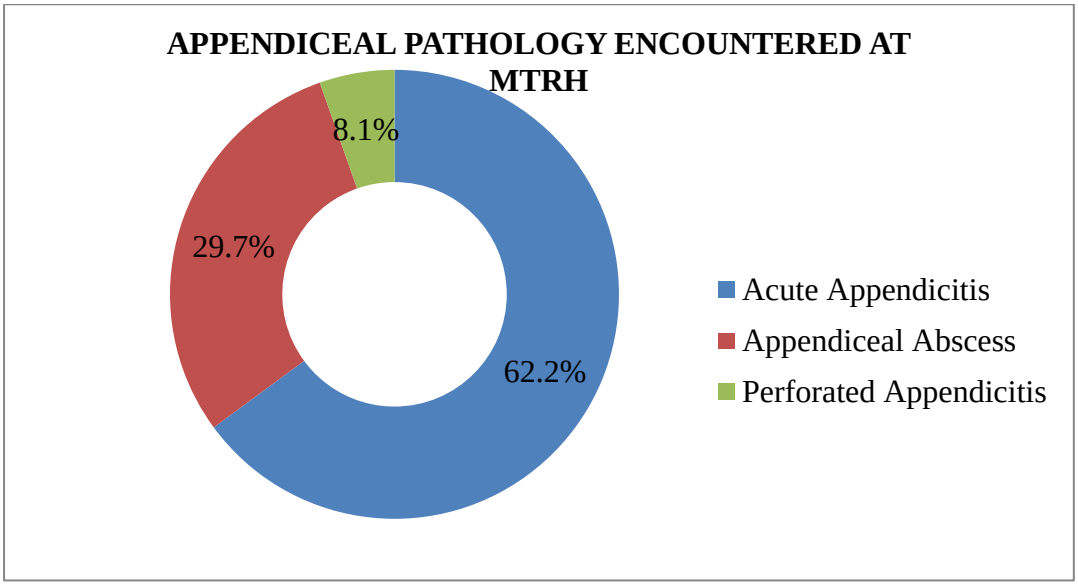



**Figure 6: Appendiceal pathology**

Appendicitis was the 3rd leading cause of operatively managed acute abdomen at 18.2% (n=37) of cases seen. Only 16.2% (n=6) of the cases were referred from other health care facilities. 13.5%( n=5) of these patients had generalized peritonitis on presentation. The median age at presentation was 26 years (IQR 20,32). More male (n=22, 59.5%), than female (n=15, 40.5%)) patients were treated for it.

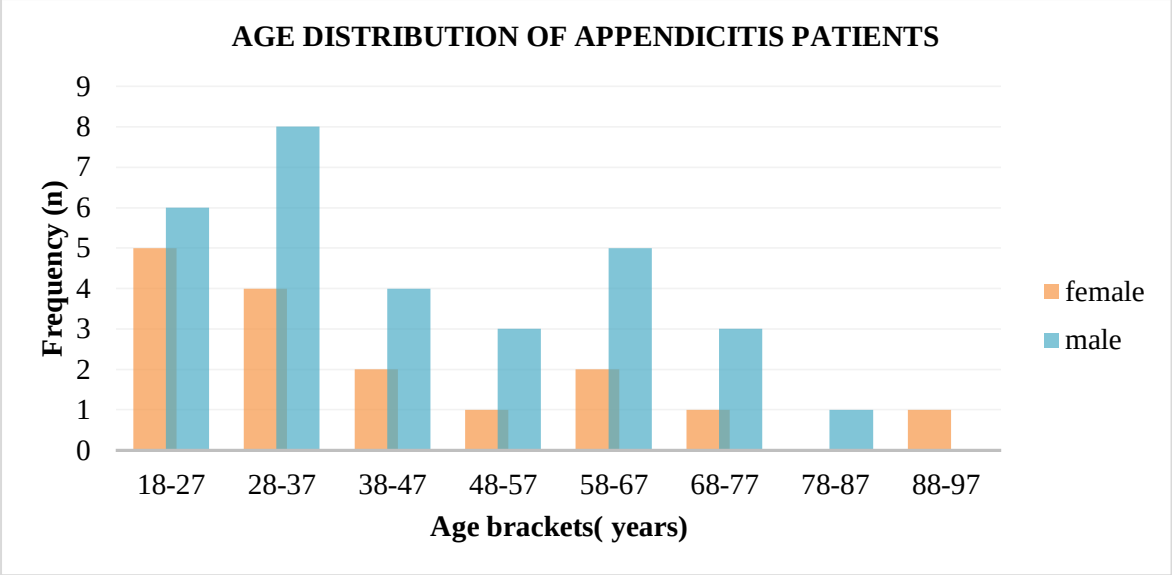



**Figure 7: Age distribution of appendicitis patients.**

Intraoperatively, the pathologies observed were, pure appendiceal inflammation (n=23, 62.2%), appendiceal abscess (n=11, 29.7%) and appendiceal perforation (n=3, 8.1%) (Table 3).

**Table 3: Appendiceal pathology distribution by sex**

| | APPENDICEAL PATHOLOGY FREQUENCY(N) | | | |
|---|---|---|---|---|
| **SEX** | **Acute appendicitis** | **Appendiceal abscess** | **Perforated appendicitis** | **Grand Total** |
| Female | 8 | 7 | - | 15 |
| Male | 15 | 4 | 3 | 22 |
| **Grand Total** | **23** | **11** | **3** | **37** |

### 4.2.5 Bowel perforation

Bowel perforation was the fourth most encountered aetiology in this study accounting for 12.8%( N=26) of all cases. It contributed 22.0% of all general surgical causes. Majority of the patients were male (84.6%, N=22), and the rest were female (N=4, 15.4%). 42% of these patients were referred in.

Perforated peptic ulcer disease was the most common cause of bowel perforation at 69.2%( N=18) of cases. It contributed to 8.9% (n=18) of all cases managed operatively for acute abdomen. The median age of patients affected was 31.5 years (IQR 25.5,56.25). Thirty-eight point nine(n=7) percent of perforated PUD cases were referred from other health facilities.

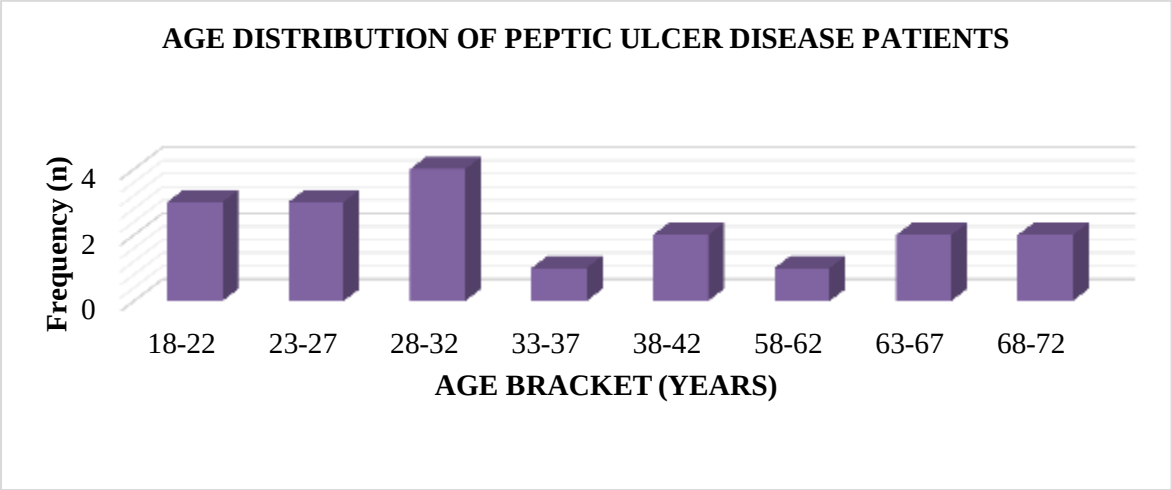



**Figure 8: Age distribution of peptic ulcer disease patients**

More male patients than females were affected, with a male-female ratio of 8:1. Duodenal (n=14,77.8%) perforations occurred more frequently than gastric perforations (n=4, 22.2%) (Table 2).

**Table 4: Perforated peptic ulcer disease distribution by sex and location**

| DIAGNOSIS | FREQUENCY(N) | % |
|---|---|---|
| **Perforated duodenal ulcer** | 14 | 77.8% |
| **Female** | 1 | 7.1% |
| **Male** | 13 | 92.9% |
| **Perforated gastric ulcer** | 4 | 22.2% |
| **Female** | 1 | 25.0% |
| **Male** | 3 | 75% |
| **Grand Total** | **18** | 100% |

Other perforations were of unclear cause and were encountered in the jejunum (N=1), ileum (N=5), and colon (N=2). Small bowel perforations (N=6, 75%) were more

frequently seen than large bowel perforations (N=2, 25%). Still, more male patients (75.0%, N=6), than female patients (35.0%, N=2) were managed for bowel perforations when perforated peptic ulcer disease was excluded.

### 4.2.6 Other general surgical causes of peritonitis.

These collectively contributed to 4.4%( N= 9), of operatively managed acute abdomen cases. Under the general surgical causes, they contributed 7.6% of cases. The aetiologies observed included primary peritonitis (n=5), psoas abscess (n= 2), peritoneal carcinomatosis (n=2).

### 4.2.7 Gynaecological causes

The median age of patients with gynaecological conditions was 28 years (IQR 23,30). Twenty-one point two percent of these patients (n=18) were referred in. Ectopic pregnancy accounted for a majority (84.7%) of cases seen with operatively managed acute abdominal conditions within the gynaecological unit.

**Table 5: Gynaecological aetiology**

| GYNAECOLOGICAL CAUSES ( N=85) | FREQUENCY | % |
|---|---|---|
| ECTOPIC PREGNANCY | 72 | 84.7% |
| OVARIAN CYST | 5 | 5.9% |
| OVARIAN TORSION | 3 | 3.5% |
| PELVIC INFLAMMATORY DISEASE | 2 | 2.4% |
| PELVIC ABSCESS | 2 | 2.4% |
| ENDOMETRIOSIS | 1 | 1.1% |

### 4.2.8 Ectopic pregnancy

Ectopic pregnancy was the most commonly encountered cause of operatively treated acute abdomen. It accounted for 35.5% (n=72) of the sample population. It contributed to 84.7% of all gynaecological causes. It affected women aged 18-42 years with a range of 24. The median age at presentation was 28years (IQR 23,30) peak incidence was observed in the 23-27, and 28-32-year age brackets (Figure 5). Twenty point eight percent (20.8%) of ectopic pregnancy cases were referred from other health facilities. Intraoperatively, right tubal ectopic pregnancies (56.9%) were found more often than left (43.1%).

