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Original Research Article

Role of ultrasonography and colour Doppler in the evaluation of gynaecological pelvic masses

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Abstract: Pelvic masses are common presentation of gynaecological pathology. Ultrasonography (USG) is widely accepted as the primary imaging modality in the evaluation of pelvic masses, and provides the necessary information to plan out the right therapeutic planning which is required in the given situation. This study was conducted with a view to find out the diagnostic value of USG, Color Doppler study, and correlate with histopathological diagnosis. Objectives were (1) to study the transabdominal and transvaginal ultrasonographic and colour doppler findings of various pelvic masses. (2)To assess the diagnostic accuracy of preoperative ultrasound with operative findings and histopathological findings wherever possible. This is a prospective correlative study conducted in the Department of Radio Diagnosis, in our Medical College & Hospital. The total number of subjects were 50 those attending the gynaecology and surgery OPD of our hospital. All the cases subjected to transabdominal ultrasonography with full bladder technique with 3.5 MHz probe and then transvaginal sonography with empty bladder technique with 6.5 MHz probe in female patients. IOTA scoring system was applied to differentiate benign and malignant ovarian tumors. This study yielded the diagnostic accuracy of 94.44 % for Ultrasound and Colour Doppler in the diagnosis of ovarian masses, increasing its reliability. Thus Ultrasound seems to be a simple, non-time consuming, easy to apply and Interpreted with reasonable accuracy and high sensitivity and specificity as initial modality of choice in the workup of every woman suspected of having an ovarian mass. And, to rule out unnecessary surgical interventions in benign masses.
Keywords: Gynaecological, masses, pelvic, malignant, benign, ovarian, adnexal.

INTRODUCTION

Female gynaecological pelvic masses often create dilemma in the mind of Gynaecologists, Surgeons and Sonologists for differentiating benign from malignant masses. In female reproductive tract the differential diagnosis of pelvic mass is quite variable because abnormality may arise from gynaecological or non-gynaecological origin. Gynaecological masses are either uterine or adnexal. Adnexal region is composed of ovary, fallopian tube, broad ligament, and associated blood and nerve supply. When evaluating pelvic masses, sonologist should consider an ovarian aetiology in addition to uterine pathologies. Indeed ovarian pathology is responsible for 70% of pelvic masses found at exploratory surgery on patients with pre-operative diagnosis of pelvic mass.[(1,2)]

Ovarian or Uterine tumors present with a variety of symptoms, including abdominal pain, abdominal or adnexal mass, bloating, urinary urgency and abnormal vaginal bleeding. Such varied clinical presentation could be caused by many different benign and malignant conditions. As a result, it is challenging to the gynaecologist to distinguish between benign and malignant tumors. Consequently, there has been vigorous research into cancer screening methods and diagnostic tools [3].

Pelvic Ultrasound today forms the primary examination mode in the evaluation of female pelvic masses. Pelvic Ultrasonography can confirm the presence or absence of suspected pelvic mass. It

provides the physician/surgeon/ gynaecologist the necessary information to plan the correct therapeutic approach required in the given situation [4]. Ultrasonography has the advantage of being inexpensive, widely available, and giving superior tissue characterization as compared to the computed tomography. The real-time imaging ability of Ultrasonography with three-dimensional ultrasonography also has the advantage of being able to identify the organ of origin of the pelvic mass.

Transabdominal sonography (TAS) gives the global view of the pelvic organs, While Transvaginal sonography (TVS) adds specificity as it gives information regarding tumor composition, texture, internal consistency and exact relationship with other pelvic organs. The combination of transvaginal probe and use of colour doppler ultrasonography for the identification of malignant ovarian masses by the detection of low resistance intra-tumoral blood vessels due to angiogenesis and neovascularization in malignant tumors opens up new avenues in gynaecological ultrasound, especially for tumour diagnosis in the lower pelvis [8, 9]. The diagnosis of ovarian tumors is based on clinical examination, sonography and measurements of CA-125 collectively known as "Triple diagnostic method" [5].

