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Radiological evaluation of ovarian mass by contrast-enhanced computed tomography abdomen with clinicopathological correlation in Eastern Indian population

Dona Saha[1], Ram Chandra Bhadra[2], Nabonita Biswas[3]

[1]Assistant Professor, Department of Anatomy, Bankura Sammilani Medical College, Bankura, West Bengal, India, [2]Associate Professor, [3]Senior Resident, Department of Radiodiagnosis, Nilratan Sircar Medical College, Kolkata, West Bengal, India.

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ABSTRACT

Background: Adenexal masses present diagnostic challenges. After identification of the ovarian mass, the most critical step is to determine the degree of suspicion for malignancy. It is mainly based on imaging modalities and clinicopathological correlation. **Aims and Objectives:** This radiological study was designed to differentiate benign and malignant ovarian masses by contrast enhanced-computed tomography (CECT) of abdomen and correlation of the radiological findings with histopathological report. **Materials and Methods:** This was a hospital-based prospective study conducted in Department of Radiodiagnosis, Nilratan Sircar Medical College and Hospital, Kolkata during January 2019–June 2020. The study was done on clinically suspected 50 patients of 15–50 years with ovarian mass having CECT diagnosed solid/complex solid cystic mass. **Results:** Among 50 cases under study, 37(74.0%) were benign which was significantly higher than that of malignant cases (26.0%). Malignancy was significantly associated with wall irregularity, solid-cystic composition, presence of thick septations, septal enhancement, presence of both septal, and solid enhancement pattern in CECT. **Conclusion:** Based on the results of the present study, multi-detector contrast-enhanced CT could be a rapid non-invasive and cost-effective step in the evaluation of ovarian masses.

Key words: Contrast-enhancedcomputed tomography; Ovarian mass; malignancy; Histopathology; Complex cyst

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INTRODUCTION

Adnexal lesions especially ovarian masses are a common presentation among women of all age groups in all social strata. Pertaining to their wide spectrum of diagnostic variation, they often perplex both the physician and the radiologist. While the docile benign ovarian lesions may be treated conservatively, the aggressive neoplastic lesions often require radical surgical and associated oncological treatment.

Ovarian cancer is a silent killer as it is often diagnosed at an advanced stage and has low 5-years survival rate of 45%. It is second only to cervical cancer in gynecological malignancies in India and has a worldwide prevalence.[1,2]

Therefore, radiological evaluation of ovarian masses is pivotal in making early diagnosis as well as in lesion characterization, distinguishing between benign, and malignant masses for determining the therapeutic approach. Various diagnostic modalities such as ultrasonography (USG), computed tomography (CT), and now Magnetic resonance imaging (MRI)help the clinician for solving these dilemmas.[3]

Although ultrasonography is widely available, cheap a considerable percentage of the ovarian masses may be considered as indeterminate.[4] CT, on the other hand, has advantage of wide availability, relative cost effectiveness, and rapidity and provides a larger field of view allowing

Address for Correspondence:
Dr. Ram Chandra Bhadra, Associate Professor, Department of Radiodiagnosis, Nilratan Sircar Medical College, Kolkata - 700014, West Bengal, India. **Mobile:** +91-9038093939. **E-mail:** rcbhadra@gmail.com

comprehensive evaluation all potential sites of peritoneal implants or lymphadenopathy as well as of the primary tumor site in the abdomen.[5,6] Oral contrast agent in the CT allows distension of the bowel and helps to differentiate bowel from peritoneal implants, which make CECT a major advantage over USG and MRI imaging. For these reasons, CECT is a very attractive method for estimating the disease extent before surgery or as a substitute for second-look laparotomy in women with ovarian malignancy.[7] Radiological diagnosis was confirmed by HPE, which was considered as the gold standard.

Aims and objectives

The purpose of the study is to preliminary delineation of an ovarian mass whether benign or malignant by clinicopathological evaluation and by CECT abdomen and correlation of the radiological findings with HPE report.

MATERIALS AND METHODS

This was a hospital-based prospective study conducted in the Department of Radiodiagnosis, Nilratan Sircar Medical College and Hospital, Kolkata during January 2019–June 2020. Clinically, suspected patients of 15–50 years with ovarian mass attending Gynecology OPD and who had CECT diagnosed solid/complex solid cystic mass were included in this study.Patients with known pregnancy, overt/known case of malignancy(to avoid overdiagnosis if known malignant cases were taken), and post-chemotherapy/radiotherapy patients were excluded from the study.

