ORIGINAL RESEARCH PAPER VOLUME-6 | ISSUE-8 | AUGUST - 2017 | ISSN No 2277 - 8179 | IF : 4.176 | IC Value : 78.46

INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

ULTRASOUND AND DOPPLER EVALUATION OF THE ADNEXAL MASSES AND CORRELATION WITH HISTOPATHOLOGY.

Radiodiagnosis

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ABSTRACT

- **Background: Ultrasonography (USG) is accepted as the primary imaging modality in the evaluation of adnexal pathologies and provides useful information regarding the nature of the lesion and to plan for appropriate intervention. This study was conducted with a view to find out the diagnostic value of gray scale USG, color Doppler, and co-relate with histopathological diagnosis.**
- **Objectives: To evaluate the Adnexal masses with ultrasound and doppler examination and correlate it with the histopathological findings.**
- **Materials and Methods: A total of 75 patients were taken in the study referred from various departments. B-mode sonomorphological criteria were used and subsequently spectral Doppler tracings was recorded by calculating resistive index (RI) and pulsatility index (PI) values. Modified International ovarian tumor analysis (IOTA) Scoring system, RI and PI value was applied to differentiate benign and malignant pelvic masses.**
- **Results: Out of 75 cases, 70 cases (93.3%) were confirmed by histopathology. USG showed an overall sensitivity of 93.3% and specificity of 84% in comparison to the histopathological findings. For ovarian lesions, USG using modified IOTA scoring system showed 98% sensitivity and 94% specificity in comparison to the histopathological findings. Most of the malignant lesions were seen in post menopausal age group.**
- **Conclusion: USG is a very useful, highly diagnostic and a reliable method in the diagnosis of adnexal pathologies with good sensitivity and specificity.**

KEYWORDS:

Color Doppler, International ovarian tumor analysis, Pelvic masses, Spectral Doppler, Ultrasonography

INTRODUCTION

- An adnexal mass may be found in women presenting with gynecological complaints or it may be an incidental finding. Early, accurate and prompt diagnosis is required to reduce the morbidities and mortalities associated with malignancies.
- Differentiation and characterization of these lesions is of prime importance for the management of ovarian tumors. Ovarian tumors form the major bulk of adnexal masses. Adnexal pathologies other than ovarian pathologies include that of the fallopian tubes, broad ligaments, peritoneal coverings also require early diagnosis and prompt treatment.
- Ultrasonography (USG) is the primary imaging modality used for the evaluation of adnexal masses as it is highly useful in the early and definitive diagnosis of malignancy of ovaries. USG can confirm the presence or absence of a mass, very accurately **(1).** A triple diagnostic method, which includes clinical examination, sonography, and CA-125 level measurements, is utilized for prompt diagnosis **(2).**
- The advances today in the use of diagnostic ultrasound has made it a mandatory mode of examination in the diagnosis of pelvic masses. Color and pulsed Doppler improve the diagnostic accuracy. USG gives the necessary information for planning the right approach required in the treatment of the patient.
- USG can help in the morphological classification of adnexal masses for example into cystic, solid, fat containing or solid-cystic. This can further help in the classification of benign versus malignant adnexal masses. The cost effectiveness of usg, its diagnostic accuracy and no exposure to ionizing radiation makes usg a better modality for localization of organ of origin of the mass, and to confirm whether it is from uterus, ovaries or other than genital organ. It also minimizes unnecessary laparoscopies/ laparotomies.
- The study was undertaken to evaluate cystic adnexal masses as it is important to consider nonovarian disease processes that may mimic those of the ovaries, because a misdiagnosis can profoundly affect patient management.

MATERIALS AND METHODS

- This study was conducted in Department of Radio diagnosis, Acharya vinobha bhave rural hospital, sawangi, wardha (m.s) .The study includes 75 patient which were referred from gynecology and surgery department irrespective of their age.
- After recording the clinical history, physical examination and Relevant investigations like blood investigations, CA-125 and urine pregnancy test were done according to their clinical findings.
- Ultrasound was performed Using a 3-5 MHz Convex Array Transducer through a transabdominal (TAB) approach, B-mode USG, color Doppler and spectral Doppler was performed and spectral tracings were recorded. Transvaginal sonography was also performed using 8-10 MHz Vaginal Transducer (aloka arietta s70).