Two main problems arise: discrimination of benign and malignant masses and choice of the appropriate surgical treatment if necessary. Overall about 2% of the adnexal masses are ovarian carcinomas or border line tumors. Presently it is well established that Ultrasonography is the gold standard for ovarian cyst diagnosis [6].

Scoring system help differentiate benign from malignant masses. Doppler flow measurement and assessment of tumor vascularity by Doppler increase the confidence with which a correct diagnosis is made. Logistic regression and neural network models are proved to be good methods and may be useful for malignancy prediction. This help to reduce the number of unnecessary surgical procedures for uterine and adnexal tumours. In case of a benign and may be functional cyst, spontaneous resolution may be followed by regular sonographic examination upto 3 to 6 months [7]. A number of prediction models have been created to maximize its predictive capability. In many countries worldwide the risk of malignancy index (RMI) which combines ultrasound features, serum CA125 levels with the menopausal status of the patient is still being used to characterize ovarian pathology. However, more recently logistic regression models and simple rules which are created by the International Ovarian Tumor Analysis (IOTA) group have been shown to perform better than the RMI [14]. The most recent systematic review and meta-analysis has concluded that based on currently available evidence, these IOTA rules and models for ovarian tumors should now be used in clinical practice [8].

The optimal approach to characterizing ovarian masses remains the subjective interpretation of the ultrasound characteristics of a mass by an expert operator. For the purposes of this review, the term 'pattern recognition' refers to the subjective evaluation of adnexal masses using grey-scale and Power/Color Doppler Ultrasonography [9, 10].

The purpose of this work is to review the literature and to establish role of Ultrasound and Colour Doppler in the evaluation of female gynaecological pelvic masses. The need for the study is to evaluate pelvic mass using Ultrasonography (Transvaginal and Transabdominal) and Doppler scan and balance the risk of surgical intervention for a benign versus malignant tumors. This study was conducted with a view to assess the diagnostic value of ultrasonography and its correlation with histological diagnosis.

MATERIALS AND METHODS

This is a prospective correlative study conducted in the Department of Radio Diagnosis, in our Medical College & Hospital. The total number of subjects were 50 those attending the gynaecology and surgery OPD of our hospital.

A detailed menstrual, obstetric and medical history of each patient taken. General, physical, systemic, pelvic and per rectal examination done. All the cases subjected to transabdominal ultrasonography with full bladder technique with 3.5 MHz probe and then transvaginal sonography with empty bladder technique with 6.5 MHz probe in female patients. TAS and TVS performed with the use of MINDRAY Diagnostic ultrasound system DC-7 and Philips En Visor C HD. Observations included size, shape and echotexture of the pelvic masses in sagittal and transverse planes. All patients then subjected to sonomorphological evaluation followed by blood flow analysis using Doppler sonography.

INCLUSION CRITERIA:

1. Female patients of all age group with relevant signs/symptoms of pelvic masses referred to Radiodiagnosis department.
2. Also asymptomatic patients where pelvic mass detected at the time of routine pelvic examination or at the time of Ultrasonography (Transabdominal and Transvaginal Ultrasonography) done for other diagnosis.

EXCLUSION CRITERIA:

1. Obstetric cases presenting with relevant complaints.

2. Masses arising from urinary tract and gastrointestinal tract.

TECHNIQUE

Transabdominal sonogram: [11, 12]

