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Original article

Role of Multi-detector CT in Assessment of Lymphatic Spread in Gynecologic Malignancies

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Abstract

Back ground: Gynecologic cancers are a leading cause of morbidity and mortality for female patients especially uterine, ovarian and cervical. The diagnosis of pelvic tumor lymphatic metastases represents an important goal and challenge of modern imaging**.** Precise lymph node staging allows more adequate treatment planning, monitoring of treatment response, and early detection of disease recurrence. Lymph node status is the single most important prognostic factor in most gynecologic malignancies, and the presence of metastatic adeno-pathies is associated with the rate of recurrence. **Aim of work:** The aim of this study is to assess role of multi-detector computed tomography in assessment of lymphatic spread in gynecologic malignancies. **Results:** the overall accuracy of MDCT in endometrial, cervical and ovarian malignancy is about 80% for lymphatic spread in gynecological malignancy in advanced stages and recurrence. **Methods:** during period from October 2020 to December 2021, a prospective evaluation of 50 patients of ovarian, endometrial and cervical malignancy underwent MDCT for staging in radiology department of Tanta cancer center in Egypt. **Conclusion: -** MDCT is recommended in advanced staging and recurrence due its wide availability and low cost than MRI as well as lower radiation dose than PET/CT.

Key words: MDCT, lymph nodes, gynecological malignancy.

Introduction

Gynecologic cancers are a leading cause of morbidity and mortality for female patients especially uterine, ovarian and cervical. Using the available diagnostic imaging modalities, the radiologist must give appropriate information to the surgeon in order to plan the best surgical approach and its timing. ***(1)***. The diagnosis of pelvic tumor lymphatic metastases represents an important goal and challenge of modern imaging**.** Precise lymph node staging allows more adequate treatment planning, monitoring of treatment response, and early detection of disease recurrence. Indeed, lymph node status is the single most important prognostic factor in most gynecologic malignancies, and the presence of metastatic

adenopathies is associated with the rate of recurrence. ***(2).***

Although not included in the International Federation of Gynecology and Obstetrics (FIGO) classification. Patients with pelvic lymph node metastases have a lower 5-year survival rate. CT detection of enlarged pelvic lymph nodes is considered equivalent to FIGO stage IIIB disease, the mean accuracy rate of MDCT in detecting pelvic lymph node metastases was 81%,which is similar to that reported for conventional CT***.(3)*** Multi-detector CT is the technique of choice for staging because of its wide availability and a complete thoraco-abdominal study can rapidly be acquired. **(4)**. CT is one of the frequently used modalities for lymph node evaluation in gynecologic malignancies due to its availability, reproducibility, and noninvasiveness. Because of its anatomic techniques, it makes use of morphologic criteria for differentiating between benign and malignant lymph nodes, with size being the main criterion **(5)**.

Materials & Methods:

- **Patients**

This study is a prospective analysis approved by the ethics committee of the Scientific Research Review Board of the Radiology Department, Tanta cancer center in Egypt.

The study included 50 patients of ovarian, endometrial and cervical malignancy with their ages ranging from 31 to 75 years. The patients were referred from their departments (Surgery or Radiotherapy) based on their physician request to perform multislices CT for staging during the period from October 2020 to December 2021.

All patients underwent total hysterectomy with bilateral salpingo-oophorectomy ,pelvic lymphadenectomy and para-aortic lymphadenectomies. All lymph nodes were evaluated by intraoperative inspection and palpation. Palpable, enlarged or fixed lymph nodes were regarded suspicious for malignancy.

Diagnosis of recurrence was based on clinical symptoms, suspicion of relapse at physical examination, or a rise of blood tumor markers (CA-125) above the normal range (>35 U/ml) after achieving normal levels, or a doubling of the lowest level after primary therapy.

- **Methods**

Post contrast CT examination of the abdomen and pelvis was performed using 128 –detector scanner (Siemens technology).

- **Technique:**

Prior scanning, 1000 ml of oral contrast medium was administrated 3 hours earlier for proper bowel opacification. Image acquisition was performed 70 seconds after contrast administration. The contrast agent
used was “Telebrex”, the dose is 1.1ml/kg body weight, with a total dose ranging between 60 to 120 ml.
In cases with known sensitivity to contrast medium “Omnipaque” was the alternative agent, the dose is 50-200 mL(Omni 300); 60-100 mL (Omni 350). The contrast was injected either by the injector or manually.
The patient was instructed to hold his breath during image acquisition. The scan time lasts about 20 seconds. All the patients were examined in the supine position.

