EVALUATION OF THE COMMON FINDINGS OF EMERGENCY ABDOMINAL X-RAYS AT UNIVERSITY OF BENIN TEACHING HOSPITAL

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A PROJECT SUBMITTED TO THE DEPARTMENT OF RADIOGRAPHY IN PARTIAL FULFILLMENT FOR THE REQUIREMENT OF THE AWARD OF BACHELOR DEGREE IN RADIOGRAPHY (B.RAD)

UNIVERSITY OF BENIN, BENIN CITY, NIGERIA

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CERTIFICATION

This is to certify the project on EVALUATION OF THE COMMON FINDINGS OF EMERGENCY ABDOMINAL X-RAYS AT UNIVERSITY OF BENIN TEACHING HOSPITAL written by ETINOSA MICHELLE with matriculation number BMS2009078 in partial fulfillment of the Bachelor of Radiography Degree (B.Rad) in the DEPARTMENT OF RADIOGRAPHY, SCHOOL OF BASIC MEDICAL SCIENCES, UNIVERSITY OF BENIN.

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(Head of Department) Date

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EXTERNAL EXAMINER Date

DEDICATION

I dedicate this work to God Almighty who has been my strength throughout this journey and also to my grandmother Lady Monica Ugheghe for being with me from the very existence till now.

ACKNOWLEDGEMENT

My profound gratitude goes to Almighty God for his grace, strength, mercy and kindness throughout the course of this study and for making its completion possible.

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LIST OF ABBREVIATIONS

UBTH: University of Benin Teaching Hospital.

ED: Emergency Department.

PAR: Plain abdominal X-Ray.

SPSS: Statistical package for the social science.

ABSTRACT

Abdominal pain is one of the most frequent presenting complaints in emergency departments (EDs), with a wide differential diagnosis ranging from benign to life-threatening conditions. These conditions include gastrointestinal pathologies such as appendicitis, peptic ulcers, and bowel obstructions, as well as non-gastrointestinal disorders like myocardial infarction or aortic aneurysm rupture. The aim of this study was to evaluate evaluate the common findings of emergency abdominal x-rays at university of Benin teaching hospital. A retrospective design was adopted and a convenience sampling was used to select 200 sample size. The results revealed that abdominal pain (30.0%), and bowel obstruction (26.0%), were the most common clinical signs. Normal study (40.0%) was the most common radiography appearance, and the most common abnormal results were dilated bowel loops and pneumoperitoneum. Demographically, young adults (20-39 years old) constituted the largest percentage (52.0) with majority of them being females (58.0) as compared to the males. The chi-square showed that there was no statistically significant relationship between age or gender and radiography findings. The conclusion of the findings was that the most common requests of an emergency abdominal X-ray at UBTH are related to patients presenting with abdominal pain with suspected bowel obstruction. Despite a large percentage of tests with normal outcomes, the modality is still applicable in the diagnosis of bowel obstruction, pneumoperitoneum, and foreign bodies.

Keywords: Gastrointestinal. Abdominal x-rays, emergency, pneumoperitoneum.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Abdominal pain is one of the most common presenting complaints in emergency departments (EDs) with the disorder having the broadest possible range of differential diagnosis of both benign and life threatening entities. Examples of such conditions are gastrointestinal pathologies of appendicitis, peptic ulcers, and bowel obstructions, and non-gastrointestinal disorders of myocardial infarction or rupture of aortic aneurysm (Abd El Bagi et al., 2016). Diagnosis of the precise obstruction of abdominal pain can be not easy particularly where the symptoms are not specific. Narrowing down the differential diagnosis is essential and must be possible at a short time in order to avoid delay in treatment especially in cases where surgical intervention is a necessity.

Plain abdominal radiography (PAR) is an older imaging method used as the first line of imaging to help one think of bowel obstructions, perforations, and foreign bodies (Chalya et al., 2023). Although a rather easy and inexpensive method of diagnostic procedure, abdominal X-rays are usually limited. Some of them do not elaborate on the underlying pathology and the process of interpretation of a radiograph may need a considerable degree of clinical experience to preclude misdiagnosis (Hogan et al., 2024). Hence the research of the diagnostic yield of abdominal X-rays in emergency rooms is necessary to enhance patient outcomes.

Plain X-rays of the abdomen are crucial in identifying various emergency cases. Specifically, they play a major role in the diagnosis of the intestinal obstructions that are one of the most prevalent causes of the acute abdominal pain. Both mechanical and functional intestinal obstructions usually have typical radiographic features, including dilated loops of bowel and air-fluid levels (Igoh et al., 2023). X-rays are also utilized in determining the presence of free air under the diaphragm which is suggestive of gastrointestinal perforation which is a surgical crisis in need of immediate care (Chalya et al., 2023).

In addition to the obstructions and perforations identification, the abdominal X-rays help detect abnormal gas patterns, including the existence of pneumoperitoneum that may indicate a vesicular perforation (Abd El Bagi et al., 2016). Even though plain radiography is essential in a preliminary examination of acute abdominal pain, it has a limited sensitivity and specificity in identifying some of the causes. As an example, appendicitis at the initial phases of the disease and other disorders that may not lead to the conspicuous variation in gas patterns do not respond to abdominal X-rays (Ugwuanyi et al., 2019).

Although the abdominal X-rays are useful, they have limitations. The lack of detailed visualization of soft tissues is one of the most significant limitations to their use, and this impairs their application in the diagnosis of diseases such as mesenteric ischemia or early stage appendicitis. In these situations, further imaging, like ultrasound, or CT scans, might be needed to do a more precise diagnosis (Hogan et al., 2024). This problem is especially pertinent to such an environment as UBTH, where high-level imaging in the form of multimodal ultrasound is not always relevant to all patients due to financial or logistical restrictions. Besides, radiographic

interpretation is a task that is highly professional. The quality of the X-ray images may make a great difference in the accuracy of findings based on the experience of the radiologist and quality (Igoh et al., 2023). Consequently, incorrect reading of X- Ray films may cause delays in diagnosis and treatment to ensure that radiograph is normal even though an underlying pathology exists.

It has been demonstrated that the diagnostic yield of plain abdominal radiographs varies widely with clinical situation and pathologic nature. As an example, a study in Jos, Nigeria, has proven that of the among those patients with acute abdominal pain, 42.9% had abnormal X-rays, intestinal obstruction was the leading pathology (Igoh et al., 2023). Another study conducted in Tanzania was dedicated to the diagnostic importance of pneumoperitoneum as one of the indicators of visceral perforation, which requires urgent surgical treatment (Chalya et al., 2023). In UBTH, the evaluation of the general findings in emergency abdominal X-rays could add a lot of value in determining the most encountered pathologies in clinical practice. This assessment may assist healthcare providers in making more rational decisions about the necessity to conduct additional imaging, along with assist in the enhancement of triage procedures in an emergency. It can also be noted that deciding which findings are most prevalent will also serve as a way to show what can be improved in the way the radiography is interpreted, and the clinical care.

The use of plain abdominal radiography in the work up of various abdominal emergencies is relevant in cost-challenged facilities such as UBTH. Nonetheless, other factors can hinder its diagnostic accuracy e.g. the requirement of clinical correlation, quality of the radiographs, and the skills of interpreting radiologist. This research seeks to evaluate the general observations in

the emergency X-rays of the abdomen at UBTH, majorly on conditions related to intestinal obstructions, abdominal perforations and atypical gas patterns. The research will help in increasing the accuracy of diagnoses, improved patient care, and clinical decision-making within the emergency department because it will lead to a better understanding of these common findings.

1.2 Statement of the Problem

The abdominal pain is one of the primary common causes of emergency department visits of a global nature, and its active differentiation is frequently complicated. Timely and proper treatment of abdominal pain depends on the skills of being able to figure out what is causing the pain. Plain abdominal X-rays is a necessary diagnostic method in resource-constrained environments like the University of Benin Teaching Hospital (UBTH), where the use of complementary diagnostic or imaging methods like CT scans or MRI is possibly constrained owing to resource limitations. Nevertheless, in this regard, the efficiency of the abdominal X-rays in detecting the causes of acute abdominal pain as well as their diagnosis remains relatively unexplored.

Although plain abdominal were in common use, the available local data on the specific findings that are typically prevalent in an emergency abdominal X-rays in UBTH is not that abundant. Even though, despite the limitation to detect certain pathologies, including bowel obstructions, pneumoperitoneum (which presents perforation), and foreign bodies, abdominal X-rays can be identified to diagnose the condition, this is contingent on the clinical presentation and the radiological interpretation (Igoh et al., 2023; Chalya et al., 2023). Moreover, little research exists

on the reliability of the abdominal X-rays in the diagnosis of less obvious diseases like appendicitis in its initial stages or mesenteric ischemia in this context. This absence of local knowledge regarding prevalent findings can create a misinterpretation or time lag in diagnosis and this can have a negative impact on the treatment of patients as well as their outcomes.

Moreover, in the context of UBTH, where a high number of emergency cases is observed, it is important to assess the frequency and nature of the abnormalities observed in emergency abdominal X-rays to inform clinical decision-making. Considering the potential consequences of delayed diagnoses and inappropriate treatment, it is important to understand the role of abdominal X-rays in determining specific emergency cases and to assess whether the optimal use of diagnostic tool is being applied.

1.3 Research Questions

1. What are the notable clinical indications for emergency abdominal X-rays in patients at the University of Benin Teaching Hospital (UBTH)?
2. What are the most common radiographic findings in emergency abdominal X-rays at UBTH?
3. What is the age and sex distribution of patients undergoing emergency abdominal X-rays at UBTH?

1.4 Research Hypotheses

Null Hypothesis (H_0): The most common radiographic findings in emergency abdominal X-rays at UBTH do not differ significantly by age or gender.

Alternative Hypothesis (H_1): The most common radiographic findings in emergency abdominal X-rays at UBTH significantly differ by age or gender.

1.5 Aim and Specific Objectives

1.5.1 Aim

The aim of this study is to evaluate evaluate the common findings of emergency abdominal x-rays at university of Benin teaching hospital.

1.5.2 Specific Objectives

1. To identify the major clinical indications for patients undergoing emergency abdominal X-rays at UBTH.
2. To assess the commonest radiographic findings in emergency abdominal X-rays at UBTH.
3. To examine the age and sex distribution of patients undergoing emergency abdominal X-rays at UBTH.