B-mode sono-morphological criteria were used for our study (modified IOTA criteria: - Assiut criteria). Subsequently, color and pulsed Doppler imaging was performed and results were recorded as being present or absent. Vessel location arrangement and morphology were noted. Spectral Doppler analysis and finding was performed by recording resistive index (RI) and pulsatility index (PI) values, and the lowest values recorded in the masses are noted. **Assiut scoring system (3)** was applied to differentiate benign and malignant ovarian tumors.

- RI $\leq$0.42 and PI $\leq$1.0 were taken as cutoff for ovarian malignancy.

Female patients irrespective of age presenting with symptoms such as infertility, amenorrhea, pain in abdomen/pelvis, PV bleeding, PV white discharge, urinary and gastrointestinal pressure symptoms and palpable mass. Asymptomatic patients where mass detected incidentally were included in the study whereas Patients with anechoic unilocular cyst of size less than 7 cms that resolves or reduce substantially in size, on follow up USG, patients undergoing radiotherapy/ chemotherapy, Post-operative patients and Patients who were not willing to undergo fine needle aspiration cytology or histopathological evaluation were excluded.

Statistical Analysis

A statistical analysis was performed using SPSS software, version 20.0 (SPSS, Inc., USA). The Chi-squared test and independent sample *t*-test were used to compare categorical and continuous variables, respectively. Data were presented as a mean ± standard deviation or proportion as appropriate. The $P < 0.05$ was significant.

RESULTS

- At the end of the study, 75 patients of adnexal masses were evaluated and found that most of the cases were of benign etiology (51%) and were seen mostly in reproductive age group, whereas malignant lesions (87.5%) were usually found in patients of post menopausal age group (between 5th and 7th decades)
- Out of the total adnexal pathologies most of the lesions are of ovarian in origin **(66.6%)** followed by tubal, paraovarian in the decreasing order of frequency. **(Table no 1).**
- Out of the overall cases confirmed by histopathology (**70 cases** i.e **93.3%)**. 46 % cases were of neoplastic etiology of ovary followed by non-neoplastic lesions of the ovary, ectopic pregnancies, parovarian cysts, hydrosalphinx, pelvic inflammatory disease. **(chart 1).**
- **Out of 75 cases, 70 cases were confirmed by histopathology in following manner ectopic pregnancy (13.3%), serous cystadenoma (8%), serous cystadenocarcinoma (8%),mucinous cystadenoma (6.6%), mucinous cystadenocarcinoma (6.6%), ovarian dermoid(6.6%), pelvic inflammatory disease(6.6%),parovarian cyst(6.6%), hydrosalphinx (6.6%), ovarian hyperstimulation syndrome (5.3%), fibroma (4 %), ovarian torsion(4%),endometrioma (2.6 %), dysgerminoma (2.6%),krukenberg tumour(2.6%),germ cell tumour(1.3 %) and hydatid cysts(1.3%).**
- According to our study most of the patients with malignant lesions were nulliparous women **(50%)** with decreasing frequency in women with increasing parity.
- Most of the benign lesion showed vessels located within the wall of the lesion **(68.1%),** followed by peri-tumoral vascularity. All the benign lesions showed normal flow with RI > 0.4 and PI > 1.0 on spectral doppler tracings. Malignant lesions showed abnormal flow with spectral doppler findings of **RI <0.4 and PI <1** with most of the vessels located within the septae followed closely by central location of the vessels within the lesion**. (table 2, chart 2)**
- Cases of Ectopic gestation presented with high velocity, low resistance flow with spectral doppler tracings of RI <0.4 and PI <1 with peripherally located vessels giving characteristic ring of fire appearance.
- Overall in our study, USG showed a sensitivity of 93.33% and specificity of 84% for adnexal pathologies and 98% sensitivity and 94% specificity for ovarian lesions.
- According to our scoring model each 2D USG finding characteristic was assigned a scoring. Based on such cumulative scoring, cut off 6 were used and the masses were classified as definitely benign (<6) and malignant (>6) scoring **(table 3).**

DISCUSSION

A total of 75 patients who presented with pelvic mass were part of this study spread over a period of 2 years. Out of 75 cases, 5 cases were wrongly diagnosed on USG.

