

# Correlation between the Pre-Operative CT Scan Findings and Surgicopathological Staging of Ovarian Cancer in a Tertiary Care Hospital

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## Abstract

**Background:** Ovarian cancer is one of the most lethal gynecological cancers, with an age-standardized incidence rate of 3.0–11.4 per 100,000 women worldwide [1], and is commonly diagnosed at an advanced stage with poor survival outcomes. Accurate staging is essential for treatment planning, and CT is the recommended imaging modality for assessing the extent of ovarian malignancy and tumour resectability. The purpose of this study was to correlate pre-operative CT scan findings with surgicopathological staging in patients with ovarian cancer. **Methods:** This observational, cross-sectional study was conducted at the Department of Gynecological Oncology, National Institute of Cancer Research & Hospital (NICRH), Dhaka, Bangladesh, from January to December 2021. A total of 100 women with suspected ovarian cancer underwent pre-operative CT and surgery, with CT, per-operative, and histopathological findings compared according to the 2014 FIGO staging system. Data were analysed using SPSS version 23.0;  $p < 0.05$  was considered significant. **Results:** Among 100 patients, mean age was  $43.2 \pm 11.7$  years; most were aged 41–50 years (38, 38.0%), urban (66, 66.0%), and poor socioeconomic status (44, 44.0%). All had a lower abdominal lump (100, 100.0%), and anemia was present in 72 (72.0%). Most masses were unilateral (72, 72.0%) and solid (78, 78.0%). Stage IA predominated on CT (60, 60.0%), peroperative (42, 42.0%), and histopathological (41, 41.0%) staging. Papillary serous cystadenocarcinoma was most common (64, 64.0%). CT sensitivity was 100.0% for IA, IIIB, and IIIC. **Conclusion:** Pre-operative CT scan is a useful tool for staging ovarian cancer, although early-stage disease may be under-staged compared with surgicopathological assessment.

**Keywords:** Ovarian cancer, Computed tomography, pre-operative staging, Surgicopathological staging, FIGO staging.

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## INTRODUCTION

Ovarian cancer is one of the most lethal gynecological cancers and has a high mortality rate. The age-standardized incidence rate of ovarian cancer ranges from 3.0 to 11.4 per 100,000 women worldwide [1]. The outcome of ovarian cancer is influenced by factors such as increasing age, histopathological type, and tumour grade [2,3]. Ovarian cancers include surface epithelial tumours, which are the most common types of ovarian neoplasms. Although the etiology and natural history of ovarian cancer are not fully understood, investigations have identified conditions such as genetic predisposition and benign inflammatory diseases as contributing factors in the molecular mechanisms of carcinogenesis. Pathological studies have demonstrated differences in ovarian cancer according to histological type, with four representative types being serous, mucinous, endometrioid, and clear cell carcinomas. Because the ovarian surface is exposed to the peritoneal cavity, tumour cells may proliferate inward and spread into the peritoneal cavity following rupture of thin cyst walls, or grow outward in papillary form and become directly exposed to the peritoneal cavity [4,5].

Epithelial ovarian cancer is most commonly detected at an advanced stage, when the overall 5-year survival rate is approximately 20–30%. Early detection and accurate staging are associated with improved survival. Currently, there is no effective strategy for ovarian cancer screening, and women with persistent or progressive symptoms require further evaluation [6,7]. Cancer staging is a fundamental step in predicting patient outcomes and is essential for planning appropriate treatment [8,9]. The goal of imaging is to assist in differentiating malignant tumours from benign lesions and to determine the extent of ovarian malignancy. CT scan is the recommended imaging modality for staging ovarian cancer and provides clinically relevant information regarding the size of the primary tumour, the size and location of peritoneal implants, and lymph node involvement [10]. This information can also assist in assessing tumour resectability.

Previous studies have reported that pre-operative CT represents a valid tool for predicting ovarian cancer staging [8]. The overall accuracy of multidetector computed tomography (MDCT) in diagnosing malignant adnexal masses has been reported to be as high as 89% [9]. CT findings predictive of malignancy include papillary projections in cystic lesions, necrosis within solid masses, and peritoneal metastases [11]. CT is also frequently used for detecting persistent or recurrent ovarian carcinoma, advanced staging, and monitoring tumour response to therapy. However, CT has limitations in detecting small peritoneal metastases. For tumour implants larger than 1 cm, CT has demonstrated a sensitivity of 85–93% and specificity of 91–96%, whereas sensitivity decreases to 25–50% for implants measuring 1 cm or less [12,13].

CT is particularly useful in patients with large amounts of ascites, which is frequently encountered in women with ovarian cancer. It has also been used to predict the outcome of primary cytoreductive surgery in advanced ovarian cancer and to identify patients who may benefit from surgery, thereby reducing unnecessary surgical procedures [8,9,13]. Peritoneal thickening, peritoneal implants  $\geq 2$  cm, bowel mesentery involvement  $\geq 2$  cm, suprarenal para-aortic lymph nodes  $\geq 1$  cm, omental extension involving the spleen, stomach or lesser sac, pelvic sidewall involvement, and hydroureter have been reported to be strongly associated with poor surgical outcomes [14,15].

