RESEARCH PAPER INTERNATIONAL JOURNAL OF PURE MEDICAL RESEARCH

Gynaecology

KEYWORDS: Ovarian cancer, multi-detector computed tomography, surgical laparotomy

# COMPARATIVE STUDY BETWEEN LAPAROSCOPY AND MULI- DETECTOR COMPUTED TOMOGHRAGHY IN OVARIAN CANCER SCORING

Volume-4, Issue-6, June - 2019 ISSN (O): 2618-0774 | ISSN (P): 2618-0766

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*Article History*
*Received:* 24.02.2019
*Accepted:* 18.05.2019
*Published:* 10.06.2019

## ABSTRAC

**Background:** Ovarian cancer (OC) was the 7th most frequent cancer diagnosis worldwide, with 238,700 new cases in 2012, and the 8th leading cause of cancer mortality. Objectives: Ovarian cancer (OC) was the 7th most frequent cancer diagnosis worldwide, with 238,700 new cases in 2012, and the 8th leading cause of cancer mortality Method: This is a prospective cross section study that was started from November 2016 to December 2017.condcuted at El-Shatby Hospital, Obstetrics and Gynecology Department, Alexandria University. 25 patients with OC were included in the study fulfilling the inclusion and exclusion criteria, after taking consents. All patients were subjected to diagnostic laparoscopy (DL), multi-detector computed tomography (MDCT), and surgical laparotomy. Results: DL was 100% sensitive in diagnosis of peritoneal carcinomtosis, meanwhile, MDCT had 61.9 % sensitivity. DL has very good agreement with laparotomy in diagnosis of surface liver infiltration. Superficial surface stomach infiltration was present in 25% of studied patients, all cases were diagnosed by laparoscopy, while MDCT diagnosed 20% of cases. Conclusion: combined findings of DL and MDCT can be used effectively for pre-operative staging of OC.

### Introduction

Ovarian cancer (OC) was the 7th most frequent cancer diagnosis worldwide, with 238,700 new cases in 2012, and the 8th leading cause of cancer mortality, with 151,900 deaths.

Laparoscopic surgery may be performed for early-stage disease when no disease is visible outside of the ovaries. Its use in more advanced disease, when spread is visible outside the ovaries, is more limited due to the scope of cytoreductive surgery necessary and the risk of port-site recurrence. Laparoscopy also has a role in second-look inspection and in the staging of apparently early-stage disease found by chance during another surgery.

Among women with ovarian disorders, CT has been used primarily in patients with ovarian malignancies, either to assess disease extent prior to surgery or as a substitute for second-look laparotomy. CT, particularly the spiral CT, has several advantages: It is widely available and can be performed rapidly and relatively easily. Moreover, CT of the abdomen or pelvis allows comprehensive evaluation of all potential sites of peritoneal implants or lymphadenopathy as well as of the primary tumor site.

### Patients and Method

**Study duration**: This is a prospective study that was started from November 2016 to December 2017.

**Study setting:** El-Shatby Hospital, Obstetrics and Gynecology Department, Alexandria University.
Type of study: cross section study.

**Sampling:** 25 patients with OC were included in the study fulfilling the following:

**Inclusion criteria:** age≥ 18 years old, assigned the formal consent, clinically stable, no other co-morbidity.

**Exclusion criteria:** pregnancy, contraindication to MDCT scan as sensitivity to IV contrast, contraindication for laparoscopic surgery as: suspected massive intestinal adhesion following previous major abdominal operation, patient unfit for surgery or anesthesia i.e. Decompensated heart disease, stage 1V ovarian malignancy; cases with hepatic or pulmonary metastasis were considered stage IV and were excluded from the study, and co-morbid obese patient who was unfit for laparoscopic surgery.

Study procedures: After taking consents, all patients were evaluated according to the following steps:

Filling a predesigned questionnaire.
Thorough clinical examination.

**Laboratory testes:** tumor markers level (CA125) carcinoembryonic antigen (CEA), and alfafeto protein (AFP).
Radiological examination:

Ultra sound examination: Combined trans-abdominal and trans-vaginal US examination were performed using 3.5MHz abdominal probe and 5 MHz vaginal probe. Assessing; Multi-locularity,

intra_cystic solid areas, presence of metastases, presence of ascites, and bi-laterality.