1.6 Significance of the Study

To Health: The study is very important to healthcare delivery especially in emergency settings. It gives important information about the diagnostic ability of this imaging modality by assessing the key clinical signs and typical radiographic observations of emergency abdominal X-rays. Plain abdominal X-rays are an essential diagnostic tool in University of Benin Teaching Hospital (UBTH) because the use of advanced testing methods might be limited. The results of this

research can be used to enhance accurate diagnosis of emergency X-rays of the abdomen which will result in faster and accurate diagnosis. Early detection of conditions like bowel obstructions, perforations and other abdominal pathology may enable timely and proper management of the conditions, which minimizes morbidity and mortality linked to undiagnosed or misdiagnosed abdominal pathology. Moreover, the age and sex distribution of patients with certain radiographic findings could also help in delivering age-sensitive and gender-sensitive care, which is vital to achieve the best health outcomes.

To the Profession: This research will offer very useful information to radiographers, radiologists, and other medical practitioners dealing with diagnostic radiography and particularly with emergency medicine. The study will help in enhancing the diagnosis of the radiography profession by determining the common radiographic features of the emergency abdominal X-rays in UBTH. Moreover, it can also point to the areas where the training and professional development can be improved to achieve higher diagnostic yield of emergency abdominal X-rays. The results may be used to guide the curriculum and continuing education of radiography professionals to enhance their proficiency in the detection and interpretation of life-threatening abdomen conditions. To the medical board and the regulatory bodies, the study will give evidence-based information regarding the role of abdominal X-rays in emergency setting which will inform policy making and initiation of uniform guidelines on the radiological practice in emergency setting.

To the Society: The wider societal effect of the study cannot possibly be exaggerated. Proper and timely diagnosis of abdominal conditions is a central figure in saving lives and ensuring that the

health complications do not escalate particularly under emergency cases. This study will enhance better health outcomes in patients in Benin City and other places in Nigeria who visit UBTH because it will enhance the accuracy of the diagnostic procedure of abdominal X-rays. By implementing early and correct intervention, the problems associated with the diseases such as bowel perforation, obstructions, and other emergencies in the abdomen can be reduced, which consequently may contribute to better patient recovery and quality of life. Moreover, the general population will have gained because of increased awareness on the diagnostic importance of abdominal X-rays, and therefore, more people will seek medical help whenever they have abdominal issues which will reduce overcrowding in the emergency rooms and will result in a better usage of the medical facilities.

1.7 Scope of Study

This study will focus on patients at the University of Benin Teaching Hospital (UBTH) who require emergency abdominal X-rays due to acute abdominal conditions. The findings will be specific to this hospital and may not apply to other hospitals outside of UBTH. The study will only consider plain abdominal X-rays and will not include other imaging methods such as CT scans, MRIs, or ultrasounds. The research will be done using examination recorded within a 1 year period.

August 2024 – August 2025.

1.8 Operational Definition of Terms

Emergency Abdominal X-ray: An abdominal X-ray done in an emergency setting to assess and diagnose conditions related to the abdomen.

Major Clinical Indications: Refers to the primary conditions that justify the need for an abdominal X-ray in an emergency setting. These clinical indications can include, but are not limited to, acute abdominal pain, suspected bowel obstruction, suspected perforation, abdominal trauma, or conditions causing abnormal gas patterns.

Diagnostic Value: The ability of an emergency abdominal X-ray to correctly identify or diagnose a particular abdominal pathology when compared to the actual clinical diagnosis or other imaging modalities (e.g., ultrasound, CT scan).

Common Radiographic Findings: The most frequently observed abnormalities or conditions on emergency abdominal X-rays. Common findings in this context may include bowel obstruction, perforations, free air under the diaphragm (suggesting perforated viscus), abdominal masses, or abnormal gas patterns in the gastrointestinal tract.

Diagnostic Outcome: The result or conclusion drawn from the radiographic imaging in relation to the patient's condition. The diagnostic outcome of an emergency abdominal X-ray includes identifying the specific abdominal pathology present, such as bowel obstruction, perforation, or gas pattern abnormalities. It is compared against clinical diagnoses to determine the accuracy of the imaging.

CHAPTER TWO

LITERATURE REVIEW

2.1 Conceptual Review

2.1.1 Anatomy of the Abdomen

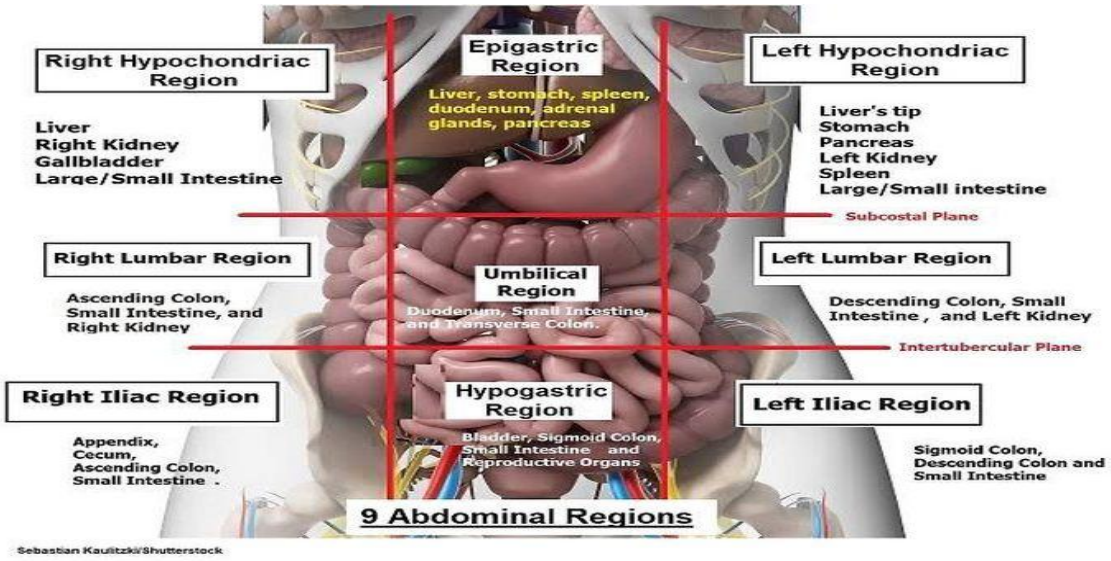

Fig 2.1 Image of the abdomen showing the nine regions (Mehboob, 2025).

The abdomen is an important region in the human body that holds and protects the organs of digestion, urination, reproduction, endocrinology, excretion, circulation and part of the genital system. Its anterior wall consists of skin, subcutaneous tissue, fascia nodes like: superficial fascia, external oblique muscle layer and transversus abdominus and deeper layers such as: Transversalis fasia, preoperitoneal fat and peritoneum. Visceral layers consist of simple squamous epithelial cells while parietal layer forms a membrane sac dimensions fluid filled cavity which reduces friction between surfaces when they move past each other relatively over each other. In the lower subdivision of the anterior abdominal wall will show the subcutaneous tissue separates into Pear shaped body fat layer called Camper's fascia and deeper membranous layer defined deeper level Scarpa's fascia which carry’s on towards perineum as Colles' Fascia.

The abdomen encloses stomach and duodenum's first compartment alongside jejunum, ileum, liver and gall bladder, transverse colon, spleen along with several associated structures. Embryologically, the abdomen is constructed from three primary germ layers. The ectoderm gives rise to the epidermis, while the mesoderm differentiates into the abdominal musculature and the smooth muscle of the intestines. The endoderm, on the other hand, is responsible for forming the lining of the gastrointestinal tract. The GI tract develops in segments: the foregut (from the esophagus down to the bile duct opening), the midgut (distal duodenum through most of the transverse colon), and the hindgut (the remaining colon and the anal canal). This segmentation underlies much of the organ-specific vascular supply.

In terms of vascularization, the central abdominal wall receives arterial blood above the umbilicus from the superior epigastric artery (a branch of the internal thoracic artery), and below the umbilicus from the inferior epigastric artery (a branch of the external iliac). Venous return mirrors this, with drainage above through the internal and lateral thoracic veins, and below via the superficial and inferior epigastric veins. Lymphatic drainage follows a similar split: lymphatic vessels above the umbilicus drain toward the axillary lymph nodes, while those below drain to the superficial inguinal nodes. Internally, the aorta and inferior vena cava serve as the principal vessels. The aorta provides three main branches to the GI tract: the celiac trunk for the foregut, superior mesenteric artery for the midgut, and inferior mesenteric artery for the hindgut. The splenic flexure is often described as a watershed area because it receives a dual blood supply, which renders it particularly vulnerable to ischemic events.

Venous drainage from the digestive tract primarily enters the portal venous system, formed by the convergence of the superior and inferior mesenteric veins and the splenic vein. Other abdominal venous return is directed to the inferior vena cava without passing through the liver. The ligamentum teres connects the portal system to the abdominal wall, and this connection can become clinically significant in the setting of portal hypertension.

The innervation of the abdominal wall's skin and musculature primarily involves the anterior and lateral branches of the thoracoabdominal nerves (T7–T11), the subcostal nerve (T12), as well as the iliohypogastric and ilioinguinal nerves derived from L1. Visceral innervation is distinctly organized: the vagus nerve supplies the foregut and midgut, while the sacral nerves (S2–S4) serve the hindgut. Sympathetic fibers originate from the greater thoracic splanchnic nerve for the

foregut, the lesser thoracic splanchnic nerve for the midgut, and the lumbar splanchnic nerves for the hindgut.

The abdominal muscles contribute significantly to respiration, visceral protection, postural support and movements including flexion, extension, and rotation of the trunk. The four principal muscles, transversus abdominis, internal oblique, rectus abdominis, and external oblique, can be conveniently recalled with the acronym TIRE (Wade & Streitz, 2023). The external and internal oblique muscles exhibit perpendicular fiber orientation; the external oblique runs in the direction of "hands in pockets," while the internal oblique traverses it (Wade & Streitz, 2023). The linea alba represents the midline raphe, formed by the aponeuroses of the external oblique, internal oblique, and transversus abdominis. Above the arcuate line, the internal oblique aponeurosis splits to envelop the rectus abdominis, whereas below this anatomical landmark, both the internal oblique and transversus abdominis pass anterior to the rectus abdominis.

Several congenital anomalies can affect the abdomen, including gastroschisis, omphalocele, congenital umbilical hernia, intestinal atresia, hypertrophic pyloric stenosis, annular pancreas, Hirschsprung disease, malrotation, and agenesis. Clinically, Clinically, the abdomen is broken into nine areas with two sagittal lines and two transverse lines and the center of the abdomen is the umbilicus. These are 9 areas, the right hypochondrium (liver, gallbladder), the epigastrium (stomach, liver, pancreas, duodenum, adrenal glands), the left hypochondrium (spleen, colon, pancreas), the right lumbar region (ascending colon, right kidney), the umbilical (small intestine), the left lumbar (descending colon, left kidney), the right iliac (appendix, cecum) and the

hypogastric(bladder, sigmoid colon, female reproductive structures), and left iliac fossa (sigmoid and descending colon).

