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Original Research Article

Sonological Accuracy in Defining various Benign and Malignant Ovarian Neoplasms with Colour Doppler and Histopathological Correlation

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Abstract:

Background and Objectives: Ovarian malignancy is one of the leading cause of death from gynaecological malignancies. The incidence of ovarian cancer is steadily increasing over the past few years, now with an overall lifetime risk is 1.8%. Due to our inability to detect malignancy when it is confined to ovary (stage I disease) the majority of women (75%) are diagnosed when there is already widespread metastatic dissemination throughout the abdominal cavity, To correlate this provisional diagnosis on the basis of ultrasonography and color Doppler, with histopathological diagnosis. To assess the value of ultrasonography and color Doppler as a diagnostic tool in differentiating benign and malignant lesions.

Material and Methods: Prospective study Patients with clinically suspected ovarian masses and referred for USG examination. Department of Radio diagnosis in collaboration with the Department of Obstetrics & Gynaecology and Pathology, Patna Medical College And Hospital. Study period Dec 2 018- Sept 2020. Altogether sixty (60) patients, who formed the patient population of this study, were taken from the Obstetrics & Gynaecology outpatients, indoor and emergency department of this Hospital with clinical symptoms and signs suggestive of ovarian pathology(neoplastic) and referred for USG and Colour Doppler.

Conclusion: our study confirms that morphological assessment of ovarian tumours is able to differentiate benign from malignant masses with high degree of accuracy (sensitivity 80% and specificity 87.8%). The sonographic diagnosis(morphological features and color Doppler findings combined together) of benign disease is 92.6.% accurate in our study.

Keywords: USG, Color Doppler, Neoplasms.

Introduction

Ovarian malignancy is one of the leading cause of death from gynaecological malignancies. The incidence of ovarian cancer is steadily increasing over the past few years, now with an overall lifetime risk is 1.8%. Due to our inability to detect malignancy when it is confined to ovary (stage I disease) the majority of women (75%) are diagnosed when there is already widespread metastatic dissemination throughout the abdominal cavity (stage III / IV).

But in past few decades, the imaging of pelvis in relation to ovarian neoplasm has shown major developments. From plain X-rays we have progressed to computed tomography (CT) and magnetic resonance imaging (MRI) for delineation of soft tissue masses. Ultrasonography (USG) has become the preferred modality of investigation for detection of ovarian neoplasms, because it is non-invasive, less costly, portable, less time consuming and easily accessible and does not cause any hazard to the patient.

Ultrasonography (USG) can delineate morphological features of an ovarian neoplasms, which helps to understand its benign or malignant nature.

- It confirms the presence or absence of an ovarian neoplasm.
- It delineates the size, wall characteristics and echogenicity of mass.
- Some features of malignancy e.g. ascites or metastatic lesion can be diagnosed.
- Spread to the adjacent organs can be detected.

Although ultrasonography can not give an accurate histological diagnosis, there are certain features which do help to differentiate benign and malignant lesions. Irregular wall, thick septation, papillary projection, solid components, taking colour on colour Doppler study, favour malignancy. Other features which suggest malignancy include poor outline, fixation and presence of ascites.

Color Doppler plays a significant role to aid to sonological diagnosis. Intratumoral vessels, low resistance flow and absence of normal diastolic notch in Doppler waveform are all signs of malignancy. High resistance flow suggests benign lesions.

By using these modalities ovarian neoplasms can be detected and differentiated in benign and malignant lesions. Proper management in early stage reduces mortality to a great extent. Overall, 5 yrs survival rate for women with Stage I epithelial ovarian cancer approaches 90% compared to 12% for advanced disease (stage III/IV).

Thus, the challenge is to detect ovarian neoplasms as early as possible using these highly sensitive and specific modern technologies .

Objectives

- To make a provisional diagnosis of an ovarian neoplasm using ultrasonography and color Doppler study.
- To correlate this provisional diagnosis on the basis of ultrasonography and color Doppler, with histopathological diagnosis.
- To assess the value of ultrasonography and color Doppler as a diagnostic tool in differentiating benign and malignant lesions.

