UTILITY OF MULTIDETECTOR COMPUTED TOMOGRAPHY (MDCT) SCAN FINDINGS IN SURGICALLY TREATED ACUTE ABDOMEN AT KENYATTA NATIONAL HOSPITAL - KENYA

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H58/78152/2015

A study Dissertation Submitted in Partial Fulfillment for the Award of Master of Medicine Degree in Diagnostic Imaging and Radiation Medicine, University of Nairobi

2019

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DEDICATION

This work is dedicated to my Mother, Mrs. Nteeni SM and my wife Nkandu for the consistent love, motivation, inspiration and support throughout the course.

ACKNOWLEDGEMENT

I give thanks to God, Almighty for his providence that enabled me to successfully complete this work.

I would like to express my sincere appreciation to my supervisors Dr. Chacha Magabe and Dr Gladys Mwango for their consistent encouragement, critical review and support at every stage of my study.

My appreciation goes to the staff of KNH radiology department in particular Dr. Mugi, Dr. Wangari, Dr Muruka, Dr Omamo, Dr Kebuka, Dr Othieno and Dr. Mamai..Your steadfast support, understanding and encouragement is greatly appreciated.

A special thank you goes out to Mr. Philip Ayieko and Mr. Kevin Omondi for their support in the data management and statistical analysis.

Heartfelt appreciation goes out to the Ministry of health, Zambia, who graciously sponsored this project in facilitation of my postgraduate studies. A special thanks to Dr Monze and Dr Ntele, my Hospital administrators for the encouragements.

Finally, I am deeply indebted to my family especially my wife, Nkandu, and my parents Mrs. Nteeni and the late Mr. Nteeni and to my brothers and sisters and my entire church family. Without you, this would not have been possible.

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LIST OF ABBREVIATIONS

AAP:	Acute abdominal pain
CECT:	Contrast -Enhanced Computed Tomography
CT:	Computed Tomography
DDIRM:	Department of diagnostic imaging and radiation medicine
KNH/UON-ERC:	Kenyatta National Hospital/ University of Nairobi Ethics & Research Committee
KV :	Kilo Voltage
MDCT:	Multi Detector Computed Tomography
NECT:	Non-Enhanced Computed Tomography
NPV:	Negative Predictive Value
PPV:	Positive Predictive Value
SPSS:	Statistical package for social sciences
UON:	University Of Nairobi
USS :	Ultrasound Scan

DEFINITION OF TERMS

Sensitivity ……. Probability of testing positive if the disease is truly present.

Specificity……. Probability of testing negative if the disease if truly absent

Accuracy……The ability of a diagnostic test to discriminate between the target condition and health.

Laparotomy……A surgical incision into the abdominal cavity, for diagnosis or in preparation for major surgery

Acute Abdomen……A condition of severe abdominal pain, usually requiring emergency surgery, caused by acute disease or injury to the internal organs

Positive predictive value ……The probability that subjects with positive MDCT findings truly had the disease.

Negative predictive value…..The probability that subjects with negative MDCT findings truly didn't have the disease.

ABSTRACT

Background: Acute abdomen is the leading cause of exploratory laparotomies in the emergency department. MDCT is the main imaging modality in most cases of acute abdomen and determines those that require surgical management. No studies have been done to show its utility in surgically treated acute abdomen in the region.

Methods: A Prospective cross-sectional analytic study was conducted at Kenyatta National Hospital involving 253 consecutive patients with surgically treated acute abdomen over a 12-month period. MDCT findings were compared with surgery and/or histological findings.

Results: Pre-surgery MDCT was performed in only 25%. The age range was 18-62 years with median age of 31. The male to female ratio was 3:1.The most common findings at MDCT for trauma were left diaphragmatic rupture with herniation (23.1%), perforated hollow viscera (19.2%) and bladder injury (15.4%); while the most common findings in non-traumatic acute abdomen were acute appendicitis (32.4%), peritonitis (29.7%) and intestinal obstruction (18.9%). MDCT findings showed strong concordance with surgical findings with the overall sensitivity, specificity, NPV, and PPV calculated as 91.7%, 100%, 37.5% and 100% respectively. Surgical findings of patients with acute abdomen were similar in both MDCT and non-MDCT group The total percentage of patients with collections or diagnoses which would have benefited from conservative, limited surgical or interventional radiology managements was 13% and included isolated mild hemoperitoneum, hepatic abscess, negative laparotomy, pancreatitis, pelvic abscess, psoas abscess and sub phrenic abscess.

Conclusion: MDCT showed strong concordance with surgical findings with high accuracy, specificity and sensitivity in all types of surgically treated acute abdomen. MDCT is accurate and reliable and should be done in all patients with acute abdomen before surgical intervention, where indicated, to minimize the incidence of exploratory laparotomies.

Chapter 1

1.1 INTRODUCTION

Acute abdomen refers to a clinical condition involving sudden onset of severe abdominal pain that requires urgent medical or surgical management. This can be due to a number of reasons ranging from insignificant disease to life threatening disease. A holistic approach in the diagnosis of the acute abdomen is therefore vital.[1]

In a study at KNH, Awori M and Jani, found that abdominal pain was the presenting compliant in 16.7% of patients that presented to the casualty department. He showed that abdominal pain accounted for 17.9% of all admissions via emergency department and 4.4% of these underwent surgery. [2] This study however did not quantify the impact of radiological imaging in the workup of patients with acute abdomen. Past studies have indicated the need for a thorough diagnostic workup before surgical intervention. [3,4,5]

A comprehensive history, thorough physical examination and appropriate radiological imaging is important in the diagnosis of acute abdomen.[4,5]. While conventional radiographs and ultrasound are the mainly available tools in most centers, MDCT is the main modality of choice in triaging patients with acute abdominal pain, more so in patients who are obese or have unclear U/S findings, bowel obstruction and other co-morbidities. MDCT enables accuracy and reproducibility of diagnoses which in turn affects management and is therefore the primary imaging tool in acute abdomen except when cholecystitis is suspected (in which case U/S is preferred). [6]

Due to its multiplanar reconstructions, MDCT is able to increase the surgeon's confidence as it provides a pictorial evaluation of disorders [6]. Therefore, there needs to be good collaboration between the referring clinician and radiologist if diagnosis of acute abdomen is to be made in a rapid but at the same time accurate manner [7,8,9].

Surgical treatment of acute abdomen is usually via an emergency laparotomy. This is a high risk procedure but at the same time gives a definite diagnosis when correlated with histological findings.[10]

MDCT is an efficient and widely used imaging modality in acute abdomen but there is a scarcity of data on its utility in the acute general surgical workload. The objective of this study was to provide baseline data on the utility and accuracy of MDCT in surgically treated acute abdomen in our local setup.

Chapter 2

2.1 LITERATURE REVIEW

Diagnostic imaging, coupled with a thorough clinical exam, is crucial in the evaluation of the acute abdomen. Accurate diagnosis leads to decreased negative laparotomies and unnecessary operations and consequently improved patient care .[11]

Federle et al, showed that since the 70's, CT imaging has continued to be the premier imaging technique for evaluating patients with acute abdomen. This has been reinforced with the advent of MDCT which has been shown to be accurate for nearly all cases of acute abdomen. The advances seen in MDCT imaging techniques and reformations have further significantly increased the diagnostic accuracy of the acute abdomen.[12,13]. Since the advent of MDCT, there has been seen a reduction in hospital admissions and also unnecessary laparotomies in patients with AAP. [14] This aspect of MDCT is also much more appreciated in the elderly population who present with non-specific signs and consequently pose a diagnostic challenge. ,[15]

In a study of patients with abdominal pain, Covarelli et al found that for most patients who underwent surgery, abdominal USS and lab workups were the most utilized imaging modalities followed by plain films and abdominal MDCT. From his study, he showed that a thorough clinical and physical exam were important, supported by investigations.[16]

One strategy to ensure holistic care for patients with acute abdomen was found to be the usage of USS first and then MDCT in those with negative or equivocal results. [17] However, rapid assessment and high diagnostic accuracy of acute abdominal disorders have recently been shown to be achieved well with MDCT alone, leading to good patient management. [18]

Surgeons have also benefitted from MDCT due to its ability to successfully define the presence of disease and also localize it and therefore increase their confidence [19].

In one study of patients with surgically treated acute abdomen, MDCT was found to be 87.3 % sensitive when only complete concordance with surgical findings was considered. However this increased to 95.6% when partial concordance was also considered. [20]

2.2 ETIOLOGY OF ACUTE ABDOMEN

There are several surgical causes of an acute abdomen in an adult. These are divided into Inflammatory, Mechanical, Vascular and Traumatic as discussed below.

2.2.1 INFLAMMATORY CAUSES

Inflammatory causes can either be due to infections or chemically mediated.

2.2.1.1 INFECTIONS

ACUTE APPENDICITIS

Appendicitis is the commonest cause of surgically treatable acute abdomen [21-22,23]. It is the most common indication for emergency laparotomy at KNH accounting for 32.3%.[21]. In order to avoid missed diagnosis at the same time provide patient safety, a thorough work up must be done. A good history and physical examination with early surgical consultation. This limits the use of advanced imaging to equivocal cases.

However, in a meta-analysis study to demonstrate the impact of MDCT on diagnosis of appendicitis, it was found that the negative appendectomy rate was 8.7% when MDCT was used compared to 16.7% when clinical evaluation was used alone. The same study noted that negative appendectomies were much rarer in the MDCT era than the pre-CT era. [24]

In a study that aimed to identify and evaluate profiles of US and CT, both modalities were seen to be adequate in categorizing patients with appendicitis. The study found that CT and US had a sensitivity of 96% and 92% respectively. [25]

One study showed that CT had a sensitivity, specificity, PPV and NPV of 90% to 100% , 91% to 99%, 92% to 98%, and 95% to 100% respectively in diagnosing appendicitis.[26]

Recent expert opinion suggest USS to be the first imaging modality relegating MDCT / MRI to those with equivocal findings [27] bearing in mind radiation safety considerations.