Therefore, accurate pre-operative assessment of the extent of ovarian cancer is important for appropriate staging and treatment planning. The present study aimed to correlate pre-operative CT scan findings with surgicopathological staging in patients with ovarian cancer.

### Objective

- To determine the correlation between pre-operative CT scan findings and surgicopathological staging of ovarian cancer.

## METHODOLOGY & MATERIALS

This observational, cross-sectional study was conducted at the Department of Gynecological Oncology, National Institute of Cancer Research & Hospital (NICRH), Dhaka, Bangladesh, between January 2021 and December 2021. A total of 100 women with clinically suspected ovarian cancer were included in the study and selected using a purposive sampling technique based on specific inclusion and exclusion criteria to assess the correlation between pre-operative CT scan findings and surgicopathological staging of ovarian cancer.

### Inclusion Criteria

- Patients with clinically suspected ovarian cancer who underwent CT scan of the abdomen and pelvis followed by surgery.
- Patients who provided written informed consent.

### Exclusion Criteria

- Patients with ovarian carcinoma who had received neoadjuvant chemotherapy (NACT).

### Operational Definitions and Staging

Ovarian cancer was defined as a malignant tumour arising from the ovary, including epithelial, germ cell, and stromal tumours. Ovarian cancer was staged according to the 2014 International Federation of Gynecology and Obstetrics (FIGO) staging system. Pre-operative CT findings were used to assess tumour laterality, tumour characteristics, ascites, peritoneal implants, omental involvement, loss of fat planes, liver

metastasis, and lymph node involvement. CT-based staging was categorized according to the corresponding FIGO stage based on the extent of tumour involvement.

### Data Collection

After fulfilling the eligibility criteria, participants were enrolled and assigned unique identification numbers. Relevant clinical information was collected through history taking, physical and abdominal-pelvic examination, ultrasonography, biochemical investigations, and serum tumour markers. CT scans of the abdomen and pelvis were evaluated for the extent of disease and FIGO staging. Per-operative findings, including tumour laterality and characteristics, ascites, peritoneal deposits, omental involvement, pelvic organ involvement, liver metastasis, and lymph node involvement, were recorded. Postoperative histopathological findings and surgicopathological FIGO staging were subsequently documented and compared with the pre-operative CT findings. Data were collected using a structured questionnaire and checked for completeness and errors before coding and analysis.

### Study Variables

Sociodemographic variables included age, residence, and monthly income. Independent variables included CT findings of tumour laterality, ascites, peritoneal implants, omental involvement, loss of fat

planes, liver metastasis, and lymph node metastasis. The dependent variable was surgicopathological FIGO staging of ovarian cancer.

### Statistical Analysis

Data were analysed using SPSS version 23.0 (SPSS Inc., Chicago, IL, USA) and Microsoft Excel. Continuous variables were expressed as mean  $\pm$  standard deviation, while categorical variables were presented as frequency and percentage. A 2 $\times$ 2 contingency table was constructed to assess diagnostic performance, and the Chi-square test was used to assess associations between categorical variables. A 95% confidence interval was used, and  $p < 0.05$  was considered statistically significant.

### Ethical Considerations

Ethical approval was obtained from the Institutional Review Board of NICRH. Written informed consent was obtained from all participants after explaining the study objectives, procedures, risks, benefits, and confidentiality measures. Privacy, anonymity, and confidentiality were maintained throughout the study. Data collection and analysis were performed with assistance from the study guide, radiology and pathology personnel, and a biostatistician.

## RESULTS

**Table 1: Demographic and Socioeconomic Characteristics of the Study Participants (n = 100)**

| Variable             | Category      | Frequency (n)   | Percentage (%) |
|----------------------|---------------|-----------------|----------------|
| Age (years)          | 21–30         | 8               | 8.0            |
|                      | 31–40         | 21              | 21.0           |
|                      | 41–50         | 38              | 38.0           |
|                      | 51–60         | 26              | 26.0           |
|                      | 61–70         | 7               | 7.0            |
|                      | Mean $\pm$ SD | 43.2 $\pm$ 11.7 |                |
| Residence            | Range         | 21–70           |                |
|                      | Urban         | 66              | 66.0           |
|                      | Rural         | 34              | 34.0           |
| Socioeconomic status | Poor          | 44              | 44.0           |
|                      | Middle        | 37              | 37.0           |
|                      | Upper         | 19              | 19.0           |

The majority of participants were aged 41–50 years (38 patients, 38.0%), followed by those aged 51–60 years (26 patients, 26.0%) and 31–40 years (21 patients, 21.0%), with a mean age of 43.2  $\pm$  11.7 years and a range of 21–70 years. Most participants were from

urban areas (66 patients, 66.0%). Regarding socioeconomic status, 44 patients (44.0%) belonged to the poor socioeconomic group, followed by the middle (37 patients, 37.0%) and upper (19 patients, 19.0%) groups.

