

**A STUDY TO DETERMINE THE OUTCOMES OF LAPAROSCOPIC
APPENDICECTOMIES AT THE UNIVERSITY TEACHING HOSPITAL,
ZAMBIA.**

By

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A Dissertation submitted to the University of Zambia in partial fulfillment of the requirements for the award of Master of Medicine Degree in General Surgery.

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Rajesh Parekh

DEDICATION

To my Father Ramesh Parekh and My Mother Bina Parekh.

DECLARATION

I, Rajesh Parekh declare that this dissertation:

- a) Represents my own work,
- b) Has not been previously submitted for a degree at this or any other University;
and,
- c) Has not incorporated any published work or material from another report.

Signed:

Date:

APPROVAL

This Dissertation of RAJESH PAREKH has been approved as fulfilling the requirements for the award of the degree of Masters of Medicine in General Surgery by the University of Zambia.

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ABSTRACT

Several studies have demonstrated the superiority of Laparoscopic appendicectomy in the management of acute appendicitis. Acute appendicitis has been managed solely by open appendicectomy at UTH. This was the first study that looked at the management of acute appendicitis by laparoscopy here at UTH. The aim of this study was to determine the outcomes of laparoscopic appendicectomy at the University Teaching Hospital. This was a prospective cohort study that included patients that were diagnosed with acute uncomplicated appendicitis. All patients admitted between August 2015 to March 2016 were included in the study. Variables analysed were patients data (age, gender, previous surgery, WBC count, symptoms, signs, symptoms), operating time, intra\post operative complications, and length of stay. A total of 9 laparoscopic appendicectomies were performed during the study period. The patients had an average age of 31.8 years, and were predominantly female (70%). One case was converted to open appendicectomy and was not included in the laparoscopic data group. The mean operative time for the procedure was 75.5 min (range 50-110min). The length of stay was on average 2.3 days (range 2-3 days), the patients in the study had no complications noted during the period of follow up. No patient developed an intra abdominal abscess during the study period.

Laparoscopic appendicectomy for uncomplicated acute appendicitis resulted in good surgical outcomes in this institution when compared to the regional statistics as reference point. It may be used as a preferred technique in patients presenting with uncomplicated appendicitis or where the diagnosis is equivocal . Laparoscopic appendicectomy is recommended especially for the young female patients in our setting.

Key Words: Laparoscopic Appendicectomy, Post Operative outcomes.

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ABBREVIATIONS

LA Laparoscopic appendicectomy

| | |
|-----|------------------------------|
| OA | Open appendicectomy |
| VS | Versus |
| RIF | Right iliac fossa |
| LOS | Length of stay |
| SSI | Surgical site infection |
| UTH | University Teaching Hospital |
| NAR | Negative appendicectomy rate |

CHAPTER ONE: INTRODUCTION

1.1 Background Information

Since its introduction by McBurney in 1894 appendectomy is the treatment of choice for acute appendicitis for most surgeons (McBurney, 1894). It soon became one of the most frequently performed surgical procedures (Sauerland, 2010).

The introduction of laparoscopic appendectomy has dramatically changed the field of surgery.

The idea of minimal surgical trauma, resulting in significantly shorter hospital stay, less postoperative pain, faster return to daily activities, and better cosmetic outcome has made laparoscopic surgery for acute appendicitis very attractive (Josloff, 2001). It is evident that the avoidance of a laparotomy incision results in less operative pain and less need of analgesia in the patient (Parker, 2003). Other advantages of laparoscopic appendectomy include decreased wound infection, ability to explore the entire peritoneal cavity for diagnosis of other conditions and effective peritoneal toileting without the need for extending the incision. The advent of minimal access technique of laparoscopy marked the dawn in surgical care of patients (Ray-Offer, 2014).

Also noted is a significant reduction in postoperative adhesion formation following minimal access surgery when compared to the commonly advocated “open” procedures (Fogli, 2002). For the surgeon the brilliant and magnified views that modern equipment provides allows the precise definition of anatomy and pathology, and with a newer generation of instruments, constantly being developed and re-developed, facilitate accurate surgery (Lin, 2006). These generic advantages apply equally to any intra-abdominal operation that would otherwise require a laparotomy (Fogli, 2002). The panoramic view of laparoscopy aids accurate diagnosis. Video-laparoscopy allows surgical assistants; anesthesiologists and nurses to view what the surgeon is doing and to actively participate in the procedure.

Laparoscopic appendectomy combines the advantages of diagnosis and treatment in one procedure with the least morbidity (Britton, 1994).

1.2 Problem Statement

Laparoscopy is not the standardized procedure for the management of uncomplicated acute appendicitis at the UTH. Since its introduction in 2011, only 15 cases have been performed, all of which have been cases of chronic appendicitis. This procedure has not been performed on cases of acute appendicitis, hence the intraoperative and postoperative outcomes (e.g. the duration of the operation, the LOS (length of stay) of the patient etc.), of this procedure on cases of acute appendicitis are unknown. The complications (e.g. bleeding, wound infection, abscess formation) developed postoperatively are also unknown. We have not accumulated any data on what the outcomes would be. Consequently we are unable to determine the benefits of the procedure to the patient. Therefore it is very essential to determine the outcomes of performing LA on patients presenting with acute appendicitis at UTH.

1.3 Study justification

Patients presenting with acute uncomplicated appendicitis at UTH are not managed by laparoscopy. Hence no information is available currently of the outcomes of LA at UTH. LA affects outcomes in terms of LOS, complication rates, NAR, etc. This directly affects the costs of operations at the institution.

The knowledge generated from this research can be used by other researchers as background information and by academicians for teaching purposes.

The methodology used can be adopted for routine practices and can be used to develop standard operating procedures.

Therefore, there exists an evidence information gap with this new mode of treatment. This Study aims to determine these outcomes and thereby provide this vital information.

Research Question

What are the outcomes of LA in patients presenting with acute appendicitis at UTH.

1.4 Hypothesis

1.4.1 Alternative Hypothesis

The outcomes of the patients with acute uncomplicated appendicitis managed by laparoscopy at UTH are favourable.

1.5 Objectives

1.5.1 Research Objectives

To determine the outcomes of LA in the management of acute uncomplicated appendicitis at UTH

1.5.2 Specific Objectives

- i. To determine the intraoperative outcomes of the procedure (operation time, intra op complications e.g. iatrogenic injury).
- ii. To determine the mean LOS of the patients (measured in Days).
- iii. To determine the post-operative complications (Bleeding, wound Infection, abscess formation, and port site hernia).

CHAPTER TWO: LITERATURE REVIEW

It is Inflammation of the appendix with the highest incidence in the second and third decades. The rate of appendectomy for appendicitis has been decreasing since the 1950s in most countries. There has been an increase in the incidence rate of nonperforated appendicitis, the increased use of diagnostic imaging has led to a higher detection rate of mild appendicitis that would otherwise resolve undetected (Schwartz, 2014).

The lifetime rate of appendectomy is 12% for men and 25% for women with approximately 7% of all people undergoing appendectomy for acute appendicitis during their lifetime. However, the rate of appendectomy for appendicitis has remained constant at 10 per 10000 patients per year. Appendicitis is most frequently seen in patients in their second through fourth decades of life, with a mean age of 31.3 years and a median age of 22 years (Jaffe, 2005).

The treatment of acute appendicitis is appendectomy, which can either be performed by open surgery or laparoscopic surgery.

Therefore a period of preoperative preparation is essential to improve outcomes.

These preparations include,

- Intravenous fluids either Ringers lactate or Dextrose normal saline.
- The patient has to be catheterized to monitor the urine output.
- Intravenous Antibiotics to reduce the incidence of postoperative wound infection.
Broad spectrum antibiotic plus an anaerobe is sufficient
- Analgesia should be administered once a diagnosis has been made.
- The patient should be nil per oral

An appendicular mass is treated conservatively (Schwartz, 2014).

Indications for laparoscopic appendectomy are almost the same as that for conventional appendectomy. There are however, specific indications for those who follow the selective applications of laparoscopic approach.

1. Appendicitis in an obese patient and young women.
2. When diagnosis is in doubt.

3. Diagnosis of appendicitis at unusual positions.
4. Normal looking appendix on laparoscopy in the absence of other pathology.
5. Incidental appendectomy along with other laparoscopic procedures should be considered if the appendix is found to be diseased.

(Palanivelu, 2002)

The following relative contraindications should be considered in choosing the approach.

