International Journal of Reproduction, Contraception, Obstetrics and Gynecology
Danish M et al. Int J Reprod Contracept Obstet Gynecol. 2024 Aug;13(8):1987-1993
www.ijrcog.org
pISSN 2320-1770 | eISSN 2320-1789

DOI: https://dx.doi.org/10.18203/2320-1770.ijrcog20241952

Original Research Article

Comparison of ultrasound and computed tomography in the diagnosis of malignant ovarian tumours at tertiary care center

Mozaffar Danish*, Shreya Bhat, Asif Khursheed, M. Shamim Ahmad

Department of Radiodiagnosis, Narayan Medical College and Hospital, Bihar, India

Received: 15 June 2024
Revised: 29 June 2024
Accepted: 01 July 2024

***Correspondence:**
Dr. Mozaffar Danish,
E-mail: mozaffardanish@gmail.com

ABSTRACT

Background: Accurate diagnosis of ovarian tumours is a diagnostic challenge. Multiple modes are used for the early detection of ovarian tumours. Early detection provides a survival advantage. Ultrasonography (USG), computed tomography (CT) and magnetic resonance imaging (MRI) are important imaging modalities in this regard. This study aims to compare the diagnostic accuracy of USG and CT imaging in the detection of malignant ovarian tumours.
Materials: An observational cross-sectional study is conducted in the department of radiodiagnosis of Narayan medical college and hospital, Bihar over a period of 18 months from August 2021 to March 2024. Fifty-three patients with suspected ovarian malignancy who were not pregnant or had contraindications for administration of contrast media were included in the study. USG, CT and histopathology reports were compared for diagnostic accuracy with respect to different components.
Results: Mean age of the patients was seen to be 49.6±13.8 years. Abdominal pain was the most common presentation Majority of the patients had vascular lesions with a well-differentiated margin, heterogenous enhancement and septations. USG and CT agree almost perfectly in, identifying septations, calcification, and in differentiating margin of the tumours and very poorly for the identification of lymphadenopathy. CT had better sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) when compared to USG for diagnosis of ovarian malignancies
Conclusions: CT has superior diagnostic accuracy compared to USG for diagnosis of ovarian tumours. However, USG provides similar diagnostic accuracy for identifying septations, calcification, and in differentiating margins of tumours.

Keywords: Malignant ovarian tumours, CT, Ultrasound, CA-125

INTRODUCTION

Ovarian carcinomas are the third most common gynaecological malignancies.[1] It is one of the leading cancers in Indian women. In the year 2012, ovarian cancer occurred in 239000 women worldwide, including new 26834 cases from India and resulted in 152000 deaths.[2]

Ovarian tumour is more lethal than endometrial and cervical cancer because of delayed in the diagnosis, lack of symptoms and early peritoneal dissemination. These tumours spread outside the pelvis in approximately 70% of cases at the time of diagnosis.[3]

Though CA-125 is a tumour marker for epithelial ovarian cancers, it is not very specific due to high false-positive results. Clinical examination and serum CA-125 levels have failed inconsistent detection of ovarian malignancy because the sensitivity of these techniques is often below 50%. Hence imaging modalities, particularly USG, CT, and MRI, have become indispensable in the detection of ovarian malignancy.[4]

Transabdominal and endo-vaginal USG have demonstrated accuracies up to 80% for the evaluation of ovarian masses. USG is the better imaging modality for the detection of masses than in the diagnosis of malignancy.

Spectral analysis of Doppler waveform by colour Doppler USG, allows detection of tumour vascularity. Doppler USG is not very consistent in the diagnosis of malignancy. USG also has an important role in guiding diagnostic procedures. Disadvantages of USG include reduced image quality in obese patients and inter-operator variability.[4]

Contrast-enhanced CT and MRI have shown accuracies of almost 80% in the diagnosis of malignant ovarian tumour and 80%-90% in the detection of transabdominal spread. CT scan has more advantages over other imaging modalities which include easy availability, short image acquisition times, large field of view, high spatial resolution and ability to rapidly conduct multiplanar reconstructions. Also, CT-guided biopsy is safe and useful procedure. Disadvantage of CT scan include the use of ionizing radiation mostly for young and pregnant patients, degradation in the quality of image with metallic implants, and adverse reaction to iodinated contrast agents.[5]

Ovarian cancers, if detected early, 70-90% of the patients can be cured. But only 20-25% percentage of the ovarian cancers are diagnosed in the early stages presently.[6] Early detection provides a survival advantage.