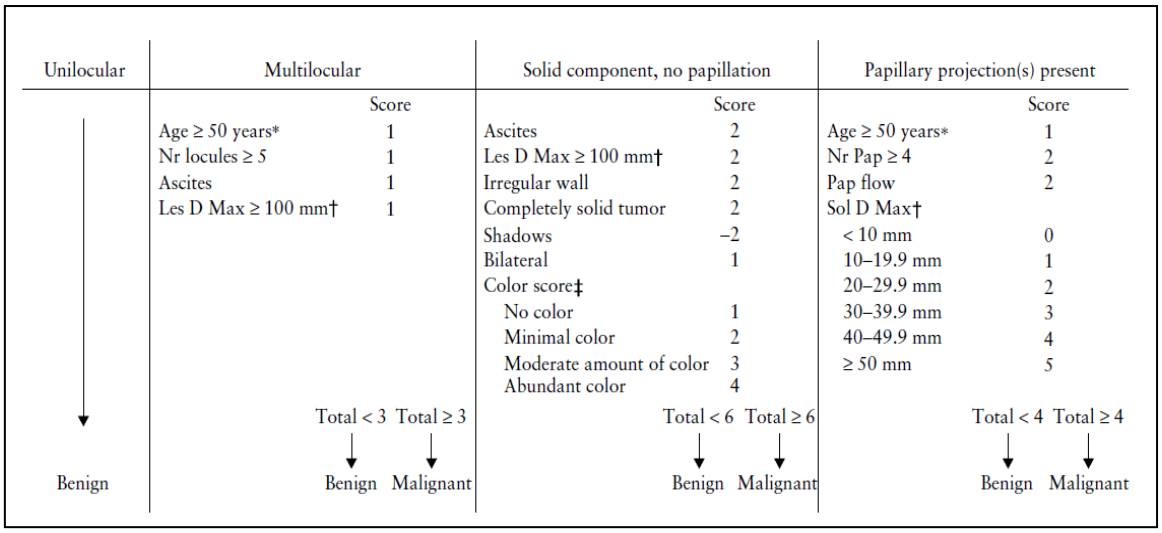
The Transabdominal sonogram was performed with distended urinary bladder which provides an acoustic window to view the pelvic organs and serves as a reference standard for evaluating cystic structures. The highest frequency transducer possible should be used in practice, most sonograms were performed using 5 MHz or 3.5 MHz. Curvilinear transducer array enabled a wide scanning field. Imaging of the uterus and adnexa was performed, in both sagittal and transverse planes. When the transabdominal sonography was performed, other target areas Scanned for free fluid in abdominal cavity, pelvis and kidneys were screened.

Transvaginal sonogram: [11-15]

For Transvaginal sonography, the bladder emptied to bring the pelvic organs into the focal zone of the transvaginal transducer. An empty bladder also provided patient comfort during the examination. Careful consideration and respect was given to the privacy. As the examiner was a male, it was essential to have a female staff member in the room during the entire examination to act as a chaperone. A pelvic exam preceded the imaging procedure to correlate the findings with image obtained. The transducer was prepared with ultrasound coupling gel and then covered with a protective sheath, usually a condom. Air bubbles were eliminated to avoid artifacts. An external lubricant was applied to the outside of the protective covering. The transducer was inserted into the vagina with the patient supine, knees were gently flexed and hips elevated slightly on a pillow. The elevated hips allowed free movement of a transducer by the operator.

In patients with narrow introitus or vagina, who experienced discomfort at attempted insertion of transducer, the examination was discontinued. During insertion of the probe, the orientation of the transducer was assessed by noting the position of the urinary bladder, which usually contains a small residual amount of urine. The normally consistent position of the angle of the bladder relative to the more variable positions of the uterus and ovaries made it a good landmark to use when initially assessing transducer position and orientation. Rotating the probe 90 degrees into the coronal plane permitted visualization of both the uterus and adnexa. Next was scanning of the Pouch of Douglas or the cul-de-sac for presence of Fluids or possible contents. To scan the cul-de-sac in meaningful way, tilted the fire of the probe toward the rectum and imaged the longitudinal section of the rectum on the same screen.

IOTA scoring system was applied to differentiate benign and malignant ovarian tumors.



IOTA subgroup scoring system [16]

RESULTS & DISCUSSION

The observations and results of the study were tabulated under the headings of age wise incidence, clinical diagnosis, usg site of lesion, histopathological diagnosis types of fibroid encountered in the study, fibroids diagnosed on USG proved by histopathology, ovarian tumors differentiation as per IOTA score, Ovarian tumors differentiation after histopathology, ovarian tumors diagnosed on USG (IOTA score) proved by histopathology and study cases diagnosed on usg proved by histopathology.

Maximum number of cases was in the age group of 31 – 50 years and the minimum number was in the age group of 61 – 70 years. Similar age incidence was observed by study done by Sharma, *et al.;* [17].