1. Inexperience with the technique, difficult anatomical locations, severely inflamed appendix / perforated appendix with peritonitis and appendicular abscess.
2. Pregnancy
3. Suspicion of malignancy.
4. Severe co-morbid illness-congestive cardiac failure.
5. Prior lower abdominal surgery.
6. Pelvic inflammatory disease and endometriosis.

(Palanivelu, 2002)

Recent studies have shown significant advantages of laparoscopic appendectomy with respect to the length of hospital stay, postoperative pain and infectious complications (Olmi, 2005).

Bowel movements were observed significantly earlier in patients managed laparoscopically, leading to earlier feeding and discharge from hospital (Yasmin, 2009).

Metabolic response to surgical trauma is less with LA, thereby shorter hospital stays, lower hospital cost and early return to work in comparison to OA (Karadayi, 2003).

In addition, Moore and coworkers, using a decision analysis model, have demonstrated an economic benefit of laparoscopic appendectomy from a social perspective, since shorter hospital stay and earlier return to daily activities is very important, especially for patients who are young and lead a productive life (Moore, 2005).

Postoperative narcotic use is less after laparoscopic appendectomies. Study done by Ortega et al revealed the pain score was very less compared to open surgery (Mishra, 2008).

Wound infections were more common after OA than after LA. Postoperative ileus occurred with frequencies of 0% in the LA group and 7.4% in the OA group ($p < 0.05$). The rate for overall complications was significantly lower in the LA group. Hence they concluded Laparoscopic appendectomy is a useful tool in the treatment of acute appendicitis. Its advantages lie in its minimal invasiveness, its better cosmetic outcome, its lower rate of complications based on surgical expertise and state-of-the-art equipment. It can be recommended as an adoptable method for the routine patient with appendicitis (Wei, 2010).

The risk of wound infection is less in laparoscopic appendectomy compared to the open procedure. A meta-analysis of randomized controlled trials has been reported with outcomes of 2877 patients included in 28 trials. Overall complication rates were comparable, but wound infections were definitely reduced after laparoscopy (2.3% to 6.1%). Rohr et al reported higher wound infection rates after laparoscopic appendectomy, but most of the literature supports the view that wound infection is less common after a laparoscopic procedure. It should be cautioned that the definition of wound infection varies between studies (Hansen, 1996).

In 2010 a study was done to balance the risk of postoperative surgical infection establishing the relationship between the surgical procedure and subsequent surgical infection both incisional and organ space infection (OSI) post appendectomy, independent of potential confounding factors. On multi variate analysis, laparoscopy was associated with a lower risk of incisional infection but with an increased risk of OSI after adjustment for confounding factors. For low-risk patients, the probability of developing an OSI was calculated to be 0.3% and 0.4%, respectively, for open versus laparoscopic appendectomy, whereas for a high-risk patient, the probabilities were estimated at 8.9% and 12.3%, respectively. The link between a laparoscopic approach and subsequent OSI has been disputed by other studies. In a multicenter series of 1017 patients with complicated appendicitis (gangrenous or perforated), Cueto et al reported similar postoperative abscess rates (7.4%) when comparing laparoscopically commenced cases with historical reports of OSI following open appendectomy. Sleem et al studied 247 patients with confirmed perforated appendicitis, where 90% were commenced laparoscopically with a conversion rate of 15.7%. The laparoscopic group

had a markedly lower rate of incisional infection (5%) compared with the open group (18%), whereas the postoperative abscess rate was not significantly different, 13.4% laparoscopic versus 12.5% in the open group, mirroring the findings of other studies. The degree of this increased risk varies depending on the clinical profile of a surgical patient. This Study aids clinicians in balancing both categories of infectious risk to choose the most appropriate operative technique for their patients (Fergal, 2010).

Conversely, intra-abdominal abscess is a serious and life-threatening complication. Intra-abdominal abscess formation was observed in 4 of the patients in the laparoscopic group (4.1 %) and in 1 patient in the open group (0.32 %). These findings are consistent with other studies that showed an increased risk of intra-abdominal abscess after laparoscopic appendectomy compared with open surgery. Several hypotheses have been suggested to find possible explanations: mechanical spread of bacteria in the peritoneal cavity promoted by carbon dioxide insufflation, especially in case of ruptured appendix, inadequate learning curve, the meticulous irrigation, instead of simple suctioning, of the infected area in severe peritonitis, that leads to contamination of the entire abdominal cavity, which is difficult to aspirate later (Antonio, 2016).

Many studies found that LA markedly reduced the postoperative wound infection rate when compared with OA (1.3 vs. 12.5%). The rate of wound infection in this study was 1.2%. This low rate of postoperative wound infection could be explained by fact that in LA the incisions are small and limited to the trocar entry sites and the perforated appendix is extracted within a retrieval bag (Rasha, 2017).

The use of LA has increased rapidly in China in recent years. LA has been found to significantly lower the postoperative complication rate, even in perforated appendicitis. The laparoscopic procedure could be the preferred method for the surgical treatment of acute appendicitis in China in the future. Multivariate analysis revealed that LA was independently associated with a decreased postoperative complication rate for all patients (Jian, 2015).

A shorter LOS was demonstrated for LA at laparoscopic-preferring hospitals vs. open-preferring hospitals for simple appendicitis. For complicated appendicitis, higher complication rates were associated with OA at laparoscopic-preferring hospitals.

Complications and resource utilization for appendicitis are associated with surgical technique and hospital procedure preference (Tashiro, 2016).

Delaying emergency appendectomy for 12 hours or more appears to have no adverse effects on 30-day outcomes, according to a retrospective review of almost 33,000 cases (Ingraham, 2010).

Over the last 4 years, the authors changed their management of acute nonperforated appendicitis from emergent surgery within the first 2 to 6 hours of admission to initiation of antibiotic therapy with operation within 24 hours of admission in those seen in the late evening or early morning (Coran, 2004).

In children with acute appendicitis, delaying surgery until the daytime hours did not significantly affect operating time, perforation rate, or complications. Delayed management allows greater efficiency and effective use of physician and hospital resources, including decreased resident involvement in operations during the night (Coran, 2004).

If operation for acute appendicitis is performed during the first 24 hours of the illness, the mortality is less than 1% (Hailes, 2008).

Despite these comparable results there are challenges in laparoscopic surgery. These include the cost of consumables, support staff, reliable electricity/power and patient acceptance. The initial experience with power instability necessitated the acquisition of an uninterrupted power system (UPS). It is an established fact that laparoscopic surgery is expensive. However to reduce the cost of surgery a reusable bipolar dissector was used to coagulate the appendicular artery before dividing thus eliminating the need for titanium clips. Secondly the division of the appendix base was done between Roeder's knots, which were constructed by the surgeon or his assistant. This further eliminates the need for more expensive clips and staplers. Finally the retrieval system of the appendix through the 10mm port eliminates the need for a retrieval bag. Surgeons need to develop indigenous ways to reduce the cost of surgery in developing countries (Afuwape, 2014).

Laparoscopic appendectomy is feasible in developing countries with similar postoperative outcome and less requirement of narcotic analgesia. The duration of surgery and overall cost were significantly higher and efforts should be made to develop expertise and reduce operative time with resultant decrease in cost. Development of standardized protocols for discharge of patients from the hospital after LA may further reduce the cost and benefit patients in developing countries (Rajab, 2010).

However, several retrospective studies, several randomized trials and meta-analyses comparing laparoscopic with open appendectomy have provided conflicting results. Some of these studies have demonstrated better clinical outcomes with the laparoscopic approach, while other studies have shown marginal or no clinical benefit (Ioannis, 2008)

While some studies claimed laparoscopic appendectomy to be superior to open appendectomy in terms of a quicker and less painful recovery, less postoperative complications, and better cosmesis, other studies found no such advantages or even favoured the traditional approach (Sauerland, 2010)

At present, although there is no consensus regarding the superiority of the laparoscopic approach over the conventional technique, there is trend towards greater utilization of laparoscopic appendectomy (Ioannis, 2008)

This meta-analysis reveals Laparoscopic appendectomy is a safe and effective method of treating acute appendicitis. There is Improvement in the outcomes of laparoscopy with increasing laparoscopic experience but open surgery appears to still confer benefits (John, 2007).

Hypothetically, in complicated appendicitis, especially in obese children, LA can benefit a patient compared with OA because it minimizes the tissues trauma, allows better visualization of abdominal spaces and meticulous peritoneal irrigation, avoids wound incision and extension, and is associated with less exposure of wound surface area to contaminated fluids (Rasha, 2017).