**Multidetector computed tomography and its protocols:**
The MDCT was performed by Department of Radio diagnosis and intervention at the Main University hospital with consistent experience in gynecologic imaging at the time of performing patient scan. The diagnosis of ovarian malignancy was assessed by the experienced radiologist, the following parameters are evaluated and described:

- Size and sites of tumor.
- Nature and amount of ascites.
- Omental implant.
- Intestinal serosal implant.
- Superficial stomach infiltration.
- Mesenteric retraction.
- Superficial liver metastasis.
- Pertioneal carcinomatosis.
- Diaghramatic carcinomatosis.
- Adhesion site and density.
- Lymph node (LNs) metastasis (pelvic and para aortic).

The CT scans were performed on a 16-slice multidetector CT machine (Brilliance, Philips, Best, and The Netherlands). A non-contrast scan followed by a single venous phase were acquired for the abdomen and pelvis starting from above the diaphragmatic cupula down to the inguinal regions. IV contrast was injected at a dose of 1.5 ml/Kg body weight, using a mechanical injector at a rate of 3 ml/s. Scanning was started at 65 seconds from the start of injection. All the exams were reviewed on a post-processing for cinematic scrolling and multi-planner display.

### Calculation of risk of malignancy index (RMI):
RMI combines three pre-surgical features: US scan score, the menopausal status (M) and the serum CA125 level (IU/ml).

RMI 1= U x M x Ca125

### Laparoscopic procedures:
Under general anesthesia, the ovarian mass was examined bimanually before procedures. After pneumo-peritoneum was initiated, a 10 mm trocar was inserted at umbilicus (umbilical port) to introduce the laparoscope.If massive ascites was present, gradual aspiration was done to avoid sudden decompression at Trendelenburg position. A sample of the ascetic fluid was taken for cytology. If there was no ascites, peritoneal wash was performed and re_aspirated to test for cytology. General exploration of the pelvis and upper abdomen. The same item of MDCT were investigated by DL.

### Statistical analysis
Data were entered into excel sheet 2016, further processing, cleaning, and check were done. Data were analyzed using SPSS 24. Mean and median were used to present quantitative data, frequency for categorical data. Kappa test was used to test degree of agreement. P-value is statistically significant if blew 0.5.

### Ethics:
Ethical approval was obtained from the Ethical Committee of Alexandria Faculty of Medicine. A written consent was obtained from all the study participants. All patients had the right of discontinuation or withdrawal from the study. Confidentiality of laboratory and radiological data of all patients was respected.

### Conflict of interest:
No conflict of interest.

### Funding agency
No funding agency.

### Results
Figure 1, shows that the mean age of studied patients was 49.8 ± 12.50 years, four cases (16%) were aged less than 40 years. The mean body mass index of the studied females with OC was 27.78± 4.77, seven cases (28%) of cases had BMI of 25 or less. The gravidity and parity ranged from (0-8); of studied patients 12% (4/25) were nulliparous..

**Figure: Age, BMI, and parity of females with ovarian cancer**

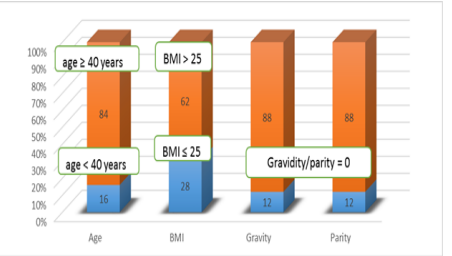


Table 1: shows that, more than half of studied cases (54%) were post-menopausal since 9.21±6.44 years. One fifth of patients were hypertensive and 28% of patients were diabetics. One case (4%) had family history of OC.

**Table 1: Menopausal status, medical, and family history of the studied patients.**

| Item | Frequency (n=25) | Percent | |
|---|---|---|---|
| Menopause | Pre-menopause | 11 | 44 |
| | Post-menopausal | 14 | 54 |
| Medical History | Diabetes mellitus | 7 | 28 |
| | Hypertension | 5 | 20 |
| | Others* | 3 | 12 |
| Family history of ovarian cancer | | 1** | 4 |

*Others: includes bronchial asthma, rheumatoid arthritis, and osteoarthritis.
**Mother had ovarian cancer.