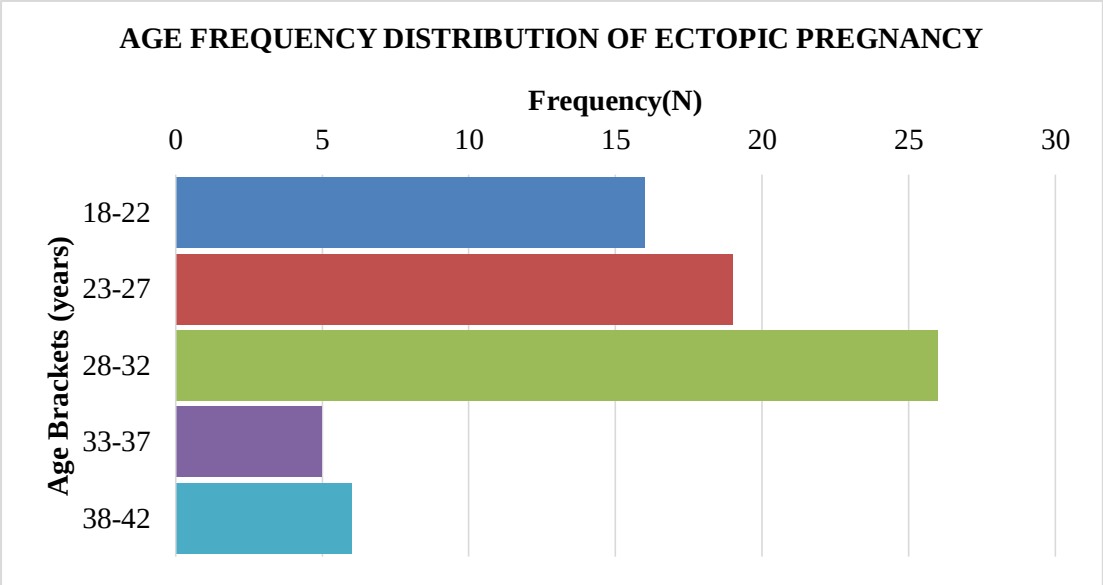



**Figure 9: Age distribution of ectopic pregnancy cases**

**Other gynaecological causes of peritonitis**

These contributed to 6.4% (n=13) of all operatively managed acute abdomen cases. The causes encountered included ovarian cyst (n=5), ovarian torsion (n=3), pelvic abscess (n=2), pelvic inflammatory disease (n=2) and endometriosis (n=1).

### 4.3 Outcomes

Postoperative complications occurred in 20.7% (N=42) of the sample population. More than one complication sometimes occurred in the same patient. More male patients (N=25, 59.5%) than female patients (N=17, 40.5%) developed a postoperative complication. 42.9% (N=18) of those with complications were referrals from other facilities. Only 14.2% (N=6) of those with complications presented more than seven days from the onset of their symptoms. Ectopic pregnancies and appendicitis reported the least complication rates at 2.8% and 10.8% respectively. Complications occurred more often in intestinal obstruction (45.7%) and bowel perforation (38.5 %) cases. The frequency of complications among referred patients is shown in table 10 below.

**Table 6: Frequency of complications among referred in patients.**

| Diagnosis | Complication | No complication |
|---|---|---|
| **Intestinal obstruction ( N=21)** | 8 ( 38.1%) | 13 |
| **Ectopic pregnancy( N=15)** | 2 (13.3%) | 13 |
| **Bowel perforation( N=11)** | 5 (45.5%) | 6 |
| **Appendicitis( N=6)** | 0 | 6 |
| **Other general surgical causes( N=3)** | 1 ( 33.3%) | 2 |
| **Other gynaecological causes( N=3)** | 0 | 3 |

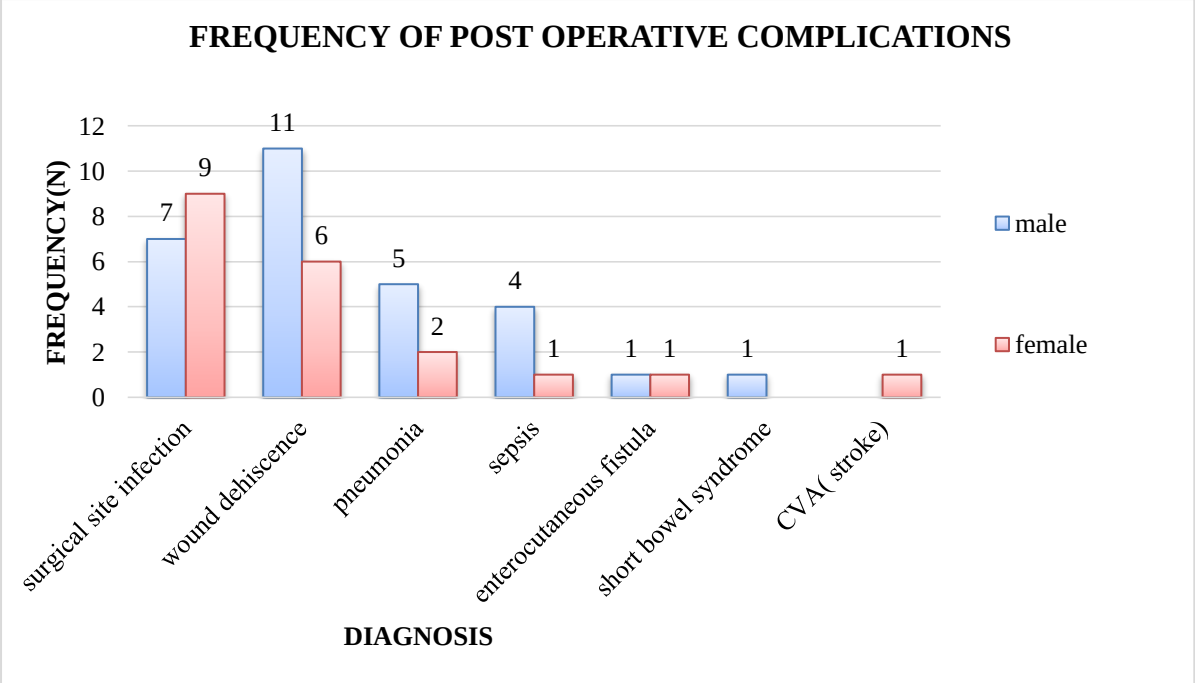



**Figure 10: Frequency of postoperative complication**

### 4.4 Wound complications

Wound dehiscence was the most frequently encountered complication in our set up. It occurred in 8.4% (N=17) of all operatively managed acute abdominal cases. It contributed 40.5% of all complications observed. It was seen in cases of intestinal obstruction (n=8), bowel perforation (n=6), appendicitis (n=1), ectopic pregnancy (n=1) and other gynaecological (n=1) causes of peritonitis. Wound dehiscence was observed post operatively in 2.4% of gynaecological and 12.7%. of general surgical cases.

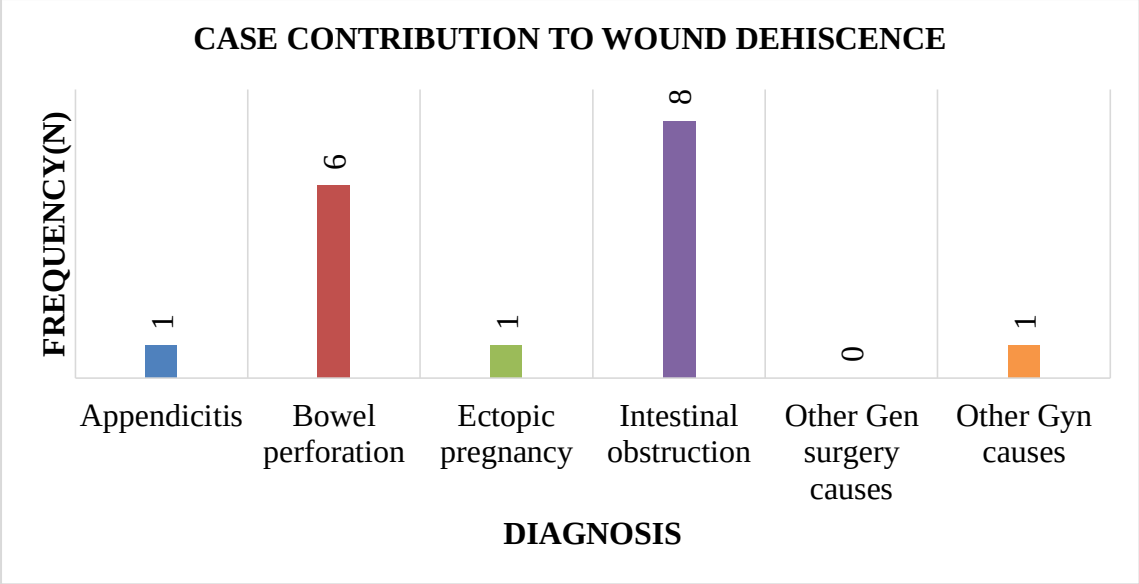



**Figure 11: Case contribution to wound dehiscence**

Assessing for association between the diagnosis and the wound dehiscence. It was observed that this was statistically significant p-0.003, meaning that the diagnosis a patient had was likely to affect the chance of developing post-operative wound dehiscence. It was observed that those with bowel perforation and those with intestinal obstruction had a significantly higher proportion of patients develop wound dehiscence compared to those with other diagnosis. The results are shown in Table 3.

**Table 7: Association between Wound dehiscence and Diagnosis**

| Diagnosis | Wound dehiscence | | Fishers' exact P-value |
|---|---|---|---|
| | No | Yes | |
| | Freq (%) | Freq (%) | |
| **Appendicitis (N=37)** | 36 (97.3%) | 1 (2.7%) | 0.003 |
| **Bowel perforation (N=26)** | 20 (76.9%) | 6 (23.1%) | |
| **Ectopic pregnancy (N=72)** | 71 (98.6%) | 1 (1.4%) | |
| **Gynaecology peritonitis other (N=13)** | 12 (92.3%) | 1 (7.7%) | |
| **Intestinal obstruction (N=46)** | 39 (84.8%) | 7 (15.2%) | |
| **Surgical peritonitis other (N=9)** | 8 (88.9%) | 1 (11.1%) | |

Surgical site infection was the 2nd most frequently encountered complication in our set up. It occurred in 7.9% (N=16) of all cases, and accounted for 38.1% of the complications encountered. It was seen in cases of intestinal obstruction (n=9), appendicitis (n=3), bowel perforation (n=3), and other gynaecological(n=1) causes of acute abdomen. Surgical site infection was observed post operatively in 1.2% of gynaecological and 12.7% of general surgical cases.

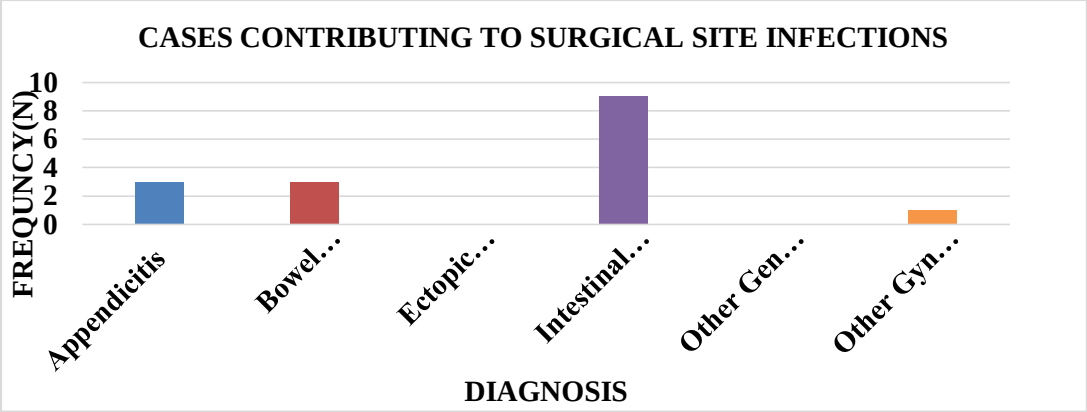



**Figure 12: Case contribution to surgical site infection**

There was a statistically significant association between the diagnosis and likelihood of developing postoperative surgical site infection with a p-value of 0.004. Patients with intestinal obstruction had a significantly higher proportion developing SSI compared to other diagnosis (Table 4).