In 1999, Jane performed a meta-analysis to determine which gave a better outcome between LA and OA for patients with suspected appendicitis. The study revealed that LA reduced time to full functioning by 5.48 days, improved postop pain at 24hrs, and decreased the absolute risk of wound infection by 3.2%. LA offers better outcomes for the patients, specifically postoperative pain and wound infection (Jane, 1999).

A meta-analysis of randomized controlled trial has been reported with outcomes for 2877 patients. The mean operating time was 16 minutes longer for laparoscopic appendectomy. A prospective randomized trial comparing laparoscopic appendectomy with open appendectomy was conducted in 158 patients by Hansen et al. They reported that despite of longer operating time, (63 versus 40 minutes) the advantages of laparoscopy (such as fewer wound infection and earlier return to normal activity) make it a worthwhile alternative for patients with a clinical diagnosis of acute appendicitis. Kazemier et al in their report of a randomized clinical trial of 201 patients found that laparoscopic appendectomy is superior to open surgery regarding postoperative pain and postoperative complications, recovery time and financial (Chung, 1999).

In almost all the literature the operating time of laparoscopic appendectomy was found to be more than that of open appendectomy. The difference in mean operating time ranged from 8.3 to 29 minute. The operating time of laparoscopic appendectomy also depends on the experience of the surgeon and the competence of their team (Chung, 1999).

Laparoscopic appendectomy reduced the rate of unnecessary appendectomy and postoperative hospital stay in the patients, potentially reducing crowding in the surgical wards. Increased use of laparoscopy especially in young women should be advocated. Patients selected for the laparoscopic approach included young females in the reproductive age group with suspected pelvic conditions, patients presenting with signs not specific to appendicitis, and older patients with features of acute appendicitis. Earlier reports have highlighted several benefits of initial diagnostic laparoscopy in these groups of patients (Adewale, 2012).

CHAPTER THREE: METHODOLOGY

3.1 Research design

This was a prospective Cohort study.

3.2 Study Site

The study was conducted at the University Teaching Hospital which is in Lusaka the capital city of Zambia.

This study was conducted in the Department of General Surgery in the laparoscopic unit.

3.3 Target Population

All Surgical patients diagnosed with acute uncomplicated appendicitis.

3.3.1 Study Population

All Surgical patients diagnosed with acute uncomplicated appendicitis that underwent laparoscopic appendectomy and met the eligibility criteria.

3.4 Sampling

Entry point

The study began after approval was received by the ethics committee (ERES CONVERGE) (see Section 3.10).

The entry point was based upon the diagnosis of appendicitis which was made in the emergency department and their eligibility for LA (see inclusion/exclusion criteria)

Age, gender, all necessary demographic details were recorded.

Patients were asked to participate in this study after a clinical diagnosis of acute uncomplicated appendicitis was made, and if they were suitable for Laparoscopy. The eligible patients were informed of the risk and benefits of the operation and were asked to sign a detailed informed consent in their respective native language, after the decision to operate was made and after fully informed consent was obtained. The patients were free to reject participation in the study and he/she could opt out of the research at any point he/she so wished. The patients were looked after like any other patient and no additional benefits were given to him/her that would influence their decision of coerce him/her to participate in the study.

Pre operative course

The preoperative assessment was used to determine the suitability of the patient for the surgical procedure.

A base line FBC was performed on all patients being operated on.

Only patients that are admitted between 06:00hrs and 14:00hrs on week days were considered for laparoscopy.

This period took into consideration the time in which the main operating theatre (phase 3) was operational.

After obtaining consent, the patient was be taken over, managed and followed up under the laparoscopic unit.

The patient were then prepared for the laparoscopic procedure.

The laparoscopic surgery was performed in phase 3 theatre.

All laparoscopic surgeries were performed by a qualified laparoscopic surgeon.

Intra operative course

Operative time was taken as the time between the first incision and application of the last stitch to the wound. Conversion from laparoscopic to open surgery was done at the surgeon's discretion (i.e. if a complication arose or if continuation of the procedure using laparoscopy proved difficult). All removed appendices were sent for histological examination

Post-operative course

All routine postoperative procedures, monitoring and medications were given according to the set protocol.

Hospital stay was recorded and defined as the number of postoperative days spent in hospital.

Day 0 was defined as the day of operation. Postoperative complications were recorded both in the hospital during admission and during follow-up.

Wound infection was defined as oedema and redness around the wound or purulent discharge from the wound (Schwartz, 2014).

Strict criteria was followed for the reintroduction of nutrition. When the bowel sounds were present, the patients were started on a clear liquid diet and advanced to regular diet once the liquid diet was tolerated and flatus was noted.

Patients were discharged when they were afebrile for 6 hours, and would have resumed their regular diet.

Follow up

Patients were followed up three times only, one week and one month and two months after the surgical procedure.

Patients were seen in the surgical clinic and checked for any complications (wound infection, intra abdominal abscess formation, etc).

Readmissions to the hospital and their cause were also recorded.

The exit point would be determined when the patient was discharged from the clinic.

This study began in Aug 2015 and ended in Mar 2016.

Sample Size

Sampling was done of patients eligible for LA during the study period

Where n = Sample required

Z = static (usually 1.96)

D = accepted accuracy range (+/- 10%)

The prevalence rate used is 7% (Jaffe 2005)

$$N = 1.96^2 \times 0.07 (1 - 0.07) / 0.1^2$$

$$= 17.$$

EQUIPMENT AND INSTRUMENTS FOR LAPAROSCOPIC APPENDICECTOMY

Video laparoscopic surgery has been made possible by the major advances in video technology. The combination of equipment and the skills to use the equipment constitute the essentials in laparoscopic surgery.

Essential Equipments:

1. Light Source: A high intensity light source with a light filter was used which provided adequate visualization of abdominal cavity at various distances.
2. A fibre optic light guide cable was used which was 5mm thick and 225cm in length.
3. Video camera - It was attached to the scope and the cable was hooked to a processor that transmitted the image to video monitor. White balancing was done for the camera before the start of the procedure.
4. Telescope –The Size of the scope was 10mm. this scope provided 45 degree angled views. The telescopes tip was developing fog due to temperature differences outside and inside the patient. This was aggravated by the cold insufflation. Warming the telescope with warm water before use and touching the tip to the liver surface prevented fogging.
5. Endoflator (CO₂ insufflator) – It was used to insufflate carbon dioxide to create pneumoperitoneum. As a safeguard, it also monitored the IAP constantly to stop the flow once 14mm Hg of pressure was achieved.
6. High resolution video monitor – It was capable of 480 Hz lines / inch for one chip camera available. Monitor was 13 inch in size for adequate visibility and was grounded.
7. Irrigation device – A pressure of 300 mm Hg was used to irrigate the abdomen powered by a suction machine. The irrigation / aspiration

probes had a single channel for both these functions.

8. Electro-cautery – It was used to dissect mesoappendix from the appendix and achieve adequate haemostasis.

Instruments:

It includes highly specialized and innovative device used to ensure safety of the procedure.

- 1 Trocars and cannulas – trocars for introduction of telescope and instruments were in two sizes i.e. 11 mm and 5.5mm. The trocar consisted of a metal tube with a sharp pyramidal tipped obturator. The outer surface of the cannula had a dull finish to minimize reflection of light in the abdomen. A flap gate prevented gas escape. All trocars had a stopcock through which carbon dioxide was insufflated.
- 2 Graspers - these are useful for grasping and retracting thick walled structures of extracting gall bladder from the abdomen. They were 5.5mm in diameter with jaws at the tip and handles with ratchets.
- 3 Dissectors and scissors - Maryland dissector has jaws bent at the tip and was used to dissect the tissues of the mesoappendix. Straight scissors was used to cut the base of the appendix.
- 4 Coagulators – was used to cut and coagulate the mesoappendix.

Patient Preparation:

As with any abdominal operation, patients were made to fast approximately 8 hours prior to the operation. Patients with no major comorbidity were admitted to the hospital on the same day surgery basis.

Anesthesia: General Anesthesia

All patients were administered a single preoperative dose of Ceftriaxone. All patients were put under general anesthesia and intubated. The abdomen was shaved and prepared in standard sterile fashion with particular care taken to rid the umbilicus of all debris.

Patient position and room setup:

Patients were positioned in supine and the trendelenberg's position (head end low).

Pneumoperitoneum:

The pneumoperitoneum was created with a closed technique using the open Hasson cannula technique. Closed technique was preferred in all. The preferred site for insertion of the Hasson cannula was the umbilicus. The needle (and subsequent trocar) were inserted at 45° angle towards the pelvis and away from the aorta and inferior vena cava as it entered through the fascia.

