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Original Article

Clinical Study on Findings of Ultrasound and Computed Tomography Scan in the Diagnosis of Ovarian Mass Lesions

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Abstract

Background: Ultrasonography (USG) is a simple and noninvasive diagnostic tool that gives lots of data to accurately characterize most of the ovarian mass lesions with a sensitivity and specificity of 88–96% and 90–96%, respectively. However, the presence of significant variability in the terminology and definition of USG findings has led to the need for more standardization and uniformity in adnexal USG. Computed tomography (CT) scan is used primarily in patients with ovarian malignancies, either to assess disease extent before surgery or as a substitute for second-look laparotomy. Moreover, spiral CT has several advantages such as its rapidity and possibility of identifying all potential sites of peritoneal implants or lymphadenopathy as well as of the primary tumor site.

Aim of the Study: The study was to the clinical findings of both USG and CT scan of abdomen and pelvis in the accurate diagnosis of ovarian mass lesions.

Materials and Methods: A total of 104 patients with mass lesions of the ovary were included and subjected to USG and CT scan of abdomen and pelvis. Transabdominal and transvaginal USG studies were undertaken in all the patients. USG findings and CT scan findings were observed recorded and analyzed. Ovarian pathologies were categorized as benign, malignant, and metastasized and the results of CT and USG were compared.

Observations and Results: A total of 104 patients with ovarian mass lesions attending the Radiology Department of a Tertiary Teaching Hospital in Kerala were included in the study; patients were aged between 18 and 68 years with a mean age of 42.46 ± 5.70 years. Patients aged between 19 and 58 years accounted for more than 80% of the entire subjects. Hemorrhagic cyst was the most common mass lesion diagnosed in this study and accounted for 28 (26.92%) patients. Tubo-ovarian abscess accounted for 19/104 (18.26%) of the total cases. This was followed by mucinous cystadenoma 17/104 (16.34%), serous cystadenoma in 13/104 (12.50%) cases, polycystic ovarian disease in 11/104 (10.57%), mature cystic teratoma in 7/104 (6.73%), simple cyst in 6 (5.76%), Brenner tumor in 2/104 (1.92%), and endometrioma in 1/104 (0.96%) patients.

Conclusions: CT scan and USG are two excellent noninvasive methods to differentiate ovarian mass lesions from benign and malignant lesions and both imaging techniques seemed to be comparable in differentiating malignant from benign ovarian tumors. CT scan was more sensitive than USG, but sonography is more specific than CT scan in diagnosis of malignant lesions. USG has high positive predictive value as compared to CT scan to diagnose malignant lesions.

Key words: Computed tomography scan, Malignancy and metastases, Ovarian tumors, Ultrasonography

INTRODUCTION

Ultrasonography (USG) is the primary imaging modality used by the physicians to identify and characterize ovarian mass lesions.[1,2] Based on the USG findings, accurate characterization of about 90% of ovarian mass lesions is possible with the collective experience from numerous centers worldwide.[3] Accurate characterization of ovarian mass lesions is important both to determine the indication for surgery and to help define the type of surgery and whether a surgical subspecialist is needed.[4] The approaches to characterize the ovarian mass lesions include subjective assessment, simple scoring systems, statistically derived scoring systems, or probability predictors based on logistic regression analysis, and more complex mathematical models such as neural networks.[5]