Present study aims to compare the accuracy of USG with CT in the diagnosis and staging of ovarian malignancy and its correlation with CA-125 assay and histopathology.

METHODS

This was a cross-sectional observational study done on 53 patients at the department of radiodiagnosis Narayan medical college and hospital over a period of 18 months from August 2022 to March 2024. Clinically suspected cases of ovarian malignancy irrespective of the stage of the disease and clinically suspected cases of ovarian malignancy with features of a benign ovarian tumour on USG were referred to department of radiodiagnosis.

USG was performed via a transabdominal approach using a Phillips Affinity 70 machine curvilinear probe. Colour and spectral doppler was performed in all cases to assess the presence or absence of vascularity.

After that CT scan was performed on the same patient using a Siemens, Sommatom emotion, 16 slice CT scanner with pre and post intravenous iodinated contrast administration along with oral and rectal negative contrast for a detailed evaluation of the tumour and peritoneal spread. Clinical, histopathological and imaging data was correlated using appropriate SPSS software (Trial version-21), diagnostic accuracy of CT and USG were evaluated using sensitivity, specificity, PPV and NPV.

RESULTS

Present study was a cross-sectional observation study among 53 patients who were clinically suspected cases of ovarian malignancy irrespective of the stage of the disease and clinically suspected cases of ovarian malignancy with features of a benign ovarian tumour on USG, conducted in the department of radiodiagnosis, Narayan medical college and hospital.

Age distribution

Majority of the patients were aged between 31-50 yeas. Mean age of the patients was 49.6±13.79 years.

Size of the lesions

Out of 53 lesions, 18 lesions were less than 10 cm and 35 lesions were more than 10 cm. Most of the malignant lesions were more than 10 cm (Table 1 and Figure 1).

Table 1: Size of the lesions of ovarian tumours.

Size (cm)	Benign	Borderline	Malignant	Total
<10	2	2	14	18
>10	7	2	26	35
Total	9	4	40	53

Figure 1: USG heterogeneously hypoechoic lesion in right adnexa showing solid and cystic components >10 cm in maximum diameter.

Presenting symptom

Pain was the most common presenting symptom, followed by menstrual irregularities and weight loss.

Margins

Most of the masses were well defined in USG and CT (Table 2). On applying Kappa statistics, it was found that the agreement between the two investigations was almost perfect (Kappa value=0.961).

Table 2: Distribution of patients as per the differentiation of margins.

Margins	USG, N (%)	CT, N (%)
Ill defined	21 (39.6)	22 (41.5)
Well defined	32 (60.4)	31(58.5)
Total	53 (100)	53 (100)

Presence of septations

Both USG and CT showed septations within most of the ovarian tumours. 46 cases were reported to have septations on USG, and 45 cases showed septations on CT (Table 3 and Figure 2). On applying Kapa statistics, there was a near-perfect agreement between USG and CT for detection of septation in ovarian tumours with Kappa value of 0.922.

Table 3: Distribution of patients as per the presence of septation in an ovarian mass.

Septation	USG, N (%)	CT, N (%)
Absent	7 (13.2)	8 (15.1)
Present	46 (86.8)	45 (84.9)
Total	53 (100)	53 (100)

Presence of vascularity on USG

Majority of the lesions showed vascularity on colour Doppler. The thirty-five (35) malignant lesions had vascularity and five of the malignant lesions did not have vascularity.

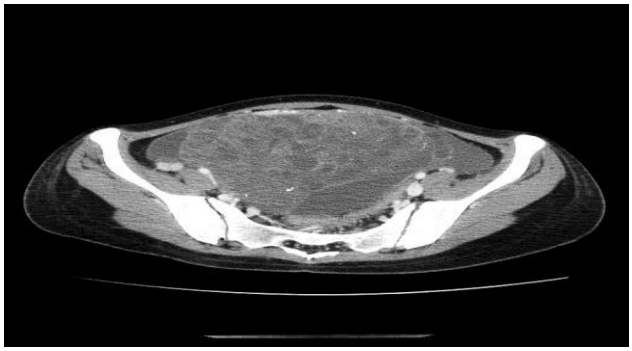

Figure 2: Contrast enhanced axial CT scan shows multilocular solid cystic lesion in adnexa with enhancing septa in a suspected case of ovarian malignancy.