Insufflation:

The trocar was connected to the insufflator and CO₂ was instilled at a rate of 1 litre /minute. A low flow rate for CO₂ was used initially to avoid gas embolism or vagal stimulation from sudden stretching of the peritoneum. Upon insufflating approximately 1 litre of CO₂, produced tympany in all 4 quadrants of the abdomen. For the intraabdominal pressure to reach 15mmHg, it generally required 3 to 6 liter of CO₂.

Port position:

The first trocar was made blindly at the umbilicus. Two additional trocars were placed under video guidance. The second suprapubic port (5mm) was made 2cm cranial to the pubic symphysis to protect injury to the dome of the urinary bladder. The third port, (5mm) was placed in the right iliac fossa and was used as a working port for the left hand. The right iliac fossa port helped in manipulation of the appendix according to the need with the left hand of the surgeon. The suprapubic port was used as a right hand working port for dissection, coagulation and division of the mesoappendix and for extraction of the appendix, according to figures 1 and 2 below.

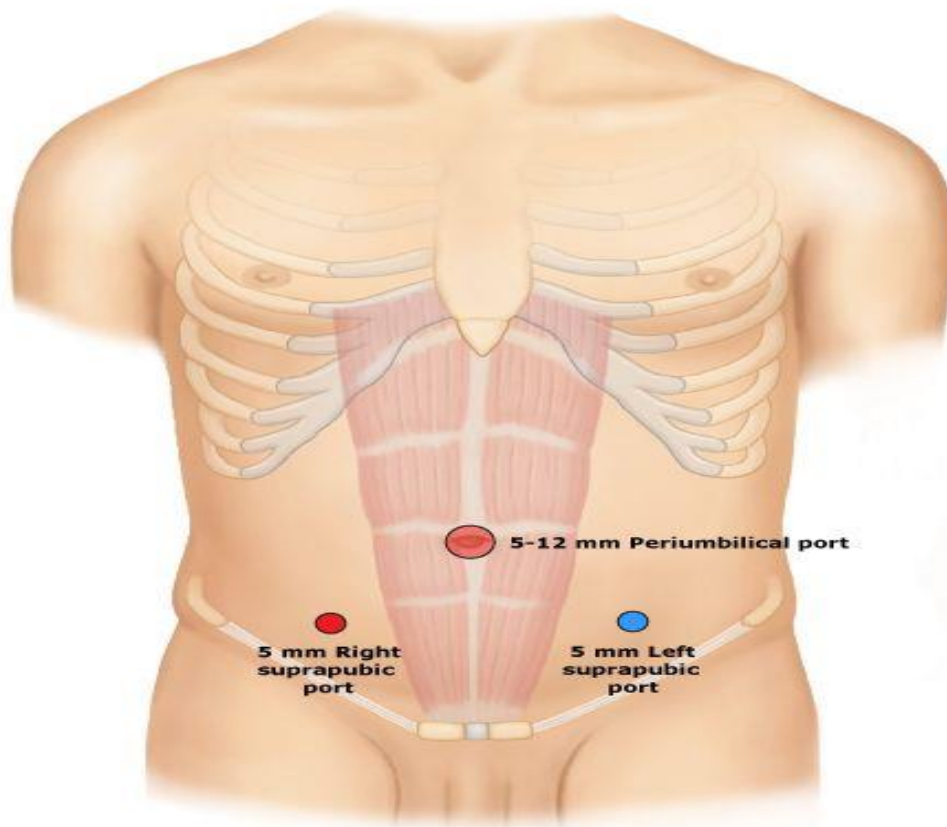


Figure – 1: Port Positions



Figure – 2: Port insertions with Cannula

Division of the mesoappendix:

The appendix was held with a grasper by the left hand and a ligature (extracorporeal knot) was applied to the base of the mesoappendix. Monopolar cautery was used to divide the mesoappendix distal to knot. The remaining mesoappendix was stripped bit by bit by using curved dissector and hemostasis was achieved using electrocautery applied carefully keeping tissues away from the appendico-caecal junction. During this skeletonization of the appendix, the level of the base had to be verified each time to avoid caecal injury. The avascular tissue lateral to the appendix was stripped by blunt dissection till the tip of the appendix was reached.

Ligation and division of appendix:

Two self made extracorporeal knot of an absorbable suture material (Vicryl 1.0) was applied to the base of the appendix using a suture pusher. The distance between the two loops was less than 5mm. The first loop was not too tight and care was taken to avoid cutting through an acutely inflamed appendix.

Extraction of the appendix:

After removing the appendix from the caecum, it was brought close to the 10mm port and extracted. After delivery, the appendix stump was sterilized by cauterizing the mucosal surface. The base of the appendix was not buried using a purse string suture. The trocars were removed under direct visualization, and the pneumoperitoneum was released. The wounds were irrigated and aponeurosis apposed with nylon 1.0 sutures and skin apposed using nylon 2.0 sutures.

Post Operative Care:

Post operatively the patient received antibiotic therapy, In our patients, oral diet was advised after 12 hours, and the patient was ambulatory soon after surgery. Patients were discharged as early as 48 hours after surgery. Patients were permitted to resume normal activities as tolerated.

3.5 Inclusion and Exclusion criteria

3.5.1 Inclusion criteria

Patients with appendicitis were included in the study performed at University teaching hospital in Lusaka.

The diagnosis of appendicitis was made on the following criteria:

History of right lower quadrant pain or periumbilical pain migrating to the right lower quadrant with nausea and/or vomiting, febrile and/or leukocytosis above 10,000 cells per mL, right lower quadrant guarding, and tenderness on physical examination.

All patients included were 16 years of age or older (Namir katkhouda, 2005).

Patients who presented with an Alvarado score of 5 and above (appendix IV).

3.5.2 Exclusion criteria

Patients were excluded if they had signs and symptoms suggesting complicated appendicitis (perforation, abscess formation, and peritonitis).

Patients with the following conditions were also excluded: history of cirrhosis and coagulation disorders, generalized peritonitis, shock on admission,

Absolute contraindication to laparoscopic surgery (large ventral hernia, history of laparotomies for small bowel obstruction, Etc),

Contraindication to general anesthesia (severe cardiac and/or pulmonary disease) (Namir katkhouda, 2005). Patients who did not consent to be part of the study were excluded as well.

3.6 Data Collection Techniques and Tools

Quantitative methods were used in this study. The data collection techniques that were used in this study were mainly data collecting sheets, questionnaire and patient files.

Postoperative outcomes were obtained of the surgical procedure mentioned.

3.7 Data processing and analysis

The data collected would be processed and analyzed both manually and the use of computer software Excel and SPSS. During data processing, the information was also

checked for completeness and internal consistency. The process also involved categorization; coding and summarization of data on spread sheets as well as frequency counts for each variable and cross tabulation. A proforma was used to collect the relevant information. Data was analyzed using the Students t-test, Chi-square analysis and P value of <0.05 was considered significant. Data was analyzed with the help of a statistician.

3.8 Plan for data collection

The data for the study was collected by the Principal Investigator while working on the research and data collection.

3.10 Ethical Considerations

The purpose of the study was explained to respondents and informed written consent was sort from all participants. Special ethical approval was sort from ERES CONVERGE. Permission to conduct the study from UTH was also obtained from UTH management.

The participants were assured of anonymity, confidentiality and no names or personal identification by using codes and not names in data collection. The numbers were reflected except numbering for records, which was done for the purposes of data entry, and editing.

2.1 Limitations

The department had only one laparoscopic machine, hence any malfunction in the hardware caused a delay in the completion of the project.

The procedure could only be carried out in the main operating theatre and only two days a week, which affected the number of cases that could be done.

The duration of the study was also very short, about 7 months. To compound this, the light source of the laparoscopic set had blown and it took 2 months to secure a new one.

The institution had only two laparoscopic surgeons who could carry out the procedure, which also limited the number of cases that could be done.

According to the department of pathology in 2014, there were only 28 cases of uncomplicated appendicitis, and 15 cases with normal appendix. Most Patients present late to the hospital to seek medical intervention and usually present with the complicated forms of appendicitis and hence cannot be enrolled in the study This small number of patients further put limits on the number of cases that could be done.

CHAPTER FOUR: RESULTS

A total of nine patients presented with signs and symptoms consistent with acute uncomplicated appendicitis and they underwent laparoscopic appendicectomy during this 7month period.

Gender Distribution

There were a total of 3 male patients and 6 female patients that were enrolled for laparoscopic appendicectomy as shown in Table 1.