Material and Methods

The Prospective study Patients with clinically suspected ovarian masses and referred for USG examination. Department of Radio diagnosis in collaboration with the Department of Obstetrics & Gynaecology and Pathology, Patna Medical College And Hospital. Study period Dec 2 018- Sept 2020. Altogether sixty (60) patients, who formed the patient population of this study, were taken from the Obstetrics & Gynaecology outpatients, indoor and emergency department of this Hospital with clinical symptoms and signs suggestive of ovarian pathology(neoplastic) and referred for USG and Colour Doppler.

Inclusion criterion

- Females with clinically suspected ovarian masses.
- Ovarian mass found incidentally on USG.

Exclusion criterion

- Patient with uterine mass lesions on USG like fibroid .
- Patients with clinically and Sonologically proven ectopic pregnancy.
- Patients with non-neoplastic ovarian lesions diagnosed on USG .
- Moribund patients and proven cases of malignancy.
- Patients unwilling to undergo study.

In this study, five (5) cases of functional cysts, one (1) endometrioma and one (1) pedunculated subserosal fibroid and two (2) ectopic pregnancies were excluded during initial sonographic study, follow up or after histopathological diagnosis and only neoplastic conditions of ovary were included.

The patients were assessed clinically, sonologically and histopathologically to correlate the findings. Patients with an ovarian space occupying lesion (SOL) detected by sonology, was given a probable diagnosis on the basis of sonological finding and color Doppler study, specially about its benign and malignant nature.

Patient places her heels together and lets her knees fall apart. Patient’s pelvis is elevated by a cushion below pelvis.

Scan is again performed in a systematic fashion in sagittal and coronal plane extending as far as possible towards pelvic wall, retropubic space and sacral hollow. Uterus acts as an important landmarks, as do the internal iliac vessels. Just anterior to these vessels’ ovary is usually positioned.

After standard Grey-scale morphologic assessment color Doppler imaging was activated. Optimal timing for color Doppler assessment is during the follicular phase. The entire ovary or tumour was surveyed for areas of neovascularization as depicted by increased color flow. Flow results were recorded as either being absent or present and if present, normal or increased. Dilated, prominent primarily parenchymal vessels and aliasing were considered as increased flow. Spectral analysis of intratumoural vessels was performed and resistance and pulsatility index values were calculated. The lowest pulsatility and resistive index values were taken as representative for the corresponding tumour. The presence or absence of a notch in the diastolic portion of the waveform was also recorded.

Histopathology: All patients underwent for biopsy of the lesion .Informed written consent were obtained. PT, a PTT, HBV and HIV tests for all patients were done. Under aseptic precautions USG guided biopsies of the lesion were done using 14G or 16G tru cut biopsies needles for solid lesions and FNAC wherever relevant.

Rules for predicting a malignant tumour (M-rules)	Rules for predicting a benign tumour (B-rules)
M1 Irregular solid tumour	B1 Unilocular cyst
M2 Presence of ascites	B2 Presence of solid components where the largest solid component is <7 mm in largest diameter;
M3 At least four papillary structures	B3 Presence of acoustic shadows
M4 Irregular multilocular solid tumour with largest diameter ≥100 mm	B4 Smooth multilocular tumour with largest diameter <100 mm
M5 Very strong blood flow (color score 4)	B5 No blood flow (color score 1)

Results

During the observation period from December 2018 to September 2020, sixty (60) ovarian neoplasms were investigated by trans abdominal and transvaginal ultrasonography. Out of sixty (60) cases, five (5) cases were functional cysts, which regressed during follow up, one case was endometrioma on histopathology and one case was pedunculated fibroid and two ectopic pregnancies.

These cases were excluded from the study. As a result, fifty one (51) ovarian neoplasms were evaluated, of these forty one (41) were benign ovarian neoplasms and ten (10) were malignant ovarian neoplasms. The sonographic criteria, which was used for evaluation of ovarian tumour, was.