CHOLECYSTITIS

The diagnosis in an acute abdomen is non specific and although sonography is the preferred method for diagnosing acute cholecystitis, MDCT is sometimes the initial modality.[28 29] MDCT can also depict complications of acute cholecystitis including perforation and gangrene. [30]

DIVERTICULAR DISEASE

CT has been shown to be effective in the diagnosis of acute abdomen caused by diverticular disease clearly delineating the extent and complication of the disease. Even though diverticular disease occurs in about 5 % in the general population, 2/3 of the patients are those older than 90 years occurring mostly in the sigmoid colon [31,32]

EPIPLOIC APPENDAGITIS

When an epiploic appendage of the colon undergoes inflammation, ischemia or torsion, this condition results which may simulate appendicitis and right- and left-sided diverticulitis clinically and on MDCT scans. MDCT findings have been well elucidated. [33,34]

SMALL-BOWEL DIVERTICULITIS

Inflammation of a pseudodiverticlum or indeed a merkels diverticulm can cause AAP. The findings at MDCT are non-specific and may show signs of inflammation with a stone within. [35,36]

TYPHILITIS

This disorder mostly affects immunocompromised patients. It is an acute inflammatory process which involves the cecum or terminal ileum and appendix. MDCT is useful as other invasive imaging procedures may lead to perforation. Findings though non-specific can readily show the inflammatory process and complications if advanced.[3738]

INFLAMMATORY COLONIC AND NON-PARASITIC PATHOLOGY

Inflammatory colonic and non-parasitic pathology can be a cause of acute abdomen and has been shown to be a well classified and characterized by use of CT. [39]

ABDOMINAL ABSCESSES

These can cause acute abdomen that may require surgery and most commonly result from the contiguous spread of bacteria from the gut, biliary tract, or genitourinary system. MDCT is the most accurate imaging examination for the diagnosis of intraabdominal abscesses. [40]

CHOLEDOCHOLITHIASIS

MDCT has a sensitivity of 88%, specificity of 97%, and accuracy of 94% in the detection of choledocholithiasis; however, positive intraluminal and intravascular contrast material can obscure calcified stones in the peripheral [37]

2.2.1.2 CHEMICAL

The main causes of gastrointestinal perforation are peptic ulcer disease, diverticulitis, severe intestinal inflammation, infarction, trauma, neoplasm, or closed-loop obstruction. [37]

MDCT is ideal for evaluating patients with signs of peritonitis, which is often misdiagnosed as another acute lesion. It can detect pneumoperitoneum that may be overlooked on chest or abdominal radiography; but in has been shown to not be quite helpful if symptomatology is less than 6hrs .[4142]

Detection of bowel perforation can be difficult, but it has been shown that loculated fluid and gas, focal mesenteric or omental infiltration, and focal enhancement of the parietal peritoneum are useful radiological signs to help pinpoint the site of perforation[37]

2.2.2 MECHANICAL

The mechanical causes of acute abdomen include incarcerated hernia, post-operative adhesions, intussusception, malrotation of gut with volvulus and carcinoma of the colon. Small bowel obstruction and large bowel obstruction account for approximately 20% of cases of acute abdominal surgical conditions [43]. MDCT aids to reveal the site, level, and cause of obstruction and to display the signs of threatened bowel viability.[4445]

INCARCERATION

Irreducible hernias are clinically diagnosed and imaging is suggestive if the hernia defect is small and the hernia sac has a narrow neck. MDCT findings include visualization of a hernia defect noting the size and contents as well as assessing for impending strangulation.[46]

POSTOPERATIVE ADHESIONS

Small bowel obstruction is mostly caused by adhesions and are difficult to diagnose. MDCT is often the mainstay of diagnosis of this condition with complications that may arise.[47] The utility of MDCT for this purpose has been well described with its ability to assess for complications.[48]

INTUSSUSCEPTION

MDCT has been shown to be useful in making a diagnosis of intussusception with clear identification of the lead point from a non-lead point which is useful for further management. [49]

CARCINOMA OF THE COLON

Matrawy and El – shaly in a study, showed that MDCT has high diagnostic efficacy in discriminating Intestinal obstruction of various causes in the emergency department including Carcinoma of the Colon. [50]

MALROTATION OF GUT WITH VOLVULUS

Detection of midgut volvulus by CT has been clearly defined using features such displacement of the superior mesenteric artery and vein aided by the inspection of the development of the pancreatic uncinate process [51]

2.2.3 VASCULAR

Mesenteric ischemia which is caused by various conditions can lead to acute abdomen. These conditions include arterial occlusion, venous occlusion, strangulating obstruction and

hypoperfusion associated with non-occlusive vascular disease. MDCT can lead to correct diagnosis of mesenteric ischemia due to characteristic finding and the various variations associated in each cause.[52]

When portions of the omentum undergo segmental infarction, they may cause an acute abdomen simulating acute appendicitis, pancreatitis, and epiploic appendagitis. MDCT is useful in demonstrating these infarcts.[53]

MDCT is also the imaging procedure of choice in patients with suspected aneurysm dissection and rupture.[54,55]

A wandering spleen may occasionally cause acute abdomen if torsion occurs. MDCT, with its multiplaner capability coupled with the ability to use contrast has been shown to be useful in the assessment of a patient with suspected acute abdomen caused by torsion of the wandering spleen.[56,57]

2.2.4 TRAUMA

Traumatic causes of an acute abdomen range from stab and gunshot wounds to blunt abdominal injuries producing such conditions as splenic, liver, and bowel injuries. MDCT is the modality of choice and is able to localize the injured organ with associated conditions such as hemoperitoneum and peritonitis.[58,59,60]

Splenic injuries, renal injuries, liver and bowel injuries can be very well described by MDCT. This allows for appropriate management depending on the extent of injury. [6162606364]

A study at KNH found the incidence of negative laparotomies to be 16.1% which was seen to be a 10% decrease over a 15-year period. The overall abdominal injuries in this same study were found have a morbidity / mortality complication of 12.3%. [65] Another study at KNH evaluated the indications and findings for laparotomy but both studies had limited radiological correlation. The role of MDCT has been well established in reducing negative laparotomies and a consequent improved patient outcome.[66]

2.3 RADIATION PROTECTION

MDCT examinations, while giving good diagnostic yield are not completely safe. In a study at KNH, patients who had abdominal MDCT exams were found to have effective doses on average about 5 times more than the recommended dose. [67] Application of the ALARA (As

Low as Reasonably Achievable) principle is important in MDCT exams if adverse effects are to be avoided. [68]

2.4 CONTRAST AND PROTOCOLS

Tsushima et al evaluated the impact of CT in the acute abdomen and found that CT findings changed the initial diagnosis in 32% patients which were concordant with the final diagnosis in 92.8%. This is in contrast to the pre-CT diagnosis which were correct in 71.2%. Contrast-Enhanced Computed Tomography (CECT), was thus seen to have a direct impact on the diagnostic certainty and the initial treatment.[69]

A prospective study to assess the use of oral contrast in acute abdomen showed that there was a 79% simple agreement between Non-Enhanced Computed Tomography (NECT) and CECT in diagnosing various causes of acute abdomen. [70]

In a recent study of patients with abdominal disorders, Hill et al, found that there was no significant difference in ability to correctly diagnose a suspected acute abdominal process when CECT was compared to NECT.[71]

Chapter 3

3.1 PROBLEM STATEMENT

MDCT is an efficient and widely used imaging modality in acute abdomen but there is a scarcity of data on its utility in the acute general surgical workload. [72] Abdominal radiography and ultrasound have been the main imaging modalities in our local setup for surgically treated abdominal pain and there are no recorded studies of MDCT utility in these patients in our local setup

3.2 STUDY JUSTIFICATION

Several studies have demonstrated the effectiveness of MDCT in most cases of acute abdomen including those cases which are surgically treated [4,5,73,24] . The benefits of this modality include surgeon confidence, time saving diagnosis and/or intervention and reduced negative laparotomies. [4,5,73,24] .

There are no published studies on the utility of MDCT in surgically treated acute abdomen in our local region. This study aimed at bridging this gap by providing baseline data which will help with formulating guidelines and this in turn will lead to more efficient patient management.

The findings will also be invaluable on a larger scale for National audit purposes and will also add to the body of scientific knowledge through publications in journals.

3.3 RESEARCH QUESTION

What is the utility of MDCT in surgically treated acute abdomen at KNH?

3.4 OBJECTIVES

3.4.1 BROAD OBJECTIVES

To determine the utility of MDCT in surgically treated acute abdomen at KNH.

3.4.2 SPECIFIC OBJECTIVES

a) To determine the proportion of surgically treated acute abdomen for which MDCT was used at KNH.

b) To determine the pattern of MDCT findings in patients with acute abdomen who undergo surgery at KNH who had MDCT.

c) To determine the surgical findings in patients with acute abdomen at KNH.

d) To determine the accuracy, specificity, PPV and NPV of MDCT in patients who present with acute abdomen and later undergo surgery at KNH.

Chapter 4

4.1 STUDY DESIGN AND METHODOLOGY

Our study used a cross-sectional prospective descriptive institutional based study.

4.2 STUDY AREA

Kenyatta National Hospital in the CT room of the department of Radiology and the general surgical wards.

4.3 STUDY POPULATION

All patients aged 18 and above who presented with acute abdomen and later had surgery within 48hrs.

4.4 SAMPLE SIZE

Sample size was be calculated using Fishers formula for estimating sample size in prevalence studies suggested in Daniels (1999).

$$n = \frac{Z^2 P(1-P)}{d^2}$$

P = Prevalence of imaging investigation using MDCT scans among surgically treated acute abdomen in KNH. Estimated at 0.066 based on a pilot study in KNH radiology unit (ref).

1-P = 1 minus the proportion of surgically treated acute abdomen investigated using MDCT scans in KNH

Z = Z statistic representing 95% level of confidence (1.96)

d = desired level of precision set to 3% (based on suggested precision for around an outcome with a low absolute prevalence (Naing 2006) e.g. patients undergoing MDCT scans in KNH)

$$n = \frac{1.96^2 \times 0.063(1-0.066)}{0.03^2}$$

$$\frac{3.84 \times 0.063(1-0.063)}{0.03 \times 0.03}$$

$$n = \frac{0.2368}{0.0009}$$

n = 253

4.5 INCLUSION CRITERIA

- All consenting patients aged 18 years and above presenting with acute abdomen to the surgical emergency department and underwent surgery within 48hrs were included in the study with or without MDCT examination.