2.1.2 Radiographic Anatomy of the Abdomen

Fig 2.2 Annotated x-ray of the abdomen highlighting the key anatomical structures often visualized (Hapugoda, 2025).

Soft tissue structures are often less well-defined due to overlapping densities. The liver, situated in the right upper quadrant, generally appears as a homogeneous soft tissue density, with its lower margin occasionally visible as a subtle, curved line extending laterally from the right costal margin. This density contrasts with the adjacent radiolucent bowel gas. The spleen, located in the left upper quadrant, is visible as a soft tissue shadow lateral to the gastric air bubble. Kidneys are typically observed as elongated, slightly oblique densities adjacent to the spine, overlying the psoas muscles. The psoas outlines themselves appear as sharp linear densities

extending from the lumbar spine to the pelvis; assessment of their symmetry and definition is clinically significant. Loss of the psoas shadow may signal pathology, such as hemorrhage or infection, which obscures the fat planes and diminishes visual contrast.

The gastrointestinal tract is primarily evaluated by its gas and fluid patterns. The stomach usually appears as a radiolucent area beneath the left hemidiaphragm due to intraluminal air. Gas-filled small intestine loops are typically central, with valvulae conniventes traversing the full diameter and producing a “stacked coins” or “feathered” appearance. The large intestine is more peripheral and is distinguished by haustral markings, which do not extend across the entire lumen, thus differentiating its gas pattern from that of the small intestine. The cecum is located in the right lower quadrant, and the course of the ascending, transverse, and descending colon can be followed by tracking gas patterns and soft tissue outlines. The rectum and sigmoid colon typically reside in the pelvis and may contain a mixture of gas and fecal material, resulting in a mottled radiographic appearance.

Additional radiopaque densities, such as calcifications, are also easily visualized. Renal or ureteric calculi manifest as distinct opacities along the expected anatomical path of the urinary tract. Phleboliths, commonly found in the pelvis, appear as rounded calcified densities with a central lucency and are associated with venous structures. Calcification of the abdominal aorta due to atherosclerosis is evident as a linear radiodense area along the lumbar spine. Ultimately, the radiographic silhouette of the abdomen is defined by the interplay between soft tissue densities and the presence of intra-luminal gas, making the plain abdominal X-ray a valuable tool for evaluating both the position and integrity of intra-abdominal organs (Wade & Streitz, 2023).

2.1.3 Abdominal X-Rays

Fig 2.3 A plane x-ray of a peadiatric abdomen in (a) supine and (b) erect view (Yoo *et al*., 2015)

A standard plain abdominal x-ray, whether performed in the supine or upright position, offers a broad overview of both osseous and soft tissue structures within the abdominal cavity. This imaging modality enables radiologists to evaluate a diverse array of potential pathologies. Radiographic imaging of the abdomen remains a 1cornerstone in diagnostic radiology, offering clinician's vital insights into the arrangement and condition of abdominal organs, as well as the presence of abnormal gas or calcifications. The standard anteroposterior (AP) supine projection, as outlined in Clark's Positioning in Radiography (13th edition), is widely regarded as the basic view. In this projection, the patient is positioned supine and the X-ray beam is directed from

anterior to posterior, typically centered at the level of the iliac crests. This view allows the visualization of the kidneys, psoas muscles, lower ribs, vertebrae, and the distribution of gas within the stomach, small bowel, and colon. The AP supine view is particularly valuable in the assessment of suspected bowel obstruction, urinary tract calculi, abdominal trauma, and postoperative evaluation. Contraindications are uncommon, though considerations include patient discomfort, hemodynamic instability, or pregnancy, in which cases ultrasound may be preferable (Whitley *et al*., 2019).

The erect abdominal projection allows for visualization of air–fluid levels and the detection of free intraperitoneal gas. In this view, gravity allows fluid to settle and air to rise within the bowel, thereby enhancing the visualization of small bowel obstruction or perforation, as well as certain infections that produce intraperitoneal air. The patient is positioned upright with their back to the detector, and the X-ray beam is directed horizontally. It is advisable that the patient remains standing for at least five minutes prior to imaging to ensure adequate redistribution of air within the peritoneal cavity. Indications for this view include suspected perforation, bowel obstruction, and trauma, while the primary contraindications involve the inability of the patient to tolerate an upright position; in such cases, the left lateral decubitus view serves as an alternative (Whitley *et al*., 2019).

The left lateral decubitus projection, in which the patient lies on their left side and a horizontal beam is directed from the right, is particularly useful when patients cannot stand. This technique facilitates the identification of free intraperitoneal air, which collects along the right flank adjacent to the liver. It is a good view to use in critically ill patients for the assessment of

pneumoperitoneum, fluid levels, and bowel gas distribution. The clinical indications for this view are the same as the erect projection. Contraindications are generally related to patient discomfort or clinical instability. Additional specialized views such as the dorsal decubitus (lateral) projection, performed with the patient supine and the beam directed horizontally from the side can be employed to assess air–fluid levels and the relative positioning of abdominal viscera in patients with limited mobility. The prone view is occasionally utilized for improved visualization of colonic and rectal gas patterns (Whitley *et al*., 2019). Projections should be used dependent on indication and area of interest (Whitley *et al*., 2019).

2.1.4 Common Findings in Emergency Abdominal X-Ray

Abdominal radiography remains a fundamental diagnostic tool within clinical practice, valued for its rapid accessibility and utility across a broad spectrum of emergent and routine presentations. Especially in acute scenarios, its capacity to delineate gas patterns, calcifications, and abnormal soft-tissue contours is crucial for guiding clinical management.

One of the most frequent and significant findings is bowel obstruction. Patients typically present with abdominal pain, vomiting, and distension, prompting the use of a supine abdominal radiograph for assessment. In cases like this it may cause the small intestine to become dilated which in turn causes pain to the patient. The large bowel also will be distended causing pain. It is better visualized in an erect abdomen view. Additional projections, such as erect or left lateral decubitus views, enhance the detection of air–fluid levels and help localize the site of obstruction (Grainger *et al*., 2015; Whitley *et al*., 2019).

Pneumoperitoneum is another critical radiographic diagnosis, often indicative of visceral perforation and requiring urgent surgical intervention. Patients may present with signs of peritonitis and severe abdominal pain. On imaging, free intraperitoneal air is most readily seen beneath the diaphragm. An erect chest or an erect abdomen view is best in visualizing pneumoperitoneum. In non-ambulatory patients, a left lateral decubitus view may reveal free air adjacent to the right flank, and even subtle amounts of gas can be diagnostically significant (Whitley *et al*., 2019).

Calcified densities are also commonly encountered, frequently related to urolithiasis or cholelithiasis. Renal or ureteric calculi present with flank or groin pain and hematuria, and may be tracked radiographically along the course of the urinary tract. Gallstones, often presenting with right upper quadrant pain and intolerance to fatty foods, may appear as calcified opacities within the gallbladder or biliary tree, although only a minority are radiodense (Grainger *et al*., 2015).

Additional urgent findings include volvulus of the sigmoid or cecum, typically presenting with abdominal distension, pain, and constipation. It is usually present in children although adults can still have it. Sigmoid volvulus manifests as a markedly dilated, "coffee-bean" shaped loop of bowel extending from the pelvis to the right upper quadrant. Cecal volvulus appears as a distended, gas-filled structure abnormally located in the mid-abdomen or left upper quadrant, both representing surgical emergencies (Whitley *et al*., 2019).

Toxic megacolon presents as a pronounced dilation of the colon, often lacking normal haustration and appearing as an extended, thin-walled, air-filled segment on plain radiographs. This condition frequently occurs in patients suffering from inflammatory bowel disease or severe infections such as Clostridioides difficile colitis. Radiographic identification of toxic megacolon is crucial, as it enables timely initiation of medical management and, when necessary, urgent surgical intervention (Grainger *et al*., 2015).

In neonates, the "double bubble" sign is a significant radiographic finding, typically associated with duodenal atresia or malrotation with volvulus. This sign, best visualized on supine or cross-table lateral abdominal films, often presents shortly after birth with symptoms such as bilious vomiting and feeding intolerance. In older children and adults, the appearance of a "target sign" or intramural air suggests intussusception, a condition characterized by intermittent abdominal pain, vomiting, and the passage of "red currant jelly" stools (Whitley *et al*., 2019).

The integration of plain film findings with clinical assessment and patient history remains foundational for the prompt diagnosis and management of potentially life-threatening abdominal conditions. Despite advancements in cross-sectional imaging, plain abdominal radiography continues to play a pivotal role, valued for its accessibility, rapid availability, and effectiveness in identifying both common and emergent pathologies requiring urgent clinical attention (Grainger *et al*., 2015; Whitley *et al*., 2019).

2.1.5 Appearance of Common Emergency Abdominal Findings on Radiographs

Plain abdominal radiographs continue to hold an essential place in clinical practice, largely because certain characteristic signs can aid in identifying common pathologies quickly and

reliably. In the setting of bowel obstruction, one of the most telling features is the presence of abnormally dilated loops of intestine. In small bowel obstruction, these loops assume a central position within the abdomen, marked by a pattern of thin, regular folds called valvulae conniventes, which extend completely across the diameter of the bowel. The radiograph often reveals air–fluid levels arranged in a "stacked coins" or "step-ladder" configuration when the patient is upright, providing evidence for obstruction and its approximate site. In contrast, large bowel obstruction typically appears with distended, peripherally placed loops adorned with haustra that only partially cross the bowel's diameter, allowing differentiation from small bowel dilation (Grainger *et al*., 2015; Whitley *et al*., 2019).

Another critical finding is pneumoperitoneum, where free air collects under the diaphragms due to perforation of a viscus. In an erect chest or abdominal radiograph, this is visualized as a sharp, crescent-shaped lucency immediately adjacent to the right hemidiaphragm. When the patient cannot tolerate an erect view, a left lateral decubitus film can be performed, allowing free air to outline the liver edge, providing equally valuable information for the detection of this life-threatening condition (Whitley *et al*., 2019).