Figure 2 shows that 52% (13/25) female did not undergo any surgical procedures before. While, 16% had either mastectomy, oophorectomy, myomectomy, or appendectomy, Moreover, 8% of the study population had cholecystectomy.

**Figure 2: Surgical history of studied females**

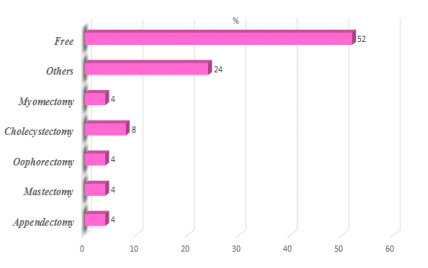


Table 2 shows that no symptoms were reported among 20% of females with OC. One fifth of cases complained of pelvic pain. Of the gastrointestinal symptoms; bloating was reported in 24% of the studied patients, constipation and eating disorders (i.e. loss of appetite) were reported in 24% of patients. Bowel obstruction was the rarest clinical findings presentation in 4% of the studied cases. Seven cases (28%) of patient had increased abdominal girth. Urinary urgency was reported among 8% of the study sample, meanwhile, back pain was the commonest symptoms, three fifth of the studied females had back pain. 12% had vaginal bleeding

**Table 2: Clinical picture of the studied females with ovarian cancer**

| Item | | No | Percentage |
|---|---|---|---|
| Asymptomatic | 5 | | 20 |
| Pelvic pain | 5 | | 20 |
| Gastrointestinal symptoms | | | |
| | Bloating | 6 | 24 |
| | Eating disorder | 3 | 12 |
| | Constipation | 3 | 12 |
| | Bowel obstruction | 1 | 4 |
| Increase abdominal girth | | 7 | 28 |
| Urinary urgency | | 2 | 8 |
| Back pain | | 15 | 60 |
| Vaginal bleeding | | 3 | 12 |

Table 3 shows that, the mean of CA 125, CA19.9, CEA, and AFP were 685.40 ± 900.97, 33.26 ± 33.89, 16.43 ± 42.16, and 5.519 ± 9.46 respectively.

**Table 3: Levels of tumor markers in patients with ovarian cancer**

| Item | Mean ± SD | Median | Mode | Rang |
|---|---|---|---|---|
| CA 125* | 685.40 ± 900.97 | 244.00 | 919.22 | (28.0-3395.0) |
| CA 19.9 | 33.26 ± 33.89 | 20.40 | 0.64 | (0.64-128.1) |
| CEA | 16.43 ± 42.16 | 2.68 | 5.26 | (0.47-208.0) |
| AFP | 5.519 ± 9.46 | 3.00 | 4.00 | (47.0-1.1) |

*two cases had CA125 below 35 U/ml, CA 125: CA 125,35 normal levels, serum CA-125 value higher than 35 U/mL in postmenopausal women or higher than 200 U/mL in premenopausal women, CEA: Carcinoembryonic antigen, the normal range is <2.5 ng/ml in an adult non-smoker and <5.0 ng/ml in a smoker. AFP: Alpha-fetoprotein, normal level is less than 10ng/ml, CA19.9: Cancer antigen, normal level is less than 37 U/ml.

Table 4 shows that 68% of cases had ascites, the tumor mass was solid, unilateral, and multi-locular in 64% of patients, 4% of patients had tumor metastasis. The US score was 1 and 3 in 88% and 12% of patients respectively.

**Table 4: US examination of abdominal of patients with ovarian cancer**

| | | | |
|---|---|---|---|
| Ascites | Present | 17 | 68.0 |
| | Absent | 8 | 32.0 |
| Tumor consistency | Solid | 16 | 64.0 |
| | Cystic | 9 | 36.0 |
| Tumor locularity | Uni-locular | 9 | 36.0 |
| | Multi-locular | 16 | 64.0 |
| Tumor laterality | Unilateral | 16 | 64.0 |
| | Bilateral | 9 | 36.0 |
| Tumor metastasis | Present | 1 | 4.0 |
| | Absent | 24 | 96.0 |
| US score | 1 | 3 | 12.0 |
| | 3 | 22 | 88.0 |

Table 5 shows that the mean of RMI was 1950±2731.10 ranging from (203-10815), the mean of US sore was 2.76±0.66.