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Among them, the subjective approach, also called a pattern recognition approach, was shown to be superior to other methods, with a sensitivity of 88–100% and specificity of 62–96% for predicting malignancy.[6-8] In addition to USG findings while determining the risk of malignancy for an ovarian mass lesion associated factors such as patient's age, menopausal status, personal or family history of breast or ovarian cancer, and serum CA-125 level should also be considered. The majority of ovarian mass lesions especially in premenopausal women are benign.[3,9-12] Usually, computed tomography (CT) scan is the investigation of choice in planning further management in patients who are diagnosed with the help of USG and believed to have metastatic disease. Spiral CT scan or multidetector CT (MDCT) also allows a comprehensive evaluation of primary tumor and the site of peritoneal metastasis and lymphadenopathy. CT scan helps to differentiate ovarian masses with features pertaining to benignity and malignancy.[13] CT scan also allows use of oral contrast agent to distend and mark the bowel and help differentiate bowel from peritoneal implants, which gives this modality a major advantage over US and magnetic resonance imaging. For these reasons, CT is a very attractive method for evaluating the extent of disease in women with ovarian malignancy. However, available studies have not demonstrated that CT is significantly superior to other modalities in staging ovarian malignancy.[14-16] Ovaries are the third most common sites of primary malignancy in female genital tract after cervix and endometrium accounting for 30% of all cancers of female genital tract. Ovaries are subjected to monthly endocrine and traumatic insult during ovulatory cycle and are a prime site for tumor genesis. About 50% of ovarian tumors are benign tumors. Of the rest, 90% are epithelial and remaining 10% are those resulting from metastasis.[17] There is very little data available for correlation studies between USG and CT of ovarian lesions. The present paper is focused to study the USG and CT scan features in patients to predict malignancy and how the features differ in benign mass lesions of ovary. This study was conducted with a view to find out the diagnostic value of USG and CT and its correlation with histopathological diagnosis.

MATERIALS AND METHODS

A total of 104 patients with ovarian mass lesions attending the radiology department for USG and CT scan referred from Obstetrics and Gynaecology (OBG) and general surgery department were included in the study. An ethical committee clearance was obtained before the commencement of the study. An ethical committee cleared consent pro forma was used for the entire study. Inclusion Criteria: (1) Female patients aged between 9 and 68 years were included in the study. (2) Patients with mass lesions of ovary presenting with lump abdomen were included in the study. (3) Patients who were diagnosed to have ovarian mass lesions incidentally were included in the study. Exclusion Criteria: (1) Patients who are not willing to for written consent were excluded from the study. (2) Patients who have undergone gynecological surgery previously for ovarian mass lesions were excluded from the study. (3) Patients aged <9 and more than 68 years were excluded from the study. All the patients were inquired of clinical history, general surgery, and gynecological examination before subjecting to USG and CT scan. The following investigations were undertaken in all the patients: (1) Complete blood picture including hemoglobin, total and differential count, and erythrocyte sedimentation rate. (2) Renal function tests: blood urea and serum creatinine. (3) Random blood sugar estimation; fasting blood sugar and 2 h postprandial if required; and viral screening and hepatitis tests. Radiological investigations included: (1) Transabdominal USG with full bladder. (2) Transvaginal USG wherever required. (3) Contrast enhanced CT scan of abdomen and pelvis with 16-slice GE spiral CT scan machine. The radiological features of USG and CT scan were compared and correlated in each patient to adjudge their accuracy in diagnosing the ovarian diseases and the nature and degree of echotexture displayed by each method. All the data were recorded and analyzed using standard statistical methods.

Type of Study

This was a cross-sectional, prospective, and analytical study.

Institute of Study

This study was conducted at Al Azhar Medical College and Super specialty Hospital, Thodapuzha, Kerala.

Period of Study

This study was from June 2018 to December 2019.

OBSERVATIONS AND RESULTS

Totally 104 patients with ovarian mass lesions attending the Radiology Department of a Tertiary Teaching Hospital in Kerala were included in this study. Patients were aged between 18 and 68 years with a mean age of 42.46 ± 5.70 years. Patients aged between 19 and 58 years accounted for more than 80% of the entire subjects [Table 1].

Various radiological diagnoses of ovarian mass lesions in the study were tabulated in Table 2. Hemorrhagic cyst was the most common mass lesion diagnosed in this study and accounted for 28 (26.92%) patients. Tubo-ovarian abscess accounted for 19/104 (18.26%) of the total cases. This was followed by mucinous cystadenoma 17/104 (16.34%), serous cystadenoma in 13/104 (12.50%) cases, polycystic

ovarian disease (PCOD) in 11/104 (10.57%), mature cystic teratoma in 7/104 (6.73%), simple cyst in 6 (5.76%), Brenner tumor in 2/104 (1.92%), and endometrioma in 1/104 (0.96%) patients. The peak incidence of ovarian masses was observed between 29 and 48 years of age groups [Table 2]. In extremes of age groups between 9–18 years and 59–68 years, the incidence was 4.80% and 11.53%, respectively [Table 2].

