COMPARATIVE STUDY BETWEEN COMPUTED TOMOGRAPHY AND SURGICAL STAGING OF OVARIAN CANCER AMONG PATIENTS ATTENDING MUHIMBILI NATIONAL HOSPITAL

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By,

Dorcas Michael Mkanje

A Dissertation Submitted in (Partial) Fulfilment of the Requirement for the Degree of Master of Medicine (Radiology) of
The Muhimbili University of Health and Allied Sciences
October, 2024

CERTIFICATION

The undersigned certify that they have read and hereby recommend for acceptance by the Muhimbili University of Health and Allied Sciences a dissertation entitled ***"Comparative study between Computed tomography and surgical staging of ovarian cancer among patients attending Muhimbili national hospital",*** in (partial) fulfilment of the requirements for the degree of Master of Medicine (Radiology) of Muhimbili University of Health and Allied Sciences.

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Date……...

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(Co-supervisor)

Date…….

DECLARATION AND COPYRIGHT

I, **Dorcas Mkanje**, declare that this dissertation is my original work and that it has not been presented and will not be presented to any other University for a similar or any other degree award.

Signature: _____ Date…….

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DEDICATION

I dedicate this research project to my loving husband Mr Robert Hosea, my parents Mr and Mrs Michael Mkanje and our wonderful children John, Josline and Joshua. Their unwavering support, patience, and understanding have been the cornerstone of my academic pursuits. Their encouragement, love, and sacrifices have inspired me to push the boundaries of knowledge and to strive for excellence. This work is a testament to our shared journey, and I am profoundly grateful for their presence in my life.

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ABBREVIATIONS

CT	Computed tomography
DCMCT	Dodoma Christian Medical Centre Trustees
FIGO	International Federation of Gynaecology and Obstetrics
HIS	Hospital Information System
MNH	Muhimbili National Hospital
MRI	Magnetic Resonance Imaging
MUHAS	Muhimbili University of Health and Allied Science
ODK	Open data kit
SPSS	Statistical Package for the Social Science
UCSF	University of California San Francisco
USA	United State of America

DEFINITION OF TERMS

Ovarian Cancer: is a malignant neoplasm originating in the ovaries, which are the female reproductive organs responsible for the production of eggs and hormones. It is characterized by the uncontrolled growth and proliferation of abnormal cells within the ovarian tissue, leading to the formation of tumours (1, 12)

Ovarian Cancer staging: is a system used to classify the extent and spread of ovarian cancer within the body. The staging system provides valuable information for treatment planning, prognosis determination, and clinical research (4, 6).

ABSTRACT

Background:

Ovarian cancer is a significant cause of mortality among gynecologic malignancies worldwide, resulting in over 200,000 deaths annually. However, in Tanzania, the understanding of the CT scan finding and their significance on the ovarian tumour staging is limited and is not used frequently. The comparison between radiological and surgical staging of ovarian cancer is crucial for guiding treatment decisions and improving patient outcomes.

Aim:

The study aim was to assess the comparison between radiological (CT scan) and surgical staging of ovarian cancer among women attending Muhimbili National Hospital (MNH).

Methods:

This was a cross-sectional, retrospective hospital-based study that utilized medical records from 43 participants who attended Muhimbili National Hospital (MNH) between January 2022 and January 2024. Data collection was conducted using Open Data Kit (ODK), which implemented a pre-developed checklist to gather information on demographics, clinical presentation, surgical findings, and CT scan results. The collected data was organized in MS Excel and analysed using SPSS version 27. Descriptive statistics were employed to summarize the data at a univariate level, using frequency distribution. Relationships between independent and dependent variables were assessed via cross-tabulation and Chi-Square tests, with statistical significance determined at a p-value of less than 0.05.

Results:

This study involved 43 ovarian cancer patients with a median age of 54 years. All participants presented with abdominal pain or swelling (100%), followed by abdominal fullness in 38 patients (88.4%) and back pain in 5 patients (11.6%). Explorative laparotomy was performed in all patients, revealing ovarian mass/masses in every case. Additionally, ascites was identified in 36 patients (83.7%), and omental caking was

observed in 25 patients (58.1%). These findings were mirrored by CT scans, with ascites present in 30 patients (69.8%) and omental caking in 24 patients (55.8%). CT scans showed a sensitivity, specificity, and accuracy of 100% for stage I, 100%, 97.2%, and 97.7% for stage II, and 80.6%, 100%, and 86.1% for stage III, respectively. The overall CT scan sensitivity and PPV was 97.4% and 81.1% respectively.

The pre-surgical CT staging was highly significant (p-value < 0.001), underscoring its crucial role in aiding surgeons to plan treatments, particularly for ovarian cancer patients before laparotomy.

Conclusion:

There is a significant association (p value <0.000) between CT scan and surgical staging that highlights the potential of CT imaging as a preoperative staging tool for ovarian cancer.

Recommendation:

In every patient with suspected ovarian cancer, a staging CT scan should be performed prior to intervention. Further research is recommended, with a bigger sample size focusing on the diagnostic power of CT scans with reference to the specific local and distant extensions of ovarian cancer disease.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background

Ovarian cancer is a global health issue, significantly impacting women's health and contributing to high rates of morbidity and mortality. Worldwide, ovarian cancer accounts for over 200,000 deaths annually, with a prevalence of 4.6% (1). Globally, it remains one of the most lethal gynecological cancers, primarily due to challenges in early detection and the advanced stages at which most cases are diagnosed. In Africa, particularly, the situation is more severe, with a higher mortality-to-incidence ratio compared to other regions, largely attributed to late diagnosis, limited access to specialized care, and inadequate treatment options (2,3).

In Tanzania and East Africa, specific data on ovarian cancer are limited, but extrapolations from global databases such as GLOBOCAN 2020 estimate an ovarian cancer incidence rate of 1.7% and a mortality rate of 1.9% (4). These numbers, however, may be underestimated due to factors like underreporting and diagnostic challenges. According to the World Health Organization, the prevalence of ovarian cancer in Tanzania has risen to 4.6%, with low rates of screening, diagnosis, and treatment across many healthcare facilities (5). The lack of awareness and absence of national screening programs further exacerbate the problem, leading to late-stage diagnoses and higher mortality rates.

Early diagnosis and staging are essential for improving outcomes, and CT scans have been used globally as a non-invasive method to detect and stage ovarian cancer (6). However, in resource-limited settings like Tanzania, where access to specialized surgical staging is constrained, the role of CT scans has not been extensively studied. Surgical staging remains the gold standard, but it is invasive, time-consuming, and often delayed due to limited resources (7). Incorporating CT scans as an initial staging method could

significantly improve early detection rates and facilitate timely treatment, especially as these scans are more accessible in many referral hospitals.

This study aims to evaluate ovarian cancer in Tanzania using Muhimbili National Hospital as a reference population, focusing on risk factors, mortality, and the role of radiological staging. It also compares CT scan findings with surgico-pathological staging according to the International Federation of Gynecology and Obstetrics (FIGO) to identify any discrepancies that might influence treatment strategies, particularly in patients undergoing surgery or chemotherapy (8).

1.2 Problem statement

Ovarian cancer remains a significant threat among gynecologic malignancies worldwide, with global studies showing varied correlations between radiologic (CT scan) staging and surgical staging in terms of accuracy, sensitivity, and specificity (5). Studies conducted in various settings, including Europe and Asia, have demonstrated that CT scans play a crucial role in initial staging and treatment planning, particularly for advanced stages of ovarian cancer, where surgical staging can be invasive and time-consuming. However, such comparative studies are lacking in sub-Saharan Africa, including Tanzania, where ovarian cancer remains underreported and underdiagnosed.

In Tanzania, the association between radiologic (CT scan) staging and surgical staging has yet to be thoroughly investigated. This knowledge gap impedes the optimization of treatment strategies, as healthcare providers rely predominantly on surgical staging, which is often delayed due to resource constraints. The study hypothesizes that CT scan staging correlates closely with surgico-pathological staging in ovarian cancer cases at Muhimbili National Hospital, providing an opportunity for earlier diagnosis and treatment planning, particularly for patients in rural or low-resource settings. Addressing this gap could significantly improve the management of ovarian cancer in Tanzania, reducing mortality rates and enhancing patient outcomes.

1.3 Conceptual framework

The observed CT scan finding for a patient with ovarian cancer will determine the stage identified by CT-Scan. On the other hand, surgical exploration will provide an insight for FIGO staging method. The comparison between the two methods can be observed with respect to staging of ovarian cancer.