4.6 EXCLUSION CRITERIA

- Pregnant patients
- Patients who refused consent to participate
- Persons under the age of 18

4.7 METHODOLOGY

This prospective study commenced after approval was obtained from university of Nairobi – Kenyatta national hospital Research Ethics Committee and permission granted by KNH radiology department.

Procedure

An IV line was secured using a superficial vein in the upper limb with a 18G cannula. No patient- bowel preparation was mandated. Scans were obtained using a Siemens SOMATOM Sensation 128 CT scanner (Munich, German) with the following set parameters. KV / Effective mAs / Rotation time (sec) of 120 / 200 / 0.5 respectively. Detector collimation were set at 1.5mm. Slice thickness was 3 or 5mm. IV contrast was 100-120ml of omnipaque 350 at an injection rate of 2-3 ml/sec. Scans were obtained at 60-80s.

Interpretation of results was done by the principal investigator under the supervision of a consultant radiologist. Patients were followed up and surgical and /or histological findings were compared with MDCT findings.

Conditions of "complete concordance"," partial" or "incorrect diagnosis" were considered. "Partial concordance" was considered when MDCT missed out some significant associated surgical findings but correctly identified the main condition.

4.8 DATA MANAGEMENT AND ANALYSIS

Data collected were analyzed using the Statistic Package for Social Science (SPSS) version 20.0 for Windows® and Chi square tests performed to determine statistical significance ($p<0.05$) of the results obtained in relation to the demographic data.

4.9 ETHICAL CONSIDERATION

Ethical approval was attained from University of Nairobi/ Kenyatta National Hospital research ethics committee. Permission to carry out the study was obtained from Kenyatta National Hospital department of radiology.

Written informed consent was obtained from the patients involved in the study by explaining what the study entails and emphasizing voluntary participation. Confidentiality and privacy of the study participants was respected by assigning patient numbers and not including their personal information such as names in the data collection tools

Information acquired will not be used for any other purpose besides in the clinical management of patients and academic purposes.

Chapter 5

5.1 RESULTS

A total of 253 study participants were recruited into the study. The overall age range was 51with a median of 30 (IQR12.5). Out of these study participants, 25% (63/253) had MDCT studies before surgery for acute abdomen. The age range of the MDCT group was 18 to 62 years with a median age of 31 years (IQR 11). The Male-to-Female ratio was approximately 3:1. All participants were further categorized according to the presence or absence of trauma.

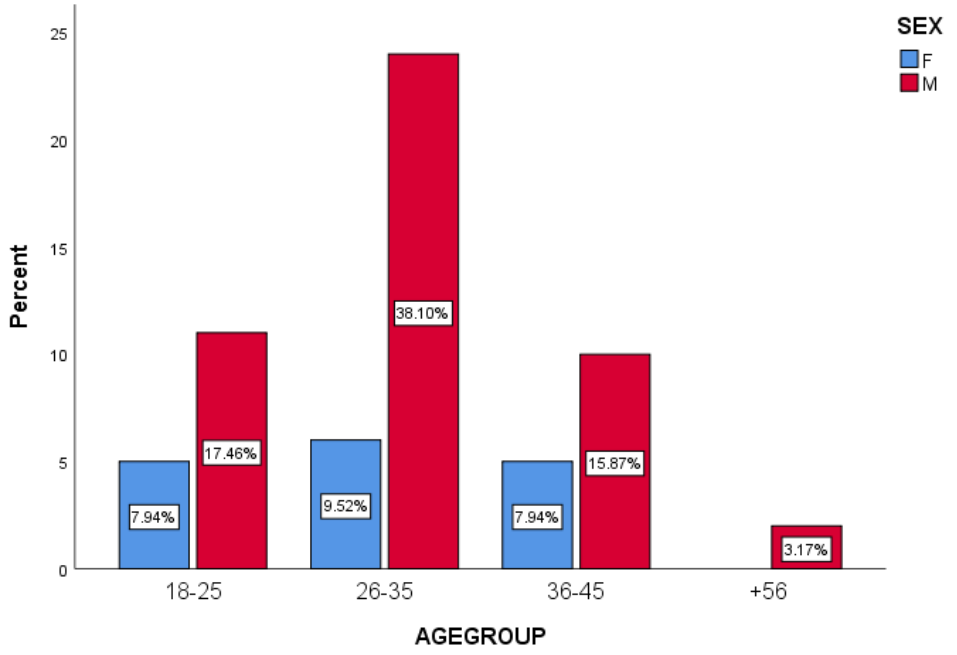

Figure 1. Age and sex distribution of adult patients undergoing surgery for acute abdomen at KNH with MDCT.

5.1.1 TRAUMATIC ACUTE ABDOMEN

There were 88 patients with abdominal trauma who were treated surgically. MDCT examinations were conducted in only 30% (26/88) of these patients. The Male: Female ratio was 12:1. Table 1gives a summary of MDCT findings in traumatic acute abdomen classified using the American Association for the Surgery of Trauma (AAST) guidelines).

Table 1: MDCT findings in traumatic acute abdomen

MDCT diagnoses	Frequency	Percent
AAST grade 1 hepatic / ASST grade 1 splenic injury	1	3.8
AAST grade 1 hepatic injury	1	3.8
AAST grade 1 splenic injury	1	3.8
AAST grade 2 hepatic / ASST grade 2 splenic injury	1	3.8
AAST grade 3 Hepatic injury	1	3.8
AAST grade 4 hepatic injury	1	3.8
AAST grade 4 splenic injury	1	3.8
Bladder injury	4	15.4
Mild isolated hemoperitoneum	3	11.5
Left diaphragmatic perforations without thoracic herniation	1	3.8
Left diaphragmatic rupture with herniation	6	23.1
Pancreatitis	1	3.8
Perforated bowel	4	15.4
Total	26	100.0

The leading findings seen in the 26 study participants undergoing MDCT for traumatic acute abdomen were; left diaphragmatic injury with herniation 6 (23%), perforated bowel 4 (19%) and bladder injury 4 (15%). Representative cases are illustrated in figures 1 - 3.

As per the AAST guidelines [74]there were 8 (31%), cases with surgical findings that suggested that these patients would have benefited from a less invasive management. These included hepatic / splenic injuries of AAST grade 1 and 2 (n = 4), Mild isolated hemoperitoneum (n=3) and pancreatitis (n = 1). Table 2 gives the surgical findings in traumatic patients

without an MDCT. It shows that the pattern of findings was similar as that seen in the MDCT group. As per AAST guidelines 23% (14/62) patients without MDCT may not have required an emergency laparotomy had MDCT been performed.

Table 2: Surgical findings in traumatic patients without an MDCT

Diagnosis	Frequency	Percent
Bladder injury	5	8.1
Grade 1 AAST hepatic injury	4	6.5
Grade 2 ASST hepatic injury	2	3.2
Grade 3 ASST hepatic injury	2	3.2
Grade 4 ASST hepatic injury	1	1.6
Grade 4 ASST splenic injury	1	1.6
Hemoperitoneum	3	4.8
Ischemic bowel	1	1.6
Left diaphragmatic injury with herniation	2	3.2
Left diaphragmatic injury without herniation	2	3.2
Left diaphragmatic rupture with herniation	2	3.2
Negative laparotomy	3	4.8
Pancreatitis	2	3.2
Perforated bowel	27	43.5
Peritonitis	4	6.5
Retroperitoneal haematoma	1	1.6
Total	62	100.0

5.1.2 NON-TRAUMATIC ACUTE ABDOMEN.

Only 22 % (37/165) in the non-traumatic acute abdomen group had an MDCT study prior to surgery.The Male: Female ratio was 3:2 in this group. The MDCT findings are illustrated in Table 3and include acute appendicitis (32%), peritonitis (30%) intestinal obstruction (19%).

Table 3: MDCT findings in non-traumatic acute abdomen

Diagnosis	Frequency	Percent (%)
Acute appendicitis	12	32
Intestinal obstruction	7	19
Large left bleeding suprarenal mass	1	3
Pelvic abscess	3	8
Perforated viscus	1	3
Peritonitis	11	30
Sigmoid volvulus	1	3
Sub phrenic abscess	1	3
Total	37	100

Representative cases are given in Fig 4 – 6, Intrabdominal abscesses, n = 4 (10.8%) found at MDCT may have benefited from non-surgical management such as interventional radiology rather than laparotomy.

This means the overall number of patients who would have benefited from non-surgical management in patients with MDCT examination was 19% (12/63)

The surgical findings of patients without MDCT in the non-traumatic group showed a similar trend as those with MDCT. Table 4 shows that the leading findings included acute

appendicitis (39%), peritonitis (27%) and intestinal obstruction (22%). Diagnoses of intrabdominal abscesses n = 7 (6%) would have benefitted from a lesser invasive percutaneous drainage than invasive laparotomy.

Table 4: Surgical findings in non-traumatic acute abdomen without MDCT

Diagnosis	Frequency	Percent (%)
Acute appendicitis	50	39
Cholecystitis	3	2
Hepatic abscess	1	1
Intestinal obstruction	28	22
Mesenteric ischemia	1	1
Ovarian torsion	3	2
Pelvic abscess	5	4
Perforated viscus	1	1
Peritonitis	35	27
Psoas abscess	1	1
Total	128	100

The overall total number of patients without MDCT with collections or diagnoses which would have benefited from non-surgical or conservative managements was 21 (11%).

It is worth noting that abdominal USS was the single most frequently used imaging modality (55%) inpatients without MDCT.

5.1.3 ACCURACY OF MDCT

The accuracy of MDCT when compared to surgical findings was 92% (58/ 63) having complete concordance where the MDCT findings completely correlated with surgical findings. There was partial concordance in 5 (8%) patients. In this group MDCT was able to identify the most important findings but missed out on some findings seen on surgery. The overall accuracy of MDCT if partial concordance was considered was 100%. In other words, MDCT was able to accurately diagnose the most important findings in all our patients which was confirmed at surgery.