Table 1: Gender Distribution

| Gender | Cases | Percentage |
|--------|-------|------------|
| Male | 3 | 30 |
| Female | 7 | 70 |
| Total | 10 | 100 |

It was noted that more females were enrolled for the study than the males as illustrated in Figure 3.

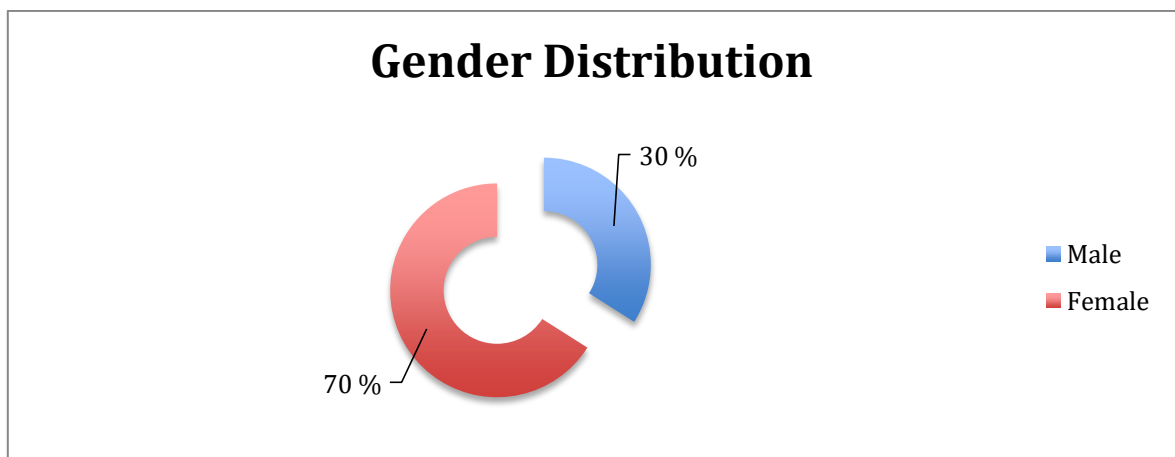


Figure 3: Gender Distribution

Age

Majority of the patients undergoing LA were in the age ranges between 21-30 years followed by the age range of 31-40 years. Two patients presented at the extremes of the age group. One patient was 18 years old while the other patient was 58 years old as seen in Figure 4 below.

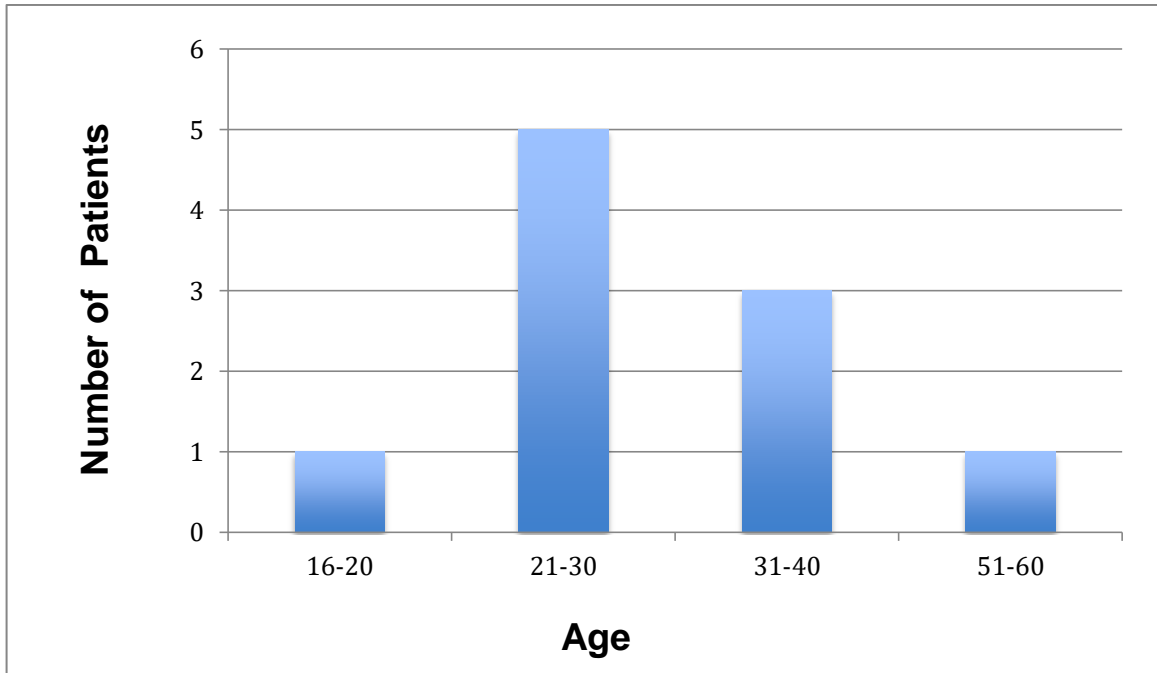


Figure 4: Age Distribution

Patients in the 21-30 years age range contributed 44% while those in the 31-40 years contributed to 33%. No patient presented in the third decade of their life. The mean age was 31 years.

4.3 Symptoms

The symptoms the patients presented with in the study included RIF pain, Vomiting, fever, and anorexia as shown in Table 2 below.

Table 2: Presenting Complaints

| Presenting Complaint | Patients | Percentage |
|-----------------------------|-----------------|-------------------|
| RIF Pain | 10 | 100 |
| Vomiting | 6 | 67 |
| Anorexia | 5 | 56 |
| Fever | 2 | 22 |

All the patients undergoing LA presented with RIF pain. Patients who presented with vomiting were 67%, while 56% of the patients presented with anorexia. Fever was noted in only 22% of the patients. These were the major symptoms the patients presented with which were captured. The graphic presentation of the patients presenting complaints is illustrated in Figure 5 below.

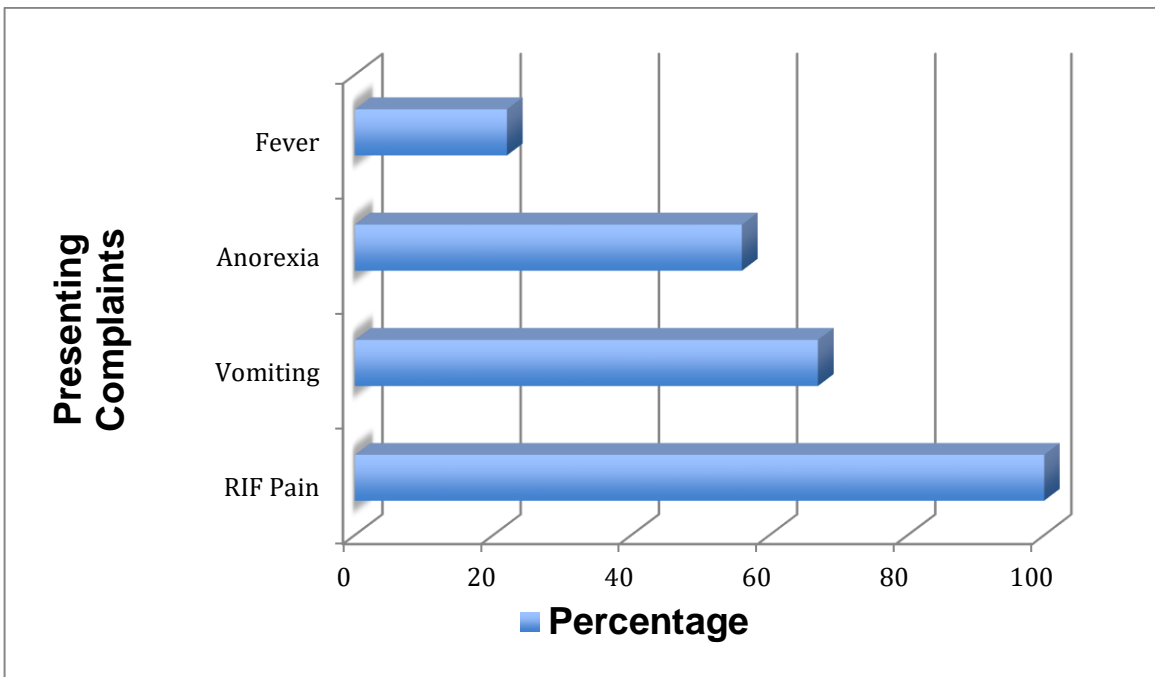


Figure 5: Presenting Complaints

4.4 Duration of Symptoms

Patients in the study had symptoms whose duration ranged from 1 day to 9 days as depicted in Table 3 below.