Parameters studied:

1. Patient demographics: Age, menstrual history, obstetric history, and surgical history.
2. Chief complaints: Abdominal pain, abdominal lump, back ache, and loss of weight.
3. Investigations: Hemogram, contrast-enhanced CT of abdomen, and pelvis.

16 slice MDCT machine – GE Brivo CT 385 was used for the study. Written consent was taken from every patient included in this study.

The study was pre-approved by the Institutional Ethics Committee (IEC) for the final permission.

Statistical analysis

Statistical analysis was performed with help of EpiInfo (TM) 7.2.2.2. Chi-square test (χ^2) test was used to test the association of different study variables. Z-test (standard normal deviate) was used to test the significant difference between two proportions. t-test was used to compare the means.Diagnostic accuracy, sensitivity, specificity, positive predictive value, and negative predictive value were calculated to compare the findings of different diagnostic tools. $P<0.05$ was taken to be statistically significant.

RESULTS

Out of the 50 cases under study, 37(74.0%) were benign which was significantly higher than that of 13 (26.0%) malignant cases($Z=6.78$; $P<0.0001$).

Chi-square (χ^2) test showed that there was significant association between age and the patients of the two groups ($P=0.046$).t-test showed that the mean age of the patients with benign mass was significantly lower than that of the patients with malignant mass ($t_{48}=3.74$; $P=0.00111$).

Abdominal pain, lump, backache, and weight loss were more associated with malignancy rather than benign ovarian mass (Table 1).

This study showed that significant association was present between the following parameters and likelihood of malignancy:

- Wall irregularity
- Solid-cystic composition
- Presence of thick septations
- Septal enhancement alone, presence of both septal, and solid enhancement pattern
- Associated features of metastasis such asascites, pleural effusion, peritoneal and omental deposits, and lymphadenopathy (Table 2).

Since one of the cell frequencies was zero, Chi-square test could not be calculated for association. Proportion of thick (>3mm) septations was significantly higher among the patients with malignancy (100.0%) than that of benign cases (18.8%) ($Z=11.66$; $P<0.0001$) (Table 3).

Chi-square (χ^2) test showed that there was significant association between serum level of CA125 and the patients of the two groups ($P=0.0012$). Proportion of raised

Table 1: Distribution of ovarian masses according to age of the patients

Age group (in years)	Benign (n=37)	Malignant (n=13)	Total
15–20	2	0	2
21–30	5	1	6
31–40	18	2	20
41–50	12	10	22
Total	37	13	50
Mean±SD	35.51±7.56	44.23±7.10	
Median	36	47	
Range	18–48	25–50	

$\chi^2=7.96$; $P=0.046$; S: Significant

Table 2: Distribution of the patients of the two groups based on CECT findings

Findings of CECT	Benign (n=37)	Malignant (n=13)	Z-value	p-value
Laterality of mass				
Unilateral	37 (100.0%)	10 (76.9%)	5.09	<0.0001 S
Bilateral	0 (0.0%)	3 (23.1%)	5.10	<0.0001 S
Composition				
Solid	1 (2.7%)	1 (7.7%)	1.55	0.06 NS
Complex cystic	25 (67.6%)	0 (0.0%)	10.15	<0.00001 S
Solid cystic	11 (29.7%)	12 (92.3%)	8.98	<0.00001 S
Density of cystic complex (n=48)				
High	14 (38.9%)	6 (50.03%)	1.56	0.06 NS
Low	22 (61.1%)	6 (50.03%)	1.56	0.06 NS
Fat calcification	10 (27.0%)	0 (0.0%)	5.58	<0.00001 S
Wall irregularity	11 (29.7%)	12 (97.3%)	9.84	<0.00001 S
Septations (present)	16 (43.2%)	13 (100.0%)	8.92	<0.00001 S
Enhancement pattern				
Septal	2 (5.4%)	3 (23.1%)	3.66	<0.00001 S
Solid	2 (5.4%)	1 (7.7%)	0.86	0.19 NS
Solid+Septal	0 (0.0%)	8 (61.5%)	9.47	<0.00001 S
Ascites	1 (2.7%)	10 (76.9%)	10.68	<0.00001 S
Pleural effusion	1 (2.7%)	4 (30.8%)	5.27	<0.00001 S
Peritoneal depth	0 (0.0%)	10 (76.9%)	11.18	<0.00001 S
Omental depth	0 (0.0%)	10 (76.9%)	11.18	<0.00001 S
Lymphadenopathy	0 (0.0%)	8 (61.5%)	9.47	<0.00001 S
Site of lymphadenopathy				
Pelvic	0 (0.0%)	4 (30.8%)	6.05	<0.00001 S
Pelvic+retroperitoneal	0 (0.0%)	2 (15.4%)	4.02	<0.00001 S
Pelvic+mesenteric	0 (0.0%)	2 (15.4%)	4.02	<0.00001 S
Diagnosis				
Benign	33 (89.2%)	1 (7.7%)	11.46	<0.00001 S
Malignant	4 (10.8%)	12 (92.3%)	11.46	<0.00001 S