Ultrasound diagnosis in all the patients is confirmed either on histopathology and on follow-up ultrasound scans. USG showed a sensitivity of 93.33% and specificity of 84% in comparison to the histopathological findings. Stein *et al.* **(4)** found similar findings of sensitivity of 98%, specificity of 62%, negative predictive value (NPV) of 99% and positive predictive value (PPV) of 50%. The most common complaint of patients enrolled in our study was pain in pelvic cavity **(5,6)** followed by menstrual irregularity, menorrhagia, palpable pelvic mass, post-menopausal bleeding, infertility, and amenorrhea were the other less common complaints in the patients of our study.

Most of cases 66.6% were arising from ovary followed by adnexal, tubal, parovarian and pelvic pathologies. Gupta KP, Jain SK. Et al **(7)** reported same findings.

Serous type of epithelial ovarian tumors was the most common epithelial type of ovarian tumors in our study accounting for 12 cases out of 22 cases of epithelial tumors, equal to 54.54 % of total epithelial tumor cases. Out of 12 cases of serous ovarian tumors 6 cases of serous cystadenoma and serous cystadenocarcinoma each. Mucinous type of epithelial ovarian tumors was the second most common epithelial type of ovarian tumors in our study accounting for 10 cases out of 22 cases of epithelial tumors, equal to 40 % of total epithelial tumor cases. 5 cases each of mucinous cystadenoma and cystadenocarcinoma. **(8)** Kawamoto S, Urban BA, Fishman EK. Et al. reported the similar findings of most common epithelial tumors.

In this study of female adnexal masses, we encountered 7 cases of germ cell tumors with 5 out of 7 cases were benign dermoid cysts or mature teratoma followed by 2 cases was dysgerminoma. A dermoid cyst were the most common type of benign germ cell ovarian tumor and dysgerminoma is the most common malignant type of germ cell ovarian tumor**. our findings were well** corroborated **with the findings of Jung SE, Wasnik AP** et al (**9,10) who reported** Dermoid cysts being most common benign germ cell tumor and were containing derivatives of all germ cells like mature skin complete with hair follicles and sweat glands, clumps of hair, and pockets of sebum, fat, bone, teeth and cartilage**. (11)** The most common manifestation is a cystic lesion with a densely echogenic tubercle (Rokitansky nodule) projecting into the cyst lumen. **Quinn SF, Erickson S, Black WC. Et al reported similar findings of Rokitansky nodule and all derivatives of all germ cell layers (12).**

Two cases of histopathologically proven bilateral ovarian metastasis showed bilateral large lobulated complex ovarian masses in the pelvic cavity. Histologic examination revealed mucin-secreting "signet ring" cells in the ovarian masses consistent with the metastatic deposits from primary rectal carcinoma also known as Krukenberg ovarian tumors **(13).**

In this study, we included 13 cases of primary fallopian tube pathologies. All these 13 cases are histopathologically proven primary fallopian tube masses which underwent laparotomy followed by histopathological examination. Primarily two tubal pathologies, the first is tubal inflammatory disease accounting for 7 cases out of 13(53.8%) and second ectopic tubal gestation accounting for 6 cases out of 13 (46.1%) encountered in our study **(14).** The most common finding in ectopic pregnancy on USG was Cystic or solid adnexal mass separate from the ovary and empty gestation sac. **Our finding was well correlated with N Murthy, A Bhat, A Kalyanpur et al (15).**

We in our study used a morphological scoring system as used by Ahmed M. Abbas, *et al. while evaluating ovarian masses* by B-mode USG. The cut-off level with the highest accuracy in detection of malignancy, was ≥6, had a sensitivity of 93.3% and specificity of 84%. Sensitivity and specificity of our study also matched well with that of *Timor Trisch et al **(16)** and* Madan *et al. **(17).***

Colour Doppler results showed predominantly peripheral localization of vessels in benign masses (68.1%) and predominantly septal or central vessel localization (39.1% and 31.2%) was observed in malignant masses. This keeps with the results of Jokubkiene et al. (2007) **(18).**

Kurjak *et al**. (19)** and Buy et al**. (20)** used the cutoff criterion of PI <1.0 and RI <0.4 for malignant lesions. In our study, we used the cutoff criterion of PI <1.0 and RI <0.4 for malignant lesions.* Using spectral Doppler analysis and an RI less than or equal to 0.4, sensitivity was 44%, and specificity was 99%. For a PI, less than or equal to 1, sensitivity was 80%, and specificity was 84%.