- **Image reconstruction**

Axial images with a slice thickness of 0.1mm were obtained for each case. Coronal and

sagittal MPR (multi-planner reconstruction) images were generated from the native axial images on the workstation with a slice thickness of 0.5 cm.

- **Image interpretation:**

CT images were analyzed for the following parameter.

1-Visualized lymph nodes were recorded by their anatomical sites and reviewed in the axial, coronal and sagittal planes. whether a lymph node is located along the pathway of dissemination of the primary tumor.

2-Shape of lymph node Lymph nodes

3-Measurements were performed in two perpendicular planes, the short axis diameter was recorded.

4-LNs with the short axis diameter ≥1.0 cm and/or the appearance of central necrosis was considered positive for malignancy on CT images.

5- A nodal diameter of more than 10 mm are the two most useful individual criteria for identifying malignant lymph nodes.

6-Lymph node enhancement heterogeneous or rim enhancement, thereby increasing the suspicion that malignancy is present.

- **Staging analysis**

Imaging were analyzed based on FIGO staging analysis. (table 1) (6)

- **Data and Statistical Analyses**

The histopathological examination results were considered as the reference standard in the evaluation of lymph node metastasis. A histopathological examination of the lymph nodes identified the lymph nodes as benign or malignant. The result of MDCT was considered a true negative(TN) if it showed negative findings, and the result was considered false positive (FP) if MDCT showed positive findings in a histo-pathologically benign lymph node.

The result of MDCT was considered a true positive (TP) if it showed positive findings, and the result was considered a false negative (FN) if it showed negative findings in a histo-pathologically malignant lymph node. The accuracy, sensitivity and specificity of MDCT in determining lymph node metastasis was calculated using a standard formula on a patient and lymph node basis.

Sensitivity = TP/(TP + FN),

Specificity = TN/(TN + FP),

Accuracy = (TP + TN)/(TP + FP + TN + FN).

Results:

The study included 50 patients which were 20 primaries and 4 recurrent ovarian malignancies, 10 primaries and 4 recurrent uterine malignancies ,10 primaries and 2 recurrent cervical malignancies that needed evaluation and staging of lymphatic spread. Mean age of included patients was 60 years old with age rang 31 and75 years.

General complaint was vaginal bleeding except for one who complain of abdominal mass.

Regarding menstrual history 60% were postmenopausal and 40% were premenopausal.

Lymph node enlargement is used as an important indicator of metastasis. When The size of short axis is used as an indicator of metastasis. The diameter of the lymph nodes ranged from 10 mm to 20 mm with a mean of15mm.

Table 2 showing Sensitivity, Specificity, Ppv, Npv And Accuracy Of CT In Lymphatic Spread In gynecological malignancy.

The results of multi-detector CT in ovarian cancer when evaluated on a patient basis showed that the accuracy, sensitivity and specificity of CT in detecting lymph node metastasis was 80%, 60% and, 88.2 % respectively with a PPV of 60% and NPV of 88% figure 1.

The results of multi-detector CT in endometrial cancer when evaluated on a patient basis showed that the accuracy, sensitivity and specificity of CT in detecting lymph node metastasis was 80%, 60% and, 90% respectively with a PPV of 75% and NPV of 80% figure 2.

The results of multi-detector CT in cervical cancer when evaluated on a patient basis showed that the accuracy, sensitivity and specificity of CT in detecting lymph node metastasis was 80%, 60% and 85.7% respectively with a PPV of 75% and NPV of 75%. Figure 3.

Table 1:TNM and FIGO Staging of Lymph Node Involvement in Gynecologic Neoplasms

Nodal Disease Characteristics	FIGO Stage
Ovarian Neoplasms	
Regional metastases to para-aortic, pelvic, or inguinal nodes	..
Regional metastasis to para-aortic nodes only (no peritoneal spread)	IIIA1
Metastasis ≤10 mm in greatest dimension	IIIA1(i)
Metastasis >10 mm in greatest dimension	IIIA1(ii)
Regional metastasis to inguinal nodes	IVB
Endometrial Neoplasms	
Regional metastasis to pelvic nodes	IIIC1
Regional metastasis to para-aortic nodes, with or without regional metastasis to pelvic nodes	IIIC2
Cervical Neoplasms	
Regional metastasis to pelvic (external, internal, or common iliac) nodes	..
Enlarged regional nodes with extracapsular spread	III
Fixed or ulcerated regional nodes	IV

Table 2: showing Sensitivity, Specificity, Ppv, Npv And Accuracy Of CT In Lymphatic Spread In gynecological malignancy.