Enhancement on CECT

On CT scan, heterogeneous enhancement was seen in 46 cases out of 53 cases, 35 out of 40 malignant lesions showed heterogenous enhancement and 5 malignant lesions showed no enhancement on post contrast (Table 4).

Table 4: Presence of enhancement in malignant lesions.

Enhancement	Benign	Borderline	Malignant	Total
Homogenous	1	0	0	1
Heterogenous	7	4	35	46
No enhancement	1	0	5	6
Grand total	9	4	40	53

Lymphadenopathy

Out of 53 patients, lymphadenopathy was detected in 6 patients by USG and 36 patients by CT. On applying kappa statistics, it was seen that there is a slight agreement between USG and CT for detection of lymphadenopathy with a Kappa value of 0.114.

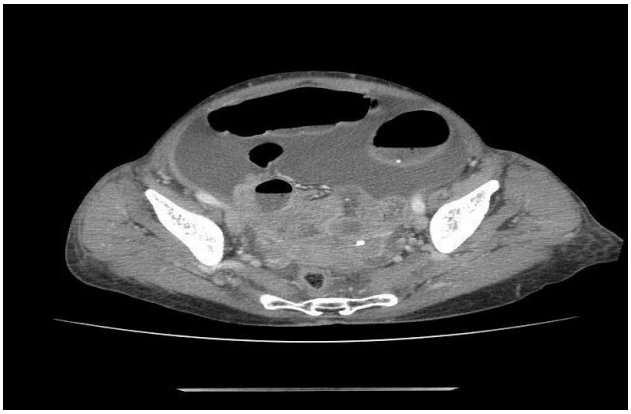

Figure 3: Axial contrast enhanced CT image shows multilocular solid mass with necrotic components and ascites.

Categorization of patients per final diagnosis by USG, CT and histopathology

Out of 53 cases, 37 were diagnosed as malignant by USG, 14 as benign and 2 as borderline. On CT 41 cases were diagnosed as malignant, 8 were benign, and 4 were borderline. On histopathology 40 were diagnosed to be malignant, 9 were benign, and 4 were borderline (Table 5). On histopathology 40 cases were found to have malignant ovarian tumours among this most common type was serous cystadenocarcinomas (Figure 3), followed by benign lesions ad borderline tumours.

Table 5: Distribution of patients as per the final diagnosis by USG, CT and histopathology.

Impression	USG, N (%)	CT, N (%)	Histopathology, N (%)
Benign	14 (26.4)	8 (15.1)	9 (17)
Borderline	2 (3.8)	4 (7.5)	4 (7.5)
Malignant	37 (69.8)	41 (77.4)	40 (75.5)

Diagnostic accuracy of USG and CT in detecting ovarian malignant lesions

On comparing the diagnosis of malignant ovarian tumours by USG and CT, 32 lesions were diagnosed to be malignant by both USG and CT scan. Seven lesions were diagnosed to be non-malignant by both USG and CT. Nine lesions were diagnosed to be malignant by CT but were diagnosed as non-malignant by USG. Out of 12 non-malignant cases, 5 cases were diagnosed as non-malignant by both USG and CT, and 7 cases reported as non-malignant only by CT. On applying kappa statistics, there was a fair agreement between both the investigations with a Kappa value of 0.325.

On a comparison between USG and histopathology, 32 lesions were correctly diagnosed to be malignant by USG, eight lesions were correctly identified to be non-malignant, eight malignant lesions were confirmed to be malignant on histopathology were diagnosed as non-malignant on USG, and 5 non-malignant lesions on histopathology were diagnosed as malignant on USG.

On comparison between CT and histopathology, 39 lesions were correctly diagnosed to be malignant by CT, 11 lesions were correctly identified to be non-malignant by CT, 1 non-malignant lesion confirmed to be malignant on histopathology was non-malignant on CT, and 2 non-malignant lesions confirmed on histopathology were diagnosed as malignant on CT.

On assessing the diagnostic accuracy of USG and CT for diagnosis of malignant lesions, USG had a sensitivity of 80%, a specificity of 61.5%, PPV of 86.5%, NPV of 50%.

CT had a sensitivity of 97.5%, specificity of 84.6%, PPV of 95.1%, NPV of 91.7% (Table 6).

Table 6: Comparison of diagnostic accuracy of USG and CT for diagnosis of malignant ovarian tumours.