Gynaecological diseases review in rural India, in 2014, with maximum cases in 31 – 60 yrs and minimum in > 60 yrs. In our study commonest Ultrasound and histopathological finding was uterine leomyoma (fibroid) which was same as in study conducted by Layla *et al.;* [18].

Fibroids are the commonest tumors which are easily diagnosed due to their classical sonographic picture. Fibroids which create confusion on Ultrasound are pedunculated Sub serosal fibroid, these are usually confused with fibroma ovary or broad ligament/retroperitoneal fibroids. In our study 12 out of 13 cases of fibroids were confirmed. There was one misleading case which on histopath turned to be fibroma ovary. Sometimes submucous or sub serous fibroid may be missed on TAS but if accompanied with TVS the sensitivity is increased. Jyothi G.S *et al.;* in 2012 [19]. Demonstrated the sensitivity of TVS for the diagnosis of these lesions to 100 %, which is same as what we got in our study. Also, In our study Ultrasonography (TAS/TVS) for Uterine fibroid gave Sensitivity -100 % ,Specificity - 50 %,Positive predictive value - 92.31 %,Negative predictive value – 100 % and Diagnostic Accuracy – 92.86 %,which are comparable with study done by Eze J.C *et al.;* [20] in 2013 with results sensitivity for uterine leiomyoma was 94.5%, with a specificity of 62.5%, accuracy of 92%.

Using B mode Ultrasonography a hydrosalphinx was visualised as cystic tubular structure. Ultrasound appearance of tubo-ovarian abscess is variable and they may be confused with endometriomas or malignancies. Patients with the diagnosis of ovarian malignancy can have wide spread disease at the time of laparotomy because of repeated lack of specific early symptoms, feeling of abdominal distention, discomfort and flatulence are usually managed as GIT disorders. Barbar *et al.;* [21] very concisely stated that "many ovarian cancers are nurtured in a sea of bicarbonate of soda and antacids".

Simple cystadenomas and benign teratoma have characteristic appearance and are easily diagnosed. In above study simple and hemorrhagic ovarian cysts were diagnosed in 10 % cases which all resolved at 2 months follow up Ultrasound suggesting their benign nature.

Krukenberg tumor (ovarian metastasis) was typically ovarian tumors of heterogeneous structure, with mostly iso echogenic with hypoechogenic areas, and with potential presence of necrosis and boss elated but smooth surface. Metastatic non-gynaecological tumors in the pelvis have a significantly different sonomorphological pattern compared with primary epithelial ovarian cancer. This pattern is dependent on the primary origin of the tumor [22].

IOTA scoring system is capable of predicting benign or malignant ovarian lesions with reasonable confidence. Almost all ultrasound features differed significantly between benign and malignant ovarian masses. At this juncture, the IOTA ultrasound and clinical multipara metric analyses and the subgroup analysis are most recent, with the best prediction of malignancy in the largest series to date, and combine the best predictors of previous studies with age and clinical variables [23].

Current study shows majority of the ovarian pathology cases were benign as compared to malignant; this goes with the study done by Yasmin *et al.;* [24] in 2008in which 89.7% were benign and 10.29% were malignant.

In our study Ultrasound as per IOTA scoring diagnosed 7 ovarian tumor cases as malignant and 10 cases as benign. On Histopathology (gold standard) 6 cases were malignant and 11 cases were benign. One case of malignant mucinous cystadenocarcinoma was misleading on Ultrasound which turned to be benign mucinous pathology. Here Ultrasound and Colour Doppler based IOTA scoring differentiated benign and malignant ovarian lesions with:

- Sensitivity -100 %, Specificity - 91.67 %, Positive predictive value – 85.71 %, Negative predictive value – 100 %, Diagnostic Accuracy – 94.44 %

Cohen's Kappa – 0.88 and Fisher exact p-value = 0.00038 which is statically significant finding.