CT	Sensitivity	Specificity	PPV	NPV	Accuracy
Endometrial Carcinoma	**60**	**90**	**75**	**80**	**80**
Cervical carcionoma	**60**	**85.7**	**75**	**75**	**80**
Ovarian carcinoma	**60**	**88.2**	**60**	**88**	**80**

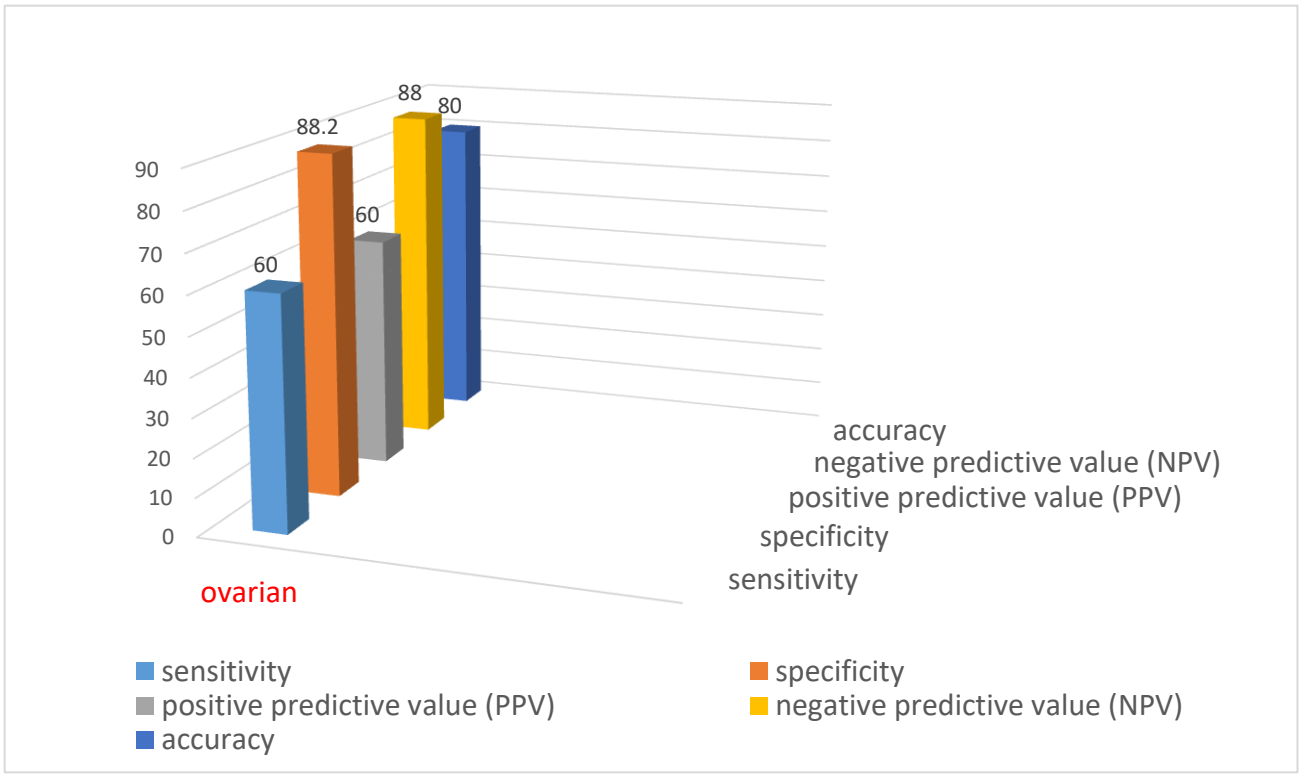

Figure 1:- Sensitivity ,Specificity , Ppv, Npv And Accuracy Of CT In Lymphatic Spread In Ovarian Cancer.