Diagnostic parameter	USG	CT
Sensitivity (%)	80.0	97.5
Specificity (%)	61.5	84.6
PPV (%)	86.5	95.1
NPV (%)	50.0	91.7

DISCUSSION

Ovarian carcinomas are the third most common gynaecological malignancies.[1] It is one of the leading cancers in Indian women. Clinical examination and serum CA-125 levels have failed with inconsistent detection of ovarian malignancy. Hence imaging modalities, particularly USG, CT, and MRI, have become crucial for diagnosis of ovarian malignancy.[4]

Ovarian masses are a common finding in daily clinical practice and may be incidentally detected or identified in symptomatic patients. Characterization of ovarian lesions is of great importance in order to plan adequate therapeutic procedures, and may influence patient's management. Optimal assessment of adnexal masses requires a multidisciplinary approach, based on physical examination, laboratory tests and imaging techniques.[7]

An algorithmic approach to the imaging evaluation of ovarian neoplasms is also discussed.[8]

Eighty percent of ovarian neoplasms occur in women over 50 years of age and trans-abdominal and trans- vaginal ultrasound have been advocated as a screening technique for the detection of ovarian cancer in post- menopausal women.[9] Spectral analysis of the Doppler waveform is useful for the detection of tumour vascularity.

Features that are more suggestive of benign epithelial tumors include a diameter less than 4 cm, entirely cystic components, a wall thickness less than 3 mm, lack of internal structure, and the absence of both ascites and invasive characteristics such as peritoneal disease or adenopathy. Epithelial tumors with low malignant potential demonstrate more proliferation of papillary projections than benign cystadenomas and are often seen in younger patients. Papillary projections are characteristic features of some epithelial neoplasms of the ovary.[10]

Assessing the diagnostic accuracy of these imaging modalities for the evaluation of malignant ovarian tumours is a crucial step towards early detection of the disease, staging and treatment planning to reduce morbidity and mortality. Therefore, aim of our study was to compare the diagnostic accuracy of USG and CT in the detection of malignant ovarian tumours. An observational cross-sectional study was conducted in the department of radiodiagnosis Narayan medical college and hospital Bihar, over a period of one-half year.

Majority of the patients (69.8%) were in the age group of 31-60 years. Mean age of the patients was 49.6±13.8 years, similar results were seen in a study by Arora et al consisting of 52 patients with ovarian masses to evaluate the role of USG and CT in correlation with histopathology.[11] In our study 35 (66.1%) out of 53 patients were having ovarian tumour size >10 cm and in 18 (33.9%) patients tumours size was <10 cm. Out of 40 malignant lesions which were confirmed on histopathology, 26 (65%) lesions were >10 cm in size and 14 (35%) were <10 cm. Pain was the most common presenting symptom in our study, and 29 (54.7%) cases out of 53 (100%) presented with pain abdomen. This was followed by menstrual irregularities (47%) and weight loss (45%) In a study conducted by Nilufer et al most common presenting symptoms were abdominal pain and distension (77.7%).[12] In our study, 32 (60.3%) out of 53 cases showed well-defined margins of ovarian mass on USG and 31 (58.4%) cases on CT. Hence there is a perfect agreement (Kappa value 0.961) between USG and CT in defining margins of the ovarian mass.