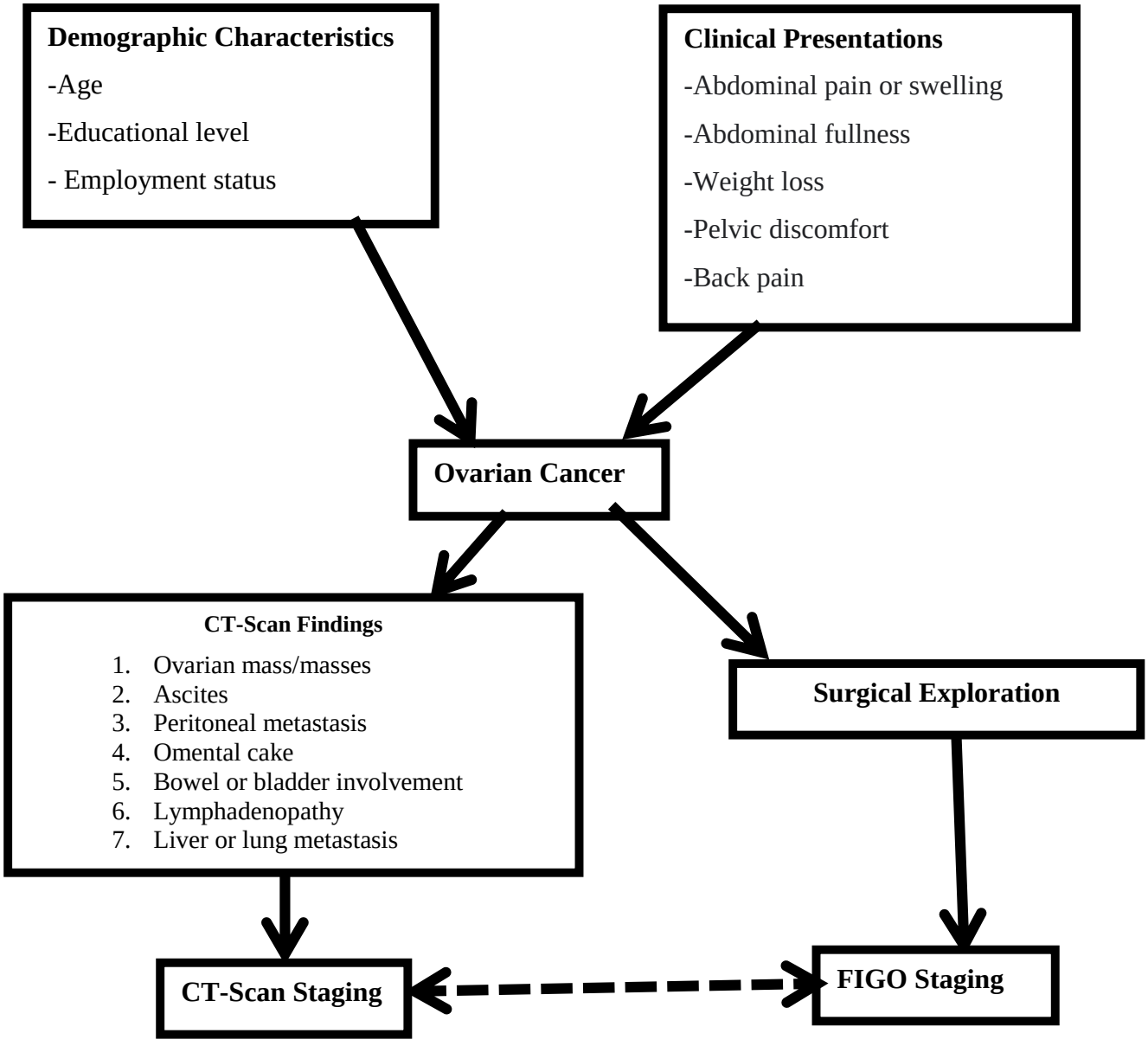


Figure 1: Conceptual framework

1.4 Rationale

The aim of this study was to compare CT-Scan staging with surgical staging of ovarian cancer among women, with the goal of determining whether pre-surgical CT evaluation can reliably align with laparotomy staging. By assessing the consistency between these two staging methods, the study sought to evaluate the effectiveness of CT scans in accurately diagnosing and staging ovarian cancer. This comparison provided a valuable insight into the potential utility of CT scans as a preoperative tool for guiding treatment decisions and improving patient outcomes. Finally, the study aimed to contribute to the optimization of ovarian cancer management strategies and improved outcomes.

1.5 Research Question

To what extend the CT scan gives similar findings as surgical in staging ovarian cancer among women attending MNH?

1.6 Research Objectives

1.6.1 Broad Objective

To compare CT-Scan and surgical staging of ovarian cancer among women attended Muhimbili National hospital from January 2022 to January 2024.

1.6.2 Specific Objectives

1. To determine socio-demographic characteristics of patients with ovarian cancer attending MNH from January 2022 to January 2024.
2. To determine CT findings of the patients with ovarian cancer attending MNH from January 2022 to January 2024.
3. To determine surgical findings of the patients with ovarian cancer who did CT scans from January 2022 to January 2024.
4. To compare CT and surgical staging of ovarian cancer in women attending MNH from January 2022 to January 2024.

1.7 LITERATURE REVIEW

1.7.1 The demographic characteristics associated with ovarian cancer

Ovarian cancer is still counted as among most common cancers in women worldwide associated with increased mortality and morbidity (4). This scenario goes parallel with increased impact in quality of life in women with ovarian cancer. A study done by Bristaw in 2015 (9) indicated that being black and of low social economic status are among the risk factors of acquiring ovarian cancer when aged above 23 years old living in the United States. This study provided a framework overview with relevant evidence regarding the association of demographic characteristic with ovarian cancer.

Another study done in China indicate the vast association between age advancement and the increased risk of ovarian cancer leading to increased mortality among women aged above 40 years (10). It associated ovarian cancer with the use of tobacco, alcohol and higher education levels among women. A previous study conducted in California USA, indicated that African American women are less likely to be diagnosed with ovarian cancer in its early stages compared to white women (11). This study went further to indicate that health insurance was a factor associated with the manifestation of ovarian cancer; in which most of the women with higher education and have health insurance were found to have ovarian cancer in early stage compared to those who have not. Similar to this observation, a retrospective study indicated that ovarian cancer is more common in white women compared to blacks with advancement in age as a common risk factor in all groups. The study also noted that, ovarian cancer was more common in women with higher residential income living in the urban areas compared to those with low residential income living in rural areas.

The American Cancer society (12) stipulates that, more than half of the women diagnosed with ovarian cancer are aged above 60 years, despite the diminishing incidence of ovarian cancer in the past 5 years. In Africa, Ovarian cancer is mentioned to be the fifth in incidence rates compared to other cancers in the continent (13). In Nigeria, ovarian cancer was found to be more common in young Nigerian women aged between 23 to 29 years compared to white women living in the country (14). Despite the distribution of ovarian cancer in Nigerian women, mortality rate was higher in white

women compared to black women living both in urban and rural areas. The observed disparities in ovarian cancer incidence and diagnosis between different populations underscore the need for further research and targeted interventions. It is crucial to explore the reasons behind the higher incidence and mortality rates among specific groups, such as African women and those of low socioeconomic status.

A previous study done to compare the distribution of ovarian cancer tumor types between Eastern Africa and Northern America, concluded that ovarian cancer was more common in Northern America, specifically Canada compared to many regions in Eastern Africa. The study revealed the higher ovarian cancer prevalence in young women population aged from 26 to 28 years in Northern America compared to the same population in Eastern Africa (19). A retrospective hospital based study conducted in Tanzania, highlighted higher prevalence of ovarian cancer among women aged from 32 to 58 years, and the overall deaths related to ovarian cancer was 17% (16).

1.7.2 Clinical characteristics associated with Ovarian Cancer

Studies report widely distributed presentation in ovarian cancer depending on the disease stage, treatment process and other clinical factors including co-morbidities (17). Bowel symptoms are reported to be among the leading presentation symptoms at both early and late stages of the disease. Abdominal pain and loss of appetite are also reported to be very common at early stages of ovarian cancer (18). The increase in symptom presentation is proportional to disease advancement and treatment disparities. Vaginal bleeding, pressure effect to the bladder and rectum are also among reported symptoms that were vastly associated with terminal stage of ovarian cancer (19).

Late diagnosis is among the shortfall leading to advancement of ovarian cancer especially in developing countries like Tanzania (16). A previous study indicated that, most of the women in Tanzania were diagnosed late with advanced stage of the disease, hence presenting with worse symptoms compared to other patients in early stages of the disease. Co-morbidities like lung disorders, physiological disorders can lead to advanced symptoms due to synergic impact during presentation and clinical assessment (15).