Table 5: Concordance between MDCT and surgical findings for specific diagnoses

DIAGNOSIS	PARTIAL	COMPLETE	TOTAL
ASST GRADE 1 HEPATIC / ASST GRADE 1 SPLENIC INJURY	0	1	1
ASST GRADE 1 HEPATIC INJURY	0	1	1
ASST GRADE 2 HEPATIC / ASST GRADE 2 SPLENIC INJURY	0	1	1
ASST GRADE 3 HEPATIC INJURY	0	1	1
ASST GRADE 4 HEPATIC INJURY	0	1	1
ASST GRADE 4 SPLENIC INJURY	0	1	1
PERFORATED APPENDICITIS	0	3	3
ANTERIOR ABDOMINAL WALL ABSCESS WITH PERITONEAL EXTENSION	0	2	2
APPENDICULAR ABSCESS	0	3	3
BLADDER INJURY	0	4	4
HEMOPERITONEUM	0	3	3
INCARCERATED INCISIONAL HERNIA	0	2	2
INCARCERATED UMBILICAL HERNIA	0	2	2
INTESTINAL OBSTRUCTION DUE TO MESENTERIC MASS	0	1	1
LARGE LEFT BLEEDING SUPRARENAL MASS	0	1	1
LEFT DIAPHRAGMATIC PERFORATIONS WITHOUT THORACIC HERNIATION	0	1	1
LEFT DIAPHRAGMATIC RUPTURE WITH HERNIATION	2	4	6
PANCREATITIS	0	1	1
PELVIC ABSCESS	0	3	3
PERFORATED VISCUS	2	4	6
PERITONITIS	0	9	9
RIGHT SUBPHRENIC ABSCESS	0	1	1
SIGMOID VOLVULUS	0	1	1
SIMPLE APPENDICITIS	0	6	6
SMALL BOWEL OBSTRUCTION	1	1	2
Total	5	58	63

There was statistically significant correlation between MDCT and surgical findings (Chi Squared and Fishers exact test p value was <0.01).

Table 6: Cross tabulation of imaging diagnosis and histological / Surgical diagnosis

IMAGING DIAGNOSIS	GOLD STANDARD – SURGICAL/HISTOLOGICAL	
	NEGATIVE	POSITIVE
HEPATIC / SPLENIC INJURY	0	6
ACUTE APPENDICITIS	0	12
ANTERIOR ABDOMINAL WALL ABSCESS WITH PERITONEAL EXTENSION	0	2
BLADDER INJURY	0	4
HEMOPERITONEUM	3	0
INTESTINAL OBSTRUCTION	0	5
LARGE LEFT BLEEDING SUPRARENAL MASS	0	1
LEFT DIAPHRAGMATIC PERFORATIONS WITHOUT THORACIXC HERNIATION	0	1
LEFT DIAPHRAGMATIC RUPTURE WITH HERNIATION	2	4
PANCREATITIS	0	1
PELVIC ABSCESS	0	3
PERFORATED VISCUS	2	4
PERITONITIS	0	9
RIGHT SUBPHRENIC ABSCESS	0	1
SIGMOID VOLVULUS	0	1
SMALL BOWEL OBSTRUCTION	1	1
Total	8	55

The overall sensitivity, specificity, NPV, and PPV for MDCT to identify surgically treated acute abdomen were calculated as 91.7%, 100%, 37.5% and 100% respectively.

Table 7: Crosstabulation on MDCT and surgically treated acute abdomen.

			OUTPUT		Total
			NO	YES	
INPUT	NO	Count	3	5	8
		% within INPUT	37.5%	62.5%	100.0%
		% within OUTPUT	100.0%	8.3%	12.7%
	YES	Count	0	55	55
		% within INPUT	.0%	100.0%	100.0%
		% within OUTPUT	.0%	91.7%	87.3%
Total		Count	3	60	63
		% within INPUT	4.8%	95.2%	100.0%
		% within OUTPUT	100.0%	100.0%	100.0%

5.2 CASE SAMPLES

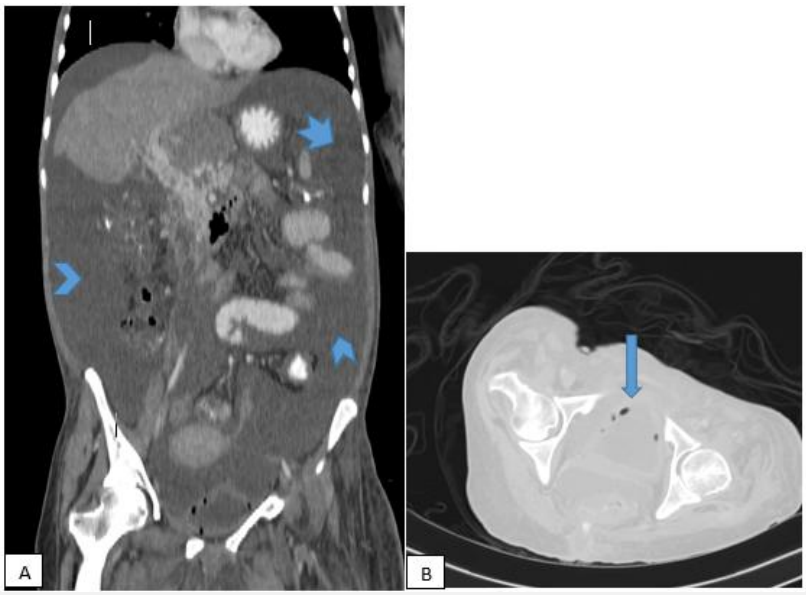

Figure 2. Bladder Injury.

Coronal CECT (A) and (B) Axial CECT (lung window) in a 35yr old male with history of blunt trauma abdominal injury showing massive intraperitoneal fluid collection (arrow heads) with a poorly distended urinary bladder which has air locules within its walls (arrow). Surgery confirmed a case of intraperitoneal bladder injury.

Figure 3. Hepatic Injury.

Axial CECT of a 29yr. old Male patient with history of blunt abdominal trauma showing a 2cm linear laceration in segment 6 corresponding to AAST grade 1 hepatic injury.

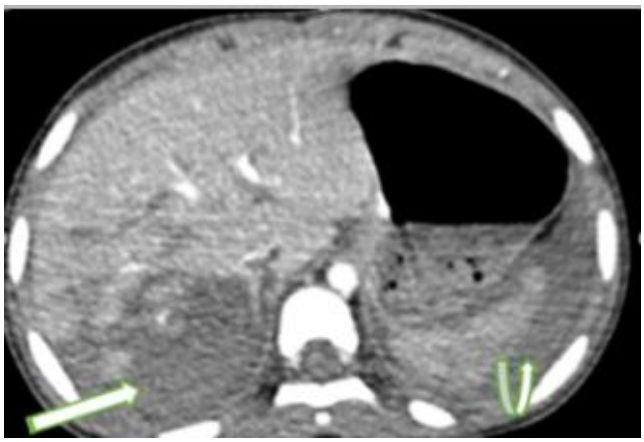

Figure 4. Hepatic Injury

CECT of a 22yr. old Male patient with history of blunt abdominal trauma shows a large parenchymal hematoma (straight arrow) in segments 6 and 7 with capsular laceration and hemoperitoneum (curved arrow) indicating AAST grade 3 injury.

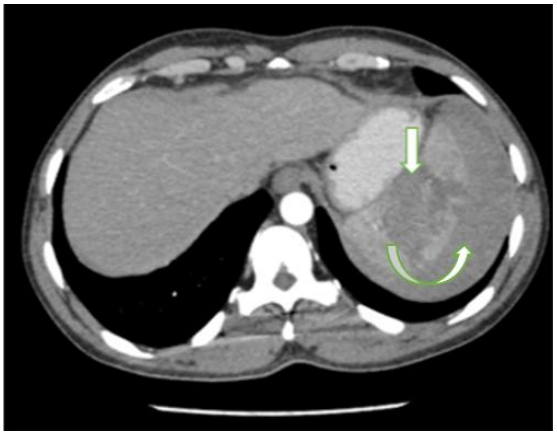

Figure 5. Splenic Injury.

AAST grade 4 splenic injury: Axial CECT in a 32yr. old Male with history of blunt abdominal injury showing a large splenic laceration extending to the hilum with associated hemoperitoneum (curved arrow).

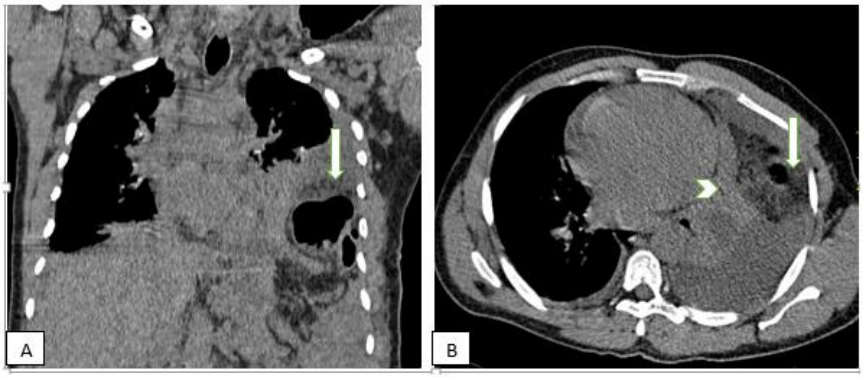

Figure 6. Left diaphragmatic Injury.

Coronal CECT of a 24yr. old Male showing omental herniation through a left diaphragmatic tear but no gastric injury.

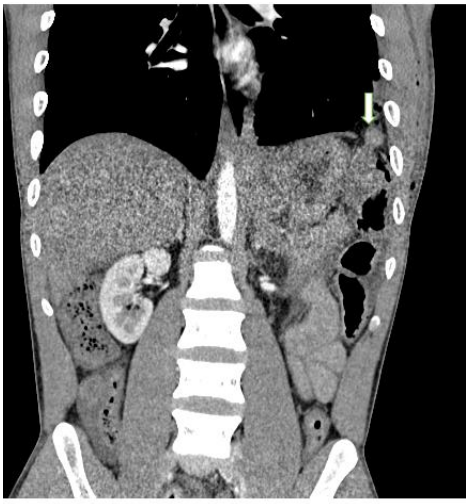

Figure 7. left diaphragmatic Injury.