Comparisons of ultrasound accuracy for ovarian cancer prediction

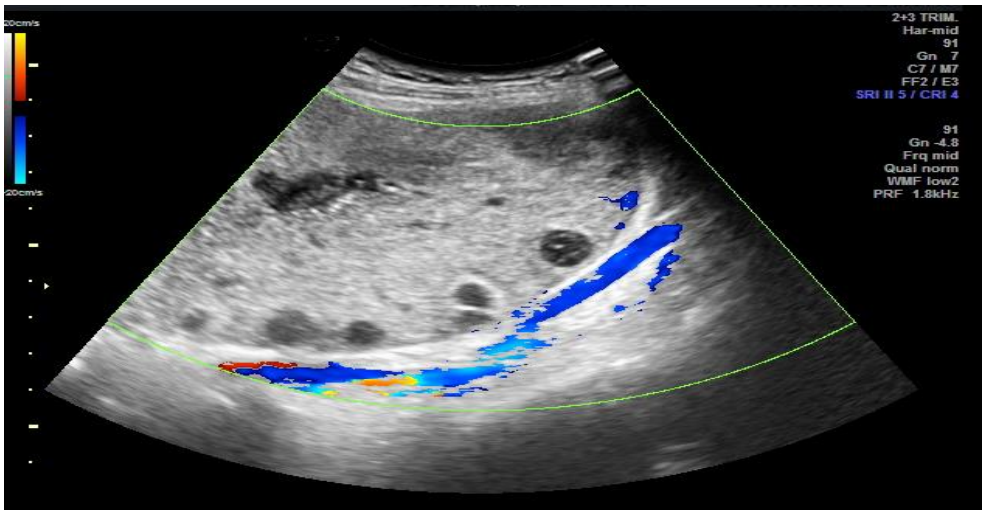
Study	Characteristics	Accuracy
Sassone *et al.;*	Gray scale characteristics score	Sensitivity 100%, Specificity 83%, PPV 37%, NPV 100%.
Fleischer *et al.;*	Pulsatility index	Sensitivity 100%, Specificity 82%, PPV 73%, NPV 100%.
Ovarian Tumor index	Combined gray scale & Doppler characteristics and age	Sensitivity 96%, Specificity 66%, PPV 29%, NPV 99%.
UKCTOCS	Multi technique screening (ultrasound and	Sensitivity 89%, specificity 99%, PPV 35%, NPV 99%.

	serum CA-125)	
DePriest Scoring system	Gray scale scoring system	Sensitivity 88.9%, specificity 50%, PPV 61.54%, NPV 83.3%.
Alcazar's scoring system	Combined gray scale & Doppler characteristics	Sensitivity 94.4%, specificity 95%, PPV 94.4%, NPV 95%.
Our Study	Combined gray-scale and color mapping, age, and other clinical variables	Sensitivity 100 %, specificity 91.67%, PPV 85.71%, NPV 100%.

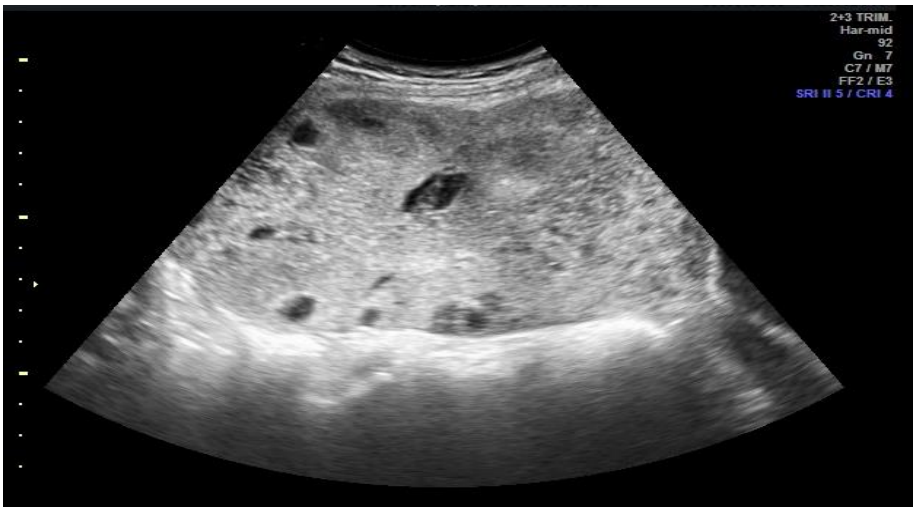
In the above mentioned table it is noted that as compared to previous studies done for differentian of benign and malignant ovarian tumors our current study shows better sensitivity, specificity, PPV and NPV. Also the diagnostic accuracy 94.44% is very appreciable.