Understanding the clinical presentation of ovarian cancer is crucial for timely management and treatment, particularly in resource-limited settings like Tanzania.

Bowel symptoms, abdominal pain, and loss of appetite are commonly reported in the early stages of ovarian cancer, while symptoms such as vaginal bleeding and pressure effects on the bladder and rectum are more prevalent in the terminal stages. The disparity in symptom presentation is often linked to disease advancement and treatment disparities. Unfortunately, late diagnosis remains a significant challenge in Tanzania, leading to advanced stages of ovarian cancer and worse symptoms at presentation.

1.7.3 CT scan staging of Ovarian Cancer

Contrast-enhanced CT scan imaging is widely recognized as the most effective imaging modality for preoperative evaluation of ovarian cancer due to its advanced detailing and accuracy in detecting and evaluating ovarian tumors (20). CT scans have been found to be particularly effective in detecting local tumor involvement of the pelvic ureter and uterine serosa. With its high accuracy (94%), sensitivity (75%), and specificity (72%) in detecting ovarian lesions, CT scan can produce important details including tumor invasion, size, and affected tissues, leading to a more reliable conclusion regarding disease stage (21).

Previous studies (6,23,25) found that CT-Scan has high accuracy in detecting and staging of ovarian cancer. In Africa, CT-Scan is widely used and available in many health facilities making it a useful imaging tool for diagnosing and staging ovarian cancer. Iyer, et all (24), suggest that CT-Scan can be used to detect ovarian cancer from early to late stage with specificity of 92%, and sensitivity of 89% but also CT Scan found to be cost effective compared to other imaging modalities.

The use of CT scan in staging ovarian cancer is a promising approach that promotes further investigation, particularly in Tanzania and other African countries where information on this topic is still limited. Contrast-enhanced CT scan imaging has been widely recognized as a highly effective modality for the preoperative evaluation of ovarian cancer due to its advanced detailing and accuracy in detecting and evaluating ovarian tumors. The high accuracy, sensitivity, and specificity of CT scan in detecting ovarian lesions and providing important details such as tumor invasion and affected tissues make it a valuable tool in determining disease stage (21).

1.7.4 Surgical staging of ovarian cancer

Surgical staging of ovarian cancer is a crucial step in determining the prognosis and appropriate treatment plan for patients with ovarian cancer. It involves a thorough surgical exploration of the abdomen and pelvis to determine the extent and spread of the disease (25). The surgical procedure typically includes a total hysterectomy, removal of both ovaries and fallopian tubes, and removal of as much of the tumor as possible (25). Lymph nodes and other tissues in the abdominal cavity are also examined to determine if the cancer has spread. The stage of the ovarian cancer is then determined based on the extent of the disease found during surgery (26). The surgical staging system commonly used is the International Federation of Gynecology and Obstetrics (FIGO) staging system. The FIGO staging system classifies ovarian cancer into four stages (I-IV) based on the extent of the cancer at the time of surgery (7). The staging system is critical in determining the prognosis and appropriate treatment plan for patients with ovarian cancer, and accurate staging requires a comprehensive surgical evaluation. In this study, the surgical findings of the patients with ovarian cancer will be recorded to compare the CT and surgical staging and determine the accuracy of CT scans in detecting and staging ovarian cancer.

CHAPTER TWO

2.0 METHODOLOGY

2.1 Study design

The study was cross-sectional retrospective hospital-based study using secondary data.

2.2 Study setting

The study was conducted at Muhimbili National Hospital, This is the tertiary hospital receiving referral cases from almost all districts and regional hospitals in the country. The hospital has an adequate number of specialists and medical officers working in all departments. The hospital has a central laboratory serving all departments. Muhimbili National Hospital has a radiology department that is well equipped with advanced imaging technology; 3T MRI, 128 slice CT-Scan, X ray and ultrasounds. The department has more than 10 radiologists, radiology residents, a number of sonographers and radiographers working around the clock. The hospital has a reliable Radiology Information System (RIS) and Hospital Information System (HIS) software for recording patient's information that can be accessed through hospital computers.

2.3 Study population

The study was carried out among patients who were confirmed to have ovarian cancer who did CT scan and managed by surgery from January 2022 to January 2024 at Muhimbili National Hospital.

2.3 Sample size estimation

Sample size estimation for this study was done using Yamane's principle. From MNH department of gynaecology it is estimated that around 48 patients have been surgically staged for ovarian cancer for two years from 2022 to 2024. Considering the low number of patients' attendance, Yamane's principle will be ideal for estimating the sample size.

$$n = N / (1 + N (e^2))$$

Where:

n: is the estimated sample size

N: is the population size

e: is the desired level of precision (expressed as a proportion or decimal)

Therefore, in this study, N = 48 (population size), e = 0.05 (desired level of precision), and CI = 0.95 (95% confidence interval).

n = 48 / (1 + 48(0.05^2))

n = 48 / (1 + 48(0.0025))

n = 48 / (1 + 0.12)

n = 48 / 1.12

n ≈ 42.86

Therefore a minimum of 43 participant's records were included in the study.

2.4 Inclusion and Exclusion criteria

2.4.1 Inclusion Criteria

Patients with confirmed ovarian cancer who imaging was performed not more than four weeks before surgery, and with complete surgical reports and CT-Scan images.

2.4.2 Exclusion criteria

Patients with ovarian cancer who missed one of the staging procedure and those with incomplete medical records.

2.5 Sampling procedures

The sampling process for this study was consist of two stages. In the first stage, data filtering was conducted using the JEEVA system to identify all available medical records that meet the inclusion criteria specified for the study. This initial filtering stage was aiming to retrieve a pool of eligible records for further consideration.

In the second stage, a random selection method was employed to choose the required number of records from the pool obtained in stage one. To accomplish this, the hospital numbers associated with the eligible records was entered into MS Excel. The randomization process was conducted using MS Excel's functions to generate a random list of 43 records, which forms the final sample for the study.

2.6 Data collection tools and methods

A self-made checklist was used to guide data collection from the medical records. The checklist had four main parts. Part one; Demographic characteristics including; age, education level, tribe, occupation and residential. Part two of the checklist collected information on the clinical presentation recorded during the time of hospitalization, this includes abdominal pain, swelling or fullness, weight loss, pelvic discomfort and back pain. Part three of the checklist extracted information on the CT-Scan patterns which includes ovarian mass or masses, ascites, peritoneal or omental implants, bowel or urinary bladder extension, local or regional lymph nodes and lung, liver or spleen involvement and then staging was done as per reviewed imaging findings. Lastly, part four extracted information on surgical findings which includes ovarian mass or masses, ascites, peritonea or omental implants, bowel or urinary bladder extension, local or regional lymph nodes and lung, liver or spleen involvement and then surgical staging was done according to the findings. Data collection was done using Open Data Kit (ODK) data collection software, in which the checklist was coded and deployed on mobile phones and tablets. Data collection was done by principal investigator.

2.6.1 Image reinterpretation and reporting

In this study, images required for analysis were obtained from the CLEARCANVAS system and reinterpreted by the principal investigator and two blinded radiologists, each with over 7 years of experience. All images were done by using 128 slice Siemens CT scanner, axial images with 2mm thickness and reconstructed images with 1.5mm thickness. The radiologists were unaware of both the CT report from Jeeva and the results from the other radiologist, ensuring unbiased interpretation. Consensus results were recorded in the checklist tool after independent interpretation, with any ambiguous findings openly discussed among the radiologists and the principal investigator. Surgical

findings were subsequently reviewed by the principal investigator, aided by a gynecology oncologist and gynecology residents, for staging according to observed findings and histopathological results. This rigorous approach enabled a comprehensive evaluation of both imaging and surgical data, facilitating a robust comparison between CT-Scan staging and surgical staging of ovarian cancer.

2.7 Study variables

Independent variables: Independent variables included all demographic variables, clinical presentations, cancer histological subtypes, CT findings and surgical findings.

Dependent variable: Ovarian cancer stage by CT scan and surgery.

CT scan patterns and staging: This variable refers to the patterns and staging of ovarian cancer as identified by CT scans during hospitalization. The patterns and staging of ovarian cancer on CT scans was compared to the surgical staging of ovarian cancer to determine the accuracy of CT scans in staging ovarian cancer.