Coronal (A) and Axial (B) CECT in a 28yr. old Male with blunt abdominal trauma showing herniated large bowel and stomach (arrows) through a large left diaphragmatic tear with collapsed ipsilateral lung (arrow head).

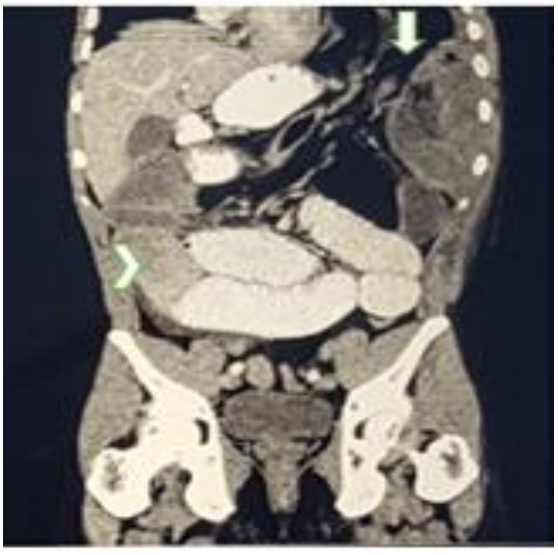

Figure 8. Left diaphragmatic Injury.

Coronal CECT scans of a large diaphragmatic tear in 39yr. old patient showing herniation of bowel (arrow) with dilatation of the proximal bowel (arrow head.

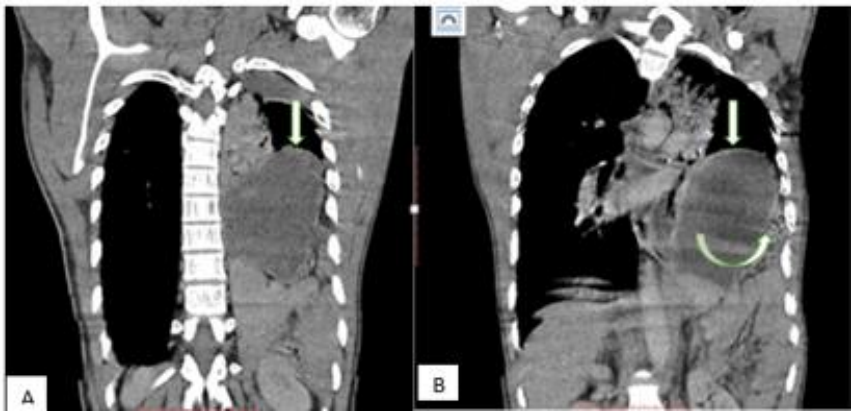

Figure 9. left diaphragmatic Injury.

(A) and (B) Coronal CECTs in a 21yr. old Male patient with history of blunt abdominal trauma showing gastric herniation through a large left diaphragmatic tear (arrows). The gastric wall appears hazy suggestive of gastric injury (Curved arrow) confirmed as gastric perforation at surgery.

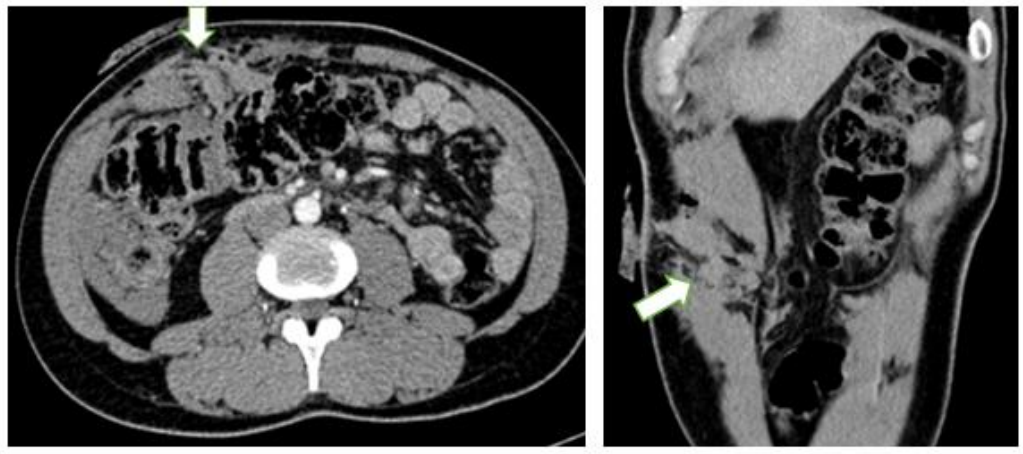

Figure 10. Penetrating abdominal injury.

26yr. old Male patient with history of penetrating abdominal injury; Axial (A) and coronal (B) CECT shows a right anterior abdominal wall injury with disruption of the overlying muscles fibers and injury to the adjacent small and large bowel.

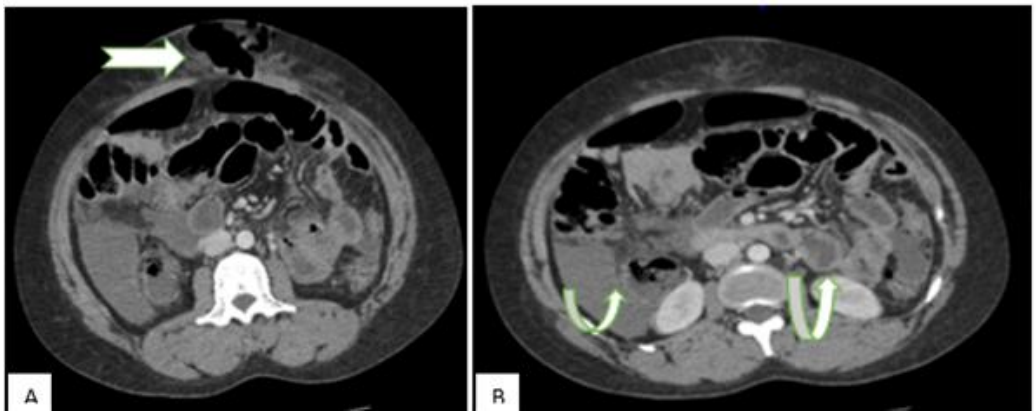

Figure 11. Anterior wall abscess.

Axial CECTs (A) and (B), in a 42. yr. old male showing an anterior wall abscess (arrow) with peritoneal extension (curved arrows).

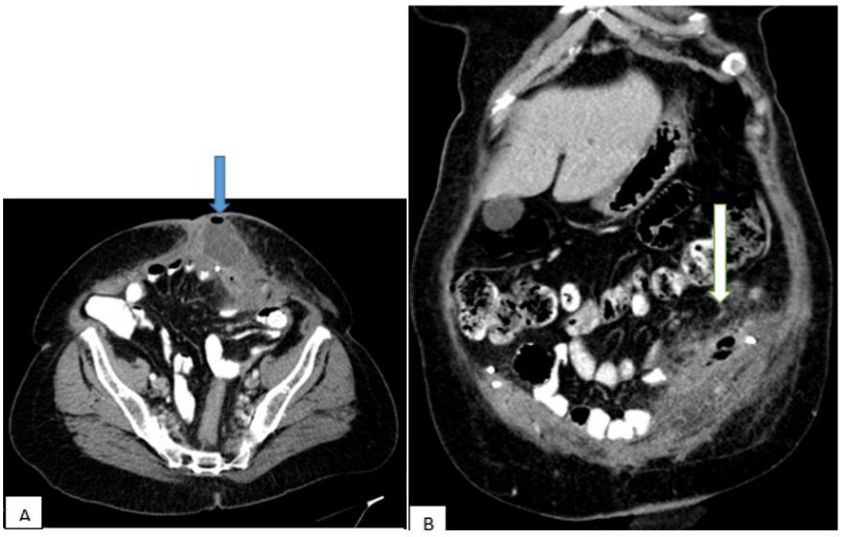

Figure 12. Anterior wall abscess.

Axial (A) and coronal (B) CECT showing an anterior wall abscess (blue arrow) in a 40yr. old female with peritoneal extension (white arrow).

Figure 13. Appendicitis.

Coronal CECTs showing an enlarged appendix with fat stranding (blue arrow) in a 32yr. old.

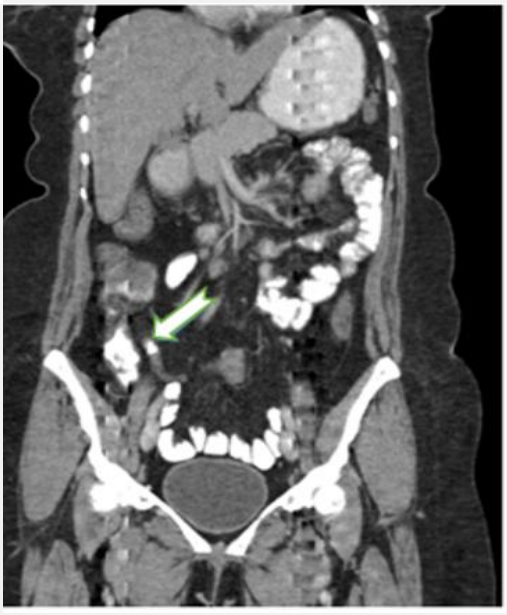

Figure 14. Appendicitis.

Coronal CECTs showing an appendicolith in a mildly inflamed appendix (white arrow) of a 23yr. old man.