This study yielded the diagnostic accuracy of 94.44 % for Ultrasound and Colour Doppler in the diagnosis of ovarian masses, increasing its eliability. Thus Ultrasound seems to be a simple, non-time consuming, easy to apply and Interpreted with reasonable accuracy and high sensitivity and specificity as initial modality of choice in the workup of every woman suspected of having an ovarian mass. And, to rule out unnecessary surgical interventions in benign masses.

CASES:

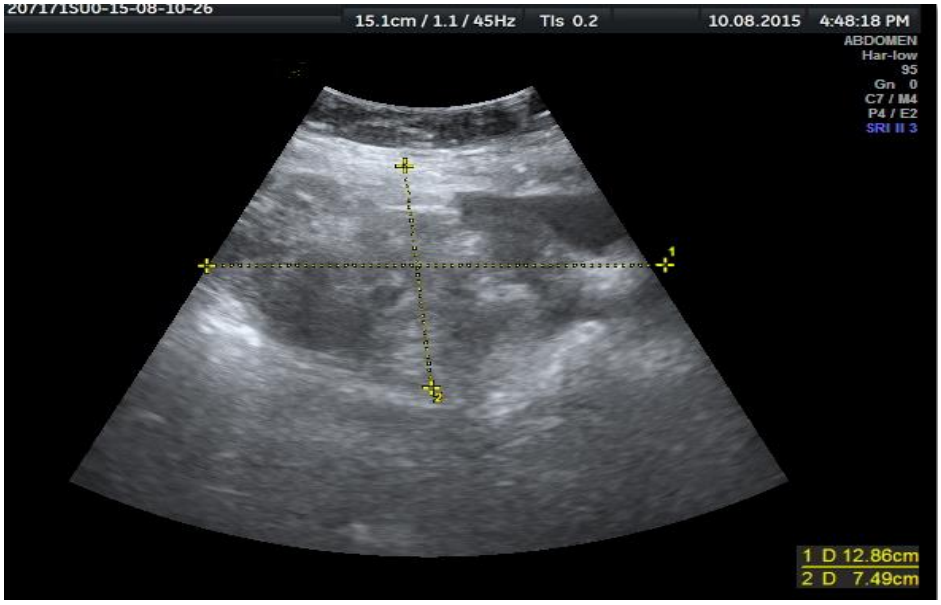