The diagnostic efficacy of the CT-Scan in ovarian cancer staging, was estimated by comparison of the results by CT-Scan and the results from surgical staging. The CT-Scan results accuracy, Positive predictive, Negative predictive value, sensitivity and specify were calculated basing on the alignment between the CT-Scan and Surgical findings.

2.8 Data management and analysis

Collected data was entered, edited, cleaned, and analysed using Statistical Package for Social Sciences (SPSS) version 27.

Descriptive statistics was used to summarize the data for the socio-demographic characteristics of the study participants. Frequencies and percentages was used to present categorical variables such as age groups, education levels, and residence. The central tendency and measures of variability such as mean, median, standard deviation, and range was used for continuous variables such as age.

Descriptive statistics was used to summarize the data for CT findings of the study participants. Frequencies and percentages was used to present the patterns and characteristics of CT findings, such as presence of mass local and distant metastases.

Descriptive statistics was used to summarize the data for surgical findings of the study participants. Frequencies and percentages was used to present the characteristics of surgical findings, such as mass, pelvic or distant metastases.

Cross tabulation and Chi-Square test was used to explore the relationship between the CT and surgical staging of ovarian cancer. The expected outcome is a statistically significant relationship between the two staging methods, indicating a high level of agreement between the two methods. The statistical significance was set at a p-value of less than 0.05.

Chi-Square test was used to determine the sensitivity, specificity and accuracy in each

Disease stage which is calculated as described in table below.

Demonstrating the basis for deriving sensitivity, specificity, accuracy, positive and negative predictive values

METRIC	**FORMULA**	**DESCRIPTION**
Accuracy	TP+TN/TP+TN+FP+FN	Proportion of correct prediction (Both true positives and true negatives).
Sensitivity	TP/TP+FN	Ability of CT to correctly stage the disease (true positives)
Specificity	TN/TN+FP	Ability of the CT to correctly negate the stage (give specific upper or lower stage)
Positive predictive value	TP/TP+FP	Proportion of true CT stage that are true in gold standard surgery
Negative predictive value	TN/TN+FN	Proportion of negative stage that are negative in surgery

The true positives (TP) and true negatives (TN) were derived from cases where the CT-Scan staging correctly matched the surgical staging. False positives (FP) were cases where CT-Scan suggested a higher or lower stage than confirmed by surgery same as false negatives (FN).

2.9 Reliability and validity issues

To ensure the validity of the study, the data collection tool, including the ODK software underwent rigorous testing and calibration to accurately capture all required information. Verified medical records with complete information was included, while incomplete records was excluded.

To ensure reliability, the data collection tools were administered through the ODK system, which reduces the potential for data entry queries and errors. Additionally, the study followed a standardized data collection protocol, and the same tools were used for all participants. Any missing data was identified and addressed promptly to ensure that the data is as complete and accurate as possible.

Furthermore, to ensure the accuracy of the CT scan findings, the scans were read and interpreted by a radiologist who is experienced in ovarian cancer diagnosis. The surgical staging was performed by a team of experienced gynaecologic oncologists and residents, to ensure that the staging is consistent and reliable. Finally, the study was employ a pilot test to evaluate the reliability and validity of the data collection tools and procedures, and necessary adjustments was made accordingly.

2.10 Ethical considerations

The proposal was presented to the MUHAS Radiology and Imaging Department. The MUHAS Institution Review Board (IRB) was providing the ethical clearance (MUHAS-REC-06-2023-1761) and submitted to the Muhimbili National Hospital administration and Radiology department for approval of data collection. Simultaneously, access to medical records in the JEEVA system and archived medical records was requested. Because this is a retrospective study, a waiver of consent was given from IRB and filed accordingly. All medical records used for the study was assigned identification numbers for research purposes only and was required solely for the study's intended purpose.

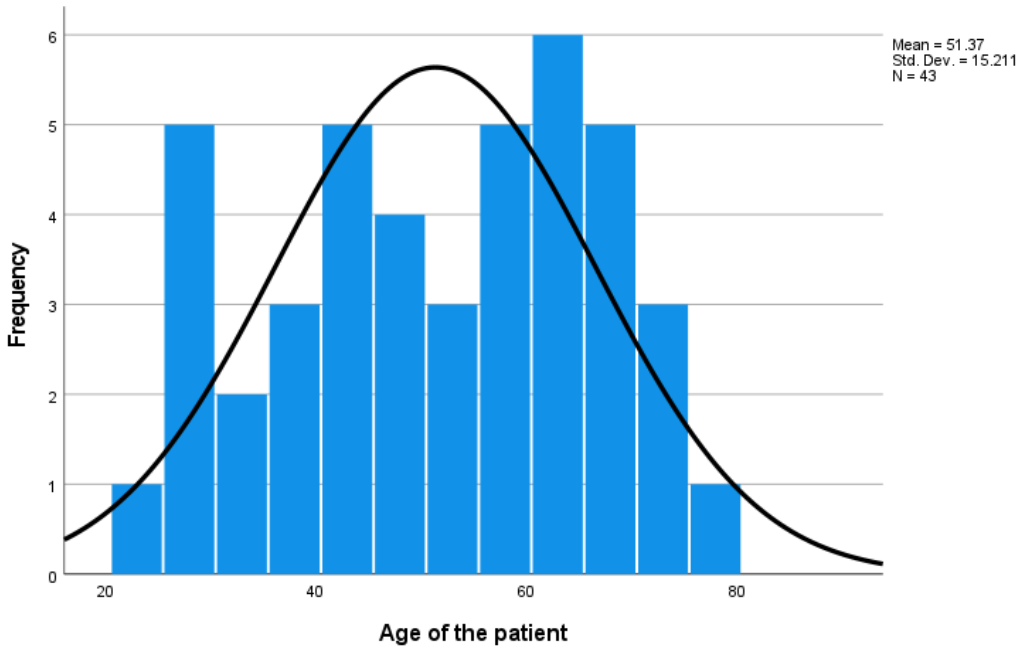
CHAPTER THREE

3.0 RESULTS

3.1 Social demographic characteristics of the patients

The study involved 43 female patients diagnosed with ovarian cancer, median age was 54yrs with a range of 55yrs spanning from 23 to 78yrs (figure 2).

Figure 2: Age distribution of the participants with ovarian cancer attended MNH between January 2022 to January 2024 (n=43).



Majority of the participants completed primary education (65.10%), those who attended college were small but still notable proportion, contributing to 18.6%. Majority of the participants were unemployed (83.70%), while small proportion were employed (14.00%) (Table 1)

Table 1: Educational and Employment status among the participants with Ovarian cancer attending MNH from January 2022 to January 2024 (n=43).

Demographic characteristics		
Educational level	**Frequency**	**Percentage**
Collage/University	8	18.60%
Secondary Education	7	16.30%
Primary education	28	65.10%
Employment status		
Employed	6	14.00%
Unemployed	36	83.70%
Retired	1	2.30%

3.2 Clinical presentation

In the study population all participants experienced abdominal pain or swelling (100.0%), followed by abdominal fullness (88.4%), and smaller fraction (11.6%) experienced back pain (Table 2).

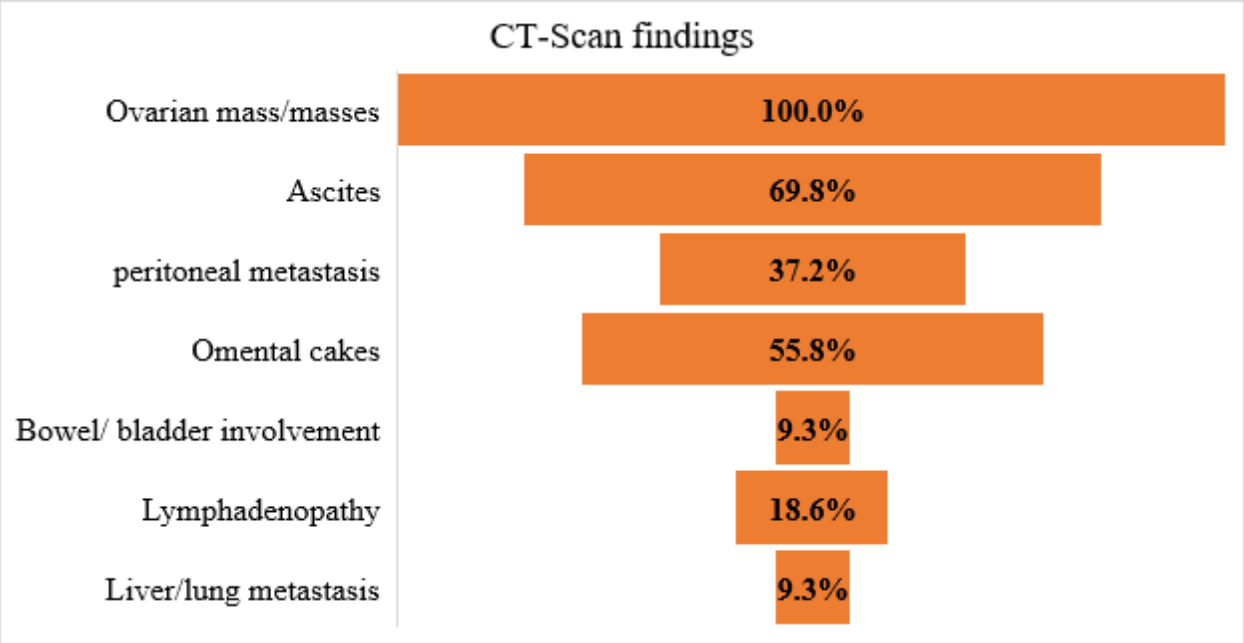
Table 2: Clinical presentation distribution for participants with ovarian cancer attending MNH from January 2022 to January 2024 (n=43).