**Table 8: Association between surgical site infection and Diagnosis**

| Diagnosis | Surgical Site Infection | | Fishers' exact P-value |
|---|---|---|---|
| | **No** | **Yes** | |
| | **Freq (%)** | **Freq (%)** | |
| **Appendicitis (N=37)** | 34 (91.9%) | 3 (8.1%) | **0.004** |
| **Bowel perforation (N=26)** | 23 (88.5%) | 3 (11.5%) | |
| **Ectopic pregnancy (N=72)** | 72 (100.0%) | 0 (0.0%) | |
| **Gynaecology peritonitis other (N=13)** | 12 (92.3%) | 1 (7.7%) | |
| **Intestinal obstruction (N=46)** | 38 (82.6%) | 8 (17.4%) | |
| **Surgical peritonitis other (N=9)** | 9 (100.0%) | 0 (0.0%) | |

### 4.5 Pulmonary complications

Postoperative pneumonia was the 3rd most frequently encountered complication. It accounted for 16.7% (N=7) of all complications observed. It occurred in 3.4% of all operatively managed acute abdomen cases. It was seen in cases of intestinal obstruction (n=2), bowel perforated (n=3), ectopic pregnancy (n=1), and other general surgical causes (n=1). Post-operative pneumonia was observed in 1.2% of gynaecological and 5.1% of general surgical cases. Table 5 shows that there was no statistically significant association between Pneumonia and diagnosis (P-value=0.075). This implies that the diagnosis didn't affect the likelihood of developing a post-operative pneumonia.

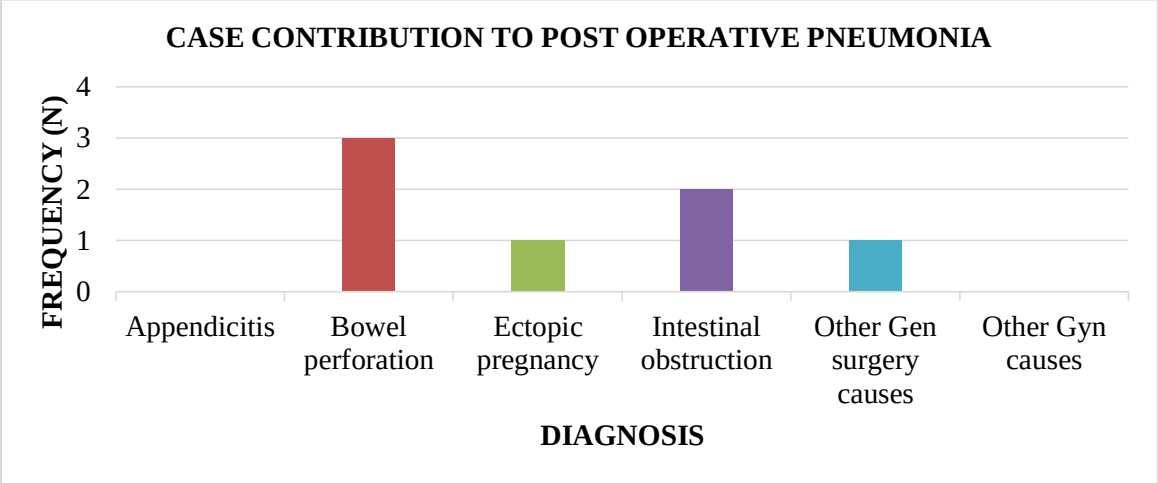



**Figure 13: Case contribution to postoperative pneumonia**

**Table 9: Association between Pneumonia and Diagnosis**

| ***Diagnosis*** | **Pneumonia** | | **Fishers' exact P-value** |
|---|---|---|---|
| | **No** | **Yes** | |
| | **Freq (%)** | **Freq(%)** | |
| *Appendicitis (N=37)* | 37 (100.0%) | 0 (0.0%) | 0.075 |
| *Bowel perforation (N=26)* | 23 (88.5%) | 3 (11.5%) | |
| *Ectopic pregnancy (N=72)* | 71 (98.6%) | 1 (1.4%) | |
| *Gynaecology peritonitis other (N=13)* | 13 (100.0%) | 0 (0.0%) | |
| *Intestinal obstruction (N=46)* | 44 (95.7%) | 2 (4.3%) | |
| *Surgical peritonitis other (N=9)* | 8 (88.9%) | 1 (11.1%) | |

### 4.6 Sepsis

This was the 4th most commonly encountered complication. It contributed to 11.9 % (N=5) of all complications, and affected 2.5% of the sample population. It was seen in intestinal obstruction(n=3), and other general surgical (n=2) causes (peritoneal carcinomatosis and psoas abscess). There was a statistically significant association between diagnosis and likelihood of developing post-operative sepsis p-value=0.005 as shown in Table 6. More male patients developed sepsis (n=4) than female (n=1).

**Table 10: Association between Sepsis and Diagnosis**

| Diagnosis | Sepsis | | P-value |
|---|---|---|---|
| | No | Yes | |
| | (%) | (%) | |
| **Appendicitis (N=37)** | 37 (100.0%) | 0 (0.0%) | 0.005 |
| **Bowel perforation (N=26)** | 26 (100.0%) | 0 (0.0%) | |
| **Ectopic pregnancy (N=72)** | 72 (100.0%) | 0 (0.0%) | |
| **Gynaecology peritonitis other (N=13)** | 13 (100.0%) | 0 (0.0%) | |
| **Intestinal obstruction (N=46)** | 43 (93.5%) | 3 (6.5%) | |
| **Surgical peritonitis other (N=9)** | 7 (77.8%) | 2 (22.2%) | |

### 4.7 Other complications

These occurred in low frequency and included enterocutaneous fistula (ECF) (n=2), cerebrovascular accidents (CVA) (n=1), and short bowel syndrome (n=1). Both ECFs occurred following surgery to treat small bowel perforations. The CVA occurred in an elderly female (74years) managed for intestinal obstruction, secondary to a femoral hernia strangulation. Short bowel syndrome was observed following surgery for a case of intestinal obstruction secondary to a strangulated hernia.

### 4.8 Mortality

This occurred in 3 patients (1.5%) out of the 203 study participants. Two of the deaths of elderly male patients were attributed to sepsis. The other of an elderly female was due to advanced metastatic disease. The patients who died were aged, 62, 78 and 80 years, and suffered from colon cancer, unspecified small bowel obstruction, and large bowel perforation, respectively.

### 4.9 Duration of stay

Two hundred of the 203 study participants were discharged following operative management for acute abdomen. 63.5% (N=127)) percent of these patients were discharged within the first 6 days. The rest were discharged between day 7 to 13(N=49, 24.5%) and after 14 days (N=24, 12.0%). Only 2.4% (N=3) of those discharged within 6 days had a complication. Complications were noted in 34.7% (N=17), and 79.2% (N=19) of patients discharged between 7-13 days and after 14 days, respectively (Table 5).

**Table 11: Duration of stay**

| | Frequency(N) | | | |
|---|---|---|---|---|
| **Duration of stay** | **No complications** | **Complications** | **Total** | **%** |
| **0-6 days** | 124 | 3 | 127 | 63.5% |
| **7-13 days** | 32 | 17 | 49 | 24.5% |
| **>14 days** | 5 | 19 | 24 | 12.0% |
| Total | 161 | 39 | 200 | 100% |

Assessing for association between diagnosis and duration of stay the results are shown in Table 8. It was observed that the association was statistically significant (P-value <0.001) that your diagnosis would likely result in a longer hospital stay. Patients with intestinal obstruction and surgical peritonitis had a significantly higher length of stay compared to the other diagnoses.

**Table 12 : Significantly higher length of stay compared to the other diagnoses.**

| Diagnosis | Duration of hospital stay | | | P-value |
|---|---|---|---|---|
| | 0 to 6 days | 7 to 13 days | >14days | |
| | Freq (%) | Freq (%) | Freq (%) | |
| **Appendicitis (N=37)** | 34 (91.9%) | 3 (8.1%) | 0 (0.0%) | 0.001 |
| **Bowel perforation (N=26)** | 12 (46.2%) | 9 (34.6%) | 5 (19.2%) | |
| **Ectopic pregnancy (N=72)** | 67 (93.1%) | 5 (6.9%) | 0 (0.0%) | |
| **Gynaecology peritonitis other (N=13)** | 8 (61.5%) | 4 (30.8%) | 1 (7.7%) | |
| **Intestinal obstruction (N=46)** | 5 (11.4%) | 27 (61.4%) | 12 (27.3%) | |
| **Surgical peritonitis other (N=9)** | 1 (12.5%) | 2 (25.0%) | 5 (62.5%) | |

# CHAPTER FIVE

## DISCUSSION

### 5.1 Introduction

This study addresses the need to generate surgical prevalence data and help fill the knowledge gap attributed to LMICs (Rose et al., 2017).

Two hundred and three adult patients who underwent operative management for acute abdomen were studied. The median age of presentation was 29 years (IQR 23, 35.5). The peak incidence for acute abdomen was highest in those aged 18-30 years. Its frequency was observed to fall with increasing age with fewer cases presenting after the 4$^{th}$ decade of life. A near similar mean age of 26.6 (Nega, 2009) and 31.3 years (Doumi El bushra Ahmed, 2018) was observed in studies that also included gynaecological conditions.

The mean age for general surgical patients on exclusion of gynaecological conditions was 37.2 years. Gynaecological patients had a mean age of 27.6 years. The mean age for general surgical cases is almost similar to other studies with means of 32.8 (Ohene-Yeboah, 2006), 33.56 (Agbo, M Oboirien, n.d.), 30.7 (Kotiso & Abdurahman, 2007) and 31.46 years (Tekalign Admasu et al., 2019) reported. Similar findings are observed in other studies on the acute abdomen from the African continent. Peak incidence is observed in the age between 20-39 years in this study in this study. Studies in Port Harcourt, and Benin city, Nigeria also noted peak incidence within the ages of 21-39 years (Alagoa, 2006; Nwashilli et al., 2017).

A fall in incidence was observed with increasing age in this study. Studies by Kotiso, Mequanint, and Agboola also observed a similar trend (Agboola et al., 2014; Kotiso & Abdurahman, 2007; Negash, 2017). The high incidence in younger age groups may

be attributable to the higher incidence of acute abdominal aetiologies (acute appendicitis and ectopic pregnancy) that occur in the 2nd and 3rd decades of life. In this study, appendicitis and ectopic pregnancy accounted for 53.7% of all cases.

It is important to note that the exclusion of gynaecological conditions from this study, results in a picture that mirrors findings from other African centers. More male (69.5%), than female (30.5%) patients present with general surgical causes of an acute abdomen. Similarly, more male patients were encountered in studies by Bizuaheyu (67.2%), Gebre (64.7%) and Agboola (71.4%) (Agboola et al., 2014; Gebre, 2016; Tassew et al., 2017). Exclusion of gynaecological conditions did not change the peak ages at which acute abdominal conditions were seen, nor its declining frequency with increasing age.

Exclusion of gynaecological causes of acute abdomen paints an incomplete picture of the burden of operatively managed acute abdominal conditions. Due to a shortage in surgical specialists especially on the African continent, a large portion of these patients are managed by medical officers. This is evidenced by World Bank statistics that examined the surgical specialist workforce per 100,000 populations across the globe; Kenya had 2.35 compared to HICs such as the United states at 55, France at 59, Germany at 108, and Greece at 164 (Meara et al., 2015). A picture that displays the burden of these conditions by surgical volume rather than limited to single specializations would better allow for responsible training programs embedded within the context of the community's problems.