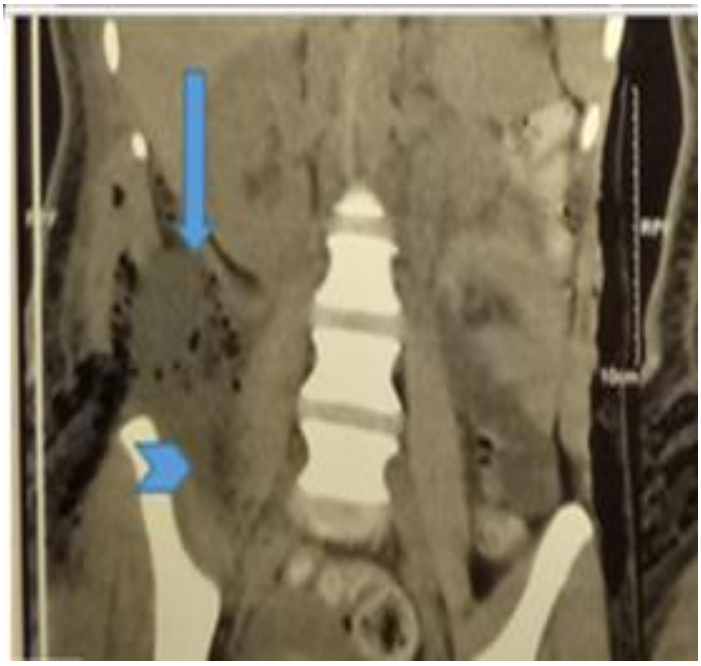

Figure 15. Appendicitis.

Appendicular abscess. Coronal CECT in a 28yr old Male showing right iliac fossa fluid collection (blue arrow) with air locules within it. Note its extension to the iliopsoas muscle with surrounding fat stranding. (arrow head)

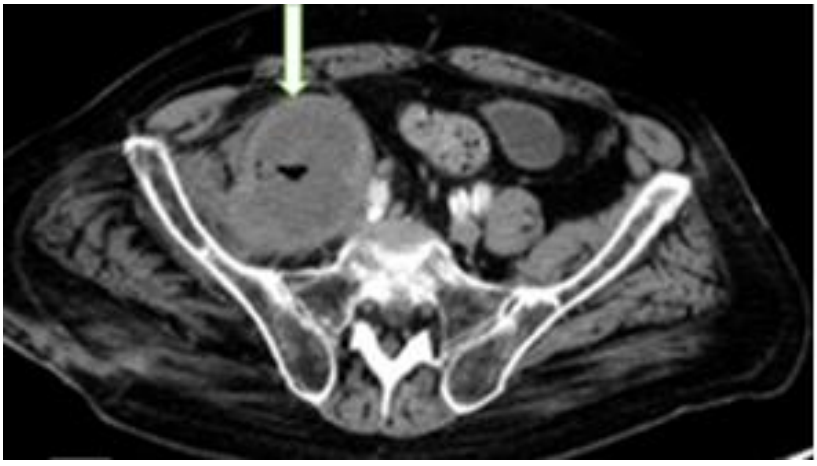

Figure 16. Appendicitis.

Appendicular abscess. Axial CECTs of a 20yr. old female showing a ring enhancing fluid collection with a central locule of gas in the region of the appendix.

Figure 17. Appendicular abscess.

Axial CECTs of a 34yr.old Male shows multiloculated fluid collection with enhancing walls (white arrow) in the right iliac fossa. Note the dilated adjacent cecum (arrow head)

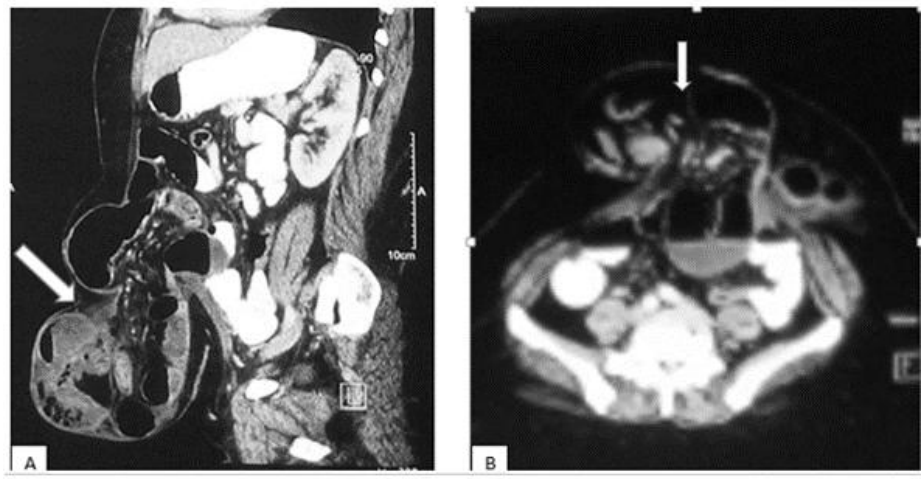

Figure 18. Anterior abdominal wall herniation.

Sagittal (A) and Axial (B) CECT in a 39yr old female showing an anterior abdominal wall defect with herniation of bowel (arrows) and mildly dilated and enhancing proximal bowel.

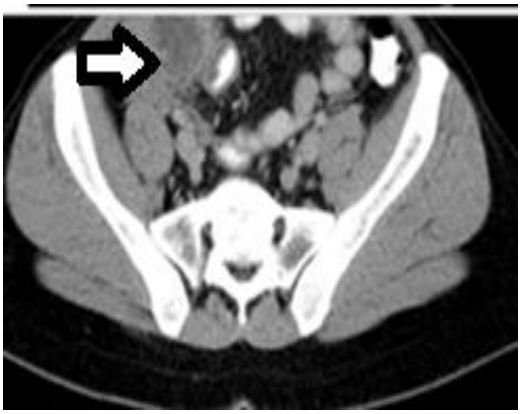

Figure 19. Appendicular abscess.

Axial CECT showing an amorphous right iliac fossa fluid collection (arrow) with enhancing wall found to be an appendicular abscess at surgery.

Figure 20. Pelvic abscess.

Coronal CECT in a 25yr. old female showing a large well-defined fluid collection with enhancing walls in the pelvis with surrounding fat stranding (arrow).

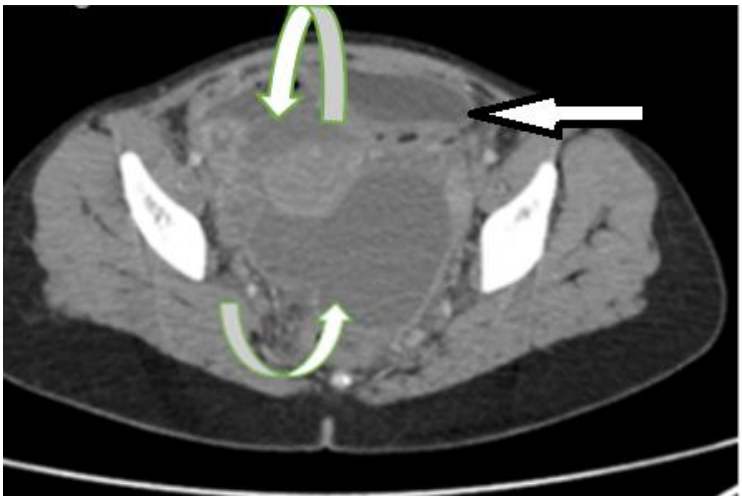

Figure 21.Pelvic abscess.

Axial CECT in a 25yr old female shows well-defined collections with enhancing wall (arrow) in the pelvis with free fluid (curved arrow) indicative of pelvic abscess with local peritonitis.

Figure 22. Peritonitis

Axial CECTs in F/32 showing peritoneal fluid collections (arrow head)

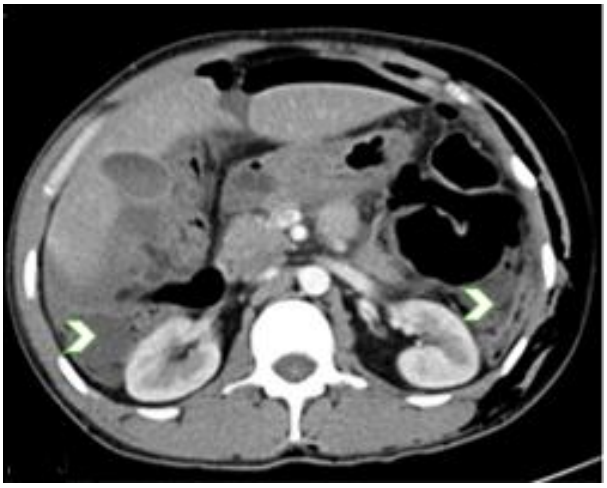

Figure 23. Peritonitis.

Axial CECTs in M/29 showing peritoneal fluid collections (arrow heads) with enhancing peritoneum (curved arrow).

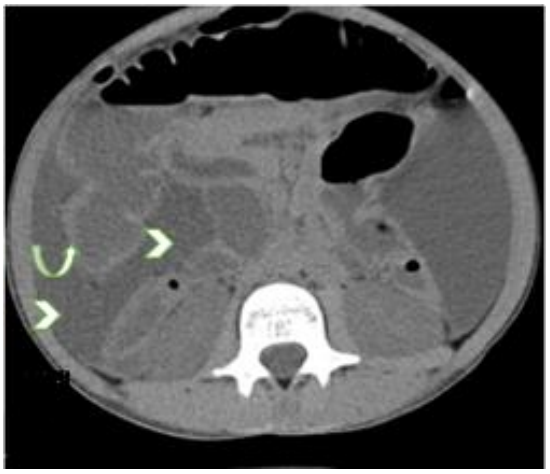

Figure 24. Peritonitis.

Axial CECTs in F/32 showing peritoneal fluid collections (arrow head)

Figure 25. Left suprarenal mass.

Coronal CECT in a 24yr. old male showing a left large irregular mass extending from the left hypochondrium to the umbilicus with moderate free fluid of increased HU suggestive of a bleeding left suprarenal mass. Final diagnosis was that of a spontaneous left adrenal bleed at surgery.

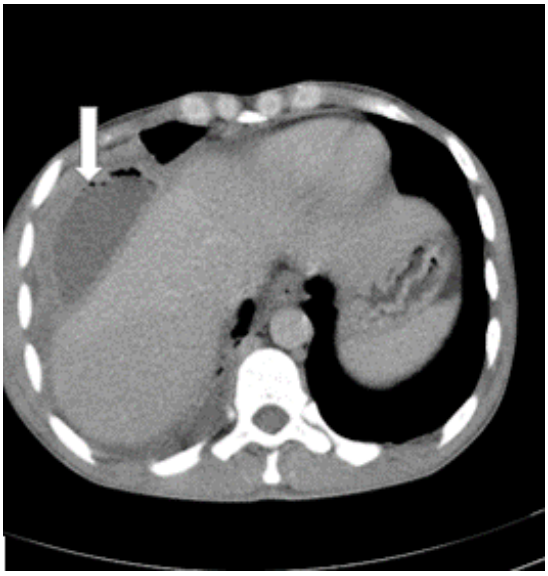

Figure 26. Right subphrenic abscess.