Additional pathology can be inferred from calcific densities. Renal or ureteric calculi, for example, appear as sharply defined, dense opacities aligned with the expected course of the urinary tract. These densities often present within the renal pelvis or at points of ureteric narrowing, such as the ureteropelvic junction, the area where the ureter crosses the iliac vessels, or at the ureterovesical junction. Gallbladder calculi, when calcified, can present similarly in the

right upper quadrant. Their appearance can range from a single dense opacity to multiple tiny densities, making plain radiography a valuable first-line tool for suspected urolithiasis and cholelithiasis, although many gallstones remain radiolucent (Grainger *et al*., 2015).

In sigmoid or cecal volvulus, plain abdominal radiographs characteristically reveal a marked distension of the affected segment with a "coffee-bean" or "bent inner tube" shape, extending from the pelvis towards the right upper quadrant in sigmoid volvulus, or from the right lower quadrant across the midline in cecal volvulus. These appearances arise due to twisting of the bowel, causing a sharp demarcation between gas-filled and collapsed segments. Such findings are highly suggestive and direct the clinical team towards urgent intervention (Whitley *et al*., 2019).

In the case of toxic megacolon, often complicating inflammatory bowel disease or severe infections, plain radiographs reveal a marked, diffuse distension of the colon, typically in the transverse or ascending segment. The haustra appear obliterated, yielding a long, smooth-walled segment prone to perforation. The diameter of the affected segment often exceeds six centimeters, making this one of the cardinal radiographic signs in clinical practice (Grainger *et al*., 2015).

In neonates and infants, plain films may reveal a "double-bubble" sign indicative of duodenal atresia, wherein the gas appears in the stomach and proximal duodenal bulb, separated by a sharp band of soft tissue due to the obstruction. This finding is highly specific and allows early surgical planning for affected infants. Meanwhile, intussusception may present with a soft-tissue mass

effect in the right lower quadrant and a paucity of gas distally, hinting at the telescoped segment of bowel (Whitley *et al*., 2019).

These radiographic patterns, when combined with clinical examination and laboratory results, enable prompt and accurate diagnosis of common and serious abdominal pathologies. Despite advances in cross-sectional and ultrasound imaging, the plain abdominal X-ray endures as an indispensable tool for early detection and patient triage (Grainger *et al*., 2015; Whitley *et al*., 2019).

2.1.6 Role of Radiographers in Carrying Out Emergency Abdominal X-rays

In the acute clinical setting, plain radiography of the abdomen has long been an indispensable tool, providing vital information within moments of patient presentation. Its role in emergencies goes far beyond the mere acquisition of images; it involves a meticulous approach that ensures patient comfort despite pain, delivers a rapid and accurate examination, and minimizes the risk of repeating studies. Radiographers, positioned as pivotal members of the multidisciplinary team, have to balance these demands with precision, compassion, and professionalism. According to Whitley *et al*. (2019), the priority when conducting an abdominal radiograph for an acutely ill patient is to adapt positioning techniques to the clinical status, especially when discomfort and pain limit their ability to assume standard positions. Patients presenting with signs such as distension, tenderness, or suspected perforation must be treated with utmost care. Radiographers use positioning aids such as sponges or wedges to reduce discomfort and still obtain a diagnostically valuable view. In instances where an erect posture is not feasible, alternatives such

as the left lateral decubitus or dorsal decubitus positions can be used, ensuring clinical questions are adequately addressed despite patient limitations (Bontrager & Lampignano, 2018; Whitley *et al*., 2019).

Another vital element of radiographic practice in emergencies is the ability to alert clinical teams quickly to critical findings. The Red Dot method, as explained by Whitley *et al*. (2019), exemplifies this role, allowing radiographers to mark and communicate abnormal findings promptly. By placing a 'red dot' marker or flagging an area of concern, radiographers can alert medical staff early to potentially serious pathologies, facilitating a swift clinical review and intervention. In emergencies such as bowel obstruction, pneumoperitoneum, or perforation, this early warning can save lives, mobilizing resources and guiding urgent medical or surgical treatment.

Moreover, the role of the radiographer in acute abdominal radiography involves ensuring that the first examination is performed correctly, avoiding the delays, patient discomfort, and added radiation exposure associated with repeat studies. According to Bontrager and Lampignano (2018), meticulous attention to patient positioning, equipment settings, and technique allows the radiographer to obtain the best possible diagnostic image the first time, making every exposure count. In emergencies where every moment is critical, precision and technique are both clinical and ethical imperatives, aligning with the core tenets of patient safety and quality care (Bontrager & Lampignano, 2018).

Radiation protection is an equally pivotal consideration. Even when clinical urgency demands a rapid examination, radiographers operate within the boundaries of justification and optimization,

as advocated by international best practices. The ‘as low as reasonably achievable’ (ALARA) philosophy governs every examination, ensuring that patient safety is prioritized despite clinical pressures (Grainger *et al*., 2015). Techniques such as collimation, the use of lead shielding where applicable, and the choice of appropriate exposure settings help minimize patient dose while achieving diagnostically acceptable images. This dual focus which are ensuring both clinical efficacy and patient safety are central to the role of radiography in emergencies (Carver & Carver, 2021).

In this way, plain abdominal radiography emerges as a pivotal intersection of clinical urgency, patient-centered care, and radiographic precision. Its role is defined by an ability to adapt positioning techniques to patient constraints, employ methods like Red Dot to alert clinical staff quickly, reduce patient discomfort and exposure by obtaining accurate images in a single attempt, and adhere to established standards of radiation protection. By doing so, radiographers contribute significantly to patient outcomes, making plain abdominal radiography an enduring cornerstone of acute medical practice (Bontrager & Lampignano, 2018).

2.2 Theoretical Framework

2.2.1 The Biomedical Model of Diagnosis

The biomedical model operates on the premise that every clinical presentation has an underlying pathology that can be objectively identified and classified. In radiology, this theory provides the foundation for interpreting X-ray images as a means of making precise, evidence-based diagnoses. According to this approach, clinical decision-making is reliant upon accurate

identification of radiographic signs such as bowel obstruction, perforation and intra-abdominal air.

Application to the Study

In this investigation at the University of Benin Teaching Hospital, the biomedical model justifies the use of abdominal X-rays for the detection and characterization of common acute findings. The radiographic appearances serve as objective markers of disease and guide the clinical team towards timely, accurate, and effective intervention. By employing this theory, the study emphasizes the role of radiology as a central diagnostic tool in emergency settings.

2.2.2 The Information Processing Model

The Information Processing Model applies cognitive psychology to medical practice, describing how radiologists perceive, interpret, and classify clinical images. It suggests that medical professionals encode visual data, compare it with stored mental templates, and draw inferences based on experience and pattern recognition. In this theory, the quality of diagnostic decisions depends on the interaction between visual inputs, prior knowledge, and clinical context.

Application to the Study

This framework applies directly to the examination of abdominal X-rays, as it underscores the role of radiologists' training and expertise in identifying common emergency findings such as bowel gas patterns, free air, or calcified structures. The study evaluates the prevalence and accuracy of these radiographic findings, highlighting the cognitive and perceptual competencies required for interpreting emergency X-rays and minimizing diagnostic error.

2.2.3 The Health Services Utilization Model

The Health Services Utilization Model analyzes how patient characteristics, clinical needs, and health system resources affect the use of medical services, including diagnostic radiology. It explains why certain diagnostic procedures are performed more frequently and how access, clinical urgency, and patient presentation shape medical practice.

Application to the Study

In the context of the University of Benin Teaching Hospital, this theory explains why certain patient groups (e.g., those presenting with acute abdominal pain) are more likely to undergo abdominal X-ray examination. The model allows the study to investigate how clinical presentation and resource availability (such as radiology equipment and staffing) affect the detection and recording of common abdominal findings. It provides a framework for understanding the patterns observed in the data, as well as for making recommendations for resource allocation, training, and clinical protocols.

2.3 EMPIRICAL REVIEW

2.3.1 Clinical Indication of Patients Undergoing Emergency Abdominal X-rays

2.3.1 Clinical is an indication of patients whose abdominal X-rays are taken in an emergency.

Burrell et al., 2023 carried out a research to determine the knowledge and practice of radiographers as far as the clinical indications of acquiring abdominal X-rays were concerned. The study was conducted on four state hospitals in Eastern Cape in South Africa. The design was a cross-sectional study with a convenience sample comprising of 85 radiographers, and a self-

report questionnaire was given via paper between February and June 2020. It was analyzed using IBM(r) SPSS(r) version 26.0, and both the descriptive statistics and chi-square were used to analyse the data. The findings indicated that the mean knowledge score of clinical indications was 59.41 and four demographic characteristics were found significantly related to the general knowledge of the radiographers, and they are age, years of experience, attendance of short training programme, and attending a pattern recognition course. Furthermore, the participation in a short course was modestly related to most of the items of practice as well as knowledge of some clinical signs, including the projections in which perforation and stab wounds are projected. A profile recognition course was also found to have a considerable relationship with knowledge of acute abdominal signs. The research has determined that even with a low access to short courses and training programmes, radiographers have competent knowledge of clinical indicators, which supersedes 50%. To sustain and enhance practice and keep it compliant, the authors suggested continuous training, creation of the available procedures, regular audits, and feedback.

Tam, 2024 reviewed to determine the contemporary practice of order of abdominal X-rays (abdominal x-rays) in one of the largest accident and emergency departments in the United Kingdom. It was intended to suggest changes to clinical practice to minimize patient radiation dose and allow more achievement of efficient resource allocation. The RCR guidelines were followed in the study and the retrospective examination of all abdominal x-rays requests received within a period of 28 days irrespective of the age of patients was done. Those patients that were involved in the accident and emergency department were taken into account whereas the requests of other departments and forsaken examinations were not taken into account. Out of this, 169 requests were received and out of them, 28 were excluded thus leaving behind 141 eligible

requests. Five of these requests were rejected in a proper manner and 115 out of the 136 X-rays recommended were justified, and the justification rate was 84.6. The most prevalent indicators that had been frequently justified included bowel obstruction and the least common justified requests dealt mostly with the suspected renal stone disease. The percentage of abnormal pathology identified in the X-rays was only 4% and the rest needed further additional imaging, which was 45 of the 200 patients, 32.4 as compared to the percent 73.7 earlier cited in the literature. The results indicated that there was excessive use of abdominal x-rays in clinical presentations where its yield was low and thus required better clinical governance, increased knowledge of the justification guidelines and the application of such visual aids as posters and clinical algorithms.