More female patients (59.6%) than male patients (40.4%), were seen in this study. This is likely as a result of including gynaecological acute abdominal causes. These contributed to 41.9% of the cases managed. In contrast, one Ethiopian study that also

included gynaecological causes observed a male predominance with a male to female ratio of 2.5:1. Gynaecological conditions made up about 11.5% of acute abdominal cases in that study (Nega, 2009). The exclusion of gynaecological causes of acute abdomen in a majority of the studies impairs our ability to see how they compare to the broader picture. This exclusion more likely results from increased sub-specialization with some acute abdominal conditions affecting women being seen separately by a general surgeon or a gynaecologist.

Ectopic pregnancy was the leading aetiology observed in this study. It accounted for 35.5% of all cases and 84.7% of all gynaecological acute abdominal cases. A study at KNH, Kenya also observed that surgery for acute abdominal conditions were higher in female patients. In that study, ectopic pregnancy was responsible for 65.3% of the surgical cases among women compared to appendicitis at 16.3% of cases (Awori & Jani, 2005). This is comparable to our study where amongst women, ectopic pregnancy at 59.5% ectopic dwarfed appendicitis cases at 12.4% surgeries for the acute abdomen. The predominance of ectopic pregnancy is contrasted by a study from Ethiopia which implicated ectopic pregnancy in only 5.6% of all acute abdominal cases (Nega, 2009). An even lower incidence is observed in Western Sudan at 0.5% of all acute abdominal cases (Doumi El Bushra Ahmed, 2018).

It is possible that both these studies had fewer women coming with ectopic pregnancies due to their largely rural catchment, as well as social practices which may have resulted in a decrease in risk factors to ectopic pregnancy among their women. The risk factors for ectopic pregnancy include smoking, sexually transmitted illnesses, prior surgery, intrauterine device use and pregnancy at older ages. Oral contraception use and sexually transmitted disease prevalence is on the increase in urban towns, as

reported in the Kenya Demographic Health Survey (KDHS, 2014). These have been identified as risks for developing ectopic pregnancy (Koshy Zachariah et al., 2019). Increased levonorgestrel only oral contraception use was associated with a risk of up to nine times, in a study on ectopic pregnancy at MTRH (Shurie et al., 2018).

Ectopic pregnancy is often compared against the number of live births (Tay et al., 2000; Thonneau et al., 2002), rather than other causes of acute abdomen. This makes it difficult to determine the extent of its surgical burden against a broader acute abdominal picture. It also makes it difficult to establish if, and why loco-regional similarities or differences may exist.

The median age at presentation for ectopic pregnancy was 28 years with a peak incidence in the 20-30-year age bracket. This is similar to findings at this same facility that reported a mean age of 27.1 years (+/- 5.4) (Shurie et al., 2018). It is noted that though ectopic pregnancy is seemingly on the rise across the globe and African continent, prevalence data in Africa is at best sparse (Thonneau et al., 2002). More prevalence studies into gynaecological conditions as a cause of the surgical acute abdomen should be encouraged. Excluding them results in an incomplete picture of the surgical acute abdomen.

The revelation that by surgical volume alone, ectopic pregnancy is the most common cause of operatively managed acute abdomen is important. Women make up large portions of the population and are solely exposed to the risk of an ectopic pregnancy. This finding should encourage education on risks of ectopic pregnancy, increase public health education on condom use to decrease sexually transmitted illness rates, increase testing for sexually transmitted illness to identify those affected and effect treatment, as well as programs to discourage smoking amongst women.

Other gynaecological conditions in this study occurred in relatively low frequency; they included ovarian cyst (n=5), torsion (n=3), pelvic abscess (n=2), pelvic inflammatory disease (n=2), and endometriosis (n=1). The endometriosis case seen caused pseudo peritonitis with a haemo-peritoneum and was rushed to surgery as a suspected ectopic pregnancy rapture.

Intestinal obstruction remains a major contributor to the surgical acute abdomen in our set up. It accounted for 22.7% of all cases and was the most frequent general surgical cause. Studies by Berhanu and Mequanint, in Ethiopia, found intestinal obstruction was the most frequent accounting for 34.9% and 49.3% of cases respectively (Negash, 2017; Nega, 2009). This differs from other studies where acute appendicitis has long surpassed intestinal obstruction (Gebre, 2016; Hanks, Lin C.P., Tefera G., 2014; Kotiso & Abdurahman, 2007; Awori & Jani, 2005). In the early 1990s, a study at KNH, our sister referral facility, noted appendicitis (37.5%) had already surpassed intestinal obstruction (28.3%). A decade later another study confirmed the same pattern at the same facility (Awori & Jani, 2005).

Mequanint postulated that facilities that served largely rural catchments were likely to see more cases of intestinal obstruction. He queried that this may be due to differences in diet between urban and rural areas (Negash, 2017). It is however important to note that no studies could be found linking dietary differences between urbanized and rural areas to the difference in observed acute abdominal aetiology. As observed by Trowell in the 1950's that Africans mostly presented with intestinal obstruction as an abdominal emergency, intestinal obstruction is the most commonly observed acute abdominal aetiology in general surgical patients presenting to our facility. MTRH serves a largely rural catchment undergoing rapid urbanization. As

championed by Ajao (Ajao, 1981), surgeons practicing within this region may be able to identify factors that may lead to a change in the dominant aetiology presenting for operative management. Unlike at KNH, it is possible intestinal obstruction has always been the most frequent cause at our set up. The earlier and rapid urbanization of Nairobi and its nearby environs could be responsible for the shift observed at KNH in the 1990s.

Adhesions were the most common cause of intestinal obstruction in this study at 28.3%, followed by hernia at 21.7% then sigmoid volvulus at 17.4%. This differs from studies by Berhanu and Mequanint in Ethiopia. Berhanu found that the most common cause of intestinal obstruction at the rural facility he conducted it in was volvulus (50%), then hernia (20%) and lastly adhesions (18%) (Nega, 2009). Mequanint noted that volvulus then intussusception and lastly adhesions in that order were the most common cause of an intestinal obstruction (Negash, 2017).

A study on the pattern of intestinal obstruction done prior at MTRH showed adhesions (32.8%), volvulus (26.1%), tumours and hernias to be the most prevalent causes (James, 2015). This is similar to what this study revealed implying no change in pattern in the intestinal obstruction causes managed at our facility. Adhesions still appear to be the most common cause of intestinal obstruction more than a decade on as evidenced by a study by Kuremu at MTRH that found that a majority of intestinal obstruction cases were due to adhesions at 40.7% (Kuremu & Jumbi, 2006). Prior surgery was observed to be a risk for adhesions with Kuremu noting 77% of patients with adhesions in his study had a history of prior laparotomy and 23% had a prior gynaecological operation (Kuremu & Jumbi, 2006). Gachini elucidated further on the prior surgeries in patients with adhesive intestinal obstruction finding that 25.9% had

a prior appendectomy, laparotomy for previous intestinal obstruction at 14.8%, herniorraphy at 11.1%, hysterectomy at 11.1% and penetrating abdominal injury (stab) at 7.4%(James, 2015). Due to the broad nature of this study and prior more focused studies into intestinal obstruction having looked at predisposing factors to adhesions, these factors were not re-examined in this study.

Adhesions are likely on the rise due to increased access to surgery (Attard & Maclean, 2007). Training programs imparting surgical skills should encourage better tissue handling, avoidance of dry pack/gauze use, minimizing foreign material placement in the abdomen, and avoiding mass ligation of omentum /mesentery to minimize the risk of adhesion formation.

More male patients (65.2%) than female patients (34.8%) present with intestinal obstruction. A male predominance (61.9%) is similarly reported in a study from Ethiopia (Tekalign Admasu et al., 2019). This is also observed in other studies from the African set up (Agboola et al., 2014; Nwashilli, 2013). The median age at presentation was 37 years with a peak incidence in the 3$^{rd}$ to 5$^{th}$ decades of life. At Tenwek Mission Hospital, a study into intestinal obstruction reported that the mean age was 40.6 years with a peak incidence in the 31- 40 year age bracket (Ooko et al., 2015). Similar observations of peak frequency in the 3$^{rd}$ to 5$^{th}$ decades of life are noted in other studies (Doumi El bushra Ahmed, 2018; Nwashilli et al., 2017).

Small bowel obstruction (73.9%) occurred more frequently than large bowel obstructions (26.1%). Small bowel obstructions are also more frequent in studies by Kotiso (52.3%), Tekalign (62.5%) and Mequanint (72.7%) (Tekalign Admasu et al., 2019; Negash, 2017; Kotiso & Abdurahman, 2007). In this study, adhesions (28.3%) were the leading cause of small bowel obstruction followed by hernias (21.7%) and

small bowel volvulus (13.0%). Adhesions were also observed to be the most frequent cause in studies by Nnamdi (41.5%), Tekalign (43%), Gebre (33.3%), and Ooko (15.1%) (Gebre, 2016; Nwashilli et al., 2017; Ooko et al., 2015; Tekalign Admasu et al., 2019).

Our etiology may soon mirror industrialized countries where adhesions account for 65-75% of small bowel obstruction cases(Attard & Maclean, 2007). Hernias which were initially seen to be the most common cause of small bowel obstruction (Agboola et al., 2014; Ajao, 1981; H.C., 1959) are likely on the decline due to increased access to surgical care. Adhesions on the other hand increase where there is increased access to surgery (Attard & Maclean, 2007).

Small bowel volvulus was observed to be the leading bowl obstruction cause in studies by Ayenew ( 57.3% ) and Mequanint (39.8%) (Ayenew et al., 2017; Negash, 2017). They attributed their variation from other studies conducted in Ethiopia (Gebre, 2016; Tekalign Admasu et al., 2019) to their largely rural catchment, and limited access to surgical services for their populace served. Other causes of small bowel obstruction such as intussusception and Meckel's diverticulum occurred in relatively low frequency in this study. A large possibility exists that the incidence of small bowel obstruction causes may vary in other regions of Kenya. A local Kenyan study found that hernias (17.8%) were the most common cause of small bowel obstruction at Kisii level 5 hospital (Bahaty, 2013). Studies at other facilities offering surgical services would shed more light on our local/regional differences.

Large bowel obstructions mostly resulted from sigmoid volvulus. It accounted for 66.7% of all large bowel obstruction cases and was the 3$^{rd}$ most common bowel obstruction cause (17.4%). It was observed to be so frequent at Kisii level 5 hospital

as to be the leading cause of intestinal obstruction. There, it accounted for 30% of cases followed by hernias (17.8%), then adhesions (16.7%) (Bahaty, 2013). Other studies from other African facilities also reported sigmoid volvulus as the most prevalent large bowel obstructive cause; Mequanint (68.6%), Tekalign (77.7%) and Kotiso (58.6%) observed this. This is in keeping with observations in Trowell's study where more than half a century ago volvulus was still a significant cause of bowel obstruction in the African populace (H.C., 1959).

Unlike western studies where large bowel obstructions are largely due to colon cancer (80.4%) (Drozdz & Budzyński, 2012), its frequency was relatively low in this study. It contributed to 16.7% (n=2) of all large bowel obstruction cases. Low frequency is also observed in the African set up by Berhanu (n=1), and Ohene (n=7) who looked at acute abdominal case prevalence over a 7-year period. (Nega, 2009; Ohene-Yeboah, 2006). One study however, observed colonic cancer ( n=9) occurred more frequently than volvulus (n=2) (Nwashilli et al., 2017). Both were still relatively infrequent when compared to adhesions and hernias. The frequency of colonic cancer remains relatively low in the African setup. This sets us at a vantage point where we can determine what factor in our populace leads to this low incidence and monitor for any rise in its frequency.