CECT: Contrast-enhancedcomputed tomography, S: Statistically significant. NS: Statistically not significant

Table 3: Distribution of ovarian masses based on septal thickness on CECT

Septal thickness	Benign (n=37)	Malignant (n=13)	Total
(>3mm)	3 (18.8%)	13 (100.0%)	16 (55.2%)
(<3mm)	13 (81.2%)	0 (0.0%)	13 (44.8%)
Total	16 (100.0%)	13 (100.0%)	29 (100.0%)

χ^2=15.20; P<0.0001, S: Significant

Table 4: Distribution of patients of the two groups based on the serum level of CA-125

Serum level of CA-125	Benign (n=37)	Malignant (n=13)	Total
Raised	4	7	11
Normal	33	6	39
Total	37	13	50

χ^2=10.38; P=0.0012, S: Significant

serum level of CA 125 was significantly higher among the malignant cases (53.8%) as compared to benign cases (10.8%) (Z=6.49;P<0.0001) (Table 4).

Chi-square (χ^2) test showed that there was significant association between findings of CECT and the patients of the two groups (P<0.0001).

CECT had detected 89.1% of the benign cases correctly as compared to HPE which was significantly higher than that of the cases wrongly diagnosed as malignant (10.8%) (Z=11.03; P<0.001).

CECT had detected 92.3% of the malignant cases correctly as compared to HPE which was significantly higher than that of the cases wrongly diagnosed as benign (7.7%) (Z=11.87;P<0.0001).

From the above table, diagnostic accuracy, sensitivity, specificity, positive predictive value,and negative predictive value of CECT were 90.00%, 92.30%, 89.18%, 75.00%, and 97.05%, respectively (Table 5).

DISCUSSION

The results of HPE showed that out of 50 cases of ovarian mass, 37 (74%) were benign which was significantly higher that of malignant cases. Sharadha et al., encountered that among ovarian neoplasms, 87.8% were benign, 10% malignant, and 2.2% borderline. Mean ages of malignant and benign neoplasm were 41 and 39years, respectively.[8]

In this study, the most frequent subtype in the malignant category was papillary serous cystadenocarcinoma followed

Table 5: Comparison of findings of CECT and HPE

Findings of CECT	HPE		Total
	Benign (n=37)	Malignant (n=13)	
Benign	33	1	34
Malignant	4	12	16
Total	37	13	50

χ^2=29.36; P<0.0001, S: Significant

by mucinous cystadenocarcinoma. The predominant histological subtype of benign ovarian mass was mucinous cystadenoma(30%) followed by serous cystadenoma (22%) of total cases. Ashraf et al., studied the histological pattern of ovarian tumors, in which benign cystic teratoma was the most common benign tumor (35.17% of all benign tumors) and serous cystadenocarcinoma was the most common malignant tumor (33.33% of all malignant tumors).[9] Suppiah found most common malignant tumor as serous carcinoma of ovary(40%).[10]

Mean age of patients with benign mass was 35.5years which was significantly lower than that of patients with malignant ovarian mass 44.2 years. Wasim et al., found that the mean age of patients with ovarian malignancy was 49.07 years and with benign ovarian mass was 36.95years.[11] Hence, most lesions in the reproductive age group are fortunately benign, whereas, the prevalence of malignant lesions increases significantly with age and menopause.