**Table 5: calculated US score and risk of malignancy index for the patients with ovarian cancer.**

| Item (n=25) | Means | ± | SD | 95 % CI | Rang |
|---|---|---|---|---|---|
| US score | 2.76 | ± | 0.66 | (2.49-3.03) | (1-3) |
| RMI* | 1950.60 | ± | 2731.10 | (823.26-3077.94) | (203-10185) |

*RMI: risk of malignancy index

Table 4: performance of MDCT and DL in comparison to laparotomy

Both modalities (DL and CT) have high sensitivity in detection of ascites, 95.24% and 100.0% respectively. With equal specificity 100.0% for each. The cumulative number of diagnosed cases was equal to that diagnosed by the gold standard technique (surgical laparotomy). The accuracy of CT was 100% and that of DL was 96%. DL was 100% sensitive in diagnosis of peritoneal carcinomtosis, meanwhile, CT had 61.9 % sensitivity. Both diagnostic modalities had 100% positive predictive value. Laparoscope has excellent agreement with the surgical laparotomy, but CT has weak agreement; 1 and 0.342 respectively. Combined results of both techniques has detected all cases diagnosed by surgical laparotomy. Both techniques had very good agreement with surgical laparotomy. CT had poorer agreement than DL than laparotomy in diagnosis of omental deposit 66% vs 82% respectively. Both techniques had 100% positive predictive value, and specificity. The sensitivity of DL was 88.9% while that of CT was 77.8%. CT has a good agreement with laparotomy but DL had weak agreement with laparotomy (87% vs 43%) respectively in diagnosis of Douglas pouch infiltration. Both tools had 100% PPV and specificity. The NPV was 33.3 and 66.67 for laparoscope and CT. DL had 52% agreement with the surgical laparotomy, while, CT had 87% agreement in diagnosis of diaphragmatic infiltration. Specificity and PPV were 100% for both modalities. The accuracy of DL and CT were 88% and 96% respectively. DL has very good agreement with laparotomy in diagnosis of surface liver metastasis, p = 0.00, agreement = 1. CT has also had a very good agreement with laparotomy, p = 0.131 and kappa =0.865. DL had 100% sensitivity and specificity in diagnosis of surface liver metastasis, while CT had 80 and 100% sensitivity and specificity respectively. DL and CT had cumulative frequency of 100% in diagnosis of stomach infiltration, DL and CT had sensitivity and specificity of 75, 95% and 80, 95% respectively. CT has a very good agreement with laparotomy while DL has weak agreement, 0.865 versus 0.595 respectively. CT had 100% sensitivity and specificity in detection of small bowel infiltration. Lower sensitivity of DL was observed (75%). CT had higher accuracy versus DL in diagnosis of intestinal infiltration. both diagnostic modalities had 100% sensitivity in diagnosis of tumor bi-laterality with very good agreement with the gold standard (surgical laparotomy). The accuracy of DL to CT was 100 to 92% respectively. that DL had higher agreement with laparotomy than CT in diagnosis of adhesions , DL had 100 sensitivity and specificity in diagnosis of adhesion. CT had 80% and 95% sensitivity and specificity in diagnosis of adhesions. The accuracy of DL and CT was 100 and 92% respectively. MDCT has a low sensitivity in detection of lymph node infiltration in comparison to laparoscopy. 56.25% and 93.75% respectively, meanwhile, both have equal specificity of 100%. the accuracy was higher in the case of laparoscope (96%), than that of CT (72%).