1. Size
2. Location-
   i) Unilateral.
   ii) Bilateral.

Table 1: Accuracy of USG in detection of ovarian neoplasms

No. of cases diagnosed as ovarian neoplasm - 60
Actual No. of ovarian neoplasms on histopathology – 51
Accuracy of USG in detecting ovarian neoplasm – 85.1%

Table 2: Showing benign and malignant neoplasms encountered in the study

Benign – 41 (80.4%)
Malignant – 10 (19.6%)

Fifty one (51) ovarian neoplasms were confirmed histopathologically and 41(80.4%) were found to be benign and 10 (19.6%) were malignant.

Table 3: Histopathological subtypes of ovarian neoplasms of this study

Sl. No.	Subtypes		Number of Case
1	Benign neoplasms (n = 41)	Serous cystadenoma	17 (41.5%)
2		Mucinous cystadenoma	11 (26.8%)
3		Benign teratoma	11 (26.8%)
4		Fibroma	1 (2.4%)
5		Brenner	1 (2.4%)
6	Malignant neoplasms (n = 10)	Serous cystadenocarcinoma	7 (70%)
7		Mucinous cystadenocarcinoma	1 (10%)
8		Endometrioid carcinoma	1 (10%)
9		Dysgerminoma	1(10%)

Serous cystadenoma was the commonest benign neoplasm (41.5%) in this study. Mucinous cystadenoma (26.8%) and cystic teratoma (26.8%) are other common benign neoplasms.

Serous cystadenocarcinoma was the most common (70%) of all malignant ovarian neoplasms.

Flow pattern	Benign	Malignant
Central flow (n=13)	6 (46.2%)	7 (53.8%)
Peripheral flow(n=30)	27 (90%)	3 (10%)
No flow(n=8)	8 (100%)	-(0%)

Our study revealed that there was no malignant tumour(o%) in the group of ovarian neoplasm where no flow was detected. Of the thirty (30) ovarian neoplasms where peripheral flow was found three (3) were malignant(10%). Highest percentage(53.8%) of malignant tumours were found among masses with central flow (7/13).

USG	H.P. Diagnosis		Total
Diagnosis	**Malignant**	**Benign**	
Malignant	8(true positive)	5(false positive)	13
Benign	2(false negative)	36(true positive)	38
Total	10	41	51

Comparison of ultrasound findings (morphological features and color Doppler study) with that of histopathology**.**

USG Result (with color Doppler study)	Histopathological Diagnosis		Total
	Malignant	**Benign**	
Malignant	8(true positive)	3(false positive)	11
Benign	2(false negative)	38(true negative)	40
Total	10	41	51

The data shows ultrasonography could predict malignant lesions correctly in 80% of cases and benign lesions in 87.8% of cases, on the basis of morphological assessment. When morphological assessment and color / pulsed Doppler finding was combined, specificity for benign lesion increased to 92.6%. Prediction of benign lesion was significantly more accurate than prediction of malignant lesion.

Discussion

Ovarian cancer remains the greatest killer of all gynaecologic cancers. Unlike other cancers, death rate from ovarian cancer in increasing. So a multimodal approach has been proposed for diagnosis of ovarian cancer, in an attempt to reduce the mortality from this disease.

Ovarian neoplasms were differentiated in benign and malignant lesions on the basis of morphological features detected by ultrasound imaging and color Doppler study . The ultrasound diagnosis was confirmed by histological studies in all cases.

In our study, sixty (60) cases were diagnosed as ovarian neoplasm by Sonography, of which fifty one(51)were found correct on histopathology. Ultrasound was 85.1% accurate in detection of ovarian neoplasms .