Table 3: Duration of Symptoms

| Duration | Number of Patients |
|----------|--------------------|
| 1 day | 5 patients |
| 2 days | 4 patients |
| 9 days | 1 patients |

Majority of the patients presented with symptoms of 1 days duration, which accounted for 55% of the patients, while 33% of the patients presented with a 2 days history of symptoms. One patient presented with symptoms with a prolonged duration of time of 9 days with accounted for 11% of the total patients. Majority of the patients presented during the acute phase of the illness as illustrated in Figure 6 below.

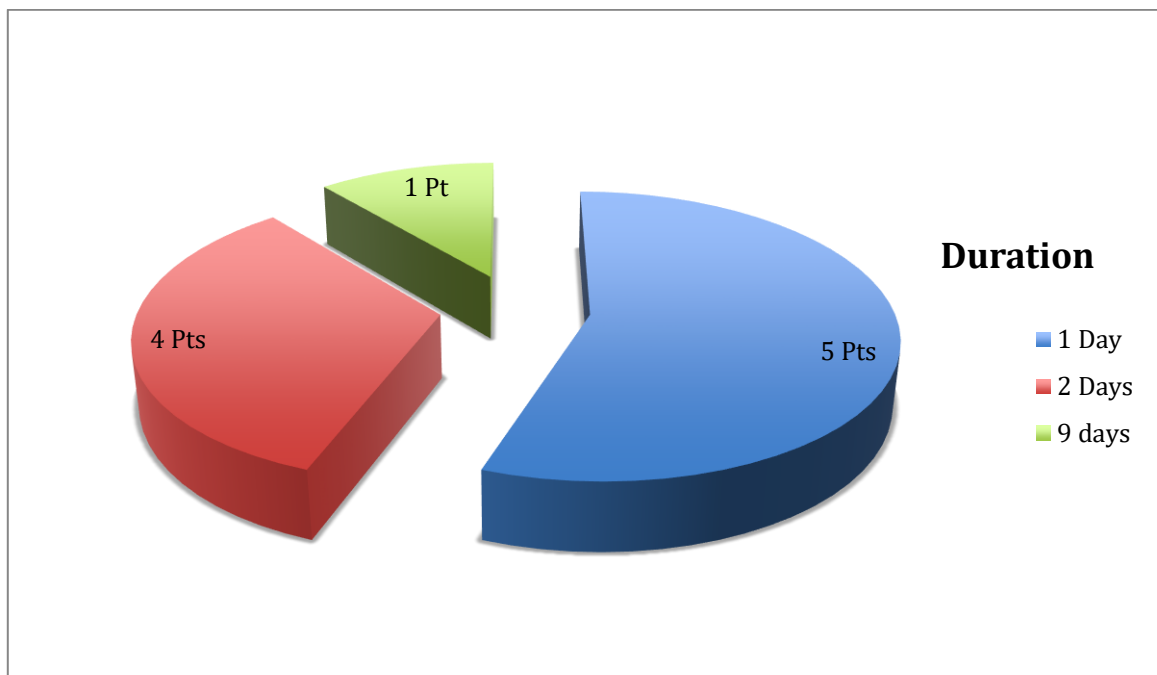


Figure 6: Duration of Symptoms

4.5 Intra Operative Findings

The Table 4 reveals the intraoperative appearance of the appendix that the patients presented with during the course of their illness.

Table 4: Gross anatomical appearance of the appendix intraoperative.

| Findings | Patients | Percentage |
|----------------------|----------|------------|
| Appendicular Abscess | 1 | 10 |
| Perforated Appendix | 1 | 10 |
| Inflamed appendix | 8 | 80 |

Majority of the patients in this study presented with an appendix that appeared to be inflamed on gross appearance contributing to 78% of the patients. One patient presented with a perforated appendix while another patient presented with an appendicular abscess both accounting for 11% of the patients. The intraoperative appearance of the appendix is represented in Figure 7 below.

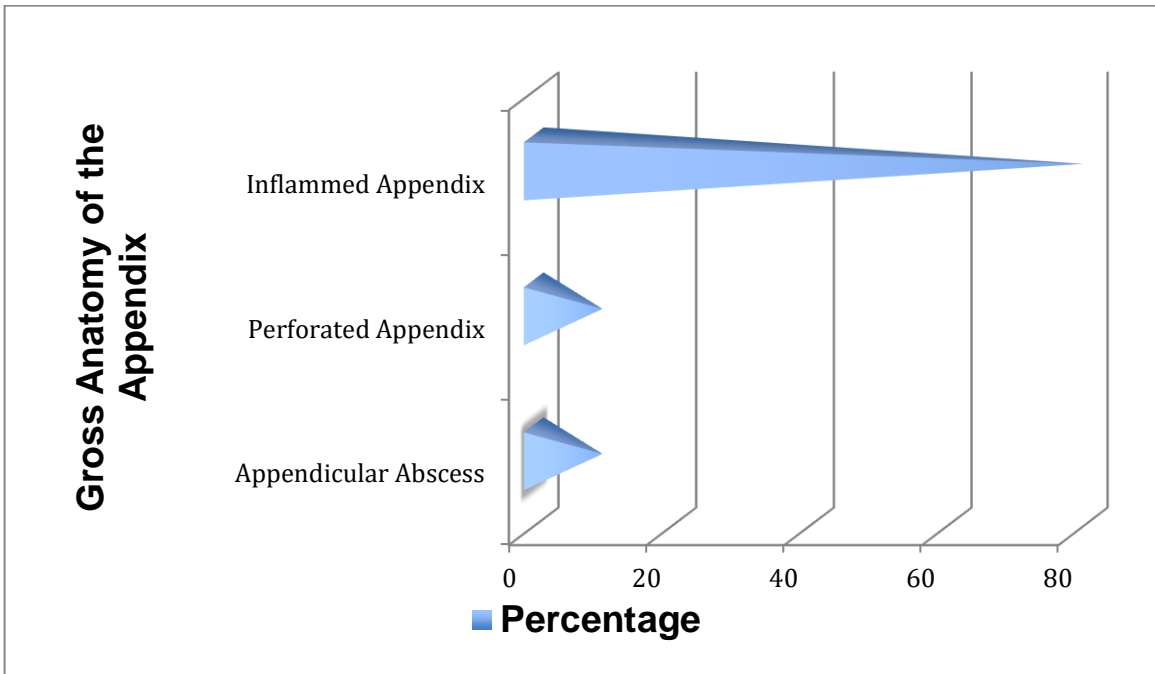


Figure 7: Gross Anatomy of the Appendix Intra operatively

4.6 Duration of Operation

The duration of the surgery of the patients ranged from 50-110 minutes as illustrated in Figure 8 below in ascending order.

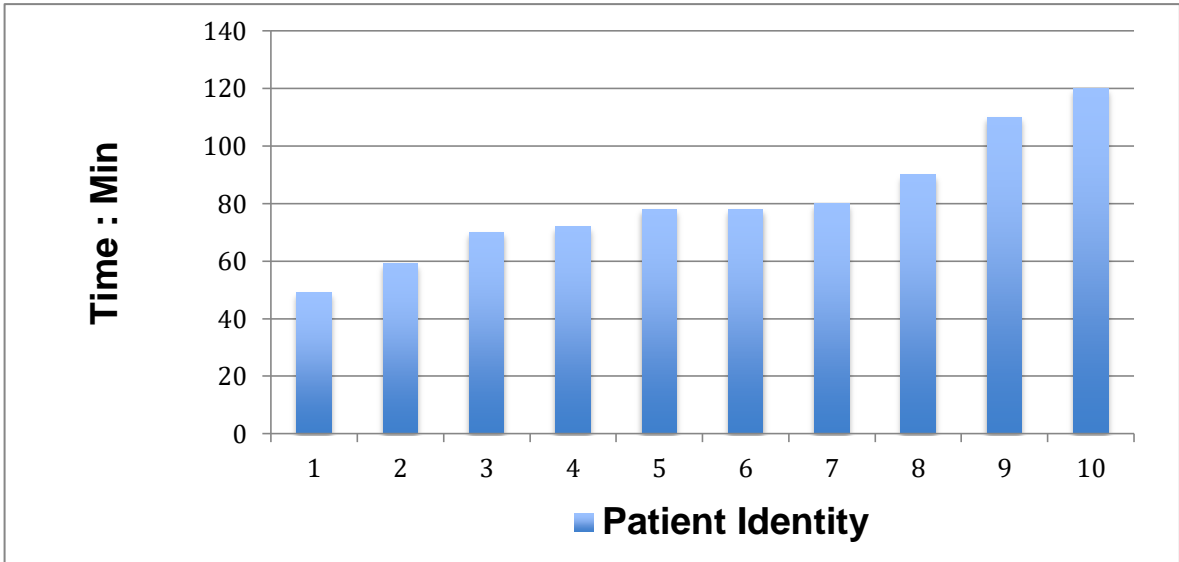


Figure 8: Duration of the surgical procedure

According to the graph above, two patients had their procedure done within 60 min accounting for 22%. Majority of the patients had their procedures done within 90 min duration accounting for 67% of the patients. One patient had a prolonged procedure lasting approximately 120 min contributing to 11% of the patients. The average time of the procedure for all the patients was 80.6 min.