Garcia et al., 2024 aimed at exploring the use, suitability, and clinical advantage of abdominal x-rays requests in emergency department in a tertiary referral hospital. The scholars retrospectively examined all the abdominal x-rays done in the department during one month, patient demographics, medical records, radiographic quality and clinical indicators according to the SERAM Appropriateness Guidelines. The use of formal radiology reports and their effect on patient management was also determined. The total number of abdominal x-rays that were conducted in case of emergency department during the study period was 429 which constitutes 9.1% of radiographic studies. The most frequently used clinical sign was abdominal pain (40% of requests), low back pain (21.4). Professional quality was appropriate in about 79.6% of the images and 12.4% of the images did not contain clinical data. It is worth mentioning, that 61.3 of the X-rays that were done proved to be inappropriate using the SERAM guidelines, customers were subjected to an average radiation dose of 0.50 +- 0.33 mSv per examination at a total cost

of EUR6,575. The findings also indicated that the inappropriate X-rays that only affected patient clinical management was found in 6% of all the inappropriate X-rays, and with the appropriately requested X-rays was 29% ($p < 0.001$). Only 3 in every 100 studies had a formal radiology report. The authors concluded that abdominal x-rays continued to be commonly utilized in the emergency department even in cases when the diagnostic and clinical utility of such a test was low, which emphasizes the necessity of more stringent compliance with the rules of appropriateness and more direct involvement of radiologists in the order and progression of the examined panorama.

Singh et al., 2021 reviewed the literature to examine the abdominal changes related to the COVID-19 infection as manifested in imaging. A literature search on PubMed, Google Scholar and Scopus was performed, including in the period between the beginning of the pandemic and 15 March 2021. It consisted of 116 studies, and this number represented 1,198 patients. The most frequent clinical manifestation of abdominal imaging was abdominal pain, detected in 50.2. In CT scans of the abdominopelvis, 48.1% did not present any results of abnormality. Segmental bowel wall thickening, which was detected in 14.7% of the cases, and bowel ischaemia (7.1%), solid organ infarction (6.7%), vascular thrombosis (6.7%), and fluid-filled colon (6.2%), were most frequently found in the abnormal findings. There were also other findings, like pneumatosis, portal venous gas, bowel perforation and appendicitis. The review has observed that incidental low lung changes were reported in a significant number of patients because of COVID-19, and secondary bowel findings were related to elevated clinical severity. It was found that abdominal manifestations are applicable in the early detection of the disease in patients with abdominal symptoms being the leading cause and in detecting complications in the diagnosed individuals.

Ugwuwanyi et al., 2019 presented a retrospective analysis of the typical results that were detected among emergency X-rays concerning the abdomen at the Nnamdi Azikiwe University Teaching Hospital and the Waves Medical Diagnostics and Research Centre in Nnewi, Anambra State. Patients who had X-ray examination as a means of diagnosing acute abdominal conditions formed part of the study. The findings revealed that the number of male patients was 53.2% whereas that of females was 46.8. The most frequent clinical presentation with acute abdominal pain patients constituting 19.6% of the total number of those who were referred and congenital anomalies constituting 0.8%.

.2.3.2 Common Radiographic Findings in Emergency Abdominal X-rays

Ugwuwanyi et al., 2019 performed a retrospective assessment of the frequent presence of the findings in the emergency abdominal X-rays of Nnamdi Azikiwe University Teaching Hospital and Waves medical diagnostics and research centre, Nnewi, anambra state. The population of the study consisted of patients who had X-ray of acute abdominal cases. The findings also showed 53.2% of the patients were males and 46.8% were females. Acute abdominal pain patients made up 19.6% of the referral cases which was the most frequent clinical presentation and congenital anomalies only constituted 0.8% cases. Patients below the age of one year had provided the highest number of referrals at 25.6% of the total, and patients between the age of one and ten years had the lowest number at 3.2%. The incidence of cases of necrotizing enterocolitis was low with four cases in patients below the age of one year and one case in the age group between 11 and 20 years. The most frequent observation was that of normal bowel gas pattern, which was observed in 57.60% of the cases. The total diagnostic yield of X-ray examination was estimated

to be 38.0% which yielded abnormal results and 43.2 yielded negative results. The outcome of diagnostics was not significantly associated with the gender or age of patients (P>0.05). The researchers concluded that although the specificity of plain X-rays was relatively low, the investigation was an important initial investigation on patients presenting with nonspecific complaints in the abdominal region.

Collins et al., 2023 evaluated the use of plain abdominal X-rays in the diagnosis and treatment of the common acute abdominal conditions among children. This was a prospective study undertaken between March 2011 and April 2021 based in paediatric emergency room, paediatric surgical wards, and neonatology units whose patients had to undergo abdominal X-rays as a method of clinical assessment. There was a total of 399 participants of which 60% (n = 240) were male and 40% (n = 159) were female with a male to female ratio of 1.5:1. The age of the patients was between one day and 16 years. The common indications were intestinal obstruction (298 cases), perforation of the gastrointestinal tract (69 cases), intra-abdominal masses (13 cases), and intra-abdominal foreign bodies (14 cases). Among the obstruction cases, the X-ray proved pivotal in the clinical and surgical management of conditions such as intussusception (66), neonatal sepsis (60), malrotation (48), intestinal atresia (42), anorectal malformations (32), Hirschsprung's disease (30), pyloric stenosis (24), obstructed hernia (22), post-operative adhesions (16), and helminthiasis (12). The role of X-ray in diagnosing perforation was equally significant, identifying perforation due to intussusception (19), typhoid ileitis (13), blunt trauma (8), strangulated hernia (11), malrotation (7), Hirschsprung's disease (6), and necrotising enterocolitis (5). The study concluded that plain X-ray remains vital in the early diagnosis and clinical decision-making for common paediatric acute abdominal conditions.

Molla *et al*., 2022 sought to characterize the common radiographic findings observed in abdominal X-rays of Crohn's disease patients presenting with acute abdominal pain. This cross-sectional review was conducted at a tertiary care hospital in Riyadh, including data collected between December 2016 and December 2021. The medical records of patients presenting with abdominal pain and a confirmed Crohn's disease diagnosis were analyzed. A total of 144 X-ray studies were included, with 54 (37.5%) yielding abnormal findings and 90 (62.5%) yielding no significant pathology. The common findings were small bowel anomalies (32.6%), acute complications (32.6%), extra-intestinal findings (2.7%), and colonic findings (1.35%). Follow-up studies were performed in 29.2% of patients, and multivariate regression revealed that males were more likely than females to require further follow-up imaging (odds ratio: 2.25, $p = 0.049$). The results suggested that although most X-rays yielded no significant findings, plain radiography remained a valuable tool for excluding acute complications and guiding clinical decisions in Crohn's disease patients presenting with abdominal discomfort.

2.3.3 Age and Sex Distribution of Patients Undergoing Emergency Abdominal X-rays

The article by Wu et al., 2023 examined how abdominal imaging is used in adults arriving at the emergency department (ED) with abdominal pain and the differences between them by age group. The authors used the data of the National Hospital Ambulatory Medical Care Survey of 2007-2019 including 23,364 patients who reflect about 123 million ED visits in the United States. The research concluded that there was an overall rise in the number of ED visits by the various age groups of the adults with the highest percentage of the patients reporting with abdominal pain. Such presentations percentage went as high as 11.6% in 18-45 years-old, 9.0% in 46-64

years-old, and 6.5% in more than 65 years-old. The proportion of CT scans, conducted on a sample of abdominal pain patients, increased to 42.6% in 2019 and 26.2% in 2007, with the highest percentage change noted in older people. Diagnostic tests positivity rate rose to 22.9% (compared to 17.2%) indicating better clinical yield in spite of increased test use. It is noteworthy that plain X-rays were still frequently used among older adults with abdominal pain, although it has low sensitivity and specificity in this group of patients.

Freedman et al., 2021 assessed clinical features and diagnostic outcome of older adults presenting with abdominal pain in the emergency departments of the United States. The authors used the results of the National Hospital Ambulatory Medical Care Survey of 2013 to 2017, with an approximate of 531,780,629 adult ED visits in 1211 departments. In older persons, 7% of these presentations were abdominal pain. Older patients with abdominal pain were more likely to be triaged as an Emergency (ESI2) than are other complaints (7.1% vs. 14.8%) though were more likely to go directly to the operating room (3.6% vs. 0.8%). The rates of discharge, death and critical care admission showed no significant differences between patients who presented with abdominal pain and those who presented with any other reason. Ultrasound or CT imaging and only 39% received an electrocardiogram (EKG) were done in about 60% of these patients. The authors concluded that older adults with abdominal pain were serious, but their triage was inadequate, which explains the possibility of better assessment and clinical management in the given category of patients..

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Research Setting

This study was carried out at the radiology department of university of Benin teaching hospital (UBTH) in Benin city Edo State, Nigeria. UBTH is a medical institution with tertiary healthcare facilities offering services that are very diverse in diagnosis and treatment, which include emergency care. It is a large referral hospital to patients in Benin City and the neighboring areas, and this is what makes it an ideal location to conduct this study on emergency abdominal X-rays. The radiology department in the hospital has a state of the art imaging equipment such as the X-ray machines which are frequently utilized in carrying out the abdominal radiographs in cases of emergency. The hospital also deals with quite a large number of emergency abdominal cases hence offering a wide and representative sample of patients that would be used in the study.

3.2 Research Design

The design selected was a retrospective descriptive cross-sectional design. This design suited well since it enabled the researcher to go through the records of the existing records of the emergency X-rays of the abdomen to determine the most frequent clinical signs and radiographic appearances. The analysis of the data over a specified time frame of one year gave the design a clear view of the practice of imaging in the emergency department of the hospital and identified patterns and trends in both the indication and the radiographic outcome.

3.3 Target Population

All patients who experienced emergency abdominal X-rays at UBTH were considered the target population of this study within the period of August 2024 and August 2025. This group spanned all age, sex, and clinical manifestation groups, though it specifically included those that present themselves with acute abdominal pain, trauma, or any conditions that require urgent imaging of the abdomen. It mainly concerned adult patients, but it was made sure that the wide range of emergency cases was represented in a sufficient manner.

Inclusion Criteria

1. Patients of all age groups and genders who underwent emergency abdominal X-rays at UBTH.
2. Patients who presented with acute abdominal pain, trauma, or other conditions requiring emergency abdominal imaging.
3. Patients whose clinical and radiographic data were complete and available for review during the study period.
4. Only those examined using plain abdominal X-rays (e.g., supine, erect, or decubitus views).

Exclusion Criteria

1. Patients who underwent abdominal imaging using modalities other than plain X-ray (e.g., CT, MRI, or ultrasound).

2. Patients whose medical records or radiographic reports were incomplete or missing key diagnostic details.

3. Abdominal X-rays performed for non-emergency or routine screening purposes.

4. Repeated radiographs of the same patient within the study period (only the first eligible examination will be considered).