Appendicitis was the 3$^{rd}$ most common aetiology encountered in this study. It accounted for 18.2% of cases and 31.4% of all general surgical causes of acute abdomen. Mequanint also observed it as the 2$^{nd}$ most common general surgical cause and reported a near similar frequency of 31.5%. Acute appendicitis is reported as the leading cause of the surgical acute abdomen in a majority of studies from the African setup. Studies by Kotiso and Mequanint observed rates as high as 52% and 49.3%

respectively (Kotiso & Abdurahman, 2007; Negash, 2017). This upsurge shows a change in inflammatory categories of acute abdomen, previously thought to be infrequent (H.C., 1959). The increase is thought to be due to increased urbanization across the African continent and westernization of diets (Ajao, 1981; Hanks, Lin C.P., Tefera G., 2014).

The median age at presentation was 26 years with a peak incidence in the 20-30-year age bracket. Similarly, a 5 year look at appendicitis in Kano, Nigeria, reported a peak age of 26.5 years (Edino et al., 2004). Other studies by also reported peak incidence in the 2$^{nd}$ and 3$^{rd}$ decades of life (Agboola et al., 2014; Tassew et al., 2017; Tekalign Admasu et al., 2019). A male predominance was observed, in keeping with surgical studies across the continent. The most common pathology seen intraoperatively was pure appendiceal inflammation (64.9%), appendiceal abscess (29.7%), then perforated appendicitis (5.4%).

In his study, Edino noted a near similar pattern with inflamed appendix (69.7%) encountered more than perforated appendicitis (23.2%), or abscess (3.5%). Perforations were fewer in our study but more appendiceal abscesses are seen. Factors such as an early presentation to a health facility or inappropriate antibiotic usage (over the counter) may be responsible for this. A study needs to conducted to determine the factors differentiating patients who present with perforated appendicitis versus appendiceal abscess. A possibility exists that in a few years, appendicitis will be the most prevalent acute abdominal cause in our facility. Having this record now puts us in a unique position to observe this change.

Bowel perforations were the 4th most common cause, encountered at 12.8 % (N=26) of all acute abdominal cases. It was the third most commonly managed condition in general surgery at 22.0% of cases. Perforated peptic ulcer disease is the most common condition causing bowel perforation. It accounted for 8.9% (N=18) of the cases in the study sample and on its own contributed to 15.3% of all general surgical cases. Other studies also reported near similar rates. Duodenal perforations (77.8%) were more frequent than gastric (22.2%). PPUD was observed in 9.0% of cases by Kotiso (Kotiso & Abdurahman, 2007) and 5.7% of cases by Bizuayehu (Tassew et al., 2017). Male predominance was observed with a male to female ratio of 8:1.

The mean age at presentation was 39.4 years which is almost similar to the findings by Kotiso (37.4 years) (Kotiso & Abdurahman, 2007). Tovey in the 1970s also reported male predominance with a mean age of 34 years in areas of West Africa (Tovey & Tunstall, 1975). Archampong noted heterogeneity across the continent with the peak incidence in the 4th and 5th decades of life with duodenal ulcers more frequent than gastric (Archampong et al., 2019). Findings from this study mirror the reports from other African centers. The increased presence of associated risks such as alcohol, non-steroidal anti-inflammatory drug use, smoking, and Helicobacter pylori infections are observed in patients, across the continent. These predispose to peptic ulcer disease with a chance of perforation as a complication (Archampong et al., 2019).

Small bowel perforations (92.3%) were more common than large bowel perforations (7.7%). Excluding PPUD, most other perforations were located within the ileum (62.5%). Paingha reported other bowel perforation frequency at 3% when PPUD was excluded, which is almost similar to this study's findings (3.9%) (Alagoa, 2006).

Berhanu noted a slightly higher frequency at 11.2%, while Ohene reported an even higher frequency with 16.2% of cases resulting from typhoid ileal perforation (Nega, 2009; Ohene-Yeboah, 2006). A study from Kigali, Rwanda, reported a much higher frequency as well with intestinal perforation accounting for 28.4% of acute abdominal cases (Nyundo M., Rugwizangoga E, Ntakiyiruta G., 2013).

Perforations frequency from African studies is much lower when compared to other studies from India. A study by Zaid in Northern India reported a frequency of 57 %, with bowel perforations being the leading cause of surgical acute abdomen (Zahid et al., 2018). Sabhnani and Chhetri both observed it as the 2$^{nd}$ most common cause in their studies with frequencies of 26.7% and 28.0% respectively (Rk & Ml, 2005; Sabhnani & Tomar, 2016). Male predominance was observed in this study with a male to female ratio of 7:1. Male predominance is also observed in studies by Ajao (4.8:1) and Faraj ( 4.9:1) (Ajao, 1981; Faraj, Molah Karim, & Fattah, 2015). The studies reviewed reported small bowel perforations occurred more frequently than large (Ajao, 1981; Alagoa, 2006; Faraj et al., 2015)

Typhoid ileitis resulting in perforation is implicated in a number of studies (Nyundo M., Rugwizangoga E, Ntakiyiruta G., 2013; Ohene-Yeboah, 2006; Ajao, 1981). Patients with small bowel perforations are empirically treated for typhoid at our facility, often without testing. An argument for empirical treatment without testing can be supported by a study in Mbarara, Uganda that reported that Salmonella Typhi was isolated in only 15% percent of patients (Mutiibwa et al., 2012). This was thought to result from patients taking antibiotics prior to presenting to health facilities. The availability of over the counter treatment with antibiotics in our set up makes the possibility of similar findings high. It would be beneficial to study this phenomenon.

The frequency of bowel perforations may also be low in our set up due to this availability of over the counter antibiotics as well.

Other general surgical causes of the acute abdomen such as primary peritonitis (n=4), psoas abscess(n=2), and peritoneal carcinomatosis (n=2) were observed to occur quite infrequently. There is a possibility of diagnostic challenge in an emergency setting for rarely diagnosed/ encountered conditions. It is also possible that with proliferation of health facilities offering surgical services around Eldoret, some of these cases are managed in these other facilities. Another possibility might also be that these conditions are low within the general populace, but no study has been carried out in our set up to verify this.

The outcomes examined in this study were the post-surgical complications, mortality, and duration of hospital stay. It was observed that 20.7% of the participants developed a complication after surgery. More male patients (59.5%) than female patients (40.5%) had a complication. Only 14.2% of the patients who developed complications had an illness duration longer than seven days Referrals from other health facilities contributed to 42.9% of those with complications. This is despite the fact that they only constituted 20.9% of the sample population. Those referred in had a higher chance of getting a post op complication with an odds ratio of 1.8305. Intestinal obstruction (21), ectopic pregnancy (15), and bowel perforation (11) cases are the most commonly referred in cases. The reasons cited include a lack of a surgeon, or theatre resource or diagnostic imaging. There is a possibility that capacity building in referring facilities will result in a drop in referrals and potentially improved outcomes for these patients. Thirty-eight point one (38.1%) of referred in intestinal obstruction cases, and 45.5% of referred in bowel perforation cases developed a complication.

Referral status may be a factor that increases the chance of developing complications; 30% of all referred patients in this study developed one. A study by Ayenew determined that patients with a more than 2-day duration of illness had a 3.8 times higher chance of a complication (Ayenew et al., 2017). This study similarly observed a majority (66.7%) of patients with complications had had an illness duration of greater than 2days. Exclusion of gynaecological conditions resulted in a complication rate of 31.4% for general surgical conditions.

Wound complications encountered included wound dehiscence and surgical site infections. Wound dehiscence was the most frequently encountered complication in 8.4% of cases. When gynaecological and general surgical conditions were examined separately, rates of 2.4% and 12.7% were observed respectively. Lower incidence was observed in studies by Berhanu (4.9%) and Nyundo (0.9%) (Nega, 2009; Nyundo M., Rugwizangoga E, Ntakiyiruta G., 2013). Intestinal obstruction and PPUD cases contributed to 58.8% of all dehiscence incidences. Wound contamination is likely to occur when laparotomies for these aetiologies are performed. Midline incision use, gastrointestinal tract damage and ostomy creations that may occur for these aetiologies are identified as risk factors for dehiscence (Ousey et al., 2018). Pfannensteil incisions are largely used in gynaecological emergencies and are possibly a reason for the lower dehiscence observed. We observe that those with bowel perforations and those with intestinal obstruction had a significantly higher proportion of wound dehiscence compared to those with other diagnosis. The likelihood of the aetiology managed resulting in a post-operative wound dehiscence was found to be statistically significant with a p value of 0.003.

Surgical site infection was encountered in 7.9% of cases and was the 2nd most common complication. Gynaecological and surgical cases separately reported rates of 1.2% and 12.7% respectively. SSI occurrence is low in gynaecological conditions and falls within the expected range for clean and clean contaminated wounds; which are the wound types most commonly handled at the unit. For general surgical conditions, and overall, the rate falls within the range identified by studies from other facilities of 5.9-21% (Nega, 2009; Negash, 2017). SSI was observed in 11.9% of cases following emergency laparotomy for bowel surgery; far lower than the 30.8% observed at KNH. The risk factors this study identified included alcohol consumption, cigarette use, wound contamination, prolonged antibiotic therapy, perioperative blood transfusion, and ASA score >1 (Miima, 2016).

Intestinal obstruction, appendicitis, and bowel perforation contributed to 87.5% of SSI cases in this study. There was a statistically significant association between diagnosis and the likelihood of developing a post-operative surgical site infection with a p-value of 0.004. Those with intestinal obstruction having a significantly higher proportion with SSI compared to other diagnosis. There is an increased risk of wound contamination following laparotomy for these conditions and coupled with a variety of patient and environmental factors, could lead to SSI. A study by Okello at MTRH looking into the susceptibility risk for surgical site infection noted an increased risk with smoking, diabetes mellitus and increased surgery time in the operating room. The organisms cultured from surgical site infections were predominantly Staphylococcus Aureus (40%), Escherichia Coli (20%), Acinetobacter Baumanii (10.9%), Klebsiella Pneumoniae (9.1%), and Pseudomonas Aureginosa (7.3%). Whether the infections were largely nosocomial or community acquired is still

unknown as well as the drug resistance spectrum of these organisms. These may be important to consider in future studies on surgical site infections.

Pneumonia was observed in 3.4% of cases and was the 3rd most encountered complication. It was observed in 1.2% of gynaecological and 5.1% of general surgical conditions. The diagnosis was made following a clinical assessment (cough, chest pain, dyspnea added chest sounds and findings on chest x ray). No clear differentiation was made between atelectasis and pneumonia, as patients presenting with respiratory difficulties were treated for pneumonia. In his study, Kotiso (3.0%) observed an almost similar frequency for all postoperative cases (Kotiso & Abdurahman, 2007). Slightly lower incidences were reported by Gebre (1.8%) and Berhanu (2.1%) (Gebre, 2016; Nega, 2009). The overall incidence in this study falls within the range of those observed in studies from the United States which ranged from 3-21% (Barie, 2012).