**Table 2: Clinical Presentation and Physical Findings of the Study Participants (n = 100)**

| Variable | Category              | Frequency (n) | Percentage (%) |
|----------|-----------------------|---------------|----------------|
| Symptoms | Lump in lower abdomen | 100           | 100.0          |
|          | Pain in the abdomen   | 68            | 68.0           |
|          | Dyspepsia             | 54            | 54.0           |
|          | Loss of weight        | 52            | 52.0           |
|          | Nausea, vomiting      | 35            | 35.0           |
|          | Abdominal distension  | 23            | 23.0           |
|          | More than one symptom | 16            | 16.0           |

| Variable       | Category                | Frequency (n) | Percentage (%) |
|----------------|-------------------------|---------------|----------------|
| Physical signs | Anemia                  | 72            | 72.0           |
|                | Palpable abdominal mass | 45            | 45.0           |
|                | Ascites                 | 17            | 17.0           |

All participants presented with a lump in the lower abdomen (100 patients, 100.0%). Abdominal pain was the second most common symptom (68 patients, 68.0%), followed by dyspepsia (54 patients, 54.0%), loss of weight (52 patients, 52.0%), and nausea or vomiting (35 patients, 35.0%). Abdominal distension was reported

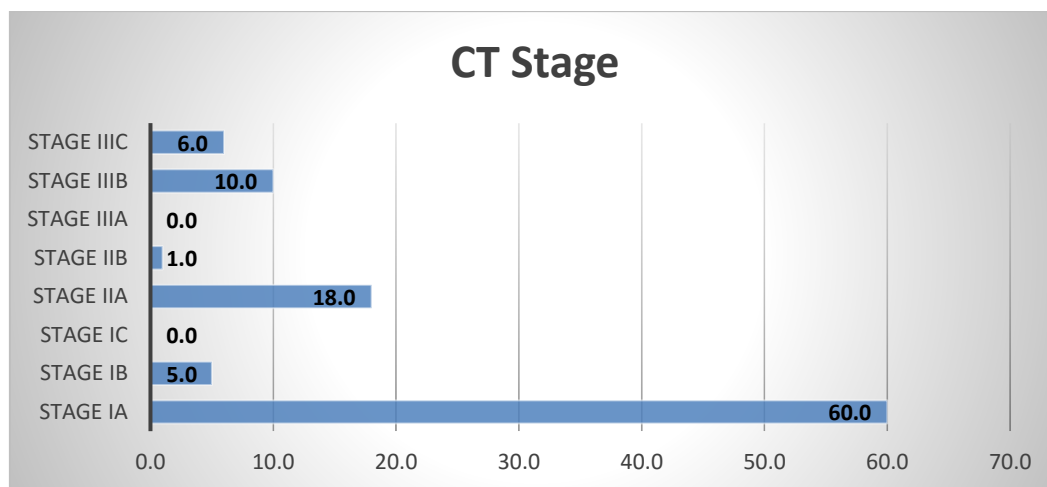
by 23 patients (23.0%), while 16 patients (16.0%) had more than one symptom. Among the physical findings, anemia was the most common (72 patients, 72.0%), followed by a palpable abdominal mass (45 patients, 45.0%) and ascites (17 patients, 17.0%).

**Table 3: Preoperative CT Scan Findings of the Study Participants (n = 100)**

| Variable                 | Category                     | Frequency (n) | Percentage (%) |
|--------------------------|------------------------------|---------------|----------------|
| Location                 | Unilateral                   | 72            | 72.0           |
|                          | Bilateral                    | 28            | 28.0           |
| Characterization of mass | Solid                        | 78            | 78.0           |
|                          | Partly cystic & partly solid | 22            | 22.0           |
| Ascites                  | Present                      | 17            | 17.0           |
|                          | Absent                       | 83            | 83.0           |
| Omental involvement      | Yes                          | 16            | 16.0           |
|                          | No                           | 84            | 84.0           |
| Peritoneal implant       | Inside the pelvis            | 19            | 19.0           |
|                          | Outside the pelvis           | 16            | 16.0           |
|                          | Absent                       | 65            | 65.0           |
| Loss of fat plane        | Between the uterus and mass  | 18            | 18.0           |
|                          | Between the bladder and mass | 1             | 1.0            |
|                          | Normal fat plane             | 81            | 81.0           |
| Liver metastasis         | Yes                          | 6             | 6.0            |
|                          | No                           | 94            | 94.0           |
| Lymph node involvement   | Yes                          | 0             | 0.0            |
|                          | No                           | 100           | 100.0          |

On preoperative CT scan, the ovarian mass was unilateral in 72 patients (72.0%) and bilateral in 28 patients (28.0%). Most masses were solid (78 patients, 78.0%), while 22 patients (22.0%) had partly cystic and partly solid masses. Ascites was present in 17 patients (17.0%), while omental involvement was observed in 16 patients (16.0%). Peritoneal implants were located inside

the pelvis in 19 patients (19.0%) and outside the pelvis in 16 patients (16.0%). Loss of the fat plane was observed between the uterus and mass in 18 patients (18.0%) and between the bladder and mass in 1 patient (1.0%). Liver metastasis was detected in 6 patients (6.0%), while no lymph node involvement was identified on CT scan.