In the present study, most common symptom was abdominal pain which was encountered in a total of 29 patients. Wasim et al., found that 76% patients with ovarian malignancy had abdominal pain[11] Radhamani et al., Al-shukri et al., and Bhagde et al., also reported almost similar finding in their studies.[12-14]

Among 23 cases which showed both solid and cystic components when evaluated by CECT, strikingly 12 out of 13 malignant ovarian masses (92%) showed solid-cystic composition. These correlate well with the findings of Arora et al.[15]

Evaluation by CECT revealed the presence of fat/calcification in a total of tencases, all of which were pathologically proven to be cases of benign germ cell tumors, that is,mature cystic teratoma.Arora et al., demonstrated a striking specificity of 100% given by the presence of fat/calcification for germ cell tumors.[15]

Suppiah showed wall irregularity, multilocularity, thick (>3mm) septations, ascites, peritoneal and omental deposits, and lymphadenopathy were predominant in cases of ovarian malignancy which also match with the present study.[10] Their concurrent presence rather than their isolated appearance is more relevant in the detection of malignancy.

Only one malignant ovarian mass was incorrectly classified as benign by CECT which was a case of low-grade mucinous cystadenocarcinoma. There was no associated ascites, pleural effusion or features of peritoneal or lymphatic spread, and the lesion did not show any septal enhancement on post-contrast study. Little enhancement in solid portion led to misinterpretation of a benign case of ovarian fibroma on CECT.

The present study showed sensitivity, specificity, positive predictive value, and negative predictive value of CECT were 92.30%, 89.18%, 75.00%, and 97.05%, respectively, which were very close to the results of Suppiah, who estimated sensitivity, specificity, positive predictive value, and negative predictive value of CECT were 95.45%, 71.43%, 63.63%, and 96.77%, respectively.[10] The findings of this study are comparable to the results of Ahmed et al., who observed CT to be 91% sensitive and 81.4% specific in evaluating benignity and malignancy in ovarian masses.[16] Another study done by Onyeka showed that the sensitivity of CT scan for ovarian malignancy was 83%.[17]

Finally, the proportion of raised level of CA-125 was significantly higher among malignant cases as compared to benign cases. Furthermore,elevated levels of CA-125 were noted predominantly in serous tumors. Similar to this study, Zurawski et al., observed that patients with non-mucinous epithelial neoplasms had CA-125 elevations more often (in 75% of the cases)than those with mucinous tumors.[18]

Limitations of the study

Possible limitations of multidetector CT included difficulty in revealing microscopic disease or small-sized tumors (of a diameter smaller than 0.5 cm), and defining whether a large adnexal mass was unilateral or bilateral. The most important limitation of CT is its inability to demonstrate small volume extra-ovarian <5mm deposits on bowel serosa, mesentery, and peritoneum, especially in the absence of ascites, necessitating the complementary role of laparoscopy in presurgical evaluation of ovarian cancer. Time constraints and small study population also influence the study results.

CONCLUSION

Modern imaging is steadily emerging as an important adjunct to the clinical assessment of ovarian cancer, contributing to the tumor detection, localization, characterization, staging, treatment planning, and follow-up. CECT is a reliable, non-invasive, and rapid scan with good sensitivity in differentiating benign and malignant ovarian tumor.

CT scan characteristics and CA125 level correlation can increase the specificity of the CECT. Meticulous study of wall irregularity, solid-cystic composition, thick septations, presence of wall enhancement, ascites, peritoneal and omental deposits, and lymphadenopathy can help in differentiating nature of the mass by CECT. Clinicians ought to be cautious for the intermediate tumors for which further imaging or laparoscopy needed for diagnosis.