CONCLUSION

- **USG showed a sensitivity of 93.33% and specificity of 84% for adnexal masses and 98% sensitivity and 94% specificity ovarian lesions**.
- In conclusion, sonography with a good equipment when appropriately performed by an experienced radiologist, using a proper methodology and standard guidelines has proved to be a very useful highly diagnostic and a reliable method with good sensitivity and specificity.
- In conclusion, Assiut Scoring Model (ASM) is simple, non-time consuming, easy to apply and interpreted with reasonable accuracy and high sensitivity and specificity, so less experienced sonographers should be trained on its application.

TABLES AND CHARTS

TABLE :-1 USG DIAGNOSIS OF THE LESION

SR NO.	DISEASES	NO. OF CASES
1.	Serous cystadenoma	6
2.	Mucinous cystadenoma	5
3.	Fibroma	5
4.	Dermoid cyst	5
5.	Mucinous cystadenocarcinoma	5
6.	Serous cystadenocarcinoma	6

7.	Dysgerminoma	2
8.	Granulosa cell tumours	1
9.	Krukenberg tumour	2
10.	Ovarian torsion	6
11.	Ovarian hyperstimulation syndrome	4
12.	Endometrioma	2
13.	Hydatid cyst	1
14.	Ectopic Gestation	10
15.	Pelvic inflammatory disease	5
16.	Parovarian cyst	5
17.	Hydroslaphinx	5

CHART :- 1 HISTOPATHOLOGICAL DIAGNOSIS TOTAL CASES:-70

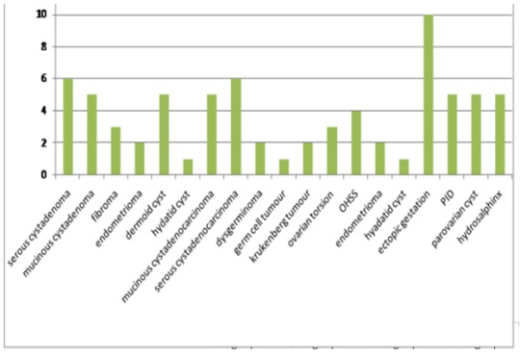


TABLE NO.2 SPECTRAL DOPPLER INDICES IN NEOPLASTIC LESIONS OF THE OVARY

RI AND PI	TOTAL	P VALUE
RI <0.40 and PI<1.0	16 (MALIGNANT)	<0.05
RI >0.40 and PI>1.0	19 (BENIGN)	<0.05

CHART NO. 2 Vessel localization Total cases:-35

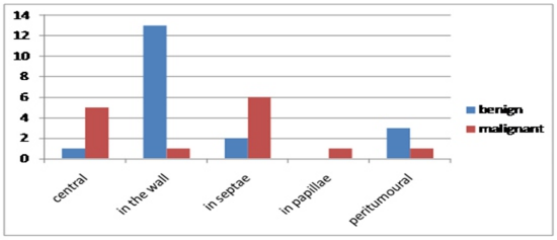


Table 3 2D US FEATURES TO DIFERENTIATE BETWEEN BENIGN AND MALIGNANT LESIONS

2DUS features	Benign(19)	Malignant(16)
Tumour volume	-	-
0 – 50 ml	**15(78.9%)**	**5**
50-500 ml		
> 500 ml	**4**	**11(68.75%)**
Type of mass	**12(63%)**	2
Unilocular Multilocular	2	3
Unilocular-solid	2	**7(43.7%)**
Multilocular-solid	3	4
Solid		
Papillary projections	18(94.7%)	**9(57.6%)**
smooth wall	1	2
	-	5
Length < 3 mm		
≥ 3 mm		
Septae	14	4
No	**5(26.3%)**	**3**
Thin < 3 mm	0	**9(75%)**
thick ≥ 3 mm		