3.4 Sample Size Determination

This study employed no sampling technique but a census method was used to get the total number of patients required for the study. After the census was carried out from August 2024 to August 2025. The total number of patients who matched the inclusion criteria was 200.

3.5 Instrument of Data Collection

Data was collected using a structured data collection form designed for this study. The form captured the following information:

1. Patient demographics (age, sex)

2. Clinical indication for the emergency abdominal X-ray

3. Radiographic findings (such as bowel obstruction, perforations, pneumoperitoneum, etc.)

4. Radiographic views performed (e.g., supine, upright, or decubitus)

5. Diagnosis or final outcome based on the X-ray results

In addition, medical records were reviewed to document the final diagnosis and correlate it with the radiographic findings.

3.6 Validity of Instrument

The experts in radiology and emergency medicine were involved in the review of the structured data collection form to guarantee the validity of the data collection instrument. The form was refined based on feedback provided by these professionals, in order to make sure it promotes the assessment of the variables of clinical indications and radiographic findings. Also, a pilot study was carried out using a small sample of patients to determine the effectiveness of the instrument in measuring the necessary data. All the problems that were discovered in the pilot study were solved prior to the complete data collection..

3.7 Reliability of Instrument

Reliability means the ability of a tool to be the same in the measurement of variables. In order to determine the reliability of data collection instrument, inter-rater reliability was conducted by administering the instrument to two independent radiographers or researchers to collect data on the same set of patients. The degree of agreement among the two raters was evaluated by application of measures of statistics like Cohen Kappa or intraclass correlation coefficient (ICC). The inter-rater reliability was high implying that the instrument would be consistent in getting the data related.

3.8 Method of Data Collection

The retrospective data collection method was used to get the data, where the data of all patients who fulfilled the criteria of an emergency abdominal X-rays at the University of Benin Teaching Hospital (UBTH) between August 2024 and August 2025 were reviewed. A structured data collection form was filled in regard to every eligible patient. Clinical records and the associated radiographic images of the patients with the interpretation of trained radiographers and radiologists were used as a source of information. The demographic information, clinical signs, radiography images, and results were also represented in the forms, and the final diagnosis was also performed to determine the correlation between the imaging results and the clinical state of the patients.

3.9 Method of Data Analysis

Data analysis was carried out using descriptive statistics. The following methods were used to analyze the collected data. Frequency and percentage distributions was used to analyze the major clinical indications for emergency abdominal X-rays and the common radiographic findings. Cross-tabulation was used to assess the relationship between demographic information and the corresponding radiographic findings (e.g., bowel obstruction, perforation). The data were analyzed using Statistical Package for the Social Sciences (SPSS) v. 21. and the data was presented in tables, charts.

3.10 Ethical Considerations

The study was conducted in full adherence to ethical guidelines for research involving human participants. Ethical approval was sought from the University of Benin Teaching Hospital Ethics Committee before the commencement of the study.

Confidentiality: All patient data was kept confidential. Patient identifiers were not be included in the final report, and all data were stored securely, accessible only to the research team.

CHAPTER FOUR

DATA PRESENTATION AND DISCUSSION OF FINDINGS

4.1 Data Presentation

Table 4.1: Age and Sex Distribution of Patients Undergoing Emergency Abdominal X-rays at UBTH (n = 200)

Variable	Frequency (n)	Percentage (%)
Age Range		
0–19 years	40	20.0
20–39 years	104	52.0
40–59 years	36	18.0
≥60 years	20	10.0
Gender		
Male	84	42.0
Female	116	58.0

Table 4.1 shows that most patients who underwent emergency abdominal X-rays were in the 20–39 years age group (52.0%), followed by those aged 0–19 years (20.0%). The least represented group was those aged ≥60 years (10.0%). Regarding sex distribution, females (58.0%) predominated over males (42.0%).

Table 4.2: Clinical Indications for Emergency Abdominal X-rays at UBTH (n = 200)

Clinical Indication	Frequency (n)	Percentage (%)
Bowel obstruction	52	26.0
Perforated viscus	20	10.0
Pneumoperitoneum	16	8.0
Abdominal pain (non-specific)	60	30.0
Ingestion of foreign body	12	6.0
Abdominal mass	4	2.0
Post-operative complication	20	10.0
Trauma	8	4.0
Nephrolithiasis	8	4.0

As shown in Table 4.2, the most common clinical indication was abdominal pain (30.0%), followed by bowel obstruction (26.0%). Other indications included perforated viscus (10.0%) and post-operative complications (10.0%). Less frequent were foreign body ingestion (6.0%), trauma (4.0%), nephrolithiasis (4.0%), and abdominal mass (2.0%).

Table 4.3: Radiographic Views Performed (Multiple Responses, n = 372 views)

Radiographic View	Frequency (n)	Percentage (%)
Supine	200	53.8
Upright	160	43.0
Decubitus	12	3.2

Table 4.3 indicates that the supine view was performed in all patients (53.8% of total views), while the upright view was also common (43.0%). The decubitus view was rarely requested (3.2%). Since multiple views could be performed per patient, the percentages are based on the total number of views recorded (n = 372).

Table 4.4: Radiographic Findings in Emergency Abdominal X-rays at UBTH (n = 200)

Radiographic Finding	Frequency (n)	Percentage (%)
Normal study	80	40.0
Dilated bowel loops	32	16.0
Multiple air-fluid levels	16	8.0
Free air under diaphragm	12	6.0
Pneumoperitoneum	20	10.0
Calcification	8	4.0
Foreign body	12	6.0

Table 4.4 shows that the largest proportion of abdominal X-rays were normal (40.0%). Among abnormal findings, dilated bowel loops (16.0%) and pneumoperitoneum (10.0%) were the most common. Less frequent abnormalities included multiple air-fluid levels (8.0%), free air under diaphragm (6.0%), and foreign body (6.0%).

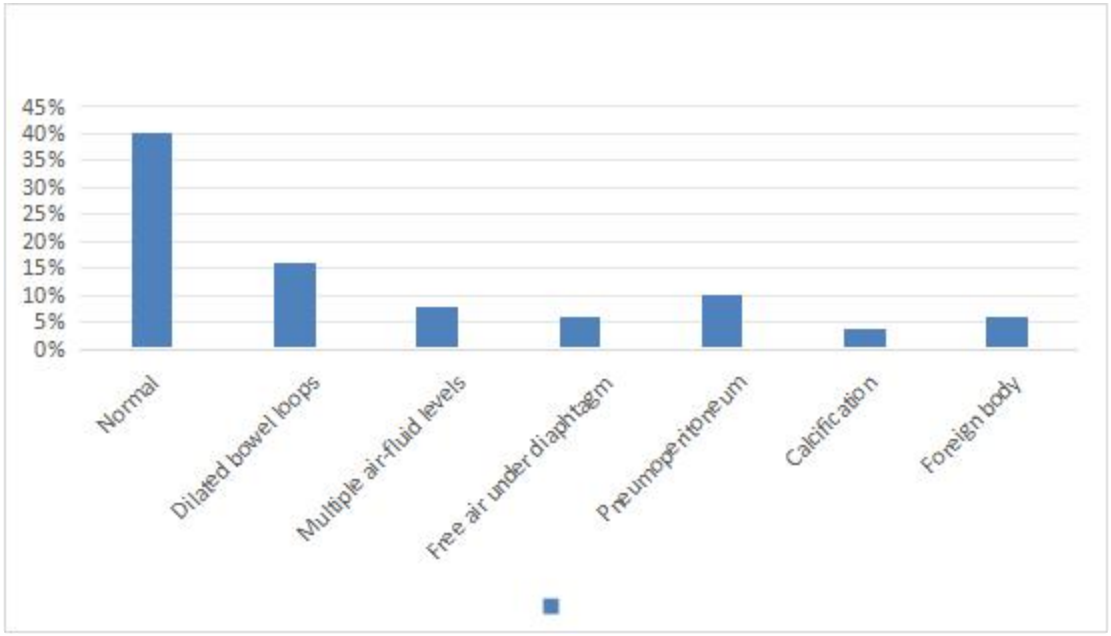

Fig 4.1 Radiographic findings

4.2 Hypothesis Testing

Table 4.5: Chi-square Test of Association Between Radiographic Findings and Age (n = 200)

Variables	χ^2 Value	df	p-value	Decision
Findings × Age group	14.26	9	0.114	Not Significant

Interpretation:

Table 4.5 shows the Chi-square test result for the association between radiographic findings and age groups. The calculated χ^2 value was 14.26 with 9 degrees of freedom and a p-value of 0.114. Since the p-value is greater than the 0.05 level of significance, the association is not statistically significant. This means that the radiographic findings among patients did not significantly vary by age group.

Table 4.6: Chi-square Test of Association Between Radiographic Findings and Gender (n = 200)

Variables	χ^2 Value	df	p-value	Decision
Findings × Gender	9.88	6	0.128	Not Significant

Table 4.6 presents the Chi-square test result for the association between radiographic findings and gender. The calculated χ^2 value was 9.88 with 6 degrees of freedom and a p-value of 0.128. Since the p-value is greater than 0.05, the result is not statistically significant. This implies that radiographic findings did not differ significantly between male and female patients. Both sexes showed similar distributions of normal and abnormal findings on emergency abdominal X-rays.

4.3 Discussion of Findings

From table 4.2 the leading indication was abdominal pain (30.0%), followed by bowel obstruction (26.0%). Others included perforated viscus (10.0%), post-operative complications (10.0%), pneumoperitoneum (8.0%), foreign body ingestion (6.0%), trauma (4.0%), nephrolithiasis (4.0%), and abdominal mass (2.0%).

This pattern reflects the real-world workflow of the emergency unit where abdominal pain often non-specific is the commonest entry point into imaging. In such scenarios, abdominal x-rays is frequently used as a rapid triage tool to look for red-flag signs that change immediate management: bowel obstruction (dilated loops, step-ladder air-fluid levels), free intraperitoneal air on erect views when perforation is suspected, or radio-opaque foreign bodies. That bowel obstruction is the next most frequent indication (26%) fits the acute nature of the study population: patients with vomiting, distension, absolute constipation, or tympanitic abdomens are quickly routed to plain films because abdominal x-rays can provide quick, bedside evidence that justifies NG decompression, fluid resuscitation, surgical call, or urgent CT when available.