Clinical presentations	**Frequency**	**Percentage**
Abdominal pain/swelling	43	100.0%
Abdominal fullness	38	88.4%
Weight loss	25	58.1%
Pelvic discomfort	28	65.1%
Back pain	5	11.6%

3.3 CT-Scan findings

In the study population, all participants had ovarian masses followed by ascites (69.8%), and omental caking (55.8%). Bowel/bladder involvement and liver/lung metastasis appear in least proportion (9.3%) by each. (Figure 3)

Figure 3: CT scan findings among the participants with ovarian cancer attending MNH from January 2022 to January 2024 (n=43).

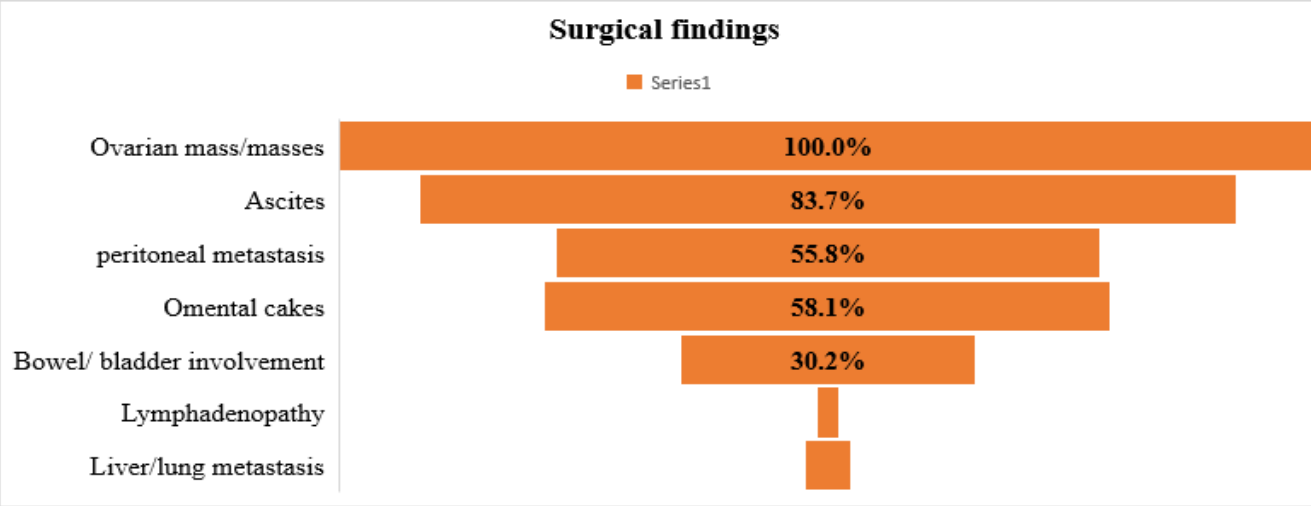


3.4 Surgical procedures performed and findings

3.4.1 Surgical findings in the study population

In the study population, all participants presented with ovarian mass/masses (100.0%). Moreover, a significant proportion showed ascites (83.7%), omental cakes (58.1%) and peritoneal metastasis (55.8%). Lymphadenopathy and liver/lung metastasis presented in minority of cases representing 2.3% and 4.7% respectively of the study population (figure 4)

Figure 4: Surgical findings among the participants with ovarian cancer attending MNH from January 2022 to January 2024 (n=43).



3.4.2 Histological subtypes in surgical biopsy

In the study population majority of the study participants 88.4% were presented with epithelial histological subtype of the malignancy, most of them being serous cystadenocarcinoma 67.44% and minority show non epithelial subtypes 11.6% (Table 3)

Table 3: Histological subtypes among the participants with ovarian cancer attending MNH from January 2022 to January 2024 (n=43).

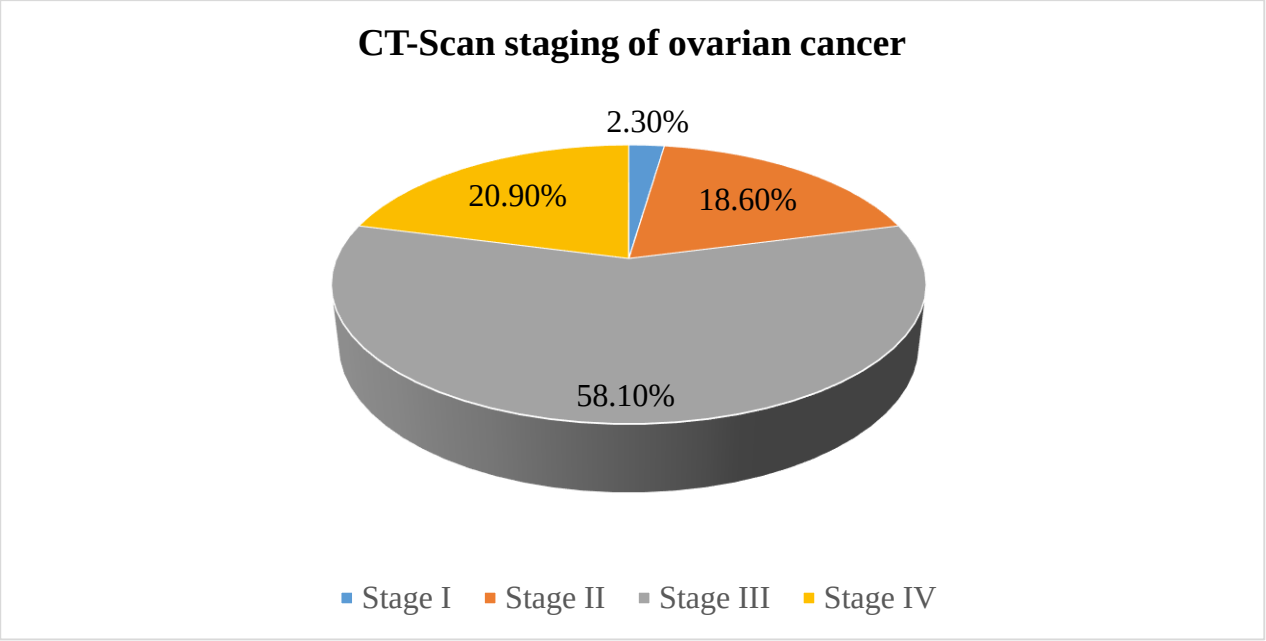
Epithelial origin	**Frequency**	**Percentage (%)**
-Serous cystadenocarcinoma	29	67.4
-Mucinous cystadenocarcinoma	07	16.3
-Undifferentiated carcinoma	02	04.7
Non epithelial origin		
-Germ cell tumor	02	04.7
-Sex cord (Malignant granulosa)	03	06.9
Total	43	100

3.5 CT-Scan and Surgical staging of ovarian cancer among patients with ovarian cancer attending MNH.

3.5.1 CT scan staging

The CT staging of ovarian cancer in this study show that, majority of patient presented with advanced disease stage where by 58.1% presented with stage III, followed by stage IV 20.9% and minority presented with lower stages, II and I accounting for 18.6% and 2.3% respectively (figure 5).

Figure 5: CT scan staging among the participants with ovarian cancer attending MNH from January 2022 to January 2024 (n=43).