Assiut score	Benign (19)	Malignant(16)
<6	18(94.7%)	2
>6	1	14(87.5%)

CASES

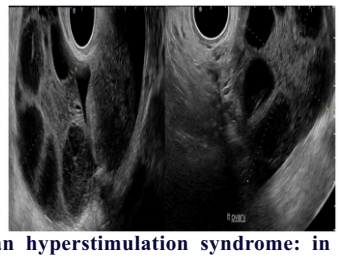


Fig.1 Ovarian hyperstimulation syndrome: in a patient on ovulation induction drugs, bilateral ovaries appears bulky with multiple peripheral follicles .

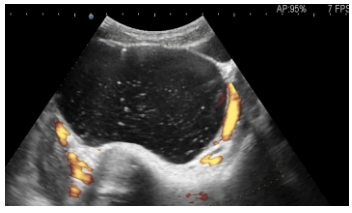


Fig .2 MUCINOUS CYSTADENOMA: large, anechoic, unilocular, cystic collection with multiple echogenic debris. The lesion shows peripheral vascularity.

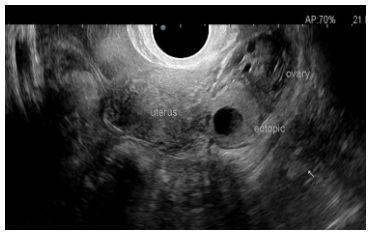


Fig .3 ECTOPIC PREGNANCY: in a patient with positive urine pregnancy test, empty uterine cavity with well defined anechoic lesion noted in right adnexa. Ovary visualized separately.

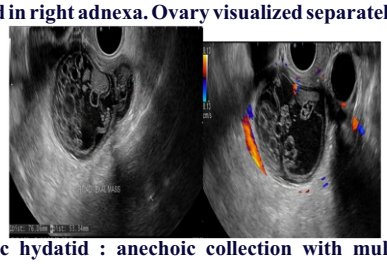


Fig 4.Pelvic hydatid : anechoic collection with multiple small daughter cysts within.



Fig .5 Dermoid cyst : anechoic lesion with multiple linear echogenic strands and well defined hyperechoic nodule within.

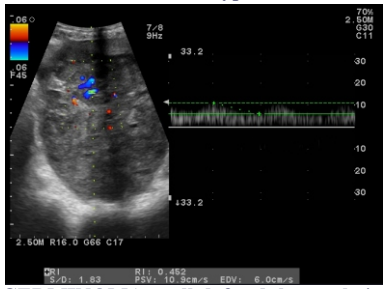


Fig .6 DYSGERMINOMA: well defined, hypoechoic solid lesion with posterior achoustic enhancement. The lesion is showing

central vascularity with RI= 0.4

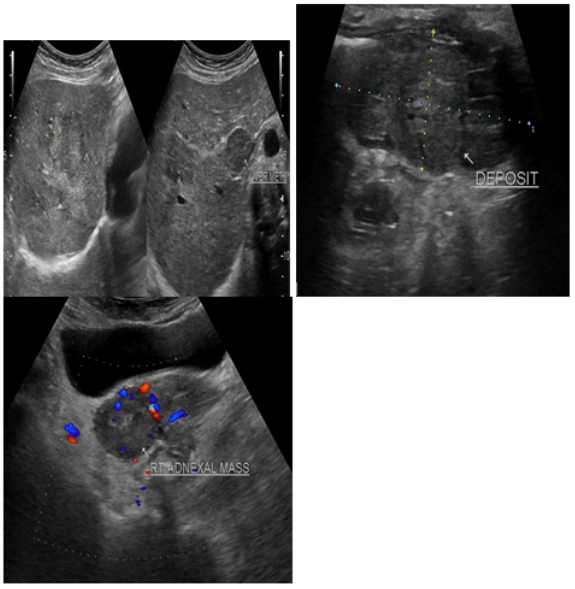


fig .7 Krukenberg tumour :in a known case of carcinoma colon, liver deposits and ascites: bilateral solid well defined hypoechoic lesion noted in adnexa showing central and peripheral vascularity.

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