**Figure 1: Distribution of Study Participants According to Preoperative CT scan FIGO Stage (n = 100)**

The majority of patients were classified as FIGO stage IA on preoperative CT scan (60 patients, 60.0%), followed by stage IIA (18 patients, 18.0%), stage IIIB (10 patients, 10.0%), stage IIIC (6 patients,

6.0%), stage IB (5 patients, 5.0%), and stage IIB (1 patient, 1.0%). No patients were classified as stage IC or stage IIIA.

**Table 4: Peroperative Findings and FIGO Staging of the Study Participants (n = 100)**

| Variable                      | Category                     | Frequency (n) | Percentage (%) |
|-------------------------------|------------------------------|---------------|----------------|
| <b>Per-operative findings</b> |                              |               |                |
| Location                      | Unilateral                   | 72            | 72.0           |
|                               | Bilateral                    | 28            | 28.0           |
| Characterization of mass      | Solid                        | 78            | 78.0           |
|                               | Partly cystic & partly solid | 22            | 22.0           |
| Ascites                       | Present                      | 23            | 23.0           |
|                               | Absent                       | 77            | 77.0           |
| Omental involvement           | Yes                          | 17            | 17.0           |
|                               | No                           | 83            | 83.0           |
| Peritoneal implant            | Inside the pelvis            | 23            | 23.0           |
|                               | Outside the pelvis           | 17            | 17.0           |
|                               | Absent                       | 60            | 60.0           |
| Involvement of pelvic organ   | Yes                          | 23            | 23.0           |
|                               | No                           | 77            | 77.0           |
| Liver metastasis              | Yes                          | 6             | 6.0            |
|                               | No                           | 94            | 94.0           |
| Lymph node involvement        | Yes                          | 4             | 4.0            |
|                               | No                           | 96            | 96.0           |
| <b>Per-operative staging</b>  |                              |               |                |
| Stage                         | IA                           | 42            | 42.0           |
|                               | IB                           | 13            | 13.0           |
|                               | IC                           | 5             | 5.0            |
|                               | IIA                          | 13            | 13.0           |
|                               | IIB                          | 10            | 10.0           |
|                               | IIIA                         | 0             | 0.0            |
|                               | IIIB                         | 11            | 11.0           |
|                               | IIIC                         | 6             | 6.0            |

Peroperatively, the ovarian mass was unilateral in 72 patients (72.0%) and bilateral in 28 patients (28.0%), with most masses being solid (78 patients, 78.0%). Ascites was present in 23 patients (23.0%), while omental involvement was observed in 17 patients (17.0%). Peritoneal implants were located inside the pelvis in 23 patients (23.0%) and outside the pelvis in 17 patients (17.0%), while pelvic organ involvement was

observed in 23 patients (23.0%). Liver metastasis and lymph node involvement were identified in 6 patients (6.0%) and 4 patients (4.0%), respectively. According to peroperative FIGO staging, stage IA was the most common (42 patients, 42.0%), followed by stages IB and IIA (13 patients each, 13.0%), IIIB (11 patients, 11.0%), IIB (10 patients, 10.0%), IIIC (6 patients, 6.0%), and IC (5 patients, 5.0%).

**Table 5: Histopathological Findings and FIGO Staging of the Study Participants (n = 100)**

| Variable                                   | Category                            | Frequency (n) | Percentage (%) |
|--------------------------------------------|-------------------------------------|---------------|----------------|
| <b>Histopathological findings</b>          |                                     |               |                |
| Malignant cell present in peritoneal fluid | Yes                                 | 4             | 4.0            |
|                                            | No                                  | 96            | 96.0           |
| Cell types                                 | Papillary serous cystadenocarcinoma | 64            | 64.0           |
|                                            | Mucinous cystadenocarcinoma         | 20            | 20.0           |
|                                            | Clear cell tumour                   | 6             | 6.0            |
|                                            | Germ cell tumour                    | 6             | 6.0            |
|                                            | Others                              | 4             | 4.0            |
| Cancer involvement                         | One ovary                           | 64            | 64.0           |
|                                            | Both ovaries                        | 24            | 24.0           |
|                                            | Uterus & FP                         | 12            | 12.0           |