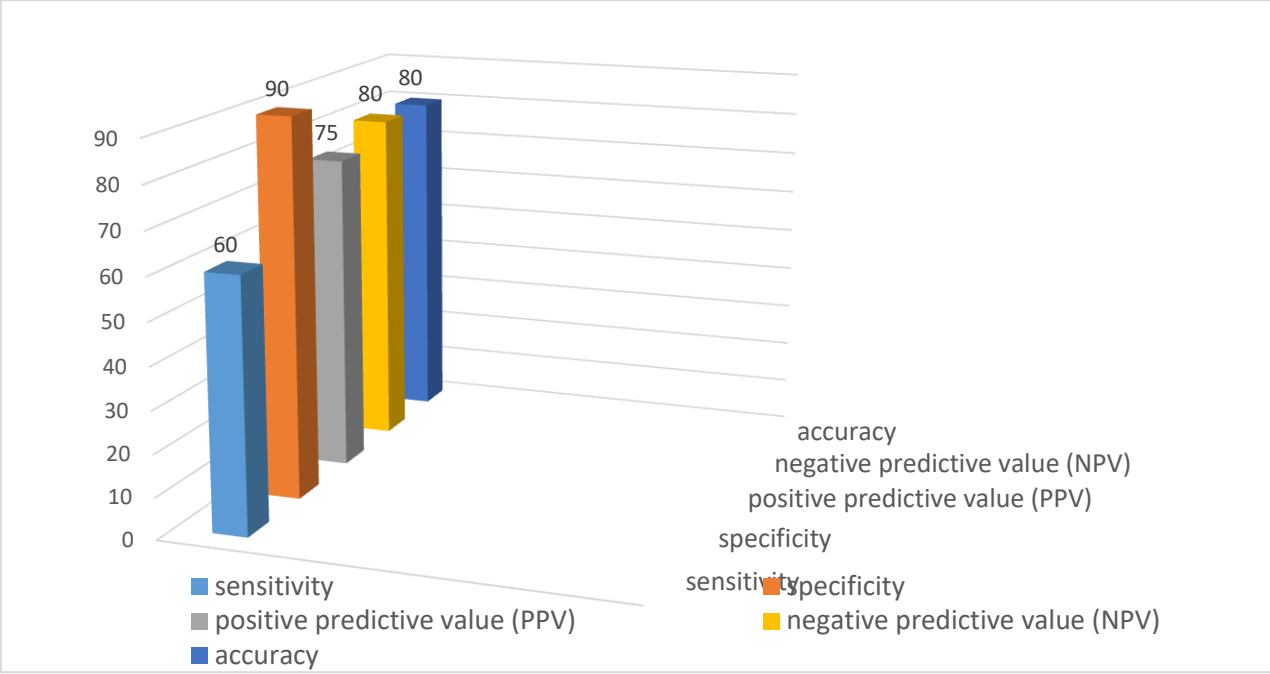

Figure 2 :- Sensitivity ,Specificity , Ppv, Npv And Accuracy Of CT In Lymphatic Spread In endometrial Cancer.