3.5.1.1 CT scan sub-staging

In the CT sub-staging of ovarian cancer, 1 participant was classified as IA (2.30%), 6 participants as IIA (14.00%), and 2 participants as IIB (4.70%). Additionally 3 individuals were classified as IIIA (7.0%). The majority of participants, 9 individuals, were categorized as IIIB (20.90%), and 13 participants were classified as IIIC (30.20%). Furthermore, 3 participants were categorized as IVA (7.00%), and 6 participants fell into IVB (14.00%) (Table 4).

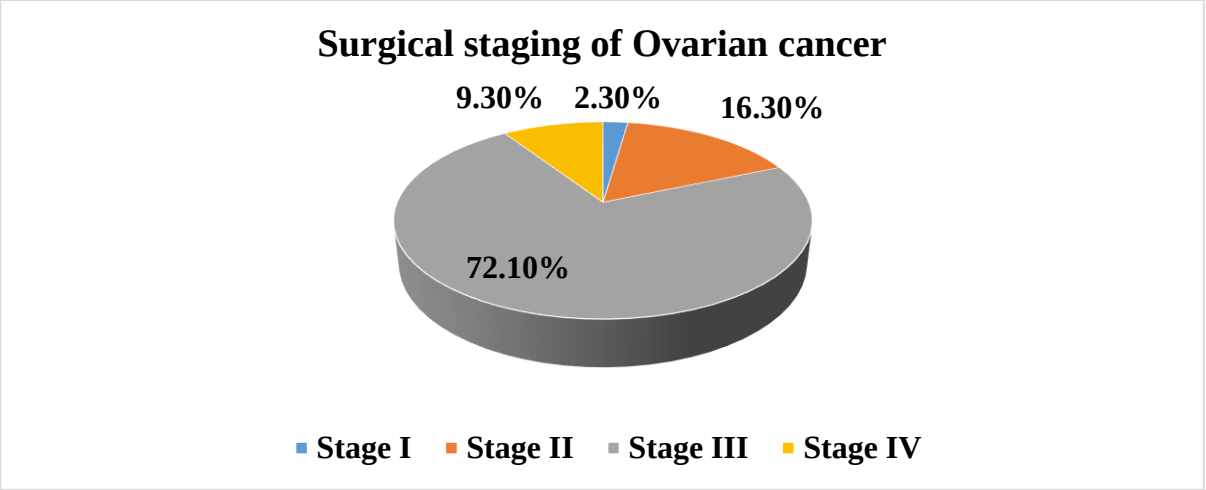
Table 4: CT SCAN sub staging among the participants with ovarian cancer attending MNH from January 2022 to January 2024 (n=43).

CT-SUB STAGE		
Sub-stage	Frequency	Percentage
IA	1	2.30%
IIA	6	14.00%
IIB	2	4.70%
IIIA	3	7.0%
IIIB	9	20.90%
IIIC	13	30.20%
IVA	3	7.00%
IVB	6	14.00%

3.5.2 Surgical staging

In the surgical staging among the study population, the majority of participants presented with advanced disease stage whereby 72.10% presented with stage III, followed by Stage II 16.30%. Moreover 9.30% presented with stage IV and only 2.3% presented with stage I (figure 6).

Figure 6: Surgical staging among the participants with ovarian cancer attending MNH from January 2022 to January 2024 (n=43).



3.5.2.1 Surgical sub staging of ovarian cancer

In the surgical sub-staging of ovarian cancer, the most common sub-stage was IIIC, with 19 participants, representing 44.20% of the study population. Following this, IIIB had 9 participants, accounting for 20.90%. IIA and IIB each had 4 participants, constituting

9.30% and 7.00% respectively. Similarly, IIIA and IVB each had 3 participants, both accounting for 7.00% of the study population. Lastly, IA had 1 participant, representing 2.30% (Table 5).

Table 5: Surgical sub staging among the participants with ovarian cancer attending MNH from January 2022 to January 2024(n=43).

SURGICAL SUB STAGE		
Sub-stage	Frequency	Percentage
IA	1	2.30%
IIA	4	9.30%
IIB	3	7.00%
IIIA	3	7.00%
IIIB	9	20.90%
IIIC	19	44.20%
IVB	4	9.30%

3.6 The comparison of CT-Scan and surgical staging

The overall CT scan sensitivity and PPV was 97.4% and 81.1% respectively, generally the findings demonstrate a significant association between CT and surgical staging, with a p-value of < 0.001, CT scan correctly stage 33 patients out of 34 (97.1%), however CT data incorrectly understaged disease in 1 patient (2.9%) (Table 6).

Table 6: Comparison of CT-Scan and surgical staging among the participants with ovarian cancer attending MNH from January 2022 to January 2024 (n=43)

		SURGICAL STAGING (FREQ AND %)						
CT STAGING (FREQ AND %)		STAGE I	STAGE II	STAGE III	STAGE IV	TOTAL	CHI-SQUARE	P-VALUE
	STAGE I	1 (100%)	0 (0%)	0 (0%)	0(0%)	1 (100%)	95.44	0.000
	STAGE II	0(0%)	7(87.5%)	1(12.5%)	0(0%)	8 (100%)		
	STAGE III	0(0%)	0(0%)	25(100%)	0(0%)	25(100%)		
	STAGE IV	0(0%)	0(0%)	5(55.6%)	4(44.4%)	9 (100%)		
TOTAL		1(2.3%)	7(16.3%)	3(72.1%)	4 (9.3%)	43 (100%)		
FREQ = FREQUENCY % = PERCENTAGE								

3.7 The Sensitivity, Specificity and staging accuracy of CT scan versus surgical pathological in patients with ovarian

CT scan sensitivity, specificity and accuracy was 100% for stage I, 100%, 97.2% and 97.7% in stage II and 80.6%, 100%, and 86.1% in stage III respectively. In both stages Chi square test showed significant association with p value <0.05 as shown in table 7

Table 7: Distribution of Sensitivity, Specificity and Diagnostic Accuracy of CT scan in each stage among the participants with ovarian cancer attending MNH between January 2022 and January 2024(n=43)

OVARIAN CT STAGING	**SURGICAL OVARIAN STAGING**				**DIAGNOSTIC EFFICACY**					
	TP	FP	TN	FN	Sensitivity	Specificity	PPV	NPV	Accuracy	p-value
Stage I	1	0	42	0	100	100	100	100	100	0.023
Stage II	7	1	35	0	100	97.2	87.5	100	97.7	0.001
Stage III	25	0	12	6	80.6	100	100	66.7	86.1	0.001

CHAPTER FOUR

4.0 DISCUSSION, STUDY LIMITATION AND MITIGATION

4.1 Discussion

This study aimed at investigating the comparison between CT-Scan and surgical findings with reference to staging of ovarian cancer among women attending Muhimbili National hospital. CT-Scan, can be reliable in providing quick results in a less invasive manner, which can be very advantageous to the patient.

In our study we found that, the average age of the participants was 51 years, which is slightly different from a previous study done in the United States, which indicated an average age of 60 years (12). Furthermore, another study done in China (10), has indicated lower average age of patients with ovarian cancer, highlighting 40 years to be the average age. This finding indicates, that ovarian cancer may occur in lower ages, which might be caused by other factors like alcohol consumption and tobacco usage at early ages. We also found out that, ovarian cancer was more frequent in patients who have primary education, compared those who have only completed their secondary or college education. There is no clear literature indicating the relationship between ovarian cancer and education level, however in our observation we noted lower frequencies in people with higher education, this could be influenced by access to health care and knowledge regarding ovarian cancer compared to other groups. Furthermore, our observation could be influence by sample size and time of data collection.

We also found out that, Abdominal pain/swelling was the most common clinical presentation, followed by abdominal fullness, weight loss and pelvis discomfort. This finding is quite similar with the previous studies (15,17), which indicated the manifestation of the same clinical symptoms among patients with ovarian cancer. The similarities might be contributed by alignment in research methods and similar sample size include both in current and previous studies. On the other hand, back pain was the least presented symptom among the patients with ovarian cancer as this is usually occurs due to severe pressure effects from the pelvic and abdomen in advanced stage.

CT-Scan findings presented ovarian mass/masses to be the most common finding in the study population, while the liver/lung metastasis and bowel/bladder involvement to be less common. This finding is quite similar with previous studies (20,21) which indicated ovarian mass to be the most prominent finding compared to other findings like ascites and omental cakes. Further, we found out that, peritoneal metastasis to be in more than one third of the study population. This observation is quite similar to previous studies, which found several metastasis including peritoneal to be common. This observation might be contributed by the fact that, many patients came for treatment when the cancer is at late stages (stage III and IV). We also investigated the surgical findings, in which we found that almost parallel findings with CT-Scan observations. In this course, we have found that all patients had ovarian mass/masses, ascites and peritoneal implants, ascites was more prevalent compared to the CT-Scan this can be contributed by the time factor between performance of CT scan and surgical intervention. This finding is quite similar to previous studies (7,25), which indicates that ovarian mass/masses is the dominant finding in patients with ovarian cancer, followed by ascites and peritoneal and omental implants. This observation is compatible with previous studies since many patients in our study population presented in advanced disease stages.