Mettler et al also found that ultrasound was 97% accurate in detection of pelvic masses. Out of fifty one (51) ovarian neoplasms in our study there was 17 (33.3%) cases of serous cystadenoma , 11(21.5%) cases of mucinous cystadenoma, 11(21.5%)cases of cystic teratoma, 7(13.7%)cases of serous cystadenocarcinoma and 1(1.9%) case of mucinous cystadenocarcinoma .

	Moyle	Koonings	Present study
Serous Cystadenoma	24%	19%	33.3%
Mucinous cystadenoma	15%	12%	21.5%
Teratoma	22%	44%	21.5%
Serous cystadenocarcinoma	10%	11%	13.7%
Mucinons cystadenocarcinoma	2%	3.5%	1.9%

The variation in the percentage of different types of ovarian neoplasms in these studies may be due to difference in population group and difference in the time period of study of these groups . In our study there were 7 (36.8%) malignant tumours among nineteen(19) ovarian tumours with thickness of septation more than 3mm. When thickness of septation was less than 3mm there was only 4.8 % malignant tumours. Brown et al also concluded that thick septations has stronger association with malignancy than thin septations.

In this study, percentage of malignant tumours rose to 33% in patients, above 50years age group from 14% in 21-30 years age group. It was also seen that mean age of patients with benign tumours was less than the mean age of patients with malignant tumours. Koonings et al has also found a 12 fold increase in the risk of malignancy from ages 20-29 years to 60-69 years .

In our study group 55% were totally or near total anechoic (solid foci less than 5%) lesion, 41%were complex lesion and 4% were solid lesions. We found in our study that totally or near total anechoic lesions were more likely to be benign (96.4%). Very small percentage (3.6 %) of anechoic lesions were malignant. Moyle et al also reported only 5% malignant lesions in anechoic ovarian tumours with less than 1% echogenic foci. When tumours were morphologically assessed as being complex the likelihood of malignancy increased (42.9 %).

Herrmamn et al reported one malignant lesion among fifty seven (57) purely anechoic tumours and 24% malignant tumours among complex group.

In a study by Luxman et al, two (2) of the thirty three (33) anechoic lesions were malignant., 29% of solid and 42% of complex tumours were malignant. Our finding in table X confirms that complex masses with non-hyperechoic solid components have much higher percentage(53%) of malignancy than complex masses with hyperechoic solid foci(0%). All complex masses with hyperechoic solid foci were benign cystic teratomas.

In the study, false positive results were encountered when we used RI=0.4 as cutoff value and there was also significant heterogenicity in RI values even in malignancy. There was also considerable overlap at cut off value 1.0 of PI. One case of malignant ovarian tumour with PI value as high as 2.3 was found.

Some of the variation can be due to lack of a predefined level of positivity of PI or RI, system variability, sensitivity and differing level of operator experience. Intercurrent diseases and vascular disorders may also affect impedance assessment. In our study gray scale morphological features to detect malignant and benign lesion was 80% sensitive and 87.8% specific. Koonings et al, in their study had found 80% sensitivity and 83% specificity. Herrmann et al had 82% sensitivity and 93% specificity in their study. Lastly in our study when color Doppler finding was combined with morphological scoring system, specificity for detection of benign tumours increased from 87.8% to 92.6%. A Study by Timor-Tritsch et al (1993) also reported that morphologic score produced a sensitivity and specificity of 94% and 87%, but when combination of morphological scoring system with color flow imaging was done acceptable level of sensitivity(94%) and specificity(99%) were obtained.

Conclusion

our study confirms that morphological assessment of ovarian tumours is able to differentiate benign from malignant masses with high degree of accuracy (sensitivity 80% and specificity 87.8%). The sonographic diagnosis(morphological features and color Doppler findings combined together) of benign disease is 92.6.% accurate in our study . Regarding color flow imaging a difference exists between benign and malignant masses with respect to flow index values . Overlap of these values precludes color flow Doppler imaging being used alone as a malignancy discriminator and combination of gray scale morphological features and color flow Doppler imaging affords us with the greatest overall accuracy in differentiating benign and malignant ovarian tumours.

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