| Variable                          | Category | Frequency (n) | Percentage (%) |
|-----------------------------------|----------|---------------|----------------|
| <b>Histopathological findings</b> |          |               |                |
| Capsule                           | Intact   | 95            | 95.0           |
|                                   | Ruptured | 5             | 5.0            |
| Pelvic peritoneum implant         | Inside   | 36            | 36.0           |
|                                   | Outside  | 24            | 24.0           |
|                                   | No       | 40            | 40.0           |
| Omental metastasis                | Yes      | 22            | 22.0           |
|                                   | No       | 78            | 78.0           |
| Distant metastasis                | Yes      | 6             | 6.0            |
|                                   | No       | 94            | 94.0           |
| Lymph node involvement            | Yes      | 6             | 6.0            |
|                                   | No       | 94            | 94.0           |
| <b>Histopathological staging</b>  |          |               |                |
| Stage                             | IA       | 41            | 41.0           |
|                                   | IB       | 0             | 0.0            |
|                                   | IC       | 1             | 1.0            |
|                                   | IIA      | 24            | 24.0           |
|                                   | IIB      | 12            | 12.0           |
|                                   | IIIA     | 9             | 9.0            |
|                                   | IIIB     | 7             | 7.0            |
|                                   | IIIC     | 6             | 6.0            |

Papillary serous cystadenocarcinoma was the most common histopathological type (64 patients, 64.0%), followed by mucinous cystadenocarcinoma (20 patients, 20.0%), clear cell tumour and germ cell tumour (6 patients each, 6.0%), and other tumour types (4 patients, 4.0%). Cancer involved one ovary in 64 patients (64.0%), both ovaries in 24 patients (24.0%), and the uterus and fallopian tube in 12 patients (12.0%). The ovarian capsule was intact in 95 patients (95.0%). Pelvic peritoneal implants were present inside the pelvis in 36

patients (36.0%) and outside the pelvis in 24 patients (24.0%), while omental metastasis was identified in 22 patients (22.0%). Distant metastasis and lymph node involvement were each present in 6 patients (6.0%). Histopathologically, stage IA was the most common stage (41 patients, 41.0%), followed by stage IIA (24 patients, 24.0%), IIB (12 patients, 12.0%), IIIA (9 patients, 9.0%), IIIB (7 patients, 7.0%), IIIC (6 patients, 6.0%), and IC (1 patient, 1.0%).

**Table 6: Correlation Between Preoperative CT scan and Peroperative FIGO Staging of Ovarian Cancer (n = 100)**

| CT scan findings | Per-operative findings |           |          |            |            |            |             |            |
|------------------|------------------------|-----------|----------|------------|------------|------------|-------------|------------|
|                  | IA (n=42)              | IB (n=13) | IC (n=5) | IIA (n=13) | IIB (n=10) | IIIA (n=0) | IIIB (n=11) | IIIC (n=6) |
| IA (n=60)        | 42                     | 8         | 5        | 5          | 0          | 0          | 0           | 0          |
| IB (n=5)         | 0                      | 5         | 0        | 0          | 0          | 0          | 0           | 0          |
| IC (n=0)         | 0                      | 0         | 0        | 0          | 0          | 0          | 0           | 0          |
| IIA (n=18)       | 0                      | 0         | 0        | 8          | 10         | 0          | 0           | 0          |
| IIB (n=1)        | 0                      | 0         | 0        | 0          | 0          | 0          | 1           | 0          |
| IIIA (n=0)       | 0                      | 0         | 0        | 0          | 0          | 0          | 0           | 0          |
| IIIB (n=10)      | 0                      | 0         | 0        | 0          | 0          | 0          | 10          | 0          |
| IIIC (n=6)       | 0                      | 0         | 0        | 0          | 0          | 0          | 0           | 6          |

Preoperative CT scan and peroperative assessment showed variation in FIGO stage classification across individual stages. Among the 60 patients classified as stage IA on CT scan, 42 were classified as stage IA peroperatively, while 8, 5, and 5 patients were classified as stages IB, IC, and IIA, respectively. All 5 patients classified as stage IB on CT