The radiological features of USG and CT scan were compared and correlated in each patient to adjudge their accuracy in diagnosing the ovarian diseases and the nature and degree of echotexture displayed by each method. 94/104 (90.38%) ovarian mass lesions in this study were benign in nature. Among these benign conditions hemorrhagic cyst was observed in 28/94 (29.78%) patients, tubo-ovarian abscess was found in 19/94 (20.21%) of patients, mucinous cystadenoma was found in 17/94 (18.08%) patients, serous cystadenoma in 13/94 (13.82%), PCOD in 11/94 (11.70%) of patients, and simple cyst in 6/81 (6.38%) [Table 3].

Among the remaining, 10 patients malignant mass lesions of the ovary were observed. Among them, mature cystic teratoma with malignant transformation was observed in 7/104 (6.73% of the patients, Brenner tumor was seen in 2/104 (1.92%), and endometrioma in 1/104 (0.96%) of the patients [Table 4].

Infertility was seen in 100% patients of PCOD patients. Association between CA 125 and the mass lesions of the ovary in this study was observed and found that it was present in 80% (8/10) of the malignant masses and 20/94 (21.27%) benign mass lesions of ovary. Incidentally, CA 125 was found positive in 3/19 (tubo-ovarian abscess patients). The findings of USG were described as hyperechoic, hypoechoic, lesions with septations, ascites, increased thickness of wall, and inner wall structures. The incidence of radiological features observed in benign and malignant mass lesions in this study was tabulated in Table 5.

The radiological findings of mass lesions of ovary on CT scan were described in the following terms: Calcification in the tumor masses associated peritoneal deposits, ascites, enhancement, and metastases. The incidence of these radiological features was tabulated in Table 6.

Comparison of pathological diagnosis of mass lesions of the ovary was done using the findings of USG and CT scan and correctness of the diagnosis was calculated and it was found in this study that of 94 benign lesions of ovary 89 (94.68%) were correctly diagnosed on USG examination of patients and 85/94 (90.42%) patients were correctly diagnosed on CT scan. Among the 10 malignant lesions, all (100%) were diagnosed by CT scan and 8/10 (80%) by USG examination. The overall accuracy of USG was 89/104 (85.57%) and overall accuracy of CT scan was 85/104 (90.42%) [Table 7].

DISCUSSION

Ovarian mass lesions are a common occurrence in radiological clinical practice. The mass lesions of ovary

Table 1: The demographic data of the study group (*n*-104)

Age group in years	Number	Percentage
09–18	5	4.80
19–28	16	15.38
29–38	29	27.88
39–48	24	23.07
49–58	18	17.30
59–68	12	11.53

Table 2: The radiological diagnoses made in the study (*n*-104)

Radiological diagnosis	Number (%)
Hemorrhagic cyst	28 (26.92)
Tubo-ovarian abscess	19 (18.26)
Mucinous cystadenoma	17 (16.34)
Serous cystadenoma	13 (12.50)
Polycystic ovarian disease	11 (10.57)
Mature cystic teratoma	7 (6.73)
Simple cyst	6 (5.76)
Brenner tumor	2 (1.92)
Endometrioma	1 (0.96)

Table 3: The incidence of various types of benign mass lesions of the ovary in the subjects (*n*-94 and 104)

Radiological diagnosis	Number	Percentage	Overall percentage
Hemorrhagic cyst	28	29.78	26.92
Tubo-ovarian abscess	19	20.21	18.26
Mucinous cystadenoma	17	18.08	16.34
Serous cystadenoma	13	13.82	12.50
Polycystic ovarian disease	11	11.70	10.57
Simple cyst	6	6.38	05.76

Table 4: The incidence of various types of malignant mass lesions of the ovary in the subjects (*n*-10 and 104)