We also investigated the association between CT-Scan and surgical findings to access the strength of CT-Scan in staging ovarian cancer. In this course we observed that, there is a significant association between CT-Scan and surgical findings in ovarian cancer staging. CT-Scan have proved to be very efficient in staging of ovarian cancer in our preliminary observations (p value= 0.000). This observation is in line with previous studies which highlighted the vast ability of CT-scan in detecting and staging ovarian cancer (20,27). The similarities might be contributed by sample size selection and methodologies applied both in current and previous studies as both studies majority of participants were patients with late-stage ovarian cancer due to the same reason that most patients attend health care facilities when they have obvious symptoms, which usually appear at late disease stages. Some studies (22,28) have quite slightly different results, in which CT-Scan was found to have a slightly weaker association with respect of surgical findings. The previous studies included patients with early stages of ovarian cancer, a step which could have contributed to the observed variations.

For the diagnostic value of CT-Scan in staging ovarian cancer, we compared the results obtain from CT-Scan and those obtained from surgical staging. We found out that, CT-scan presented with 100% sensitivity, specificity, and accuracy, negative and Positive predictive values in Stage I detection and staging. In the early stages of ovarian cancer, there are fewer complications present, making it easier to interpret imaging results compared to more advanced stages. This indicate that, CT-Scan can be reliable in detecting and staging ovarian cancer in early stages, marking a promising future to incorporate CT-Scan in first line diagnosis. This step could be more advantageous to the patients since CT-Scan is less invasive and has a short turnaround time to obtain the results. The same results have been observed in previous studies (15,21), in which CT-Scan presented with high accuracy, specificity and sensitivity.

In Stage II, where tumours were typically localized within the pelvis, CT scans demonstrated excellent sensitivity and specificity due to the relative ease of detecting the lesions. However, as ovarian cancer advanced to Stage III with spread beyond the pelvis, CT scan sensitivity significantly decreased. This was contributed by the increase in complexity of disease involvement and the potential for small metastatic areas to be covered by surrounding structures or tissue densities, leading to a higher false negative rate and lower negative predictive value. This has been in line with previous studies (24,29) that reported the same findings in advanced stages of ovarian cancer.

In Stage IV CT-scan showed a sensitivity of 100% which indicates the ability of CT scans to detect Stage IV tumours reliably, capturing the presence of widespread metastasis throughout the abdomen and beyond. However, the lower specificity (87.2%) suggests a higher rate of false positives, which could be due to the challenge of distinguishing between benign and malignant lesions in advanced disease stages. This leads to a lower positive predictive value (PPV) of 44.4%, indicating that a larger of positive findings on CT scans may not correspond to true positive cases. On the other hand, the high negative predictive value (NPV) of 100% showing the reliability of CT scans in ruling out Stage IV disease when no abnormalities are detected. The overall accuracy of 88.4% reflects the balance between sensitivity and specificity in diagnosing advanced-stage ovarian cancer using CT scan staging, emphasizing the importance of

integrating clinical judgment with imaging findings to guide treatment decisions effectively. There is no clear indication regarding such a comparison in the literature, despite the fact that some previous studies (24,28) have highlighted decreased accuracy with respect to advanced ovarian cancer.

4.2 Study Limitation

This retrospective cross-sectional study offers a static snapshot of data at a singular time point, thus constraining the capacity to monitor temporal changes.

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

Based on this study's findings, CT scans demonstrate high sensitivity, specificity, and accuracy in pre-surgical staging of ovarian cancer, particularly in early stages, aligning closely with surgical and pathological outcomes. The ability of CT scans to accurately identify ovarian masses, ascites, and omental caking highlights their critical role in facilitating precise treatment planning prior to laparotomy. These results suggest that integrating CT scans into routine preoperative assessments can significantly enhance early detection and treatment strategies for ovarian cancer, ultimately improving patient outcomes, especially in resource-limited settings.

5.2 Recommendations

1. Based on the study's findings, it is recommended that staging CT scans be performed for every patient with suspected ovarian cancer prior to intervention, ensuring comprehensive preoperative evaluation and accurate disease staging. The high sensitivity, specificity, and accuracy of CT scans in identifying ovarian masses and peritoneal metastasis emphasize their importance as a reliable diagnostic tool.

2. The integration of CT scans into the diagnostic pathway for ovarian cancer holds promise for enhancing early detection, guiding treatment decisions, and ultimately improving patient care. And thereafter, further research focusing on the diagnostic power of CT scans with reference to specific local and distant disease extension in ovarian cancer is recommended to advance our understanding and optimize clinical practice.

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APPENDICES:

APPENDIX I: CONTRASTED CT IMAGES OF THE ABDOMEN AND PELVIC.

IMAGE I.

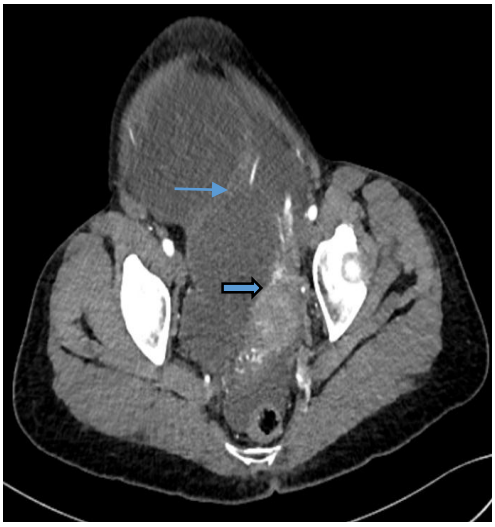


IMAGE A



IMAGE B

Image A and B (Contrasted axial and sagittal reformat CT scans respectively) show huge cystic left ovarian mass with enhancing septation (*arrow*), the uterus is inseparable from the mass (*block arrow*), and mild ascites is also seen, well appreciated in image B (*curved arrow*). This was a case of serous cystadenocarcinoma in 42years old with FIGO stage IIA, Which was correctly staged by CT and Surgery.

IMAGE II:

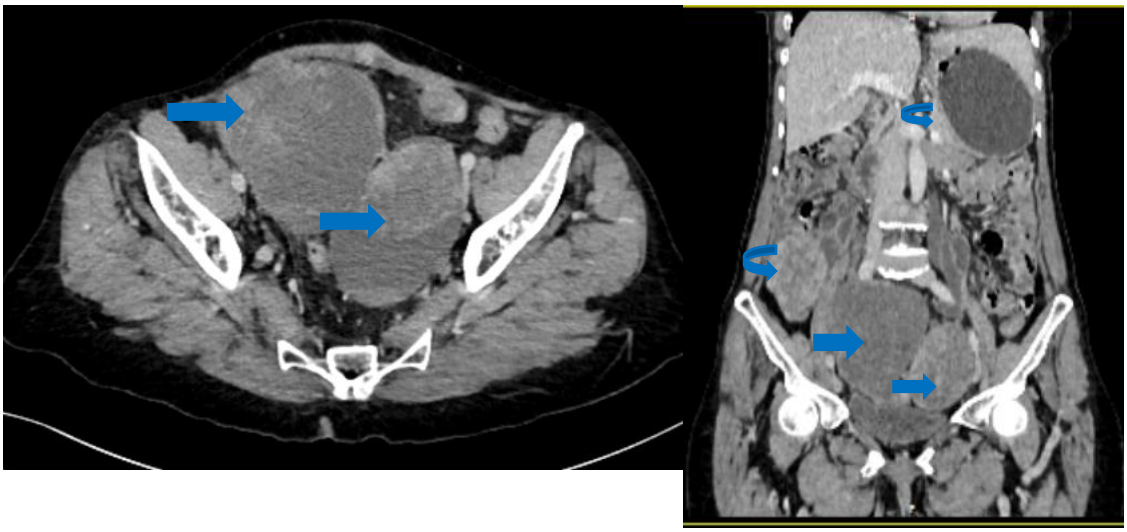


IMAGE A **IMAGE B**

In image II: Images A and B (Contrasted axial and coronal reformat CT scans respectively) show bilateral ovarian masses with enhancing soft tissue components (*block arrows*), extensive peritoneal implants were also noted in the pelvic, lesser sac and right paracolic gutter (*curved block arrows*). This was a case of bilateral serous cystadenocarcinoma in 71years old FIGO stage IIIC, which was correctly staged.