Axial CECT in a 34-yr. old woman showing a right subphrenic ring enhancing fluid collection with air locules within it consistent with a right subphrenic abscess.

Chapter 6

6.1 DISCUSSION

This is the first study, to our knowledge, done at KNH showing the utility and accuracy of MDCT in surgically treated acute abdomen. Generally, there was a high male: female ratio in both the traumatic (12:1) and non-traumatic (3: 2) groups which was comparable to other studies. Musau et al, in a study at KNH for traumatic acute abdomen found the ratio to be slightly higher at 12.3:1[65] while Edino in Kano, Nigeria, in his study on the pattern of abdominal injuries had an all-male sample of 67.[75]. Laal, Mardanloo, & Trauma in their study of the atraumatic abdomen also found a male predominance of approximately 2:1. [11] and they also found , as in our study , that the commonest age group was that of young adults.

This study showed that there was a small percentage of study participants, 25% (n= 63) that were subjected to an MDCT examination before surgery and abdominal USS was the single most commonly used imaging study. However other studies have shown that while the efficacy of USS in appendicitis and cholecystitis is unquestionable, it cannot match the details that MDCT can provide such as sight of obstruction, complications of various disorders and a "path to move" for the surgeon which in turn elevates surgical confidence. [76,77] Nagurney et al, in his study of patients who presented with non - traumatic acute abdomen in an urban university hospital in the US, found a slightly higher proportion (39%) having an MDCT scan. [78]

In our study, patients who had no MDCT showed a similar surgical pattern as those who had MDCT for both trauma and non-trauma group. The infrequent unavailability of the CT scanner due to mechanical problems could have contributed to the low MDCT use. The other

reason for low MDCT usage could have been due to the fact that patients who were hemodynamically unstable were not subjected to MDCT. In our setup, the reliance on conventional radiography, ultrasound and clinical skill seems to be quite high and could be the leading cause of low MDCT use. The cost effectiveness of MDCT and various imaging modalities was beyond the scope of this study.

In a study of non-traumatic acute abdomen Laal et al, showed a similar pattern of findings as our study where appendicitis, peritonitis and intestinal obstruction where the leading causes for acute abdomen. [11] A Nigerian study differed slightly and found that the commonest cause of non-traumatic acute abdomen was appendicitis (30.3%) followed by intestinal obstruction (27.9%), perforated typhoid ileitis 14.9% and peptic ulcer disease (7.6%), respectively.[79].An Ethiopian study found that acute appendicitis accounted for 52% followed by intestinal obstruction (26%) and perforated peptic ulcer disease (PPUD) (9%). These differences point to the important role that different environments may play in the causes of acute abdomen.

MDCT showed complete concordance in solid viscera as well as in bladder injuries. Diaphragmatic injuries showed a 13% incidence at surgery in keeping with other studies which show them to have an incidence of approximately 0.8 to 15 %.[80]. Complete concordance for diaphragmatic injuries was recorded in 5 cases while 2 cases showed partial concordance. This was because in our study, MDCT was unable to detect underlying gastric injury in the two cases while clearly showing the diaphragmatic injury. This is a well-known limitation of diaphragmatic injuries in relation to perforations involving the gastric wall and duodenum.[81] Our study also found that all the cases of diaphragmatic injuries were on the left side. This could be partly due to the relatively few numbers of patients with these injuries but also due to the fact that left diaphragmatic injuries are the commonest.[80] It is postulated that

the liver provides a "shield" on the right and the left diaphragm is embryologically laxer than the right[82]. Furthermore, most cases of stab wounds are more likely to occur on the left as the assailant is presumed to be right-handed in most cases[83].

Partial concordance was also seen in two patients with bowel perforation in which MDCT was able to suggest bowel injury due to free peritoneal air but unfortunately unable to correctly localize it. It is well understood that even though MDCT is the main imaging modality in determining the site of perforation, it has only an accuracy of 86%. [84] MDCT was able to correctly diagnose small bowel ileus but failed to identify adhesions in the one case we had. A study with a large number of patients with adhesive small bowel obstruction would be more objective in quantifying the impact of MDCT in such patients in our region.

Overall the accuracy of MDCT in surgically treated acute abdomen was 92% with 58 of the 63 patients having complete concordance. There was partial concordance in 5 (8%) patients. In other words, MDCT was able to accurately diagnose the most important finding in all our patients which was confirmed at surgery and histology where applicable.

Low numbers within specific diagnoses hindered the study from analyzing specific MDCT diagnoses in comparison to surgical findings. However, overall sensitivity, specificity, NPV, and PPV for MDCT to diagnose surgically treated acute abdomen were calculated as 91.7%, 100%, 37.5% and 100% respectively,

. Lamaris et al found that the sensitivity and specificity were 89 % and 77 %respectively with a significantly higher number of non-traumatic patients [29]. Priola et al, with 181 patients, found that the overall sensitivity in the detection of the main condition and the associated findings to be 87.3% but this increased to 95.6% when partial concordance was considered.[20] Chin et al, with a significantly higher number of MDCT scans showed an 87.5% accuracy [5].

In our study there were 12 patients (19%) with MDCT who had diagnoses which may have benefited from non-surgical management. These included intrabdominal abscesses and pancreatitis were less invasive management has been shown to have better outcomes. [85, 86]. The role of MDCT is localizing the intra-abdominal abscesses is beyond question [87] and a holistic approach is emphasized so that an appropriate and best management plan is effected. It has been shown that complications, inadequate drainage and duration of drainage are much less in percutaneous drainage compared to major operative procedures[88]. Therefore it has been suggested that these two approaches should not be looked at as competitors but as complementary, giving the patient and hospital the best possible outcome.[89] A healthy collaboration between the radiologist and the surgeon is therefore indispensable.

Isolated mild hemoperitoneum can be easily and objectively quantified using MDCT and used as a parameter for surgical intervention. In the absence of other solid and hollow visceral injuries and in a stable patient, hemoperitoneum of less than 250ml is not an indication for surgical intervention. Studies have shown that conservative management has excellent outcomes in these patients.[90]In our study, we found three of such patients. Low-grade visceral injuries such as AAST grades 1 and 2 have been shown to benefit from conservative management as well. However, the overall clinical picture must be taken into account and also the presence of hemoperitoneum. A low grade injury in the presence of hemoperitoneum may require surgery. [91],[92]

This study has shown that overall, 13% patients would have benefited from non-surgical or conservative managements such as interventional radiology or laparoscopic surgery. This study therefore highlights the need for a multidisciplinary approach in treating acute abdomen so that every patient gets the best possible treatment and avoids unnecessary long hospital stay that may come from more invasive procedures.

6.2 LIMITATIONS

Industrial actions by Kenyan doctors from December 2016 to March 2017 resulted in a delay in data collection lengthening the study period. Surgeries were carried out by several different doctors and may have resulted in inter-operator differences which could not be quantified.

6.3 CONCLUSION

MDCT showed strong concordance with surgical findings with high accuracy, specificity and sensitivity in all types of surgically treated acute abdomen. Surgical findings of patients with acute abdomen were similar in both MDCT and non-MDCT group. MDCT also identified a good proportion of acute abdominal conditions which would have benefitted from lesser invasive management such as interventional radiology or conservative management. MDCT is accurate and reliable and should be done in all patients with acute abdomen before surgical intervention, where indicated.

6.4 RECOMMENDATIONS

All stable patients should have MDCT done prior to an exploratory surgery except in cases of cholecystitis or unequivocal appendicitis in which case, clinical evaluation and / or USS are adequate.

Multidisciplinary consultation to be held between the radiologists and clinicians to avoid unnecessary laparotomies in patients who may otherwise benefit from interventional radiology or less invasive management. Further studies to determine the cost effectiveness of MDCT in acute abdomen at KNH should be considered so as to better quantify its impact all cases of acute abdomen at KNH.

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Chapter 7 APPENDICES

7.1 Appendix I: Main Data Collection Form

Patient No.

Centre:

Patients Tel No.

Referring Doctors Tel No. Date:

Name			
Age			
Sex			
Marital Status	Single		
	Married		
	Divorced/Separated		
	Widowed		
Gender	Male		
	Female		
Prior Abdominal Disease	Yes If Yes Specify		
	No		
Employment	Yes		
	No		
Residence	Rural		
	Urban		
Clinical Diagnosis			
Imaging Done	Yes	Xray	
		U / S	
		MDCT	
	No		
If MDCT Done, Diagnosis	Yes		
	No		
Surgical Diagnosis			
Histological diagnosis where applicable			
If Trauma		Penetrative	
		Blunt	
IF TRAUMA, STABILITY		YES	
		NO	

7.2 Appendix II: Diagnosis Analysis Form

No of Patient:

Patient I.D	**Clinical Diagnosis**	**Radiological**	**Surgical/Histological diagnosis**

7.3 Appendix III: Concordance Summary Form

Patient I.D	Final Diagnosis	Partial Concordance	Complete Concordance	Incorrect Diagnosis

7.4 Appendix IV: Summary of Findings

No Of Exploratory Laparatomies Due To AA	No of Patients With MDCT	Other Modalities		No. With No Imaging Done
		Us	Xray	

7.5 Appendix V: Time Frame

	Jan 2017	Feb 2017	Mar 2017	Apr 2017	May 2017	Jun 2017	July 2017	Aug 2017	Sep 2017	Oct 2017	Nov 2017	Dec 2017	Jan 2018	Feb 2018	Mar 2018	Apr 2018	May 2018	Jun 2018
Proposal Write Up																		
Correction of Supervisor's Input																		
1st submission To KNH-ERC																		
2nd Submission & Corrections																		
Final Submission & Expected Approval																		
Data Collection																		
Data Entry																		
Data Analysis																		
Report Witting																		
Dissertation Submission																		