The minimal variation across different facilities may be due to the standardization of post-operative care. Physiotherapy involving deep breathing exercises and early mobilization is carried out for post-operative patients. This decreases the chance of developing pneumonia. The occurrence of pneumonia was almost equally distributed among the various causes of acute abdomen. There was no statistically significant association between Pneumonia and diagnosis (P-value=0.075).Though increasing age is identified as a risk (Chughtai et al., 2017), this study did not observe an increasing incidence with age.

Sepsis (septic shock) occurred in 2.5% of the sample population. The diagnosis of sepsis was made using the systemic inflammatory response syndrome (SIRS) criteria leading to multiple organ dysfunction (MODS). MODS is the presence of altered

organ function in an acutely ill patient such that homeostasis cannot be maintained without intervention. Primary MODS results from a well-defined insult in which organ dysfunction occurs early and can be directly attributable to the insult itself. Secondary MODS develops as a consequence of a host response and is identified within the context of SIRS. This entailed a fever (>38.0 degrees Celsius), tachypnea (>90 breaths per minute), tachycardia, and hypotension.

It was the 4$^{th}$ most commonly encountered complication. Near similar rates were observed in studies by Mequanint (3.0%) and Nyundo (3.5%) (Negash, 2017; Nyundo M., Rugwizangoga E, Ntakiyiruta G., 2013). Higher rates were observed by Hanks (7%) and Bizuaheyu (8%). Our finding is almost similar to the 2.3% rate reported by the U.S. national surgical quality improvement program perspective(Moore et al., 2009). It is of importance to note that 4 out of the 5 patients in this study with sepsis had the features prior to surgery. Thus it may be that sepsis was a result of the disease process rather than stemming from their management. It would be important to set up a study looking at patients who present to the facility with sepsis features, and determine the potential gaps in our interventions to decrease mortality.

A push is being made for the use of the Sequential Organ Failure Assessment (SOFA) as opposed to the SIRS criteria. This score assesses for organ system dysfunction by looking at platelet count, bilirubin levels, mean arterial pressure, Glascow Coma Scale score and renal function. Each component is scored from 0-4 and the worst score in 24 hours is taken note of. A modified version of the score involving only respiratory rate, mental status change and low systolic BP is also available (Rhodes et al., 2017). The SOFA score is reported to have a higher predictive value for mortality than the SIRS criteria but the lack of rapidly available laboratory values impairs its use outside

of an ICU (McLymont & Glover, 2016). The extra expense from the numerous testing required would probably be an impediment in our set up.

A debate still exists as to the prognostic accuracy for in hospital mortality between the SIRS criteria and the modified SOFA score. This is yet to be examined in our set up. Aseptic techniques and improved perioperative care, with antibiotic usage are probably responsible for the low rates sepsis reported. Sepsis in this study occurred in patients with bowel perforation(n=2), and small bowel obstruction(n=3).

Other complications such as ECF(n=2), CVA(n=1) and short bowel syndrome(n=1), occurred in low frequency. They are often grouped when mentioned in other studies from African settings due to their low frequency (Negash, 2017; Tassew et al., 2017; Nyundo M., Rugwizangoga E, Ntakiyiruta G., 2013).

The mortality rate of 1.5% was observed in this study. The deaths were all attributable to general surgical causes. Exclusion of gynaecological conditions still resulted in a relatively low general surgical mortality rate of 2.5%. Post-operative mortality from a study by Kotiso at 14.0% was used to calculate the sample size (Kotiso & Abdurahman, 2007). Thus in comparison, mortality from this study was low. This is lower than that reported in other African studies by Ohene (7.4%), Hanks (18%), Mequanint (4.1%) and Bizuaheyu (5.4%) (Hanks, Lin C.P., Tefera G., 2014; Negash, 2017; Ohene-Yeboah, 2006; Tassew et al., 2017). The higher mortality in these centers was attributed to late referral, inadequate resuscitation, and late presentation (especially with patients from rural areas) (Negash, 2017; Nyundo M., Rugwizangoga E, Ntakiyiruta G., 2013). Adequate resuscitation, early time to surgery, and good post-operative care may be factors contributing to lower mortality in our set up. Two of the deaths in our set up were from elderly male patients with sepsis, while the other was

in an elderly female with advanced metastatic colon cancer. The two patients with sepsis developed it post operatively, and progressed to multiple organ dysfunction syndrome leading to their deaths.

A majority of patients (63.5%) were discharged within a week of their admission. This is in contrast to Nyundo's study where 64% of patients stayed longer than 7 days. A large number of referrals ( 83.4%) in his study compared to ours (20.9%) likely resulted in this (Nyundo M., Rugwizangoga E, Ntakiyiruta G., 2013). Referrals are often severely ill and have longer illness durations. These are factors observed to contribute to an extended hospital stay (Marfil-Garza et al., 2018). In this study, cases PPUD (49.5%) and intestinal obstruction (89.1%) often resulted in stays longer than 7 days. Thirty-four point seven (34.7%) and 79.2% of patients discharged between 7-13 days and after 14 days respectively, had a complication. Measures to reduce occurrences of complications by identifying and improving perioperative factors will most probably result in a decreased hospital stay.

This study has the advantage of broadly defining operatively managed acute abdominal conditions encountered at MTRH. This will allow our facility to participate in the conversation around the burden of acute abdominal aetiology on the African continent. The outcomes show that by sheer volume ectopic pregnancy is the most commonly encountered aetiology followed by intestinal obstruction. As this is a training center, emphasis should be laid on imparting the surgical skills necessary to manage the most common aetiology in our set up. Future studies into the operatively managed acute abdomen should include gynaecological cases for a more complete picture, as well as to allow comparability between studies. In terms of public health policy, more emphasis should be laid on educating women on risk factors surrounding

ectopic pregnancy. Wound complications especially dehiscence is most commonly encountered and as at now, only one study seems to have examined surgical site infection risk, but none has examined wound dehiscence risk. Studies should thus be set up to determine the risk factors associated with wound dehiscence at MTRH.

## 5.2 Study Limitations

As this is a facility based study, and due to its design, the results are not generalizable to the community served by the facility. Due to resource and time constraints only short term outcomes were considered. Patients were followed up to the point of discharge or death within the facility. As such, wound infections up to 30 days' post operatively, or mortality related to the disease process outside of the facility were not assessed.

Inter departmental differences couldn't be controlled for in terms of management differences. Also different surgical teams performed the surgeries thus a difference in skill level couldn't be controlled for within this set up.

There's also a risk of interaction effect modification meaning there is always a possibility that for example, examining a wound may introduce infection or result in dehiscence. This was mitigated by gentle handling and use of aseptic technique.

# CHAPTER SIX

## 6.0 CONCLUSIONS AND RECOMMENDATIONS

### 6.1: Conclusion

Ectopic pregnancy is the most frequently encountered cause of operative acute abdomen at MTRH. It is followed by intestinal obstruction, appendicitis, then bowel perforations in that order.

Adhesions and not herniae are the most common cause of intestinal obstruction in our set up with no change in this fact occurring over the past decade. Colon cancer occurs in relatively low frequency in our set up in keeping with what prior studies concluded about it in Africa.

Wound complications, pneumonia and sepsis are the most frequently encountered complications post operatively. There is an association between surgery for intestinal obstruction and bowel perforation and increased chances of developing a post-operative complication (specifically wound complications).

Mortality following surgery for acute abdominal conditions is low at MTRH. Complications contribute to longer hospital stays.

### 6.2: Recommendations

A 5-10 yearly review of acute abdominal aetiology should be carried out at MTRH to allow us to monitor for any future changes. A study to identify the risk factors for wound dehiscence in MTRH should be carried out with the aim of improving the influencing perioperative factors. Emphasis should be laid on surgical training around the management of ectopic pregnancy, intestinal obstruction, acute appendicitis and bowel perforation with the aim of improving post-operative outcomes for these cases.

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# APPENDICES

## Appendix 1: Data collection form

This data collection form is prepared to assess emergency surgical operation performed for acute abdomen Moi teaching and referral hospital during the year 2018-2019. This will be filled by the Principal investigator and research assistants.

(Tick the box where appropriate)

**Study participation number**…… **Date:** ……..... (DD/MM/YY)

**Sex:** male ☐ female ☐

**Age:** ……

**Referral status:** non referral ☐ referred ☐

If referred, specify the reason why:

……
……
……

**Presenting complaints** (tick appropriate box when symptom is present)

**Duration of illness:** 1 day 2 days ☐ 3 days ☐ 4 days ☐ 5 days ☐ 6 days 7days and above ☐

**Abdominal pain** ☐

On the pain scale, was it: mild (0-3) ☐ moderate (4-6) ☐ severe (8-10) ☐

**Nausea** ☐ **Vomiting** ☐ **Constipation** ☐ **Diarrhea** ☐

**Physical findings**

**Vitals:**

- **PULSE** normal ☐ tachycardia ☐ bradycardia ☐

Normal range: 60-100/min

- **BP** normal ☐ hypotension ☐ hypertension ☐

Normal range: 120/80 -140/90 mmHg

**Examination findings** (Tick the appropriate box if the physical finding is present on examination)

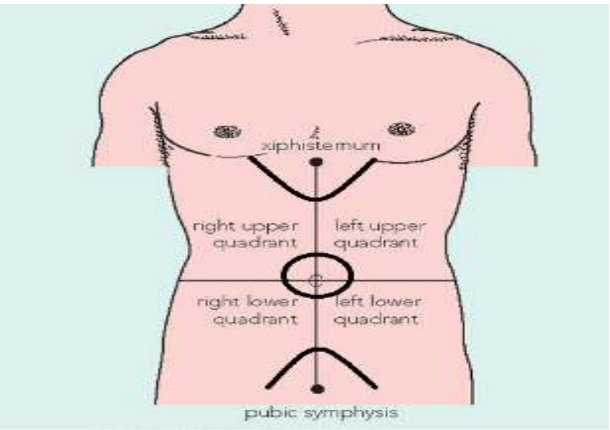
**Abdominal distention**

**Tenderness**

If tenderness is present, is it: generalized localized

If localized, which part of the abdomen is it most marked? (shade appropriate area in diagram)

1. RUQ
2. LUQ
3. RLQ
4. LLQ
5. Epigastric
6. Periumbilical
7. Suprapubic




**Investigation**

**UECS**: Urea (normal values: 1.2- 3mmol/L) High Low

Potassium (3.5-5 mmol/L) High Low

Sodium (135-145 mmol/L) High Low

Chloride(95-105 mmol/L) High Low

Creatinine (0.8-1.3 mg/dL) High Low

**IMAGING (tick if done): (summarize findings in space below)**

Plain abdominal X-ray ……

CT scan ……

Ultrasound ……

Other specify……

**Preoperative/working diagnosis**……

**Emergency procedure done**

Laparotomy ☐ Laparoscopy ☐

**Operative findings (tick appropriate box if pathology found)**

1. **Appendicitis** ☐

Acute ☐ Abscess ☐ Perforated ☐

2. **Intestinal obstruction** ☐

A) Large bowel obstruction ☐

Sigmoid volvulus ☐ Gangrenous ☐ Non gangrenous ☐

Colonic cancer ☐

Ileo- sigmoid knotting ☐

Others ☐ specify: ……

B) Small bowel obstruction ☐

Primary volvulus ☐ ➡ gangrenous ☐ Non- gangrenous ☐

Adhesion/band ☐➡ gangrenous ☐ Non - gangrenous ☐

Hernia ☐➡ gangrenous ☐ Non - gangrenous ☐

Intussusceptions ☐➡ gangrenous ☐ Non - gangrenous ☐

Others ☐ specify: ……

3**. Peritonitis**

Following perforated PUD ☐

Bowel perforation specify (small versus large gut)……

Primary peritonitis

Others specify: ……

**Outcome**

**Surgical site infection**

**Wound dehiscence**

**Enterocutaneous fistula**

If yes, is it high output (> 500mL/day) or low output (<500mL/day)