A

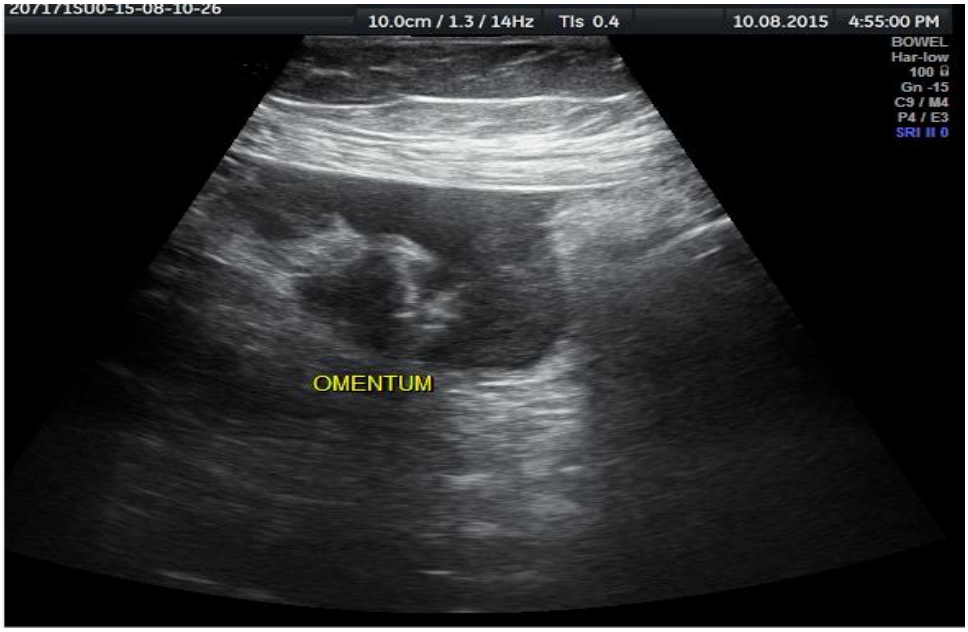


B

Fig 1 (A & B): Large solid cystic lesion with predominant echogenic solid component and multiple peripherally arranged tiny cysts. No abnormal vascularity noted.

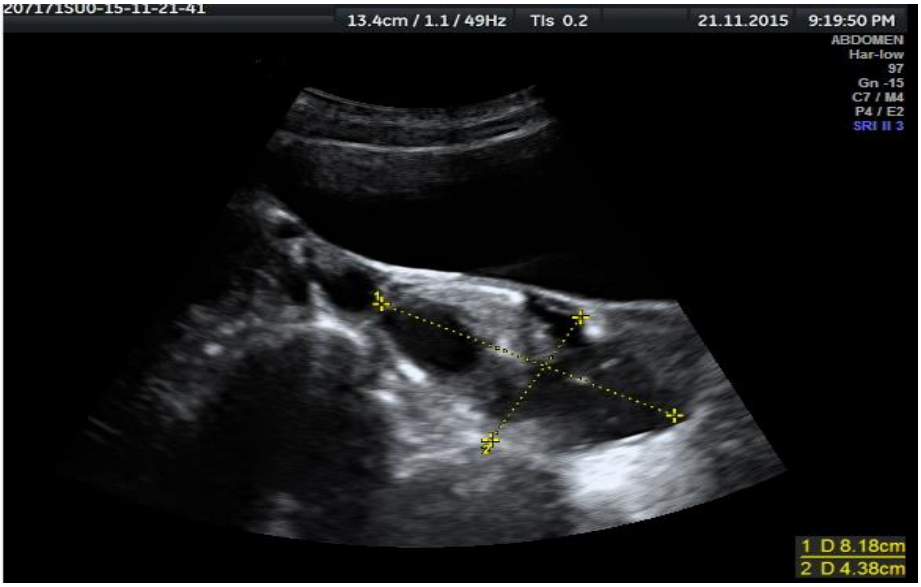


A

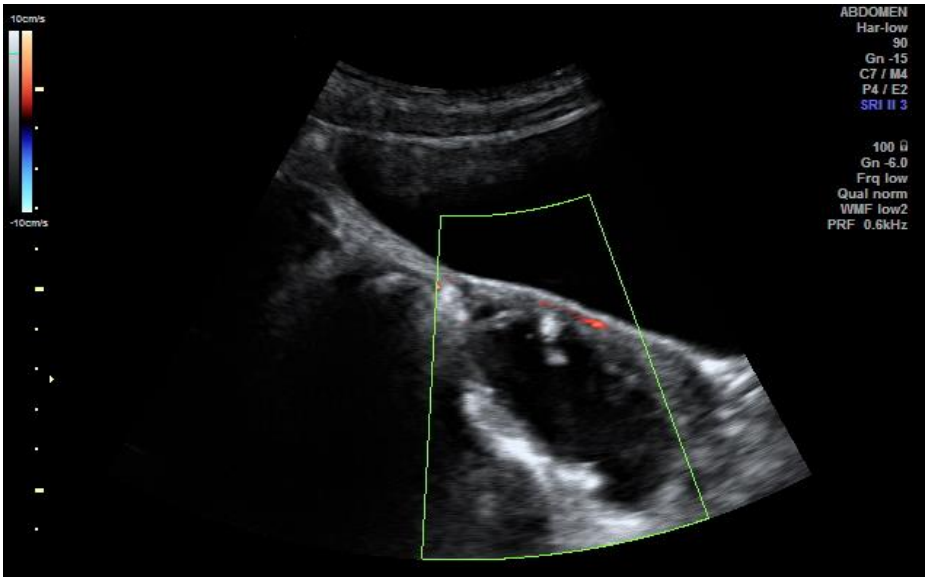


B

Fig 2 (A & B): Heterogenous mass lesion in right adnexa with right ovary not seen separately. Few echogenic omental deposits seen at umbilical region and associated mild ascites.