7.6 Appendix VI: BUDGET

S:NO	CATEGORY	PARTICULARS	UNITS	COST	TOTAL (KSH)
1.0	Proposal development	Internet search for literature	N/A 3 month Zuku subscription	4300	12900
		Printing and binding proposal copies	10	2000	20000
		Institutional review board fee	N/A	5000	5000
		Endnote reference purchase	1	25000	25000
2.0	Materials	Printing of data collection sheet and consent forms	50 @ 2 pages 50 @ 2 pages	10 10	1000 1000
		Other stationaries	Assorted	4000	4000
		Airtime to call patient for biopsy result follow-up	N/A	5000	5000
3.0	Data collection	Research assistant lunch and transport	2x per week for 8 month (96)	300	28800
		Principle investigator lunch and transport	2x per week for 6 month (96)	300	28800
4.0	Data entry	Statistician	1	25000	25000
5.0	Report writing	Dissertations copies	10	2000	20000
6.0	Miscellaneous				2000
7.0	Contingency				21500
	GRAND TOTAL				**200000**

7.7 Appendix VII: Consent Form for Participation in The Study

This consent has three parts

- Participant Information sheet –to share information about the research
- Consent form- for signing
- Statement by the researcher

PARTICIPANT INFORMATION SHEET

Investigator's statement

My name is Dr Nteeni Mutinta S., a postgraduate student at the University of Nairobi – department of diagnostic radiology and radiation medicine. I am conducting a study on the use and utility of multidetector computer tomography (MDCT) scan in surgically treated acute abdomen. I am requesting you to participate in a research study. The purpose of this consent form is to help you decide whether you can participate in this study or not. Please read through this form carefully. You are free to ask any questions about the study. The investigator will be available to answer any queries that come up during the study and thereafter.

Brief description of study

Acute abdomen refers to a clinical syndrome involving sudden onset of severe abdominal pain that requires urgent medical or surgical management. This can be due to a number of reasons. Early diagnosis and management of this condition is important. MDCT has been considered to be the main modality of choice in triaging patients with acute abdominal pain. When used in an acute setting, it is accurate and diagnostic of nearly all causes of acute abdomen reducing the patient expenses and mortality/morbidity. Despite its well-known usage, there is a scarcity of data on the use and utility of CT in the acute general surgical workload in our local setup.

This Study aims to bridge this gap and demonstrate the utility of MDCT in acute abdomen in our local setup.

Summary of MDCT abdomen

You will be required to give consent for your participation in the study on the utility of Multidetector computer tomography (MDCT) scan in surgically treated acute abdomen at KNH. In this study MDCT images of your abdomen will be obtained and the doctor will review the images and together with your attending doctor, decide on the best management for you.

Through your participation I hope to come up with ideas on how to improve managing patients like you with acute abdominal pain promptly.

Benefits

The purpose of this study is to evaluate the accuracy of this imaging modality in our population and to lay down baseline data. The results will lead to increased awareness of the role of this tool in early and accurate detection and follow up of a patient with acute abdomen. This awareness will in the long run assist in reducing unnecessary surgeries.

Duration of the study

8 months.

Compensation

You will receive no compensation for participating in this study.

Right to refuse or withdraw

You are free to choose whether or not you wish to participate. You will suffer neither penalties nor loss of any benefit should you decide not to participate.

Confidentiality

If you agree to be part of this study, the information from your examination will be kept strictly confidential and only used for the purpose of the study. Information obtained will be kept under lock and key and soft copy information shall be password protected. No specific information of any participant will be revealed to any person without their permission in writing. Your name will not appear on any of the records used for this study.

Risks

During the CT examination procedure, we do not expect any complications. You may experience cold and back pain due to lying on your back. However, this usually occurs in few patients. I would like to assure you that we will do our best to prevent any complications that may arise, and if they occur, we will manage them accordingly. In addition, MDCT use will follow the international guidelines so as to prevent complications.

Voluntariness

Your participation in this study will be fully voluntary and there will be no financial rewards for participation. You are free to withdraw at any point during the study. Refusal to participate will not compromise your integrity.

Who to Contact

If you have any questions about the study or your participation in the study you can contact the main investigator on;

Dr Nteeni Mutinta S.

Department of Diagnostic Imaging and Radiation medicine

University of Nairobi

P.O Box 15167- 00100

Nairobi

Telephone number: 0707047582 Email address: mnteeni@gmail.com

If you have any questions on your rights as a research participant you can contact the Kenyatta National Hospital Ethics and Research Committee whose task is to ensure research participants are protected from harm

Kenyatta National Hospital and University of Nairobi Ethics and Research Review Committee -KNH/UON-ERC

University of Nairobi
College of Health Sciences
P.O Box 19676 - 00202
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Contact Person
Esther Wanjiru Mbuba
e-mail: uonknh_erc@uonbi.ac.ke

Participant Consent Form and Participant's Statement

I hereby confirm that the doctor has explained to me about the above study and I understand fully. I have been given the opportunity to ask questions which have been adequately answered.

I understand that my participation is voluntary and that I have not been forced to participate. I understand that I can decline without giving any reason, without my medical care or legal rights being affected.

I understand that I will not receive any compensation either financial or otherwise, and will not receive any preferential treatment, gift or reward, for participating in the above study.

I understand that my personal information will be kept confidential, but that any relevant medical information regarding the results of my scans and the data collected will be accessible to the researcher, and may be looked at by his supervisors where relevant to the study. I give them permission to have access to this information.

I hereby consent to take part in the above study

Respondent's Signature:…….…..……. Date ……

Respondent's Code ……

Statement by the Researcher/ Researcher Assistant

I hereby confirm that I have accurately read out the contents of the information sheet to the participant. To the best of my ability, I have made sure the participant understands the following;

- Participation in this study is on voluntary basis and no compensation will be given.
- Refusal to participate or withdraw from the study at any point will not in any way compromise the quality of care accorded to the patient.
- All the information that shall be given will be treated with confidentiality.

Name ……Signature……

Date …….

7.8 KIBALI CHA KUSHIRIKI KATIKA UTAFITI

Maelezo kwa ufupi kuhusu matafiti

Jina langu ni Daktari Mutinta S.Nteeni, mwanafunzi wa shahada ya uzamivu katika chuo cha udaktari, Chuo Kikuu cha Nairobi. Ninafanya utafiti juu ya utumiaji na matumizi ya Multidetector Computer (MDCT) skani katika matibabu upasuaji matumbo wa dharura katika hospitali ya taifa ya Kenyatta.Nikuomba ushiriki katika utafiti. Madhumuni ya fomu hii ya idhini ni kukusaidia kuamua kama wanaweza kushiriki katika utafiti huu au la. Tafadhali soma fomu kwa makini. Uko huru kuuliza maswali yoyote kuhusu utafiti. Mtafiti atakuwa tayari kujibu maswali yoyote yatakayo kuja wakati utafiti na baada ya hapo.

Kujitolea kwa hiari

Ni muhimu kuelewa kwamba kushiriki katika utafiti huu ni kwa hiari yako mwenyewe. Unaweza ukabadili nia yako kuhusu kuendelea kushiriki wakati wowote bila ya kuathiri huduma zako za kiafya

Fidia yakushiriki katika utafiti

Hakuna malipo yoyote utakoyopokea kwa kushiriki katika utafiti huu.

Siri ya utafiti

Taarifa zote na matokeo ya utafiti huu zitalindwa vilivyo na kuwekwa katika hali ya siri

Ahsante sana kwa ushirikiano wako. Kwa maelezo zaidi unaweza kuwasiliana na mtafiti mkuu kwa anuani ifuatayo;

Dr Nteeni Mutinta S.

Idara ya radiology-Chuo Kikuu cha Nairobi

Sanduku la posta 37441-00100

Nairobi.

Nambari ya simu-0723700911

Au

KNH-UoN ERC Secretariat

Katibu wa utafiti

Chuo kikuu cha Nairobi-Hopitali Kuu ya Kenyatta

Sanduku la posta, 20723-00202 KNH

Nairobi

Nambari ya simu: 72600-9

Fax: 725272

Email: UoNknherc@UoNbi.ac.ke

FOMU YA IDHINI ILI KUSHIRIKI KATIKA UTAFITI

Mimi ninatoa dhibitisho ya kwamba Daktari amenieleza kiundani kuhusu utafiti ambao kichwa chake kimetajwa hapo juu. Ninakiri pia nimepewa fursa ya kuuliza maswali kuhusu utafiti huu na nimeridhika na majibu niliyopewa na Dakitari/Mtafiti msaidizi .

Ninaelewa kwamba ushiriki wangu katika utafiti huu ni kwa hiari yangu mwenyewe sijalazimishwa.

Ninaelewa kwamba sitapokea fidia yoyote iwe fedha au vinginevyo wala sitapokea matibabu yoyote ya upendeleo, takrima au tuzo kwa ajili ya ushiriki wangu katika utafiti huu.

Naelewa kwamba taarifa zangu binafsi zitakuwa siri. Hata hivyo taarifa kuhusu matokeo ya chunguzi zitakazokusanywa wakati wa utafiti zitaangaliwa na kuchambuliwa na mtafiti mkuu na hata wasimamizi wake pindi itakavyohitajika.

Ninatoa idhini yangu kushiriki katika utafiti huu.

Sahihi ya Mshiriki ……..……Nambari ya Mshiriki……

Tarehe …..……....

DHIBITISHO LA MTAFITI/MTAFITI MSAIDIZI

Ninadhibitisha ya kwamba nimemwelezea mshiriki mambo yafuatayo kuhusu utafiti huu

- Kwamba kushiriki ni kwa hiari yake
- Hatapokea fidia yoyote kwa ajili ya kushiriki katika utafiti.
- Anaweza kubadili nia ya kushiriki wakati wowote bila kuathiri haki yake ya huduma zake za kiafya.
- Haki zake zitalindwa na habari atakakazotoa au ile itakayopatikana kumhusu itawekwa katika hali ya siri wakati wote na itatumika kwa ajili ya utafiti pekee yake.

Jina……

Sahihi ……

Tarehe ……