APPENDIX II: FIGO STAGING OF OVARIAN CANCER 2014

STAGE I Tumour confined to ovaries	1A: Tumor limited to 1 ovary, capsule intact, no tumor on surface, negative washings
	1B: Tumor involves both ovaries otherwise like IA.
	1C: Tumor limited to 1 or both ovaries i. IC1: Surgical spill ii. IC2: Capsule rupture before surgery or tumor on ovarian surface iii. IC3: Malignant cells in the ascites or peritoneal washings
STAGE II Tumor involves 1 or both ovaries with pelvic extension (below the pelvic brim) or primary peritoneal cancer	11A: Extension and/or implant on uterus and/or Fallopian tubes
	IIB: Extension to other pelvic intraperitoneal tissues
STAGE III Tumor involves 1 or both ovaries with cytologically or histologically confirmed spread to the peritoneum outside the pelvis and/or metastasis to the retroperitoneal lymph nodes	IIIA: Positive retroperitoneal lymph nodes and /or microscopic metastasis beyond the pelvis -IIIA1: Positive retroperitoneal lymph nodes only (IIIA1(i) Metastasis ≤ 10 mm IIIA1(ii) Metastasis > 10 mm) -IIIA2: Microscopic, extrapelvic (above the brim) peritoneal involvement ± positive retroperitoneal lymph nodes
	IIIB: Macroscopic, extrapelvic, peritoneal metastasis ≤ 2 cm ± positive retroperitoneal lymph nodes. Includes extension to capsule of liver/spleen.
	IIIC: Macroscopic, extrapelvic, peritoneal metastasis > 2 cm ± positive retroperitoneal lymph nodes. Includes extension to capsule of liver/spleen
STAGE IV Distant metastasis excluding peritoneal metastasis	IVA: Pleural effusion with positive cytology
	VB: Hepatic and/or splenic parenchymal metastasis, metastasis to extraabdominal organs (including inguinal lymph nodes and lymph nodes outside of the abdominal cavity

APPENDIX III: CHECKLIST

1. **Socio-demographic information:**

a) Age: _____

b) Residential Area: _____

c) Education level: _____

d) Marital status: _____

e) Occupation: _____

f) tribe: _____

2. **Clinical presentations:**

a) Abdominal pain or swelling: [ ] Yes [ ] No

b) Abdominal fullness: [ ] Yes [ ] No

c) Weight loss: [ ] Yes [ ] No

d) Pelvic discomfort: [ ] Yes [ ] No

e) Back pain: [ ] Yes [ ] No

f) Other symptoms: _____

3. **CT findings:**

a) Date of CT scan: _____

b) Results of CT scan: _____

c) [ ] Ovarian mass/masses

d) [ ] Ascites

e) [ ] Peritoneal metastasis

f) [ ] Omental cake

g) [ ] Bowel or bladder involvement

h) [ ] Lymphadenopathy

i) [ ] Liver or lung metastasis

j) [ ] Other (please specify): _____

k) Any suspicious lesions or masses identified?: [ ] Yes [ ] No

l) Any other relevant information: _____

4. Surgical findings:

a) Date of surgery: _____

b) Type of surgery performed: _____

c) Results of surgery: _____

d) [ ] Ovarian mass/masses

e) [ ] Ascites

f) [ ] Peritoneal metastasis

g) [ ] Omental cake

h) [ ] Bowel or bladder involvement

i) [ ] Lymphadenopathy

j) [ ] Liver or lung metastasis

k) [ ] Other (please specify): _____

l) Any suspicious lesions or masses identified: [ ] Yes [ ] No

m) Any other relevant information: _____

5. CT and surgical staging comparison:

a) CT stage: _____

b) Surgical stage: _____

c) Any discrepancies between CT and surgical staging: [ ] Yes [ ] No

d) Any other relevant information: _____

APPENDIX IV: ETHICAL CLEARANCE

UNITED REPUBLIC OF TANZANIA

MINISTRY OF EDUCATION, SCIENCE AND TECHNOLOGY

MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES

OFFICE OF THE DIRECTOR – RESEARCH, PUBLICATIONS AND INNOVATION

Ref. No.DA.282/298/01.C/1761 Date: 28/06/2023

MUHAS-REC-06-2023-1761
DORCAS MICHAEL MKANJE
SCHOOL OF MEDICINE
MUHAS

RE: APPROVAL FOR ETHICAL CLEARANCE FOR A STUDY TITLED: CORRELATION BETWEEN CT SCAN AND SURGICAL STAGING OF OVARIAN CANCER IN WOMEN ATTENDING MUHIMBILI NATIONAL HOSPITAL (MNH).

Reference is made to the above heading,

I am pleased to inform you that the Chairperson has on behalf of the University Senate, approved ethical clearance of the above-mentioned study, on recommendations of the Senate Research and Publications Committee meeting accordance with MUHAS research policy and Tanzania regulations governing human and animal subjects research.

APPROVAL DATE: 28/06/2023
EXPIRATION DATE OF APPROVAL: 28/06/2024

STUDY DESCRIPTION:
Purpose:
The aim of this study is to determine the correlation between radiologic and surgical staging of ovarian cancer among women attending Muhimbili National Hospital.
The approved protocol and procedures for this study is attached and stamped with this letter, and can be found in the link provided:
https://irb.muhas.ac.tz/storage/Certificates/Certificate%20-%2014681.pdf and in the MUHAS archives.

The PI is required to:

1. Submit bi-annual progress reports and final report upon completion of the study.
2. Report to the IRB any unanticipated problem involving risks to subjects or others including adverse events where applicable.
3. Apply for renewal of approval of ethical clearance one (1) month prior its expiration if the study is not completed at the end of this ethical approval. You may not continue with any research activity beyond the expiration date without the approval of the IRB. Failure to receive approval for continuation before the expiration date will result in automatic termination of the approval for this study on the expiration date.
4. Obtain IRB amendment (s) approval for any changes to any aspect of this study before they can be implemented.
5. Data security is ultimately the responsibility of the investigator.
6. Apply for and obtain data transfer agreement (DTA) from NIMR if data will be transferred to a foreign country.
7. Apply for and obtain material transfer agreement (MTA) from NIMR, if research materials (samples) will be shipped to a foreign country,
8. Any researcher, who contravenes or fail to comply with these conditions, shall be guilty of an offence and shall be liable on conviction to a fine as per NIMR Act No. 23 of 1979, PART III section 10 (2)
9. The PI is required to ensure that the findings of the study are disseminated to relevant stake holders.
10. PI is required to be versed with necessary laws and regulatory policies that govern research in Tanzania. Some guidance is available on our website https://drp.muhas.ac.tz/.

Dr. Nahya Salim Masoud,

Chairperson, MUHAS Research and Ethics Committee



APPENDIX V: PERMISSION LETTER

THE UNITED REPUBLIC OF TANZANIA

MINISTRY OF HEALTH

MUHIMBILI NATIONAL HOSPITAL

In reply please quote;

Ref. No.: MNH/CRTCU/Perm/2023/444 **Date: 17th July, 2023**

Head of Department,

- Imaging Diagnostic Section
- Medical Records

Muhimbili National Hospital

RE: PERMISSION TO COLLECT DATA AT MNH.

Name of Student	**Dorcas Michael Mkanje**
Title	**"Correlation Between CT Scan and Surgical Staging of Ovarian Cancer in women Attending Muhimbili National Hospital".**
Institution	Muhimbili University of Health and Allied Sciences
Supervisors	Dr. Zuhura Nkrumbih (MUHAS)
Co - Supervisor	Dr. Flora Rwakatare (MNH)
Period	17th July, 2023 to 30th October, 2023

Approval has been granted to the above mentioned student to collect data at MNH. **A final study report should be lodged with Clinical Research, Training and Consultancy Unit.** Dissemination of study findings to MNH stakeholders shall be overseen by **Dr. Flora Rwakatare** (MNH) Co – supervisor.

Kindly ensure that the student abide to the ethical principles and other conditions of the research approval.

Sincerely,

Dr. Jessie Mbwambo
Head of Clinical Research, Training and Consultancy Unit

HEAD, TEACHING, RESEARCH & CONSULTANCY UNIT P. O. Box 65000 DAR-ES-SALAAM MUHIMBILI NATIONAL HOSPITAL

c.c DCSS, DICT

c.c Dr. Flora Rwakatare

c.c **Dorcas Michael Mkanje**