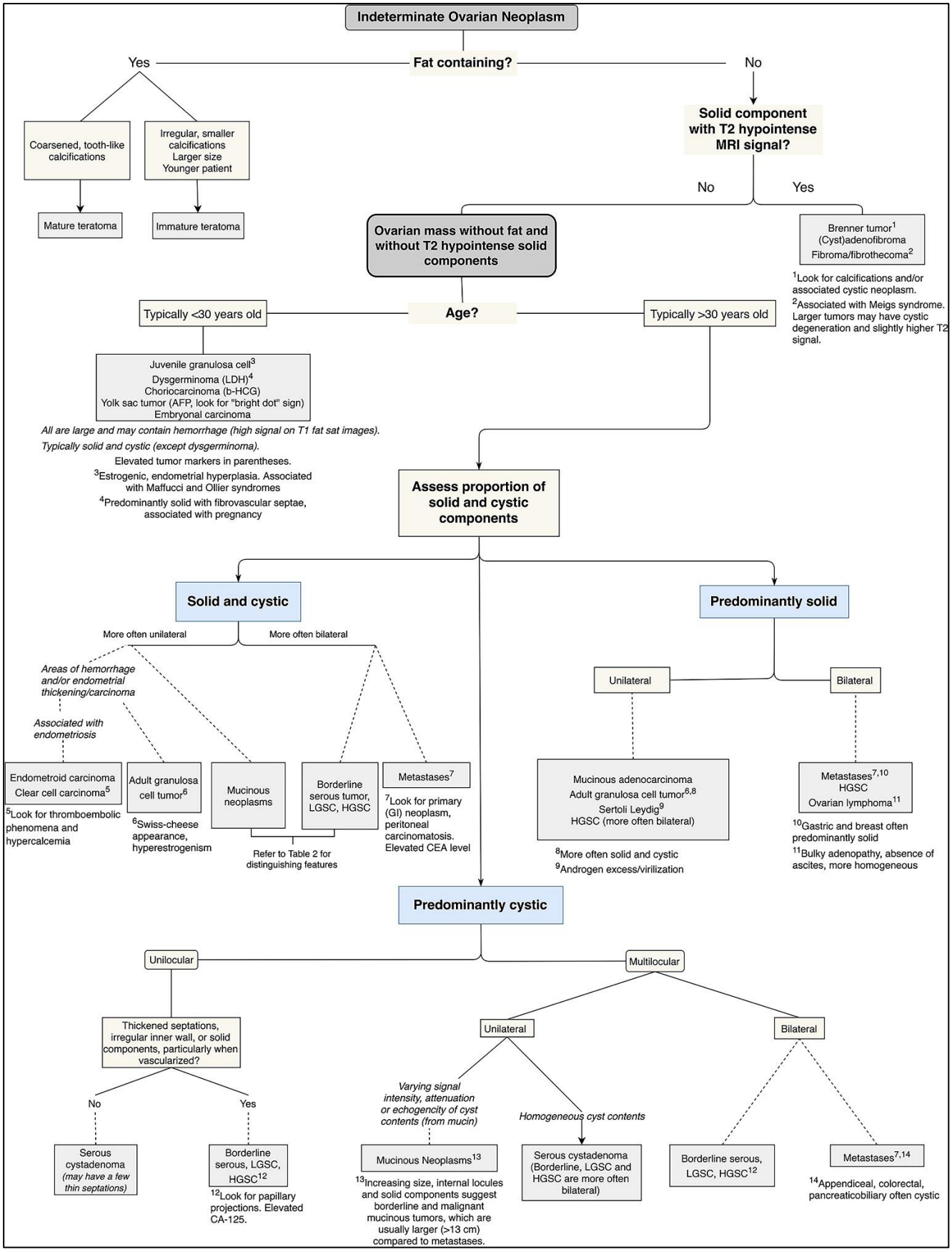

Figure 4: Flowchart outlines an algorithmic approach to ovarian neoplasms.[8]

USG and CT were equally good for detection of septation within the ovarian tumour. Out of 53 cases, septations were seen in 46 (86.7%) cases on USG and 45 (84.9%) cases on CT (Figure 3 and 4). In a study by Bhimani et al septation was the predominant feature of a malignant ovarian tumour.[13] The 35 of the malignant lesions had septations, whereas only 25 benign lesions were found to have septations. In our study vascularity was detected in 88.7% (n=47) cases on colour doppler, 11.3% of cases (n=6) did not show any vascularity on colour doppler, it was most commonly seen in patients with malignant lesions, 35 out of 40 malignant lesions showed vascularity. Though resistive index less than 0.4, and pulstility index less than 1 suggestive of malignancy.

More than 85% of the lesions showed heterogeneous enhancement. In our study lymphadenopathy was detected in only 6 cases (11.3%) by USG, whereas 36 cases (67.9%) were found to have metastatic lymphadenopathy by CT. CT is superior to USG in diagnosing lymphadenopathy.

In our study 75.4% of the patients were having malignant tumours based on histopathology, 17% were benign, and 7.5% were borderline, 80% of the malignant lesions were correctly diagnosed by USG, and 97.5% were detected correctly by CT. However, both imaging modalities could not specifically identify the histopathological subtype of malignant ovarian tumour.

Diagnostic accuracy

In our study, we observed that USG had a sensitivity of 80%, the specificity of 61.5%, PPV of 86.5%, NPV of 50% in the diagnosis of malignant ovarian tumours, while CT had a sensitivity of 97.5%, a specificity of 84.6%, PPV of 95.1%, NPV of 91.7%.