**Pneumonia**

**DVT**

**Others** specify: ……

**Final outcome**

**Discharge**

*(cross this statement if against medical advice and indicate in the space below why)

……

**Duration of stay**: 0-6 days 7-13days 14days and above

**Death**

specify cause: ……

**Appendix 2: Consent form**

**MOI UNIVERSITY COLLEGE OF HEALTH SCIENCES / MOI TEACHING AND REFERRAL HOSPITAL**
**INSTITUTIONAL RESEARCH AND ETHICS COMMITTEE (IREC) INFORMED CONSENT FORM (ICF)**

**Study Title: ETIOLOGY AND OUTCOMES OF OPERATIVELY MANAGED ACUTE ABDOMEN AT MOI TEACHING AND REFERRAL HOSPITAL.**

**Name of Principal Investigator(s): DR. PHILIP B. OKOTH**

**Name of Organization: Moi Teaching and Referral Hospital, PO BOX 3, Eldoret, Kenya.**

**Informed Consent Form for: Patients (adults) undergoing surgical care for operatively managed acute abdomen.**

**This Informed Consent Form has two parts:**

- Information Sheet (to share information about the study with you)
- Certificate of Consent (for signatures if you choose to participate)

You will be given a copy of the signed Informed Consent Form

**Part I: Information Sheet**

**Introduction:**

You are being asked to take part in a research study. This information is provided to tell you about the study. Please read this form carefully. You will be given a chance to ask questions. If you decide to be in the study, you will be given a copy of this consent form for your records.

Taking part in this research study is voluntary. You may choose not to take part in the study. You could still receive other treatments. Saying no will not affect your rights to health care or services. You are also free to withdraw from this study at any time. If after data collection you choose to quit, you can request that the information provided by you be destroyed under supervision- and thus not used in the research study. You will be notified if new information becomes available about the risks or benefits of this research. Then you can decide if you want to stay in the study

**Purpose of the study:**

The purpose of the study is to find out the cause of your illness (acute abdomen) and management outcomes following surgery. The study is for research purposes but we hope that the information obtained will be used to inform the hospital and other policy formulators which will result in improved healthcare service delivery.

**Type of Research Project/Intervention:**

The study involves filling out a questionnaire with no interference with your standard of care nor added invasive procedure.

**Why have I been identified to Participate in this study?**

You have been chosen to participate in this study to help fill an information gap that will be useful in epidemiology and future clinical practice.

How long will the study last?

You will be in this study at any point from the time you are admitted to your time of discharge.

The research shall be carried out over the course of one year (2018) and enquiries into it can be directed at us even after the conclusion of this period.

What will happen to me during the study?

We are asking you to help us learn more about the patterns and outcomes of interventions for operatively managed acute abdomen at MTRH. If you accept, you will be asked to fill a predesigned questionnaire and examined with the assistance of the research investigators who will then follow you up during the course of your hospital stay.

Questions asked will include your age, sex, residence, referral status, duration of illness, and presenting complaints with you then being examined and followed up over the course of your management until you are discharged.

What side effects or risks I can expect from being in the study?

There are no risks involved in this study. This study will be anonymous. You will receive normal treatment as per the diagnosis and the hospital /faculty protocols.

Are there benefits to taking part in the study?

You may not benefit personally from this study.

The possible benefits to society may include improved healthcare service delivery based on the findings of this study.

**Reimbursements:**

There is no cost to you.

No compensation shall be given to patients for participation in this study.

**Who do I call if I have questions about the study?**

Questions about the study: If you have questions, complaints or concerns about this study, you can contact the investigator from Moi University, School of Medicine, department of General surgery, Postgraduate programme; Dr. Okoth Philip B. +254710285977 email: philipbrian3000@gmail.com

Questions about your rights as a research subject: You may contact Institutional Review Ethics Committee (IREC) 053 33471 Ext.3008. IREC is a group of people that reviews studies for safety and to protect the rights of study subjects.

**Will the information I provide be kept private?**

All reasonable efforts will be made to keep your protected information (private and confidential. Protected Information is information that is, or has been, collected or maintained and can be linked back to you. Using or sharing ("disclosure") of such information must follow National privacy guidelines. By signing the consent document for this study, you are giving permission ("authorization") for the uses and disclosures of your personal information. A decision to take part in this research means that you agree to let the research team use and share your Protected Information as described below. As part of the study, Dr. Okoth and his study team may share the results of your examination, investigation and management. These may be study or non-study related. They may also share portions of your medical record, with the groups named below:

The National Bioethics. Committee,

- The Institutional Review and Ethics Committee,

National privacy regulations may not apply to these groups; however, they have their own policies and guidelines to assure that all reasonable efforts will be made to keep your personal information private and confidential.

[The sponsor may give your personal health information, not containing your name, to

others or use it for research purposes other than those listed in this form. In handling your personal information, the sponsor, [PI] and associated staff will keep your information in strict confidence, and shall comply with any and all applicable laws regarding the confidentiality of such information.]

The study results will be retained in your research record for at least six years after the study is completed. At that time, the research information not already in your medical record will be made available in your records. Any research information entered into your medical record will be kept indefinitely.

Unless otherwise indicated, this permission to use or share your Personal Information does not have an expiration date. If you decide to withdraw your permission, we ask that you contact Dr. Okoth Philip in writing and let him know that you are withdrawing your permission. The mailing address is Moi Teaching and Referral Hospital, PO BOX 3, Eldoret, Kenya. At that time, we will stop further collection of any information about you. However, the health information collected before this withdrawal may continue to be used for the purposes of reporting and research quality.

[You have the right to see and copy your personal information related to the research study for as long as the study doctor or research institution holds this information. However, to ensure the scientific quality of the research study, you will not be able to review some of your research information until after the research study has been completed.]

Your treatment, payment or enrollment in any health plans or eligibility for benefits will not be affected if you decide not to take part. You will receive a copy of this form after it is signed.

**The questionnaire will be administered at any time prior to your discharge from the facility**.

**Please note that at any point if you the patient are in distress and not in a position to give consent, your guardian/health proxy will be allowed to do so for you.**

**Part II: Consent of Subject:**

I have read or have had read to me the description of the research study. The investigator or his/her representative has explained the study to me and has answered all of the questions I have at this time. I have been told of the potential risks, discomforts and side effects as well as the possible benefits (if any) of the study. I freely volunteer to take part in this study.

_____ _____ _____

Name of Participant Signature of subject/thumbprint Date & Time

(Witness to print if the

subject is unable to write

_____ _____

Name of Representative/Witness Relationship to Subject

_____ _____

Name of person Obtaining Consent Signature of person Date

Obtaining Consent

_____ _____ _____

Printed name of Investigator Signature of Investigator Date

**Fomu ya kibali**

**MOI UNIVERSITY COLLEGE OF HEALTH SCIENCES / MOI TEACHING AND REFERRAL HOSPITAL**
**INSTITUTIONAL RESEARCH AND ETHICS COMMITTEE (IREC) INFORMED CONSENT FORM (ICF)**

**MADA YA UTAFITI: ETIOLOGY AND OUTCOMES OF OPERATIVELY MANAGED ACUTE ABDOMEN AT MOI TEACHING AND REFERRAL HOSPITAL.**

Mtafiti mkuu: DR. PHILIP B. OKOTH

Jina la shirika: Moi Teaching and Referral Hospital, PO BOX 3, Eldoret, Kenya.

Fomu ya kibali cha: wagonjwa (watu wazima) watakayofanyiwa operesheni kutibu maumivu makali ya tumbo.

Hii fomu imegawanywa mara mbili:

• Kipande cha ujumbe (kukupa habari juu ya utafiti)

• Fomu ya kibali (pahali pa sahihi ukikubali kujiunda na utafitti)

Utapewa nakala ya hii fomu ya kibali

Sehemu ya I: kipande cha ujumbe

Utangulizi:

Unaulizwa ujiunde na utafiti. Haya maneno yatakupa habari juu ya utafiti huu. Tafadhali soma fomu hii kwa umakini. Utapewa nafasi ya kuuliza maswaliukikubaki kujiunda na huu utafiti, utapewa nakala ya hii fomu ya kibali.

Kujiunga na utafiti huu ni kwa hiari yako. Unaweza kataa kujiunda nayo. Utapokea matibabu ya kawaida. Kukataa kujiunga haita kiuka haki yako kwa huduma ya afya au utumishi. Uko na uhuru ya kujiondoa wakati wowote. Iwapo baada kupatiana majibu uamue kujiondoa, uaneza uliza majibu ulioyapeana yaondolewe- haitatumika kwa utafiti. Utajulishwa kukiwa na matukio mapya yanayohusu faida au shida inayoambatana na huu utafiti. Unaruhusa ya kuamua kubaki kwenye utafiti.

Kusudi la utafiti:

Kusudi la utafiti ni kutambua kinacho sababisha ugonjwa (maumivu makali ya tumbo) na usaidizi wa kioperesheni. Uchunguzi huu ni wa utafiti natunatuami

kwamba majibo tutakayoyapata yatatusaidia kuipasha hospitali kwa minajili ya kuiendeleza huduma ya afya.

Aina ya utafiti:

Uchunguzi huu unahusu kujaza fomu ya maswali bila kuadhiri upeanaji unayoipata.

Mbona nimechaguliwa kushiriki na huu utafiti?

Umechaguliwa kujihusisha na huu utafiti kusaidia kujaza maswala yanahitajika ambayo yatakuwa ya msaada katika epidemiologia na huduma bora huko mbeleni.

Utafiti huu itachukawa muda gani?

Utaingia kwenye huu utafiti wakati wowote kutoka utakavyoingia hospitali hadi utakavyo toka.

Utafiti huu utafanyika kwa muda wa mwaka moja (2018) na maswali yeyote yamehusishwa ni muhimu kwetu hata baada ya kufunga utafiti wako.

Ni nini itanifanyikia kwenye huu utafiti?

Tunakuuliza utusaidie kujifunza mengi kuhusu yale yanayosababisha maumivu makali ya tumbo yanayohitaji operesheni kenye hospitali huu ya rufaa. Ukikubali utatulizwa ujaze fomu ukiangaliwa na usaidizi wa uchunguzi mkuu, ambaye atakuangalia wakati utakuwa umelazwa kwenye hospitali.

Maswali utakayoulizwa yatakuwa juu ya miaka, jinsia, ukaazi, hospitali iliyokutuma au la, muda wa ugonjwa yako, shida uliyokuwa nayo na utachunguzwa na kufuatiliwa kwa ule muda utakayolazwa mpaka wakati utapewa ruhusa ya kuenda nyumbani.

Naweza tarajiya shida gani kutoka kwenye utafiti huu?

Hakuna shida yeyote utatarajiya kwenye huu utafiti. Hautajulikana na utapata matibabu unayohitaji kwa njia ya kawaida.

Kuna manufaa gani ya huu uchunguzi?

Hauta lipwa kujiunga na huu utafiti.

Utafiti huu utasaidia jamii na unaeza endeleza huduma bora ya afya kutoka kwa majibu tutakayoyapata.

Malipo :

Hutalipwa kushiriki katika utafiti huu. .

Niite nani nikiwa na maswali kuhusu utafiti huu?