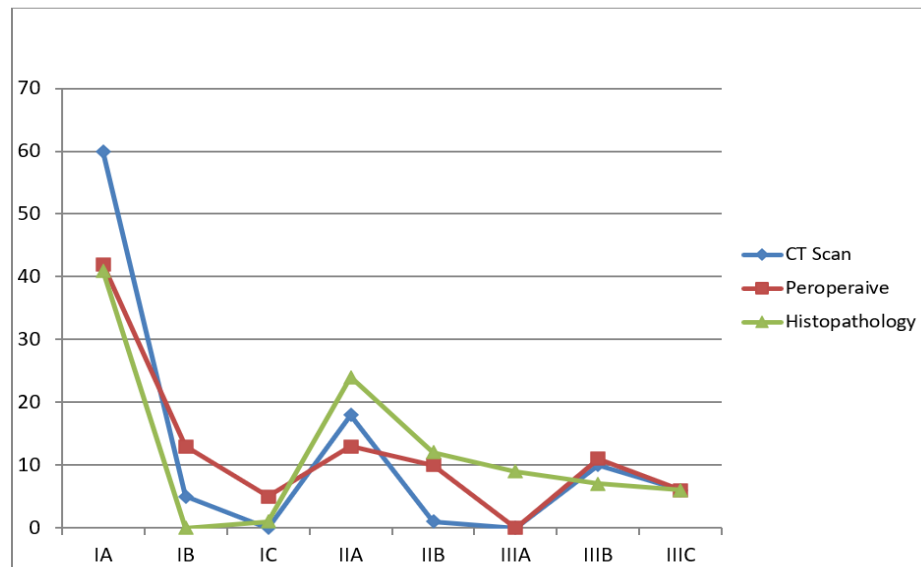
scan remained stage IB peroperatively. Of the 18 patients classified as stage IIA on CT scan, 8 were classified as IIA and 10 as IIB peroperatively. The single patient classified as stage IIB on CT scan was classified as IIIB peroperatively, while the 10 patients classified as IIIB and 6 patients classified as IIIC on CT scan remained in their respective stages peroperatively.

**Table 7: Correlation Between Preoperative CT scan and Histopathological FIGO Staging of Ovarian Cancer (n = 100)**

| CT scan findings | Surgicopathological staging |          |          |            |            |            |            |            |
|------------------|-----------------------------|----------|----------|------------|------------|------------|------------|------------|
|                  | IA (n=41)                   | IB (n=0) | IC (n=1) | IIA (n=24) | IIB (n=12) | IIIA (n=9) | IIIB (n=7) | IIIC (n=6) |
| IA (n=60)        | 41                          | 0        | 0        | 6          | 8          | 1          | 4          | 0          |
| IB (n=5)         | 0                           | 0        | 1        | 3          | 0          | 1          | 0          | 0          |
| IC (n=0)         | 0                           | 0        | 0        | 0          | 0          | 0          | 0          | 0          |
| IIA (n=18)       | 0                           | 0        | 0        | 15         | 3          | 0          | 0          | 0          |
| IIB (n=1)        | 0                           | 0        | 0        | 0          | 1          | 0          | 0          | 0          |
| IIIA (n=0)       | 0                           | 0        | 0        | 0          | 0          | 0          | 0          | 0          |
| IIIB (n=10)      | 0                           | 0        | 0        | 0          | 0          | 7          | 3          | 0          |
| IIIC (n=6)       | 0                           | 0        | 0        | 0          | 0          | 0          | 0          | 6          |

Preoperative CT scan and histopathological examination showed variation in FIGO stage classification across individual stages. Among the 60 patients classified as stage IA on CT scan, 41 were confirmed as stage IA histopathologically, while the remaining patients were distributed across stages IIB, IIA, IIIA, and IIIB. Of the 5 patients classified as stage IB on CT scan, none were confirmed as stage IB

histopathologically. Among the 18 patients classified as stage IIA on CT scan, 15 were confirmed as stage IIA and 3 as stage IIB. The single patient classified as stage IIB on CT scan was confirmed as stage IIB histopathologically. All 6 patients classified as stage IIIC on CT scan were confirmed as stage IIIC histopathologically.

**Figure 2: Correlation Among Preoperative CT scan, Peroperative, and Histopathological FIGO Staging of Ovarian Cancer (n = 100)**

Preoperative CT scan classified 60 patients as stage IA, 5 as IB, 18 as IIA, 1 as IIB, 10 as IIIB, and 6 as IIIC, with no patients classified as IC or IIIA. Peroperatively, 42 patients were classified as stage IA,

13 as IB, 5 as IC, 13 as IIA, 10 as IIB, 11 as IIIB, and 6 as IIIC. Histopathological examination classified 41 patients as stage IA, 1 as IC, 24 as IIA, 12 as IIB, 9 as IIIA, 7 as IIIB, and 6 as IIIC.

**Table 8: Diagnostic Performance of Preoperative CT scan According to FIGO Stage Compared with Histopathological Staging (n = 100)**

| Stage of cancer | TP (a) | FP (b) | FN (c) | Sensitivity (%) | Specificity (%) | PPV (%) | NPV (%) | p-value |
|-----------------|--------|--------|--------|-----------------|-----------------|---------|---------|---------|
| IA (n = 60)     | 41     | 19     | 0      | 100.0           | 67.0            | 68.3    | 82.9    | 0.275   |
| IB (n = 5)      | 0      | 5      | 0      | 0.0             | 95.0            | 0.0     | 74.9    | 0.086   |
| IC (n = 0)      | 0      | 0      | 1      | 0.0             | 100.0           | 0.0     | 100.0   | 0.064   |
| IIA (n = 18)    | 15     | 3      | 9      | 62.5            | 96.0            | 83.3    | 89.0    | 0.576   |
| IIB (n = 1)     | 1      | 0      | 11     | 85.3            | 100.0           | 100.0   | 65.9    | 0.371   |
| IIIB (n = 10)   | 7      | 3      | 0      | 100.0           | 96.8            | 70.0    | 100.0   | 0.893   |
| IIIC (n = 6)    | 6      | 0      | 0      | 100.0           | 100.0           | 100.0   | 100.0   | 0.982   |