4.7 Length Of Hospital Stay

In this study 66% of the patients who underwent LA had a hospital stay of 2 days duration while 34% of the patients had a length of hospital stay of 3 days as shown in Table 5 below.

Table 5: Length of Hospital stay

| Length of Stay | Percentage |
|-----------------------|-------------------|
| 2 days | 30 % |
| 3 days | 70% |

None of the patients were discharged on the same day of the surgical procedure and no patient spent more than 3 days in the hospital after the surgery as illustrated in Figure 9 below.

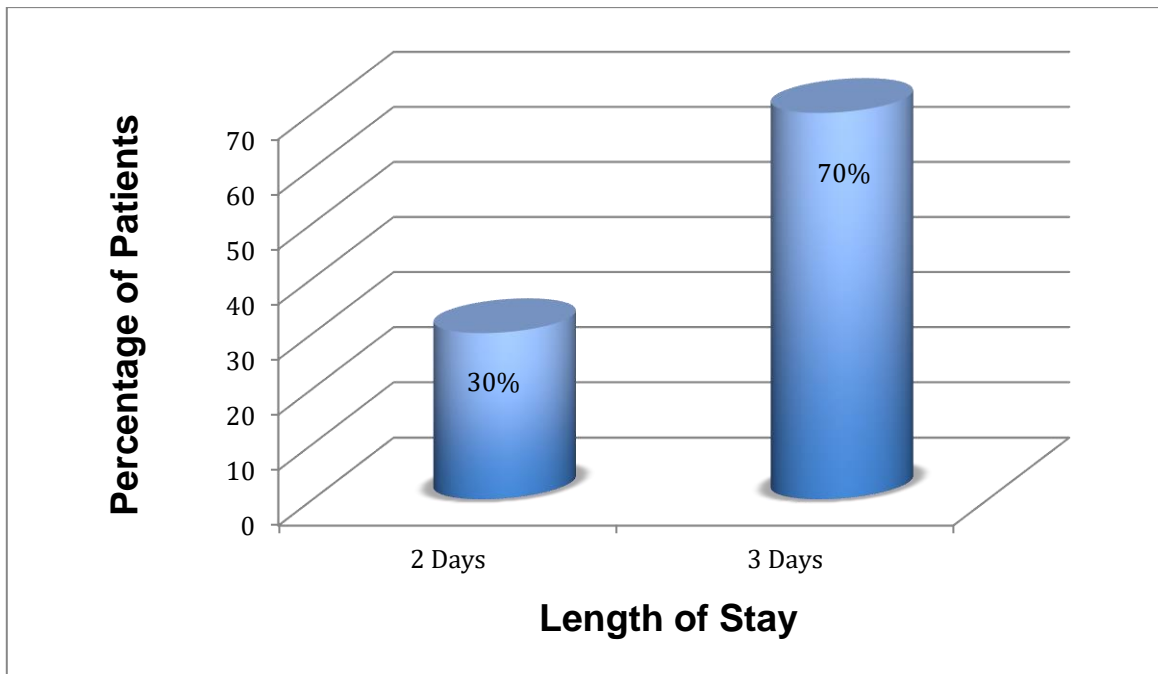


Figure 9: Length of stay of the Patient postoperatively

4.8 Complications

There were no complications recorded in all the 9 patients who were enrolled in this study during the entire course of their hospital stay till they were discharged from their clinic reviews accounting for 100% of the patients.

One patient was converted from laparoscopic appendicectomy to open appendicectomy, which accounts for 10%.

CHAPTER FIVE: DISCUSSION

Laparoscopy is a major advancement that has changed the field of surgery and has now become the preferable approach for management of most surgical conditions. The potential benefits that exist for LA regionally and globally have made us utilize this procedure for the management of acute uncomplicated appendicitis here at UTH. As this is the first study of its kind we analyzed the outcomes of this procedure on patients presenting with acute appendicitis. The outcomes of LA were measured primarily using the duration of the surgical procedure, the length of hospital stay of the patient, and the post operative complications like wound infection, intra abdominal abscess formation and port site hernias.

In our study, more women than men were recruited because of the early health seeking behavior and low pain threshold compared to men, which caused them to seek medical help earlier. Therefore they had a higher chance of presenting with uncomplicated appendicitis than the men.

In a study done by Richard et al, 49.9% were males while 50.1% were females (Richard, 2016). In another study a larger number of female patients were selected for the laparoscopic approach than the male patients (Adewale, 2012). However, in a study done by Rajab et al, more male (60%) patients underwent LA compared to female (40%) patients for the entire duration of his study (Rajab, 2016). Hossain et al had more male (62.5%) to female 37.5%) ratio in his study (Hossain, 2014).

The ages of the patients in this study ranged from 18-58 years with the mean age of presentation being 31.8 years. Most of the patients were in the third decade of life. There was one patient who presented with appendicitis and was above 50 years old. The findings in these researches are similar revealing the common age groups affected by appendicitis.

The mean age of presentation in a study done by Richard et al was 35.5 years which was slightly higher comparable to other studies (Richard, 2016). Adewale et al in his

study had patients in the laparoscopy group aged between 15yrs to 51yrs with a mean age of 29 years (Adewale, 2012). Rajab et al in his study had similar results with a mean age of 28 years (Rajab, 2010).

Only patients who presented within 24-48 hours of the onset of symptoms were considered because of the lower rate of complicated appendicitis within this period of time. In this study 56% of the patients with acute appendicitis had duration of symptoms of less than 24hrs, one of whom presented within 2 hours of the onset of symptoms, and 33% presented within 48hrs. One of the patients presented with a history of symptoms with a duration of nine days 11%. This patient had signs and symptoms of uncomplicated appendicitis and was on antibiotics and had no RIF mass clinically and radiologically, hence the patient was enrolled for the study. These findings show that the earlier the patient presents the less likely he is to have a complicated form of appendicitis. Hence, in both of the studies above, most of the patients had a short duration of symptoms and most of them had uncomplicated appendicitis which were similar to our findings.

In a study done by Mwero, majority of his patients presented with symptoms of duration of less than a week (Mwero, 2003). Antonio et al in his study had 85% of the procedures involving uncomplicated appendicitis and only 15% with complicated appendicitis (Antonio, 2016).

Most common symptom of presentation was pain in the abdomen (99.1%), which was the main reason for seeking medical intervention. All of the patients in this study presented with right iliac fossa pain. Vomiting was present in 66% of the patients, anorexia was present in 22% of the patients and fever was present in 22 % of the cases. The other symptoms like nausea were not included due to inadequacies in the history taking. In both the studies above the patients presented with the common symptoms of acute appendicitis which was as expected.

Rajab et al had comparable results with 94%, of the patients presenting with abdominal pain, 51% with nausea, 49% with vomiting, 24% with fever, 91% with tenderness, and 97% presenting with guarding (Rajab, 2010).

The duration of the operation ranged from 50-110min with a mean of 75.5min for all the procedures. One of the factors that can be attributed to the increase in duration was due to the use of the extra corporeal knot ligation for the appendiceal stump. Metallic clips used in more developed countries would have reduced the duration, however, they are very costly to procure. The setup of the laparoscopic unit in theatre didn't take much time because everything necessary was present in theatre and the theatre crew was very well conversant with the setup and use.

The procedure that took the longest to perform was because the appendix was perforated and it took time to locate the base, ligate and excise the appendix.

The duration of operating time in this study was comparable globally/regionally as similar results were observed in some of the studies as depicted in Table 6 below.