| item | | sensitivity | specificity | NPV | PPV | PLR | NLR | Accuracy | K | p |
|---|---|---|---|---|---|---|---|---|---|---|
| Ascites | DL | 95.24 | 100 | 80 | 100 | | 0.05 | 96 | 0.9 | 0.01 |
| | MDCT | 100 | 100 | 100 | 100 | | 0.00 | 100 | 1.0 | 0.01 |
| PC | DL | 100 | 100 | 100 | 100 | | 0.0 | 100 | 1.0 | 0.01 |
| | MDCT | 61.9 | 100 | 33.3 | 100 | | 0.4 | 68 | 0.3 | 0.02 |
| Omental deposit | DL | 88.9 | 100 | 77.8 | 100 | | 0.1 | 92 | 0.8 | 0.01 |
| | MDCT | 77.8 | 100 | 63.6 | 100 | | 0.2 | 84 | 0.7 | 0.05 |
| Douglas Pouch | DL | 82.6 | 100 | 33.3 | 100 | | 0.17 | 84 | 0.4 | 0.01 |
| | MDCT | 95.7 | 100 | 66.7 | 100 | | 0.04 | 96 | 0.8 | 0.01 |
| Diaphragmatic infilt | DL | 40 | 100 | 87.0 | 100 | | 0.6 | 88 | 0.5 | 0.01 |
| | MDCT | 80 | 100 | 95.2 | 100 | | 0.2 | 96 | 0.9 | 0.01 |
| Liver infilt | DL | 100 | 100 | 100 | 100 | | | 100 | 1.0 | 0.01 |
| | MDCT | 80 | 100 | 95.6 | 100 | | 0.3 | 88 | 0.9 | 0.1 |
| Stomach affection | DL | 75 | 95 | 95 | 75 | 15 | 0.3 | | 0.7 | 0.2 |
| | MDCT | 80 | 95 | 95 | 80 | | 0.2 | | 0.7 | 0.2 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Intestinal infiltration | DL | 75.0 | 100.0 | 95.2 | 75 | | 0.3 | 92 | 0.6 | 0.2 |
| | MDCT | 100.0 | 100.0 | 100.0 | 100 | | 0 | 100 | 0.9 | 0.1 |
| Tumor bi-laterality | DL | 100 | 100 | 100 | 100 | 7.0 | | 92 | 1.0 | 0.01 |
| | MDCT | 100 | 85.7 | 100 | 84.7 | | | 100 | 0.8 | 0.2 |
| Adhesion | DL | 100 | 100 | 100 | 100 | | | 100 | 1.0 | 0.01 |
| | MDCT | 78.9 | 100 | 60 | 100 | | 0.2 | 84 | 0.9 | 0.1 |
| | MDCT | 56 | 100 | 56.2 | | | 0.44 | | 0.5 | 0.01 |

## Discussion

The risk of developing OC gets higher with age; OC is rare in women younger than 40. The peak incidence of invasive epithelial OC is 56 to 60 years. Most OC develop after menopause (7). Half of all OC are found in women 63 years of age or older.(8).

In this study, 16% of the studied females were 40 years or less with mean age 49.80±12.5 years. Similar result was reported by Muhabat et al,(9) 28.8% of females with OC were aged 40 years or less. Conceding with this results, the mean age years for OC was 51.46±14.28 ranging from 18-77 years according to a large study recruited 1244 females with gynecological cancer.(10) Our finding may be biased due to the small number of studied cases but still alarming finding.

In the current study, the mean body mass index (BMI) of the studied patients was 27.78±4.77. Comparable result was reported based on a prospective study that investigated the association between BMI and OC among 94,525 U.S. women, followed from 1996–1997 to December 2003, the multivariate relative risk (MVRR) of O.C for obese women (BMI ≥30 kg/m2) was 1.26 (95%-CI=0.93–1.68). (11) In contrast to this finding, a pooled analysis of 12 cohort studies found no effect modification of the BMI and OC.(10)

In this study, 12% of patients were nulliparous, this was explained by the hypothesis that anovulation reduces a woman's OC risk by reducing her burden of mutated epithelial cells at risk of conversion to malignancy. These mutations may reflect some ovulatory consequence (such as rupture of the ovarian epithelium or cellular exposure to follicular fluid or to hormonal fluctuations). The long-term benefits of anovulation (i.e, reducing the burden of premalignant cells) may be attenuated by the occurrence of additional somatic mutations occurring as part of normal ovarian tissue aging.(12)

In this study, 54% of patients were post-menopausal. The post-menopausal period was associated with increased risk of OC, this finding was explained by increased estrogen metabolites that were associated with non-serous OC.(13) On the other side , Weiderpass (14) reported that menopausal status at cohort enrollment was not associated with epithelial OC risk.