The diagnostic performance of preoperative CT scan varied across individual FIGO stages when compared with histopathological staging. Sensitivity was 100.0% for stages IA, IIIB, and IIIC, while specificity was highest for stages IC, IIB, and IIIC at 100.0%. The PPV was highest for stages IIB and IIIC (100.0%), while the NPV was 100.0% for stages IIIB and IIIC. The corresponding p-values ranged from 0.064 to 0.982.

## DISCUSSION

This observational cross-sectional study was carried out in the Department of Gynecological Oncology, National Institute of Cancer Research & Hospital, Dhaka, to correlate pre-operative CT scan findings with surgicopathological staging in patients with ovarian cancer. A total of 100 patients were enrolled according to the inclusion and exclusion criteria. A detailed history of all selected cases was obtained using a structured questionnaire, followed by thorough clinical examination and relevant investigations.

At the time of admission, a thorough physical examination and relevant investigations were performed. The present study showed that a lump in the lower abdomen, abdominal pain, and weight loss were the most common presenting symptoms, reported by 100.0%, 68.0%, and 52.0% of patients, respectively. Other manifestations included dyspepsia, nausea or vomiting, and abdominal distension. Sixteen patients (16.0%) presented with more than one symptom. On physical examination, anemia was the most common finding, present in 72.0% of cases, followed by a palpable abdominal mass in 45.0% and ascites in 17.0%. Another study showed that among women presenting for primary care, 95% reported at least one previous symptom during the preceding year. The other symptoms included back pain (60%), fatigue (52%), indigestion (37%), urinary tract problems (35%), constipation (33%), and abdominal pain (28%) [16,17].

CT scan was performed in all patients. In this study, 72.0% of tumors were unilateral and 78.0% of the masses were solid. Ascites was present in 17.0% of cases, while omental involvement was found in 16.0% of cases. Peritoneal implants were located inside the pelvis in 19.0% of cases and outside the pelvis in 16.0% of cases. Liver metastasis was detected in 6.0% of cases, while no lymph node involvement was identified on CT scan. Another study revealed that approximately 86% of cases had unilateral neoplasms, 10% had hemorrhagic peritoneal collections, and 64% of masses were cystic [17].

Peroperative findings revealed that 72.0% of tumors were unilateral and 78.0% of masses were solid. Ascites was present in 23.0% of cases, while omental involvement was found in 17.0% of cases. Peritoneal implants were located inside the pelvis in 23.0% of cases and outside the pelvis in 17.0% of cases. Pelvic organ involvement was observed in 23.0% of patients, while

liver metastasis and lymph node involvement were detected in 6.0% and 4.0% of cases, respectively.

In our study, the correlation between CT scan and peroperative staging showed variation across the FIGO stages of ovarian cancer. Among the 65 patients classified as stage I on CT scan, 60 were classified as stage I peroperatively, while 5 were upstaged to stage II. Among the 19 patients classified as stage II on CT scan, 23 patients were classified as stage II peroperatively, with the increase resulting from upstaging of 5 patients from CT stage I and one patient from CT stage IIB being classified as stage IIIB. Overall, 17 patients were classified as stage III peroperatively compared with 16 patients classified as stage III on CT scan.

Previous studies noted that CT could depict tumor implants larger than 1 cm with a sensitivity of 85–93% and specificity of 91–96%; however, the sensitivity decreased to 25–50% for detecting implants measuring 1 cm or smaller [12,13]. Another study showed that CT scan has contributed substantially to the staging of ovarian cancer through its availability, meticulous technique, efficacy, and familiarity among radiologists and physicians. This study also showed that whole-body MRI with diffusion-weighted sequences had greater accuracy than CT for the characterization and detection of early-stage ovarian cancer [6].

In our study, histopathological findings revealed papillary serous cystadenocarcinoma in 64.0% of patients, mucinous cystadenocarcinoma in 20.0%, clear cell tumour in 6.0%, germ cell tumour in 6.0%, and other tumour types in 4.0%. Cancer involved one ovary in 64.0% of patients, both ovaries in 24.0%, and the uterus and fallopian tube in 12.0%. The ovarian capsule was intact in 95.0% of cases. Omental metastasis was present in 22.0% of cases. Peritoneal implants were located inside the pelvis in 36.0% of cases and outside the pelvis in 24.0% of cases. Distant metastasis and lymph node involvement were each present in 6.0% of patients [5].