The 10% share for perforated viscus and the 8–10% for pneumoperitoneum-related requests likely come from clinicians leveraging the erect abdominal (or chest) view to detect subdiaphragmatic free air still a pragmatic pathway where CT access is delayed or where a fast, low-cost, low-dose screening step is needed. Post-operative complications (10%) are also an expected driver, abdominal x-rays is commonly used to evaluate ileus versus early obstruction, to check tube/line positions, or to reassess bowel gas patterns when recovery is not following the expected course.

Lower frequencies for foreign body ingestion (6%), trauma (4%), nephrolithiasis (4%), and abdominal mass (2%) are clinically coherent. In many centers (including UBTH), ultrasound or CT is often preferred for renal colic and masses, abdominal x-rays' role there is limited to radiopaque stones or baseline documentation. For blunt abdominal trauma, the initial work-up may prioritize FAST ultrasound and CT in hemodynamically stable patients, with abdominal x-rays reserved for specific questions (e.g., NG tube confirmation, suspected foreign body, or when other modalities are temporarily unavailable). Overall, the indication profile points to abdominal x-rays being used strategically as a first-line, rule-in/rule-out test for a small set of high-impact pathologies, while also accommodating the high volume of non-specific pain where clinicians want a quick screen before escalating.

The dominance of abdominal pain in our cohort aligns with Garcia *et al*. (2024), who found abdominal pain to be the leading clinical indication for abdominal x-rays (about 40%) in a tertiary emergency department. It is also broadly consistent with Singh *et al*. (2021), where abdominal pain was the most common presenting complaint driving abdominal imaging during the COVID-19 era (albeit their primary modality mix included CT). Conversely, our pattern differs from Tam (2024), who emphasized that, when judged strictly against RCR criteria, bowel obstruction was the most common justified indication, while a significant fraction of abdominal-pain requests were unjustified and low-yield highlighting how appropriateness frameworks can shift which indications "should" dominate. In addition, Burrell *et al*. (2023) reported that radiographers' knowledge and training were particularly strong around acute indications (e.g., perforation, obstruction) and projection choices, implying that systems with structured training

and embedded protocols may show a higher relative share of specific, high-yield indications than non-specific pain.

For UBTH, the indication profile signals two priorities. First, abdominal x-rays is serving its intended rapid-triage role in suspected obstruction and perforation. Second, the sizeable proportion of non-specific abdominal pain requests suggests room to tighten justification practices e.g., reinforcing local pathways that route likely biliary, gynecologic, or renal colic presentations to ultrasound first, and reserving abdominal x-rays for scenarios where it meaningfully alters immediate management. Embedding visual algorithms, ongoing short courses/pattern-recognition training, and audit-feedback loops can improve appropriateness, reduce unnecessary dose, and free capacity for cases where abdominal x-rays is most informative.

According to table 4.4 the most frequent radiographic finding was normal study (40.0%). Among abnormal results, dilated bowel loops (16.0%), pneumoperitoneum (10.0%), and multiple air-fluid levels (8.0%) were the most common. Other less frequent findings included free air under diaphragm (6.0%), foreign body (6.0%), and calcifications (4.0%).

The predominance of normal radiographs (40.0%) reflects a well-documented trend in abdominal radiography, where plain films often yield limited diagnostic findings in non-specific abdominal pain presentations. While the examination is fast, widely available, and inexpensive, its sensitivity for many abdominal pathologies is inherently low compared to ultrasound or CT. In spite of this restriction, the clinicians still employ abdominal x-rays as a first-line exclusion method as a way of fast ruling out obstruction, perforation, or clear foreign bodies before it has to be progressed to another imaging method. The unusual results of the present study were

concentrated to a great extent around the conditions in which plain radiography is still clinically useful. Dilated bowel loops (16.0) and multiple levels of air-fluid (8.0) are strongly related to intestinal obstruction and the abdominal x-rays plays a significant diagnostic part in only a few conditions of the abdomen. Similarly, pneumoperitoneum (10.0%), free subdiaphragmatic air (6.0%), however, are also important findings since their identification has direct surgical consequences. Aboriginal objects (6.0%) and calcifications (4.0%) are identified in the abdominal x-rays in the determination of radio-opaque bodies or urinary tract stones, but such are secondary in most emergency departments.

The fact that a significant percentage of studies were normal points to the conflict between the low yield of the abdominal x-rays and its use as a screening and triage instrument. Abdominal x-rays are often conducted on patients who report abdominal pain not because it is anticipated to provide a final diagnosis, but rather to rule out high-risk emergencies and help make decisions effectively in the emergency unit.

The result is similar to the work of Ugwuwanyi et al. (2019) in Anambra State, who found that normal bowel gas pattern was the most frequently used (57.6%), and only 38% produced abnormal results. On the same note, Molla et al. (2022) in Saudi Arabia noted that 62.5% of Crohn disease patients on abdominal radiography did not have any significant pathology and only 37.5% had abnormalities. These researches affirm the conclusion that normal findings very often prevail in the results of abdominal x-rays. However, the findings are compared with those of Collins et al. (2023), who, in pediatric cohort, reported that abnormal findings dominated (intestinal obstruction and perforation) and that the radiograph was decisive in the surgical

management. This disparity might be due to the fact that Collins examined only children with acute surgical conditions, in which radiography is more likely to produce some abnormalities, in comparison to the present study; which examined a wider range of emergency population with the majority of non-specific complaints.

The results strengthen the idea that the use of x-rays of the abdomen has poor sensitivity, but it remains useful as a preliminary test in the detection of obstruction, perforation, and foreign bodies. The large percentage of normal studies though is an indication that there is the need to have more refined clinical protocols that are designed to make the use more specific. In the situations where a differentiating abuse of unnecessary exposure, low-yield imaging, and more efficient ordering of patients to ultrasound or CT as abdominal x-rays is unlikely to add value, appropriateness criteria (e.g., SERAM or RCR guidelines) should guide emergency physicians and radiographers.

Table 4.1 indicates that most patients fell in the age group of 20-39 years old (52.0%), 0-19 years old (20.0%), 40-59 years old (18.0%), and [?] 60 old age (10.0). On sex, the figures were higher among the females (58.0) than the males (42.0).

The age distribution of this research study is that young adults (20-39 years) formed the majority of those who reported to the emergency with abdominal radiographs. This is not surprising because this population group tends to be the most socially and economically active and thus, more likely to come to emergency departments with acute abdominal issues of gastrointestinal infections up to trauma. The fact that the share of children and adolescents (0-19 years, 20) is rather significant (0-19 years, 20) also points to the susceptibility of this population group to

acute abdominal pain, the ingestion of foreign bodies, and congenital anomalies. Conversely, the smallest group (10%), which was the elderly ([?]60 years), might be explained by the fact that such patients usually undergo more expensive imaging like a CT scan when giving acute abdominal symptoms, or the difference in health-seeking behavior.

The distribution of sex in relation to the current study showed that there was a greater number of female patients (58) than males (42) patients. This imbalance can be predetermined by a number of factors. Females of childbearing age tend to be diagnosed with abdominal pain that is caused by gynaecological and obstetric issues (e.g., pelvic inflammatory disease, ovarian cysts, ectopic pregnancy), thus imitating acute surgical abdomen and causing them to refer to abdominal X-rays despite the constraints of the modality. Also, women tend to be more inclined to medical consultation earlier than men which may be the reason of overrepresentation among the study sample. The female dominance could also be due to institutional referral practices in which clinicians in emergency departments are conservative when excluding abdominal emergencies in women with non-specific pain.

This observation that young adults predominate in the utilization of abdominal x-rays is consistent with Wu et al. (2023) who found that there was a rise in the use of abdominal imaging in emergency departments by all age groups, but especially the 18-45 years age range that had the highest increase in abdominal pain presentations. Likewise, in their assessment of older patients, Freedman et al. (2021) also established that the older citizens do not show abdominal pain most often, but younger patients are the ones who use imaging services more often, which is due to a higher prevalence of complaints of acute abdominal pain, as well as their greater

diagnostic ambiguity in this group. Conversely, the elevated number of the female patients in the current study contrasts a little with the Ugwuwanyi et al. (2019) research who identified a male dominance (53.2%) of X-ray referrals of the abdomen in Nnewi. This difference can be associated to the variation in the population composition, health seeking behavior, or local referral patterns. Although some centers tend to experience more males especially because of trauma-related presentations, others could experience more females because of the reproductive-age abdominal emergencies.

According to the results, emergency abdominal X-rays in UBTH have been applied more among young adult and female populations. This has clinical implications of specific diagnostic pathway: although abdominal x-rays can be used as a first-line screening tool, its clinicians should be aware of its low specificity in cases of gynaecology, in which ultrasound could prove to be better. Also, taking into consideration the comparably low usage in older adults, it becomes vital to make sure that high-risk elderly patients are not under-researched and that more sensitive modalities are used when needed.

According to the findings of table 4.5 and 4.6, Chi-square test found no significant relation between the results of the radiographic and the age (2 = 14.26, 9, 0.114) and the chi-square tested no significant relationship between radiographic and the gender (2 = 9.88, 6, 0.128). Both p-values were more than 0.05 which made the null hypothesis accepted. These findings indicate that the distribution of radiographic appearances including bowel obstruction, pneumoperitoneum, loops of dilated loops, or normal studies were not dependent on the age and sex of patients. That is, the probability of getting an abnormal abdominal X-ray did not largely

depend on the age of the patient, gender (male or female). This observation reinforces the lack of discrimination of emergency abdominal conditions: bowel obstruction or perforation can occur in all age groups or both sexes, and the plain radiograph, as a general screening examination, is a manifestation of this distribution.

The absence of statistical difference also indicates the clinical universality of the presentations of abdominal pain. Although the etiologies underlying them might be age- or gender-specific (i.e. paediatric intussusception, gynaecological causes in women, neoplastic obstruction in the elderly), the radiographic appearances of the condition merge around similar patterns of distended bowel loops, multiple levels of air-fluid, or pneumoperitoneum. This is the reason that the results of the abdominal x-rays do not follow demographic lines but rather there is no significant difference in frequency.

This is in line with the findings of Ugwuwanyi et al. (2019), who in their retrospective study of abdominal X-rays at Nnewi did not discover a significant correlation between the outcomes of diagnoses and the gender or the age of the patients ($p > 0.05$) in their study. Their study supports the notion that radiographic observations are more or less distributed in terms of demographics in emergent cases.

The results are however somewhat different to that of Wu et al. (2023) who established that older individuals in the U.S. tended to have higher diagnostic yields with abdominal imaging than their younger counterparts and in instances of higher modalities like CT. The difference could be indicative of the fact that CT is more sensitive to subtle pathology than abdominal x-rays which are less prone to variations in diagnostic yield with age. Equally, Freedman et al. (2021)

observed older adults tended to have severe abdominal pathology and had to be operated on, which might be the reason why the high yields were observed in older patients, but not in the case of abdominal x-rays alone.