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REFERENCES

1. Parkin DM, Bray F, Ferlay J and Pisani P. Global cancer statistics, 2002. CA Cancer J Clin. 2005;55(2):74-108.
   https://doi.org/10.3322/canjclin.55.2.74
2. Nand KA. Consolidated report of population based cancer registeries. Indian Council Med Res. 2001;1:212.
   https://doi.org/10.1007/s13193-010-0004-z
3. Joshi M, Ganesan K, Munshi HN, Ganesan S and Lawande A. Ultrasound of adnexal masses. Semin Ultrasound CT MR. 2008;29(2):72-97.
   https://doi.org/10.1053/j.sult.2008.01.004
4. Funt SA and Hann LE. Detection and characterization of adnexal masses. Radiol Clin North Am. 2002;40(3):591-608.
   https://doi.org/10.1016/s0033-8389(01)00009-4
5. Devine C, Szklaruk J and Tamm EP. Magnetic resonance imaging in the characterization of pelvic masses. Semin Ultrasound CT MR. 2005;26(3):172-204.
   https://doi.org/10.7860/IJARS/2017/27573:2272
6. Bennett GL, Slywotzky CM and Giovanniello G. Gynecologic causes of acute pelvic pain: Spectrum of CT findings. Radiographics. 2002;22(4):785-801.
   https://doi.org/10.1148/radiographics.22.4.g02jl18785
7. Kurtz AB, Tsimikas JV, Tempany CM, 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.
   https://doi.org/10.1148/radiology.212.1.r99jl3619
8. Sharadha SO, Sridevi TA, Renukadevi TK, Gowri R, Binayak D and Indra V. Ovarian masses: Changing clinico histopathological trends. J Obstet Gynaecol India. 2015;65(1):34-38.
   https://doi.org/10.18203/2320-1770.ijrcog20183320
9. Ashraf A, Shaikh AS, Ishfaq A, Akram A, Kamal F, Ahmad N, et al. The relative frequency and histopathological pattern of ovarian masses. J Biomed. 2012;28:98-102.
   https://doi.org/10.1007/s13224-014-0575-7
10. Suppiah S, Kamal SH, Zabid AZ and Hassan AH. Characterization of adenexal masses using multidetecor contrast enhanced CT scan-recognizing common pitfalls that masquerade as ovarian cancer. Pertanika J Sci Technol. 2017;25(1):337-352.
11. Wasim T, Majrroh A and Siddiq S. Comparison of clinical presentation of benign and malignant ovarian tumours. J Pak Med Assoc. 2009;59(1):18-21.
12. Radhamani S and Akhila MV. Evaluation of adnexal masses correlation of clinical, sonological and histopathological findings in adnexal masses. Inter J Sci Study. 2017;4(11):88-92.
13. Al-Shukri M, Mathew M, Al-Ghafri W, Al-Kalbani M, Al-Kharusi L and Gowri V. A clinicopathological study of women with adnexal masses presenting with acute symptoms. Ann Med Health Sci Res. 2014;4(2):286-288.
   https://doi.org/10.1097/GCO.0000000000000048
14. Bhagde AD, Jani SK, Patel MS and Shah SR. An analytical study of 50 women presenting with an adnexal mass. Inter J Reprod Contracept Obstetr Gynecol. 2016;6(1):262-265.
   https://doi.org/10.18203/2320-1770.ijrcog20164671
15. Arora M, Thakker VD, Sindhwani G and Gogoi RK. Ovarian masses: Hitting the oncological dart with ultrasound and CT. A comparative study in a remote Northeast Indian Town. Int J Anat Radiol Surg. 2017;27573:2272.
   https://doi.org/10.7860/IJARS/2017/27573:2272
16. Ahmed A, Zamir S and Saghir NJ. Characterization of adnexal masses on trans abdominal ultrasonography and CT scan. Ann Pak Inst Med Sci. 2013;9(1):48-51.
17. Onyeka BA, Attalla A and Deemer H. Comparative diagnostic values of grey-scale USS versus CT scan in primary management of gynaecological pelvic mass with emphasis on ovarian detection and staging. J Obstet Gynaecol. 2001;21(5):516-519.
   https://doi.org/10.1080/01443610120072126
18. Zurawski VR, Knapp RC, Einhorn N, Kenemans P, Mortel R, Ohmi K, et al. An initial analysis of preoperative CA 125 levels in patients with early stage ovarian carcinoma. Gynecol Oncol. 1988;30(1):7-14.
   https://doi.org/10.1002/ijc.2910420507

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Work attributed to:
Nilratan Sircar Medical College, Kolkata - 700 014, West Bengal, India.

Orcid ID:
Dr. Dona Saha - https://orcid.org/0000-0003-4707-6160
Dr. Ram Chandra Bhadra - https://orcid.org/0000-0001-9393-6673
Dr. Nabonita Biswas - https://orcid.org/0000-0002-4139-4451

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