Similar results were found in a study by Manda et al and Shazia et al.[14,15]

Limitations

The study was conducted in a single hospital with a small sample size, also, patients included in this study belonged mostly to the same region. So, the results may not represent the whole community.

CONCLUSION

Majority of the patients were in the age group between 30-60 years with pain abdomen being the most common presenting symptom. Size of most of the malignant tumors were more than 10 cm and there was almost perfect agreement between USG and CT in identifying septations, calcification, and margins of the tumours CT had better sensitivity, specificity, PPV, NPV when compared to USG for the diagnosis of ovarian malignancies, therefore CT has superior diagnostic accuracy compared to USG for the diagnosis of malignant ovarian tumours. However, USG provides similar diagnostic accuracy for identifying septations, calcification, and in differentiating margins of the tumours.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Siegel R, Naishadham D, Jemal A. Cancer statistics, 2012. CA Cancer J Clin. 2012;62(1):10.
2. Ferlay J, Soerjomataram I, Ervik M, Dikshit R, Eser S, Mathers C, et al. Estimated cancer incidence, mortality and prevalence in 2012. Int J Cancer. 2015;136(5):E359-86.
3. Basu P, De P, Mandal S, Ray K, Biswas J. Study of 'patterns of care' of ovarian cancer patients in a specialized cancer institute in Kolkata, eastern India. Indian J Cancer. 2009;46(1):28-33.
4. Kurtz AB, Tsimikas JV, Tempany CMC, Hamper UM, Arger PH, Bree RL, et al. Diagnosis and staging of ovarian cancer: Comparative values of doppler and conventional US, CT, and MR imaging correlated with surgery and histopathologic analysis - Report of the radiology diagnostic oncology group. Radiology. 1999;212(1):19-27.
5. Mubarak F, Alam MS, Akhtar W, Hafeez S, Nizamuddin N. Role of multidetector computed tomography (MDCT) in patients with ovarian masses. Int J Womens Health. 2011;3(1):123-6.
6. Mathieu KB, Bedi DG, Thrower SL, Qayyum A, Bast RC. Screening for ovarian cancer: imaging challenges and opportunities for improvement. Ultrasound Obstet Gynecol. 2018;51(3):293-303.
7. Foti PV, Attinà G, Spadola S, Caltabiano R, Farina R, Palmucci S, et al. MR imaging of ovarian masses: classification differential diagnosis. Insights Imaging. 2016;7(1):21-41.
8. Taylor EC, Irshaid L, Mathur M. Multimodality Imaging Approach to Ovarian Neoplasms with Pathologic Correlation. RadioGraphics. 2021;41(1):289-315.
9. Johnson RJ. Radiology in the management of ovarian cancer. Clin Radiol. 1993;48(2):75-82.
10. Jung SE, Lee JM, Rha SE, Byun JY, Jung JI, Hahn ST. CT and MR Imaging of Ovarian Tumors with Emphasis on Differential Diagnosis. RadioGraphics. 2002;22(6):1305-25.
11. Arora M, Thakker VD, Sindhwani G, Gogoi RK. Ovarian Masses: Hitting the Oncological Dart with Ultrasoundand CT-A Comparative Study in Remote Northeast Indian Town. Int J Anat Radiol Surg. 2017;6(2):68-74.
12. Nilufer M, Shripad SH, Lavanya R, Shyamala G, Prashant A. Comparison of CA-125, conventional ultrasound and CT imaging in diagnosis and staging of ovarian cancer correlated with surgico-pathological findings. Int J Reproduct Contracept Obstet Gynecol. 2014;3(4):924-3.

13. Bhimani D, Garasiya V, Raychaudhuri C. Role of USG and CT scan in evaluating ovarian lesions. IAIM. 2018;5(5):156-66.
14. Manda C, Madhavi D. Comparative study of USG and CT in the evaluation of suspicious ovarian masses. Int J Gen Med Pharm. 2016;5(2):39-46.
15. Shazia M, Khan SA, Hussain M, Adil SO. Role of multidetector computed tomography in evaluation of ovarian lesions in women clinically suspected of malignancy. Asian Pacific J Cancer Prev. 2017;18(8):2059-62.

Cite this article as: Danish M, Bhat S, Khursheed A, Ahmad MS. Comparison of ultrasound and computed tomography in the diagnosis of malignant ovarian tumours at tertiary care center. Int J Reprod Contracept Obstet Gynecol 2024;13:1987-93.