The majority of research dealing with the healthcare and patient burdens of complications related to peritoneal adhesions have focused on the consequences of laparotomy.(16) However, since the early 1990s laparoscopy has offered increasing advantages compared to open surgery for a number of pelvic,(17) abdominal,(18) and cancer procedures.(19)

In this study, 6 cases (24%) had undergone either pelvic or abdominal surgery, like cholecystectomy, appendectomy, oophorectomy, and myomectomy. This surgical intervention resulted in abdominal adhesions in 5 cases (20%), consequently, the diagnostic performance of DL and CT were affected due to the presence of adhesions. For instance, the cumulative number of cases had diaphragmatic infiltration by both modalities was below the actual number by laparotomy.

In the present history, one fifth of the studied patients were asymptomatic and were discovered accidentally, where pelvic pain was reported in 20%, 52% of cases had gastrointestinal symptoms were a complaint of 52% (bloating 24%, eating disorder12%, constipation 12%, bowel obstruction 4%), increase abdominal girth, urinary urgency, back pain and vaginal bleeding were pronounced in 28%, 8%, 60%, and 12% of patients respectively. Compared to a study conducted in Pakistan, 97 women were included 44.3% of them had abdominal mass, but unlike the current study , (19.6% of them were asymptomatic) the difference between both studies may due to the few number of cases in the current study.(9) Another retrospective study by Jamal at el.(20) states that bleeding per vagina the was most common symptom followed by abdominal pain, pelvic mass and gastric intestinal symptoms, which differs with the reported symptoms in this study common symptoms, where vaginal bleeding was present in only 12 % of cases.

CA-125 been reported to be elevated only in 47% of women with early stage OC but is elevated in 80–90% of patients with advanced stage disease. (21) In this study, 8% of cases with OC had normal CA125 level. These two cases were stage I, explaining the low level of ca-125, similar findings were reported by Teeling etal,(22) all patients with OC at stage I had normal level of CA-125.

Using a RMI cut-off level of 200, the sensitivity in the original study of Jacobs was 85% and the specificity was 97% in diagnosis of OC. Patients with a RMI score over 200 had, on average, 42 times the background risk of cancer and those with a lower value 0.15 times the background risk.(23) In this study, all the studied females had RMI above 200. Two females had RMI above 200 but pathological examination and computed tomography were negative for malignant changes so they were excluded from the study.

Many studies approved the feasibility of laparoscopy in the exploration of the ascites of unknown origin as well as its high sensitivity and specificity.(24) In this study, both modalities (DL and CT) have high sensitivity in detection of ascites, 95.24% and 100.0% respectively. With equal specificity 100.0% for each. The cumulative number of diagnosed cases was equal to that diagnosed by the gold standard technique (surgical laparotomy). The accuracy of CT was 100% and that of DL was 96%. This minor difference between CT and DL may due to presence of localized amount of ascetic fluid hidden by adhesions and thus was not noted by DL.

In this study, DL was 100% sensitive in diagnosis of peritoneal carcinomtosis, meanwhile, CT had 61.9 % sensitivity. Both diagnostic modalities had 100% positive predictive value. Laparoscope has excellent agreement with the surgical laparotomy, but CT has weak agreement; 1 and 0.342 respectively.

Conceding with our result, CT and PET/CT presented low preoperative staging reliability for advanced intraperitoneal cancers, and this can strongly influence the ability to implement the correct treatment strategy for patients with peritoneal carcinomatosis (PC). (25) The CT sensitivity for PC varies from 60% to 90%, depending on the disease extent and the single nodule size.(26, 27) A multi-institutional study of colorectal PC found no correlation between the PCI obtained by CT (mean PCI value 8.6) and the intraoperative PCI (mean PCI value 13.2 .(28) Peritoneal carcinomatosis localization may also limit CT sensitivity, which is very low for mesenteric deposits.(28), it is well known that CT can detect metastasis only above the size of 5mm, this also cause of reducing sensitivity.

On the same line, A prospective comparison of laparoscopy and CT scan showed that in a series of patients in whom a CT scan identified peritoneal disease in only 47.8 %, subsequent laparoscopy detected peritoneal spread in 100 % of the patients.(29)

In the present study DL proved to be sensitive in detecting omental deposits reaching level of 89 % compared to CT especially when the size of these metastasis was less than 5mm. Most of the metastasis was diffuse involvement except in two cases when they were in the

form of small nodules. The sensitivity of CT was 78 % for the same lesions. Similarly, Singh etal., (30) showed a sensitivity of staging laparoscopy of 92% for detecting omental metastasis as against 63 % for CT.