Table 6: Mean Operating time

| | Present Study | Pakistan Rajab (2010) | India Goudar (2011) | Nigeria Adewale(2012) | Bangladesh Rahmann (2014) |
|----------------------|----------------------|------------------------------|----------------------------|------------------------------|----------------------------------|
| Operating time (min) | 75.5 | 82 | 72.5 | 56.2 | 84.4 |

The mean operative time in a study done by Rasha et al was 75.5± 28.8min (Rasha, 2017).Rajab et al in his study had a median operative time of 82 (range: 40-180) minutes (Rajab, 2010), (Tashiro, 2016).

In Antonio et al study, the mean ± standard deviation (SD) operative time was shorter than the others at 54.9±14.7 min (Antonio, 2016).

Other studies have reported various durations of operative time (Yau, 2007), (Leily, 2014). This difference could be attributed to the difference in the level of laparoscopist's skills

Most of the patients had an appendix that appeared inflamed and was freely mobile. The patient who had a history of 9 days duration of symptoms is the one who had an appendicular abscess intraoperatively. The abscess was drained and lavage done and a drain was inserted. The patient was discharged 3 days later. The other patient had a perforated appendix that was adequately excised.

The similarities in these results reveal the period in time the patient presented signifying an uncomplicated form of appendicitis in most of the patients. The focus of our study was to capture patients with an uncomplicated form of appendicitis, and hence we were enrolling patients with a very short duration of symptoms.

The Intraoperative findings of a study done by Adewale et al, included a grossly inflamed appendix in 62.2% of patients, and perforated appendix in (5.4%) patients (Adewale, 2012). Another study done by Rajab et al had gangrenous perforated appendix in 8% of patients, Appendicular abscess in 2% of patients (Rajab, 2010). In Rajab et al's study, 16% of the patients had a grossly normal looking appendix intraoperatively and the histopathological results revealed 19% of the appendices were normal (Rajab, 2010).

Our findings are in agreement with several studies that demonstrated a significantly short hospital stay for the laparoscopic approach as depicted in Table 7 below.

Table 7: Length of hospital stay

| | Present Study | Pakistan Rajab (2010) | India Goudar (2011) | Nigeria Adewale (2012) | Bangladesh Rahmann (2014) |
|--------------------------|--------------------------|--------------------------------------|------------------------------------|---------------------------------------|--|
| Length of stay (days) | 2.3 | 2 | 2.5 | 1.8 | 3.9 |

Antonio et al noted that the hospital stay was significantly shorter in the laparoscopic group with a mean \pm SD of 1.4 ± 0.6 days (Antonio, 2016).

Jian et al In his study recorded a slightly longer duration of hospital stay with a mean of 5.4 days (Jian, 2015), (Tashiro, 2016). The average length of stay of the patients ranged from 2-3 days with mean stay of 2.3 days.

In line with the objectives of the study, two important parameters were used to compare the results of this study with those in the region and globally. It was noted that the results of this study compare well with the results of similar studies done in the region/globally as noted above. These two parameters were the duration of the operating time and the length of hospital stay.

Only one patient was converted to open appendicectomy due to the difficulty encountered in locating the appendix which was located retrocaecally and was adherent to the caecum. The decision was made by the surgeon who decided to convert in the interest of time and the duration of anaesthesia.

The conversion rate in this study was within acceptable range and was close to the findings in the above studies. The conversion rate in this study would have been even lower had more patients been operated on.

In a study done by Rasha et al, the conversion rate was 2.4%, which nearly matches that reported in other studies (Li X, 2010). On the other hand, Vahdad et al observed a higher conversion rate of 24% (Vahdad, 2013), whereas Wang et al. reported no conversion in their study (Wang, 2009). We believe that the surgeon's experience plays an important role in determining the rate of conversion (Rasha, 2017).

LA markedly reduced the postoperative complication rate as observed in other similar studies (Rasha, 2017), (Antonio, 2016), (Tashiro, 2016) and (Jian, 2015). In a Cochrane review that consisted of 5000 patients, it was revealed that patients undergoing LA were half as likely to develop wound infection postoperatively, however, on the other hand they were three times more likely to develop intraabdominal abscess formation (Cochrane, 2007). Other studies also showed an increased risk of intra-abdominal abscess after laparoscopic appendectomy (Rasha, 2017), (Antonio, 2016). Only one postoperative complication was recorded in the study for all the 9 patients that were operated on till they were finally discharged from the study. This low rate of complications was within acceptable range as similar studies recorded very low complication rates among patients who had undergone LA. Additionally, the low number of patients that were enrolled in this study also contributed to this low complication rate.

No mortalities were recorded among the patients that were admitted during the course of this study. These results are consistent with other similar studies carried out (Richard, 2016), (Jian, 2015), (kamath, 2015).

CHAPTER SIX: CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

The practice of Laparoscopic Appendectomy in our environment is feasible despite the numerous and surmountable challenges.

It may be used as a preferred technique in patients presenting with acute uncomplicated appendicitis, or where the diagnosis is equivocal.

LA can be used especially for young female patients in our setting who may present with gynecological causes of RIF pain, where LA may be used for diagnostic purposes as well.

6.2 Recommendation

There is need for adequate training of more laparoscopic surgeons, support staff and a dedicated theatre suite.

The institution needs to purchase more Laparoscopic towers and consumables.

Phase 3 needs to be able to perform LA daily to accommodate for emergency cases.

Anesthetists need to be assigned who will be available to perform LA anytime in case of an emergency.

A study with a longer duration of time is needed so more patients can be recruited and therefore increases the strength of the study with its results.

A study to determine the outcomes of LA in patients presenting with complicated appendicitis should be carried out.

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APPENDICES

Appendix I: PATIENT INFORMATION SHEET

Introduction

This form is given to let you know more about the study. After understanding it, you can decide whether to take part in the study or not.

Who is carrying out this study?

The study is being conducted at the surgical department, UTH by Dr Rajesh Parekh a University of Zambia postgraduate student in Surgery

The purpose of the study

This study aims to look at the outcomes of Laparoscopic appendicectomy in patients who present with acute appendicitis at the UTH. Several outcome parameters will be assessed to determine the advantages of the technique.

Benefits

All patients who agree to be included in the study will be seen immediately and managed according to the protocol within the shortest possible time. They will be regularly followed up to monitor their postoperative condition at no additional cost. All patients will have easy access to the study team should they have any questions or problems.

Risks

The study will not perform any additional treatments other than what any other patient with suspected acute appendicitis receives. . Any injury which the patient suffers during the course of treatment will be treated expeditiously by the research team.

Confidentiality

Taking part in this study is voluntary, as such, you may choose to participate or not. Your name and other personal identifiers will not be used in this study. The information of this may be revealed by the study investigator to the examiners appointed by the University of Zambia. You are free to ask any questions regarding the study.

Questions

Should you seek any clarifications concerning this study or your rights as a research participant, feel free to contact;

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Appendix II: CONSENT

I _____ do hereby agree at free will to take part in this study having being fully informed.

Participant signature or Thumb print:

Witness signature :

APPENDIX III: Data Collecting Sheet

PATIENTS PARTICULARS

DATE.....
NAME.....AGE.....SEX.....
FILE NUMBER.....STUDY ID.....
NUMBER.....
OCCUPATION..... MARITAL
STATUS.....
ADDRESS.....

B. CLINICAL DETAILS

SYMPTOMS

1.1 Migrating right iliac fossa pain.....Y / N
1.2 Nausea or Vomiting.....Y / N
1.3 Anorexia.....Y / N

SIGNS

2.1 Elevated Temperature..... Y / N
2.2 tenderness Right iliac fossa.....Y / N
2.3 Rebound Tenderness Right iliac fossa.....Y / N

3. INVESTIGATIONS

3.1 Leukocytosis..... Y / N

3.2 shift to the left of neutrophils..... Y / N

4. PERIOPERATIVE DETAILS

Duration of procedure.....minutes.

Intraoperative complications;

- Iatrogenic injury.....Y/N

LOS of the patient.....days

Postoperative complications

- Bleeding.....Y/N
- Wound site infection.....Y/N
- Pelvic collections.Y/N
- Port site hernias.....Y/N

APPENDIX IV: Alvarado score

| | |
|---|---|
| Migrating right iliac fossa pain..... | 1 |
| Nausea or Vomiting..... | 1 |
| Anorexia..... | 1 |
| Elevated Temperature..... | 1 |
| Tenderness Right iliac fossa..... | 2 |
| Rebound Tenderness Right iliac fossa..... | 1 |
| Leukocytosis..... | 2 |
| Shift to the left of neutrophils..... | 1 |

Score

Possible

Probable

>9 Very Probable