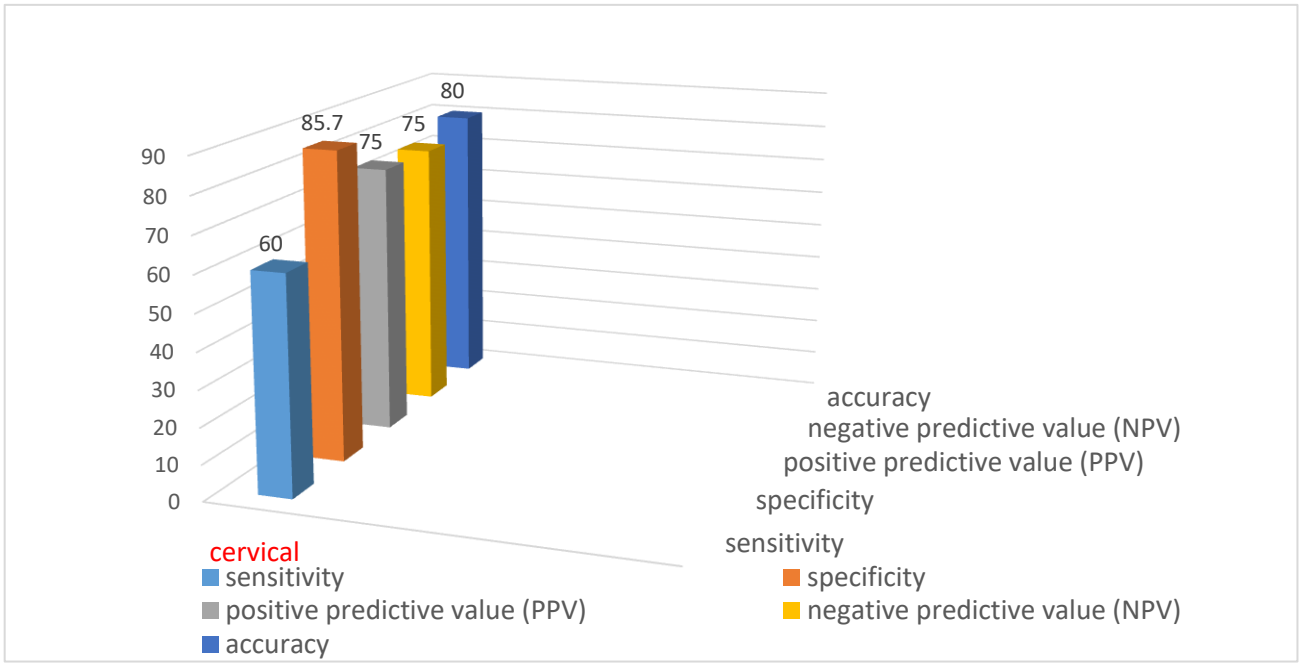

Figure 3:- Sensitivity ,Specificity , Ppv, Npv And Accuracy Of CT In Lymphatic Spread In cervical Cancer.

Figure 4: Stage IIIA1(ii) cancer ovary (serous cystadenocarcinoma) axial images (a) showing left cystic and enhanced solid component seen deeply seated posteriorly to the uterus (b) showing left para-aortic lymph nodes measuring (10mm)**.**