Radiological diagnosis	Number	Percentage	Overall percentage
Mature cystic teratoma	7	70	6.73
Brenner tumor	2	20	1.92
Endometrioma	1	10	0.96

Table 5: The ultrasonography findings in benign and malignant diseases of mass lesions of ovary (*n*-94)

Nature of mass lesions	ECHO			Wall thickness	Septations	Inner wall structures		Ascites
	Hyper	Hypo	Mixed	<3 mm	>3 mm	Smooth	Irregular	-
Benign masses	39	37	15	41	54	38	56	15
Malignancy	2	6	1	1	9	3	7	8

Table 6: The computed tomography scan findings in benign and malignant diseases of mass lesions of ovary (*n*-94)

Radiological findings	Benign	Malignant
Calcification	17	6
Peritoneal deposits	0	4
Ascitis	15	8
Enhancement	31	10
Metastases	2	10

Table 7: The accuracy of USG and CT scan investigations in diagnosing benign and malignant mass lesions of ovary (*n*-104)

Diagnosis	Number	Accurately diagnosed with USG (%)	Accurately diagnosed with CT scan (%)
Benign	94	89 (94.68)	85 (90.42)
Malignant	10	08 (80)	10 (100)
Total	104	97 (93.26)	95 (91.34)

USG: Ultrasonography, CT: Computed tomography

may be benign or malignant and sometimes borderline in nature. Whenever, the patients present with mass lesions of ovary, the role of radiologist is to opine whether it is benign or malignant and if it is malignant to give the exact extent of the lesion.[18,19] Accurate diagnosis by the radiologist helps the surgeon to avoid surgery and cost to the patient. In malignant lesions, accurate staging helps in cost-effectiveness of the treatment and further post-operative planning.[20,21] A review of literature shows that sometimes CT scan underestimates the staging and pelvic examination by the surgeon and serum CA-125 are of limited value in the diagnosis of pelvic masses and their sensitivity is often below 50%.[20] The sensitivity of morphologic analysis with ultrasound in predicting malignancy in ovarian tumors has been shown to be 85–97%, whereas its specificity ranges from 56% to 95%.[21-23] In the present paper, of 94 benign lesions of ovary 89 (94.68%) were correctly diagnosed on USG examination of patients and 85/94 (90.42%) patients were correctly diagnosed on CT scan. Among the 10 malignant lesions, all (100%) were diagnosed by CT scan and 8/10 (80%) by USG examination. The overall accuracy of USG was 89/104 (85.57%) and overall accuracy of CT scan was 85/104 (90.42%) [Table 7]. A meta-analysis conducted by Kinkel *et al*. described that CT shows sensitivity and specificity of 81% and 87%, respectively, when used for indeterminate masses seen on ultrasound.[24] Similarly, Lin *et al*. reported that positron emission tomography/CT scanner shows a sensitivity of 87% and specificity of 100% for differentiating benign from malignant ovarian cancers.[24,25] USG was useful in distinguishing cystic from solid mass lesions and exact localization and near accurate pathological diagnosis of ovarian mass lesions.[26] In a few studies, USG could achieve accurate diagnosis in 75–95% of the mass lesions of the ovary.[27-29] All unilocular ovarian cysts in the present study were benign on histopathological examination irrespective of size. Meire *et a1*.[30] have described a 10.5% incidence of malignancy in unilocular tumors more than 5 cm in diameter. Multiloculation, thick septa, and solid nodules are reliable indicators of malignancy on USG.[30] In the present paper, of 94 benign lesions of ovary 89 (94.68%) were correctly diagnosed on USG examination of patients. An ovarian dermoid can be diagnosed by its typical appearance of a complex adnexal mass with clusters of highly reflective dense echoes within the lesion.[31]

CONCLUSIONS

CT scan and USG are two excellent noninvasive methods to differentiate ovarian mass lesions from benign and malignant lesions and both imaging techniques seemed to be comparable in differentiating malignant from benign ovarian tumors. CT scan was more sensitive than USG, but sonography is more specific than CT scan in diagnosis of malignant lesions. USG has a high positive predictive value as compared to CT scan to diagnose malignant lesions.

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