A prospective study [18] conducted at the Clinical Center of Serbia also reported histopathological findings in ovarian cancer that were comparable with those of the present study. However, findings differed from a study [17] conducted in Australia, in which papillary serous cystadenocarcinoma was the most commonly recorded histological type of ovarian cancer in 2002, accounting for 23.2% of new cases. Serous cystadenocarcinoma, not otherwise specified, was the second most common type, accounting for 13.1% of cases in 2002. Singer *et al.*, demonstrated that serous carcinoma is the most common type of ovarian cancer and is the most lethal gynecologic malignancy [19].

Cancer staging is a fundamental principle and one of the first and most important steps used to predict patient outcomes and plan the most appropriate

treatment [9]. Ovarian cancer stages range from FIGO stage I to stage IV. In our study, the correlation between pre-operative CT scan findings and histopathological staging showed variation across the FIGO stages of ovarian cancer. Among the 65 patients classified as stage I on CT scan, 42 were classified as stage I histopathologically, while 17 were classified as stage II and 6 as stage III. Among the 19 patients classified as stage II on CT scan, all 19 were classified as stage II histopathologically. Among the 16 patients classified as stage III on CT scan, 10 were classified as stage III histopathologically, while 6 were classified as stage II. Overall, histopathological examination classified 36 patients as stage II and 22 patients as stage III, compared with 19 and 16 patients, respectively, on pre-operative CT scan.

Previous studies noted that laparotomy and histopathological diagnosis correlated accurately with CT findings [20,21]. The overall accuracy of CT has been reported to be as high as 89% [9]. In our study, CT scan findings showed variation from histopathological staging across the FIGO stages, and the overall association was statistically non-significant. The discrepancies were more evident in the earlier stages, where several patients classified as stage I on CT scan were subsequently classified as stage II or III histopathologically, indicating upstaging of some early-stage cases after definitive pathological assessment.

Taking histopathology as the gold standard, the diagnostic performance of CT scan varied according to FIGO stage. For stage IA, CT showed 100.0% sensitivity, 67.8% specificity, 68.3% PPV, and 100.0% NPV. For stage IB, the specificity was 95.0% and PPV was 0.0%; sensitivity and PPV could not be meaningfully interpreted because no histopathologically confirmed stage IB cases were present. For stage IC, sensitivity was 0.0% and specificity was 100.0%, with no CT-positive cases. For stage IIA, CT showed 62.5% sensitivity, 96.1% specificity, 83.3% PPV, and 89.0% NPV. For stage IIB, CT showed 8.3% sensitivity, 100.0% specificity, 100.0% PPV, and 88.9% NPV. For stage IIIA, no patients were classified as stage IIIA on CT scan; therefore, the PPV could not be calculated, while sensitivity was 0.0% and specificity was 100.0%. For stage IIIB, CT showed 42.9% sensitivity, 92.5% specificity, 30.0% PPV, and 95.6% NPV. For stage IIIC, CT showed 100.0% sensitivity, specificity, PPV, and NPV.

A previous study noted that, taking histopathology as the gold standard, the sensitivity, specificity, PPV, and NPV for MDCT were 95.6%, 97.3%, 93.5%, and 97%, respectively, which were broadly comparable with the diagnostic performance observed in our study [22].

The pre-operative evaluation of patients with advanced ovarian cancer has traditionally relied on

physical examination, serum tumour markers, and USG. More recently, CT scan has been integrated into the standard evaluation in many centers [23]. Currently, there is increasing evidence that CT scan may provide a valuable tool for assessing the extent of disease and staging patients with advanced ovarian cancer.

Additionally, CT has been used to predict the outcome of primary cytoreductive surgery in patients with advanced ovarian cancer. It is crucial to determine which patients will benefit from surgery, thereby minimizing the number of patients undergoing unnecessary surgery [8,9,13]. Therefore, CT scan is an important imaging modality for staging ovarian cancer. CT provides clinically relevant information, including the size of the primary tumour, the size and location of peritoneal implants, and lymph node involvement [10].

### Limitations of the study

This study was not without limitations. The limitations of the study were as follows:

- The study had a small sample size.
- It was a single-centre study conducted at NICRH; therefore, the findings may not reflect the overall situation in Bangladesh.
- As the study was conducted in a tertiary care hospital, the findings may not be representative of patients managed at primary or secondary healthcare centres.
- Participants were selected using a purposive sampling method, which may have introduced selection bias.

### CONCLUSION

This study demonstrated that pre-operative CT scan findings correlated with surgicopathological staging in ovarian cancer across all stages. However, the correlation was lower in early-stage disease compared with advanced stages, with some early-stage cases being upstaged on surgicopathological assessment. Pre-operative CT scan can therefore be used as a useful tool for assessing the stage of ovarian cancer and planning appropriate subsequent management.

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