Kwa maswali yoyote kuhusu uatfiti huu ama madhara yoyote kutokana na utafiti, pigia simu Moi University, School of Medicine, department of General surgery, Postgraduate programme; Dr. Okoth Philip B. +254710285977 email: philipbrian3000@gmail.com

Maswali juu ya haki zako kama mwenye kujihusisha na utafiti: unaweza uliza Institutional Review Ethics Committee (IREC) 053 33471 Ext.3008. IREC ni chama cha watu wanayochunguza utafiti na kukinga haki za wanayojihusisha na utafiti.

Je, majibu nitakayopewa yatawekwa kibinafsi

Bidii itafanya kukinga majibu yako kwenye utafiti huu. Majibu yatakayokingwa ni yale utakayoipa wakati wa uchunguzi na unaweza kutumiwa kukutambulisha. Kutumia au kupatiana haya majibu inapaswa kufuata maagizo ya kielelezo cha kibinafsi ya nchi. Ukipeana kibali kujihusisha nah ii utafiti, unapeana makubaliano ya kutumia majibu utakayopeana na maelezo juu yako. Uamuzi kuhusiana na hii uchunguzi ina maanisha kuwa unakubali wachunguzi watumie na wapeane melezo yako ya kibinafsi.

Kwenye uchunguzi, Dr. Okoth na timu yake inaeza hisa majibu yako na jinsi ulivyotibiwa. Yaweza kuwa juu ya uchunguzi au la. Wanaweza pia onyesha majibu yako kwenye haya mashirika yaliyotajwa humu chini:

- The National Bioethics. Committee,
- The Institutional Review and Ethics Committee,

Maagizo ya kielelezo cha kibinafsi ya nchi yanweza kuwa hayafwatwi na haya mashirika;lakini, wako na sheria na maagizo yao yatakayweka maelezo yako kwa njia ya kibinafsi

Uchunguzi hii itawekwa kwenye taarifa yako ya afya kwa muda wa miaka sita utafiti ikiwa ishaisha. Wakati huo arifu yeyoteambayo haitakuwa kwenye taarifa yako ya afya itawekwa. Taarifa yeyote ya uchunguzi utawekwa kwa muda mrefu kwenye rekodi yako.

Kibali cha kutumia na kupasha taarifa yako hauna muda wa kuyoyoma. Ukitaka kuondoa kibali chako, unaeza andikia Dr. Okoth Philip umwambiesanduku la posta ni Moi Teaching and Referral Hospital, PO BOX 3, Eldoret, Kenya. Wakati huo, tutasimamisha kuchukuwa taarifa yeyote juu yako, lakini haya majibu uliyopewa hapo awali yataendelea kutumika kwenye uchunguzi.

[uko na haki ya kuona majibu yako kwenye huu utafiti daktari yako akiwa na hay taarifa. Lakini kuchunga sifa ya utafiti huu, hautaweza kuangalia taarifa mengine juu ya utafiti huu mpaka iishe]

Haki yako ya kupata rufa ya afya hautapunguka ukikataa kujiunga na uchunguzi huu. Utapata nakala ya hii fomu ukishaitia sahihi.

**Fomu ya maswali itapewa uijibu wakati wowote kabla ya wewe kupewa ruhusa kutoka kwenye hospitali**

**Tafadhali jua kana kwamba mgonjwa akiwa kwenye hali mbaya na kutoweza kupeana kibali, mchungaji wake atapewa huu wajibu.**

**Kiswahili: Fomu Ya Kibali**

**MADA YA UTAFITI: ETIOLOGY AND OUTCOMES OF OPERATIVELY MANAGED ACUTE ABDOMEN AT MOI TEACHING AND REFERRAL HOSPITAL.**

**MTAFITI: Dr. Philip B. Okoth**

**RUNUNU: 0710285977**

Mimi _____ wa Sanduku la Posta _____, Nambari ya Simu_____ najitolea kwa hiari yangu mwenyewe kutoakibali cha kujihusisha katika utafiti uliotajwa hapo juu unaendelezwa katika kaunti ya Uasin Gishu. Nimepokea maelezo yatafsili kuhusu utafiti huu kutoka kwa Daktari Philip katika lugha, kanuni na masharti ninayoelewavyema. Nimehakikishiwa kuwa, sitadhurika kamwe kutokana na kujihusisha kwangu katika utafiti huu. Ilibainishwa kuwa kujihusisha katika utafiti huu ni kwa hiari na nina uhuru wa kujiondoa wakati wowote ule bila ya kuhujumiwa. Zaidi ya hayo, nilihakikishiwa kuwa, kanununi zote za maadili ya utabibu, uhuru, haki, na manufaa zitazingatiwa katika utafiti huu.

Jina la Mhojiwa_____

Sahihi _____

Tarehe _____

Jina la shahidi _____

Sahihi _____

Tarehe _____

## Appendix 3: IREC Approval Letter

**INSTITUTIONAL RESEARCH AND ETHICS COMMITTEE (IREC)**

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

MOI UNIVERSITY
COLLEGE OF HEALTH SCIENCES
P.O. BOX 4606
ELDORET

Reference: IREC/2017/221
***Approval Number: 0002091***

29th March, 2018

Dr. Philip B. Okoth,
Moi University,
School of Medicine,
P O Box 460630100,
**ELDORET-KENYA.**

INSTITUTIONAL RESEARCH & ETHICS COMMITTEE
- 9 MAR 2018
APPROVED
P. O. Box 4606 - 30100 ELDORET

Dear Dr. Okoth,

**RE: FORMAL APPROVAL**

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

***"Etiology and Outcomes of Operatively Managed Acute Abdomen at Moi Teaching and Referral Hospital".***

Your proposal has been granted a Formal Approval Number: ***FAN: IREC 2091*** on 29th March, 2018. You are therefore permitted to begin your investigations.

Note that this approval is for 1 year; it will thus expire on 28th March, 2019. If it is necessary to continue with this research beyond the expiry date, a request for continuation should be made in writing to IREC Secretariat two months prior to the expiry date.

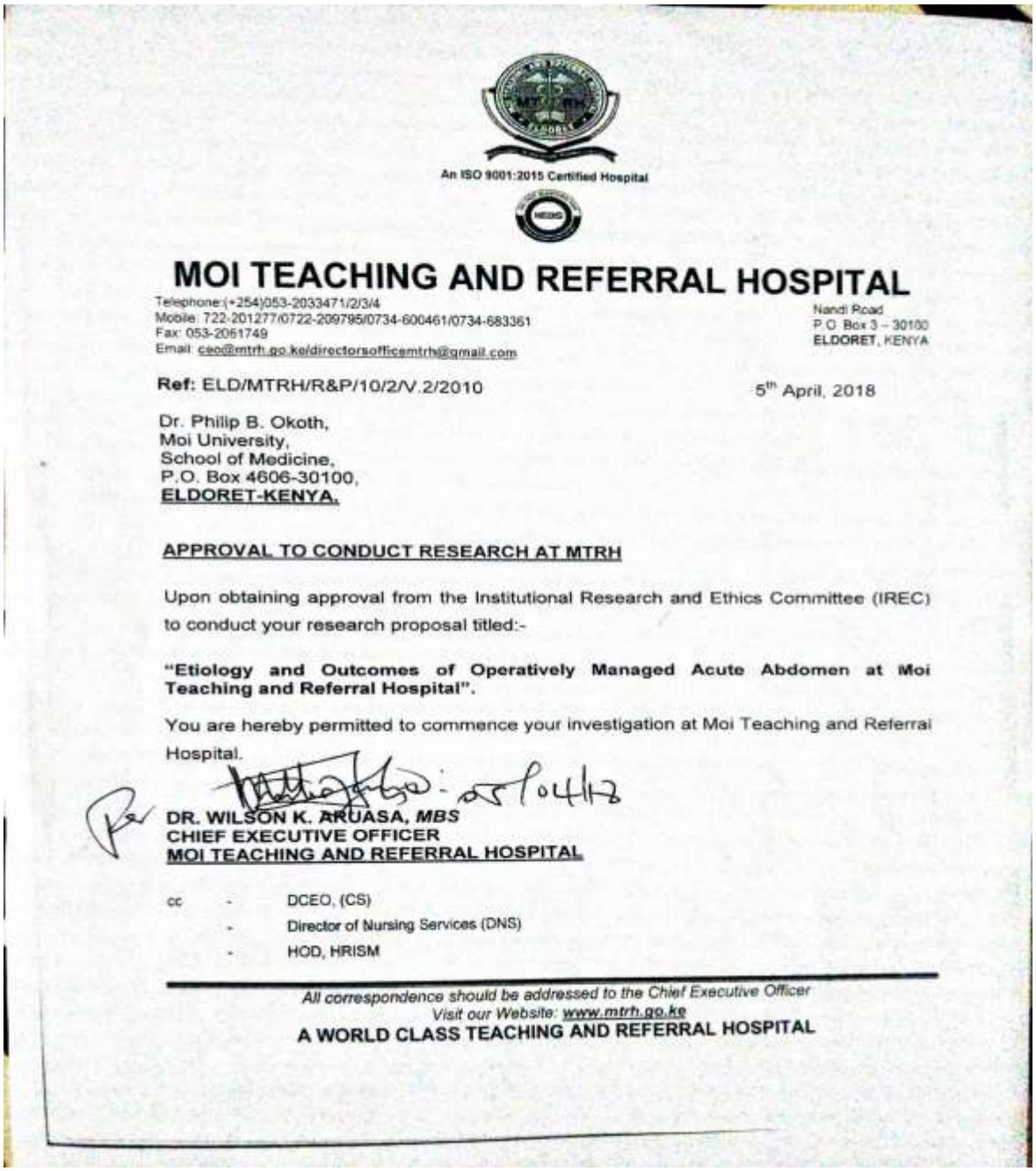
You are required to submit progress report(s) regularly as dictated by your proposal. Furthermore, you must notify the Committee of any proposal change (s) or amendment (s), serious or unexpected outcomes related to the conduct of the study, or study termination for any reason. The Committee expects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

Sincerely,

**DR. S. NYABERA**
**DEPUTY-CHAIRMAN**
**INSTITUTIONAL RESEARCH AND ETHICS COMMITTEE**

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

## Appendix 4: Hospital Approval Letter



An ISO 9001:2015 Certified Hospital

# MOI TEACHING AND REFERRAL HOSPITAL

Telephone:(+254)053-2033471/2/3/4
Mobile: 722-201277/0722-209795/0734-600461/0734-683361
Fax: 053-2061749
Email: ceo@mtrh.go.ke/directorsofficemtrh@gmail.com

Nandi Road
P.O Box 3 – 30100
ELDORET, KENYA

**Ref:** ELD/MTRH/R&P/10/2/V.2/2010

5th April, 2018

Dr. Philip B. Okoth,
Moi University,
School of Medicine,
P.O. Box 4606-30100,
**ELDORET-KENYA.**

**APPROVAL TO CONDUCT RESEARCH AT MTRH**

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

**"Etiology and Outcomes of Operatively Managed Acute Abdomen at Moi Teaching and Referral Hospital".**

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

**DR. WILSON K. ARUASA, *MBS***
**CHIEF EXECUTIVE OFFICER**
**MOI TEACHING AND REFERRAL HOSPITAL**

cc - DCEO, (CS)
- Director of Nursing Services (DNS)
- HOD, HRISM

*All correspondence should be addressed to the Chief Executive Officer*
*Visit our Website: www.mtrh.go.ke*
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