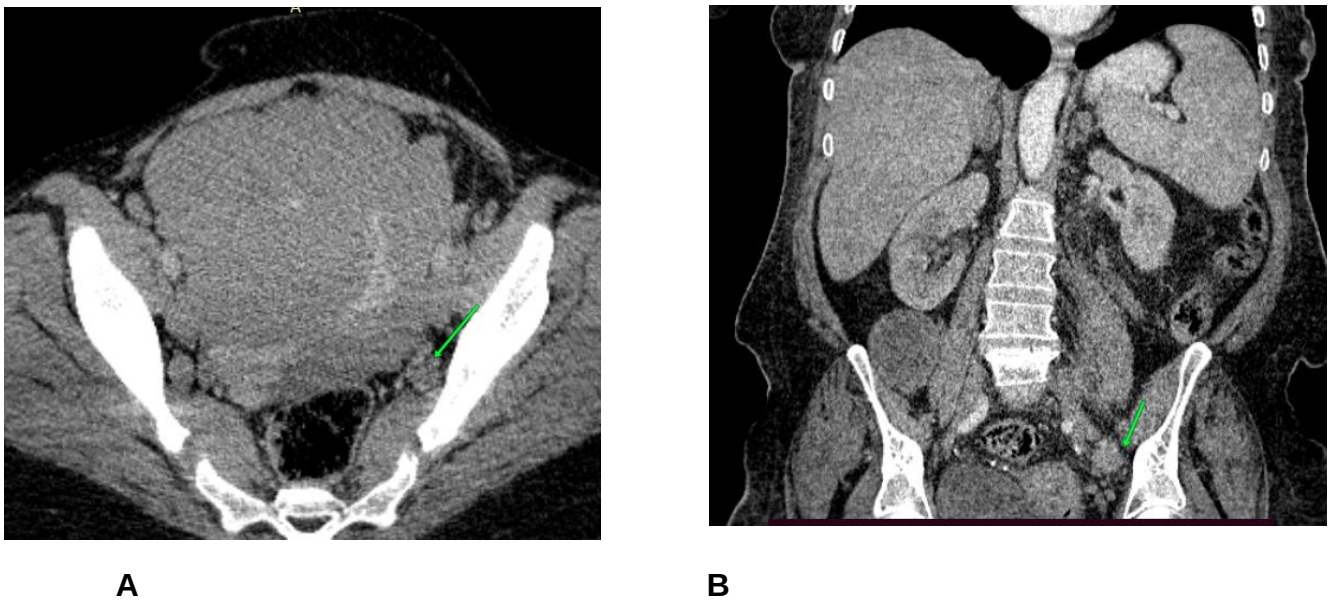

figure 5: - A case of metatstic leiomyosarcoma .(A) axial and (B) coronal images showing Huge pelvi-abdominal macro-lobulated well-defined mass like lesion with mixed densities with major soft tissue component seen in (A) with necrotic and enhancing internal iliac lymph nodes measuring (2cm) seen in (B)

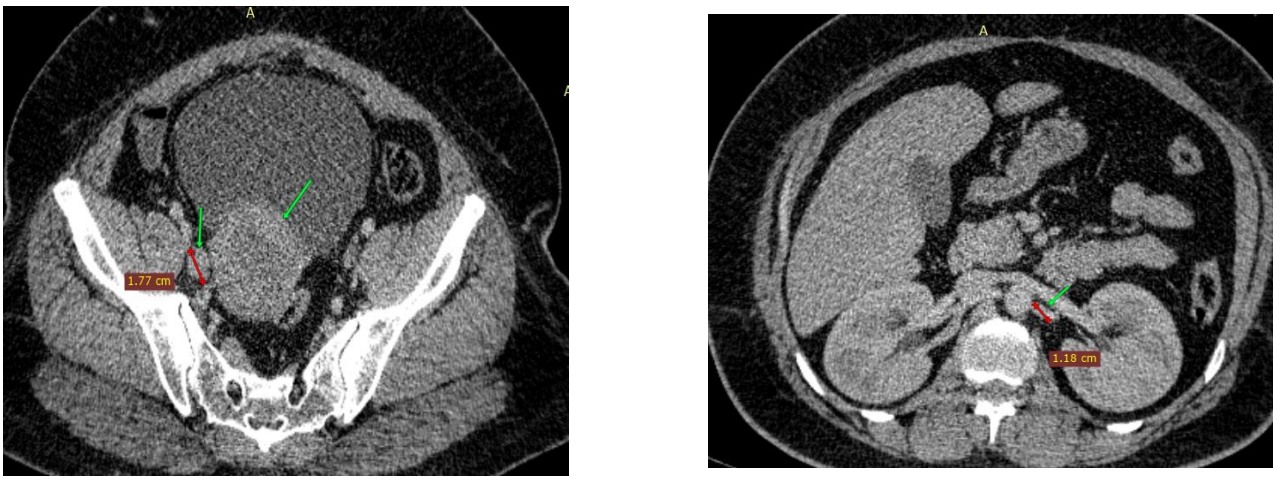

Figure 6: Stage IIIC2 endometrial carcinoma (endometrial adenocarcinoma) axial images(A) and (B) showing hypo-attenuating endometrial mass associated with bilateral external iliac lymph nodes measuring (17mm) seen in (a)and enlarged left para-aortic lymph nodes measuring (11mm) seen in (b).

Figure 7: - Stage III cervical carcinoma (squamous cell carcinoma) (A) axial and (B) coronal images showing heterogeneously enhancing cervical mass displacing the uterine body with internal iliac lymph nodes measuring (17mm).

Discussion

Multidetector-row computed tomography (MDCT) has emerged as a novel imaging technique in recent years. It is increasingly accepted by clinician to preoperatively assess regional lymph node status in a variety of cancers MDCT can obtain high-quality multiplanar images in fast scan time and allow three-dimensional reconstruction. (7)

MDCT has good density resolution, can avoid intestinal peristalsis and other effects to a certain extent. It is visual and has certain

advantages in finding lymph node diffusion, but its diagnostic sensitivity to cancer staging is not strong. .