In this study, DL was 40% sensitive in detection of diaphragmatic metastasis, while CT was 80% sensitive. As expected, both copulae of the diaphragm should be visualized at laparoscopy to plan the best surgical incision, but because adhesions, the true prevalence of asymptomatic diaphragmatic invasion in this series of patients was not accurately detected by DL .In the current study, if the anterior diaphragm was lacking a sentinel lesion, it seemed unnecessary to place asymptomatic patients in reverse Trendelenburg position to examine the posterior diaphragm.

In this study, research team diagnosed 23 cases with Douglas Pouch infilteration. MDCT has a good agreement with laparotomy but DL had weak agreement with laparotomy (87% vs 43%) respectively in diagnosis of Douglas pouch infiltration. Both tools had 100% PPV and specificity. The NPV was 33.3 and 66.67 for laparoscope and CT. Presence of adhesion in large number of cases may be the cause of inconvenience of DL in diagnosis of Douglas Pouch infiltration.

The liver is a common site of metastatic lesions from malignant tumors. Advances in various imaging techniques have improved the detectability of metastatic liver tumors.(32) Small superficial metastatic lesions of the liver surface, however, are not easy to detect preoperatively.(33)

In this study, superficial liver infiltration was present in 25% of studied patients, all cases were diagnosed by laparoscopy, while CT diagnosed 20% of cases. Both techniques had very good agreement with the standard diagnostic toll (Laparotomy). This result was not consistent with what was reported by Warshaw et al. (34), they found that, CT did not depict small liver and peritoneal metastatic lesions in 86 of 88 cases of cancer of the pancreas and the ampulla.

In the current study, superficial stomach infiltration was diagnosed in five cases by laparotomy. Both techniques (DL and MDCT) had cumulative frequency of 100% in diagnosis of superficial stomach infiltration, DL and MDCT had sensitivity and specificity of 75, 95% and 80, 95% respectively. Both modalities had nearly equal agreement 0.702 and 0.75.

In the recent study, CT has a very good agreement with laparotomy while DL has weak agreement, 0.865 versus 0.595 respectively. CT had 100% sensitivity and specificity in detection of intestinal infiltration. Lower sensitivity of DL was observed (75%). CT had higher accuracy versus DL in diagnosis of intestinal infiltration. Intestinal, peritoneal adhesion and ascites are suggested explaination for reducing DL sensitivity, in addition the limited ability of DL to mobilize and visualize all bowel loops may be another cause of inability to assess hidden lesion.

Similar result was gained from a study that recruited ninety-eight women with symptoms suggestive of colorectal endometriosis underwent MDCT and DL. MDCT did not identify cases with rectal involvement infiltrating the muscular layer. MDCT had a sensitivity of 98.7%, a specificity of 100%, a positive predictive value of 100% and a negative predictive value of 95.7% in identifying women with intestinal lesions.(35)

Tumor bi-laterality: both diagnostic modalities had 100% sensitivity in diagnosis of tumor bi-laterality with very good agreement with the gold standard (surgical laparotomy). The accuracy of DL to MDCT was 100 to 92% respectively, and agreement was 1 and 0.841 respectively.

In this study, laparoscopy and MDCT had very good agreement with laparotomy findings in assessing peritoneal adhesions, similar result was reported by Ghonge eta.,(38) MDCT findings are likely to correlate with laparoscopy to a varying extent, depending upon the type and location of adhesions and also on the secondary effects on the adjoining structures.

Since the diagnosis of lymph node metastases with CT and MRI is based on the size and shape of lymph nodes, sensitivity of both imaging modalities is rather disappointing for lymph node staging. Several studies and pooled analyses have demonstrated sensitivities of 15–50% and 25–56% and specificities of 85–92% and 86–91% for CT and MRI, respectively, in the detection of lymph node metastases in patients with advanced cervical cancer.(40) In this study, we did not detect any case with LNs infiltration by DL, this may be due to associated adhesion or the small size of LNs by MDCT.

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