Acceptation of the null hypothesis in this study implies that the use of abdominal x-rays is a generalizable tool that can be used in all ages and sexes with equal chances of diagnosis without bias in demography. It does, however, also point out the shortcomings of plain radiography its low sensitivity obscures differences that can be better seen using CT or ultrasound. Clinically this implies that although abdominal x-rays may be a universal 1 st line test, more specific diagnostic approaches are still needed: clinicians cannot suppose that a normal film eliminates disease, particularly in the elderly or in women with gynaecological manifestations, where more sophisticated imaging can be needed.

CHAPTER FIVE

SUMMARY, CONCLUSION AND SUGGESTION FOR FURTHER STUDIES

5.1 Summary of the Study

This study examined clinical signs, radiographic characteristics and demographics of patients who underwent an emergency abdominal X-ray in the University of Benin Teaching Hospital (UBTH). Two hundred cases were examined by use of a structured data extraction form. The results indicated that abdominal pain (30.0%), bowel obstruction (26.0%), was the most frequent clinical indication. The most dominant radiographic result was normal study (40.0%), and the most common abnormal result was dilated bowel loops and pneumoperitoneum. On the demographics, the majority were the young adults between the ages of 20-39 years of age (52.0%), with females (58.0%) dominating over males.

5.2 Conclusion

The most common requests of abdominal X-rays at UBTH are made by patients with abdominal pain and suspected bowel obstruction. Even though a high percentage of the examinations gave normal findings,the modality is still applicable in identifying the bowel obstruction, pneumoperitoneum, and foreign bodies. The findings also indicate that the outcomes of radiographs are not dependent on age or gender, which confirmed the discrimination-free use of abdominal x-rays in the emergency practice. Nevertheless, the prevalence of the normal findings shows the importance of heavier compliance with the justification guidelines and the addition of complementary imaging modalities to enhance the efficiency of the diagnostic process.

5.3 Recommendations

1. Strengthen justification protocols: Emergency clinicians and radiographers should apply internationally recognized guidelines (e.g., RCR, SERAM) to reduce unnecessary abdominal X-rays.

2. Promote the use of alternative imaging: Where available, ultrasound or CT should be considered as first-line modalities in cases where abdominal x-rays is unlikely to provide diagnostic benefit.

3. Training and life-long learning: Radiographers and the referring physicians must be trained on clinical indicators and interpreting the findings of the abdominal x-rays on a continuous basis.

4. Audit and feedback: Audits of abdominal x-rays requests and findings in the department should be regular so as to mandate adherence to standards of justification.

5. Enhance documentation: Final diagnoses must always be recorded in patient records to enhance the validity of the research and clinical audits.

5.4 Limitations of the Study

5.4 Limitations of the Study

1. Retrospective design: This is a study based entirely on patient records, and hence they did not have much control on the quality of data, completeness and consistency of documentation.

2. There was no comparison of advanced imaging modalities (e.g., CT and ultrasound), and this restricted the possibility of measuring diagnostic accuracy.

5.5 Suggestions for Further Studies

1. In accordance with the enhancement of diagnostic yield, studies with the use of advanced imaging modalities (CT, ultrasound) should be implemented in addition to abdominal x-rays.

2. The study ought to test the cost-effectiveness of abdominal X-rays in the emergency environment of Nigeria against alternative imaging modalities.

3. Future researchers may evaluate the effect of radiographer-led justification and decision support tools on inappropriate requests of abdominal x-rays.

4. Research should also be done to determine patient outcomes and clinical decision making after normal and abnormal abdominal X-ray findings

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APPENDIX I

Emergency Abdominal X-ray Data Extraction Form (UBTH)

Section A: Patient Demographics

Age range;

☐ 0–19 yrs

☐ 20–39 yrs

☐ 40–59 yrs

☐ ≥60 yrs

Gender;

☐ Male

☐ Female

Section B: Clinical Indication for X-ray

☐ Bowel obstruction

☐ Perforated viscus

☐ Pneumoperitoneum

☐ Abdominal pain (non-specific)

☐ Ingestion of foreign body

☐ Abdominal mass/distension

☐ Post-operative complication

☐ Trauma

☐ Others (specify): _____

Section C: Radiographic Views Performed

☐ Supine

☐ Upright/erect

☐ Decubitus

☐ Others (specify): _____

Section D: Radiographic Findings

☐ Normal study

☐ Dilated bowel loops

☐ Multiple air-fluid levels

☐ Free air under diaphragm

☐ Pneumoperitoneum

☐ Calcifications/stones

☐ Foreign body

☐ Others (specify): _____

Section E: Final Diagnosis/Outcome

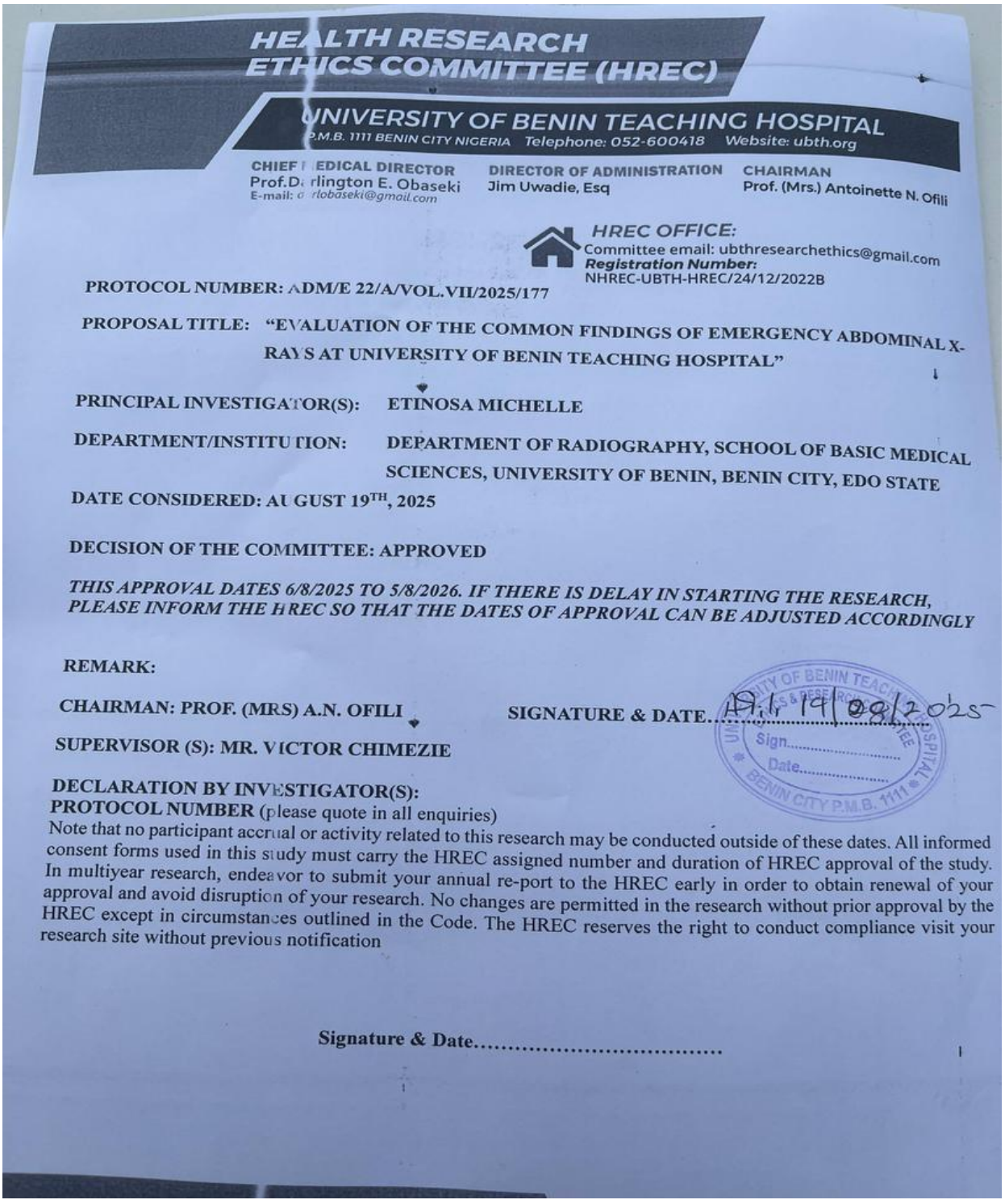
☐ Confirmed bowel obstruction

☐ Perforation

☐ Pneumoperitoneum

☐ Other (specify): _____

APPENDIX II



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Registration Number:
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PROTOCOL NUMBER: ADM/E 22/A/VOL.VII/2025/177

PROPOSAL TITLE: "EVALUATION OF THE COMMON FINDINGS OF EMERGENCY ABDOMINAL X-RAYS AT UNIVERSITY OF BENIN TEACHING HOSPITAL"

PRINCIPAL INVESTIGATOR(S): ETINOSA MICHELLE

DEPARTMENT/INSTITUTION: DEPARTMENT OF RADIOGRAPHY, SCHOOL OF BASIC MEDICAL SCIENCES, UNIVERSITY OF BENIN, BENIN CITY, EDO STATE

DATE CONSIDERED: AUGUST 19TH, 2025

DECISION OF THE COMMITTEE: APPROVED

THIS APPROVAL DATES 6/8/2025 TO 5/8/2026. IF THERE IS DELAY IN STARTING THE RESEARCH, PLEASE INFORM THE HREC SO THAT THE DATES OF APPROVAL CAN BE ADJUSTED ACCORDINGLY

REMARK:

CHAIRMAN: PROF. (MRS) A.N. OFILI SIGNATURE & DATE 19/08/2025

SUPERVISOR (S): MR. VICTOR CHIMEZIE

UNIVERSITY OF BENIN TEACHING HOSPITAL BENIN CITY P.M.B. 1111 Sign Date

DECLARATION BY INVESTIGATOR(S):
PROTOCOL NUMBER (please quote in all enquiries)
Note that no participant accrual or activity related to this research may be conducted outside of these dates. All informed consent forms used in this study must carry the HREC assigned number and duration of HREC approval of the study. In multiyear research, endeavor to submit your annual re-port to the HREC early in order to obtain renewal of your approval and avoid disruption of your research. No changes are permitted in the research without prior approval by the HREC except in circumstances outlined in the Code. The HREC reserves the right to conduct compliance visit your research site without previous notification

Signature & Date.....