The relevant parameter whether lymph nodes are considered benign or malignant is their size, and a size of 10 mm or more in short-axis diameter is considered pathological(8)**.**

An important challenge is represented by the lymph nodes involvement. The ability to correctly identify metastatic lymph nodes depends on lymph node size; in fact, sensitivity varies with nodes diameter (100, 67, and 13 % in metastatic nodes ≥10, 5–9, and ≤4 mm, respectively)**(9).**

Preoperative knowledge of the lymph node status in cancer ovary is of enormous importance for therapy planning. So preoperative cross-sectional imaging should always be performed if ovarian carcinoma is suspected; in this case CT is most frequently used as a tool to evaluate intra-abdominal and retroperitoneal (lymph node) tumor spread**.(10)**

In our study, The accuracy, sensitivity and specificity of CT in detecting lymph node metastasis in ovarian carcinoma was 80%, 60% and, 88.2 % respectively**.**

Other study concluded that CT is the technique of choice for staging in ovarian cancer because of its wide availability and because a complete thoraco-abdominal study can rapidly be acquired, with rates of diagnostic precision of 60%–90% for all stages . CT has a low sensitivity (40%–43%) but a good specificity (89%–96%) for lymph node involvement**(4).**

A separate analysis for pelvic and para aortic lymph node involvement showed a better diagnostic performance of computer tomography for the detection of positive para-aortic lymph nodes (41.2, 93.1, 84.0, and 64.3% for sensitivity, specificity, positive predictive value and negative predictive value, respectively) as compared to the detection of positive pelvic lymph nodes (25.6, 91.8, 62.5, and 69.8%). **(11)**.

In previous meta-analyses evaluated CT, MRI, PET and PET/CT for the detection of metastatic lymph nodes in ovarian cancer patients. PET and PET/CT were a more accurate modality for lymph node metastasis detection, with a global pooled sensitivity and specificity of 73.2% and96.7% respectively. CT and MRI showed similar diagnosticperformance, with pooled sensitivity of 42.6% and 54.7% and pooled specificity of 95.0% and 88.3%, respectively. (12)

Lymph node metastasis is the most common form of extrauterine disease spread. Several studies have found that lymph node involvement is a strong predictor of recurrence and survival, and its presence warrants upstaging to stage IIIC disease.(13)

In our study ,The accuracy, sensitivity and specificity of CT in detecting lymph node metastasis in endometrial carcinoma was 80%, 60% and, 90% respectively with a PPV of 75% and NPV of 80%.

In other study, For CT assessment of pelvic lymph node metastases, the reported sensitivities(specificities) [accuracies] are 14–55% (77–100%)[74–82%] respectively. **(14).**

In other study documented low sensitivities and moderate to high specificities for CT for preoperative detection of LNM in endometrial

cancer., the reported sensitivities and specificities of CT were 28–64 and 69–94 %, respectively**.(15).**

Metastatic node detection in endometrial carcinoma with MRI is similar to a high-quality CT scan with variable sensitivity ranging from 38% to 89% and specificity ranging from 78% to 99**. (16).**

One of the greatest difficulties in the clinical staging of cervical neoplasms is the assessment of lymph nodes. Paradoxically, a precise preoperative assessment of the lymph nodes is vital from a clinical point of view because the presence of adenopathy is a determining factor in the decision to administer concurrent pelvic radiation therapy and adjuvant chemotherapy. **(2)**

In our study The accuracy, sensitivity and specificity of CT in detecting lymph node metastasis in cervical carcinoma was 80%, 60% and, 90% respectively with a PPV of 75% and NPV of 80%.

In other study, the sensitivity and specificity CT for detecting LN metastases from cervical cancer are reported to be 51.4% and 85.9%. **(17).**

In other study , the evaluation of pelvic node involvement by CT had sensitivity and specificity of 72.7% and 92.9%, respectively, with a PPV of 88.9% and NPV of 81.3% for detection of pelvic nodal involvement. PET/CT imaging had a sensitivity and specificity of 95.5% and 92.9%, respectively, with a PPV of 91.3% and NPV of 96.3% for detection of pelvic node involvement **(18).**

Subgroup analysis on lymph node region in cervical malignancy (pelvic versus para-aortic), the sensitivity was higher in the para-aortic region compared to the pelvic region for both CT (68% vs 48%) and PET-CT (81% vs. 55%) (19)

Conclusion

The accuracy of MDCT in endometrial, cervical and ovarian malignancy is about 80% for lymphatic spread in gynecological malignancy in advanced stages and recurrence. So, MDCT is recommended in advanced staging and recurrence due its wide availability and low cost than MRI as well as lower radiation dose than PET/CT.

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