A



B

Fig 3 (A & B): Complex right ovarian cystic lesion internal echogenic components represent lipoid material, few peripheral calcifications noted.

Table 1: USG diagnosis

USG Diagnosis	No. of cases	Percentage of cases (%)
Fibroid	13	26
Adenomyosis	3	6
Endometrial cancer	2	4
Endomerial polyp	2	4
Carcinoma cervix	2	4
Ovarian torsion	2	4
Ovarian dermoid	2	4
Ovarian simple cyst	3	6
Ovarian hemorrhagic cyst	2	4
Ovarian endometrioma	2	4
Ovarian serous cystadenoma	4	8
Ovarian mucinous cystadenoma	2	4
Ovarian serous cystadenocarcinoma	2	4
Ovarian mucinous cystadenocarcinoma	3	6
Ovarian Dysgerminoma	1	2
Ovarian Metastasis	1	2
Hydrosalphinx	2	4
Tubo-ovarian abscess	1	2
Vaginal vault cancer	1	2
Total	**50**	**100**

Table2: Histopathological diagnosis

Histopathological Diagnosis	No. of cases	Percentage of cases (%)
Fibroid	12	28.57
Adenomyosis	3	7.14
Endometrial cancer	2	4.76
Endomerial polyp	2	4.76
Carcinoma cervix	1	2.38
Ovarian torsion	2	4.76
Ovarian dermoid	2	4.76
Ovarian endometrioma	2	4.76
Ovarian serous cystadenoma	4	9.52
Ovarian mucinous cystadenoma (1 was cystadenocarcinoma on USG)	3	7.14
Ovarian serous cystadenocarcinoma	2	4.76
Ovarian mucinous cystadenocarcinoma	2	4.76
Ovarian dysgerminoma	1	2.38
Ovarian Metastasis	1	2.38
Vaginal vault cancer	1	2.38
Ovarian fibroma (On USG it was subserosal fibroid)	1	2.38
Cervical polyp (On USG it was cervical cancer)	1	2.38
Total	**42**	**100**

Table 3: Ovarian tumors diagnosed malignancy positive/negative on USG (IOTA score) proved by histopathology

USG (As per IOTA score)	Histopathology (Gold standard)		Total
	Positive	Negative	
Positive	6	1	7
Negative	0	11	11
Total	6	12	18

When IOTA scoring system was compared with Histopathology following results were obtained on stastical analysis for IOTA scoring:

- Sensitivity -100 %
- Specificity - 91.67 %
- Positive predictive value – 85.71 %
- Negative predictive value – 100 %
- Diagnostic Accuracy – 94.44 %
- Cohen's Kappa – 0.88
- Fisher exact p-value - 0.00038 (statically significant)

Table 1: Study cases diagnosed on USG proved by histopathology

USG	Histopathology (Gold standard)		Total
	Positive	Negative	
Positive	39	3	42
Negative	0	3	3
Total	39	6	45

Out of total 50 cases, 8 were resolved on follow up, 39 cases were correctly diagnosed on Ultrasonography and Colour Doppler, and 3 cases were wrongly diagnosed.

When USG and Colour Doppler were compared with histopathology, on application of appropriate stastical analysis we got the following results:

- Sensitivity – 100 %
- Specificity – 50 %
- Positive predictive value – 92.86 %
- Negative predictive value – 100 %
- Diagnostic accuracy – 93.33 %
- Cohen's kappa – 0.6341
- Fisher exact p-value = 0.00141 (Statically significant)

CONCLUSIONS

Evaluation of female gynaecological pelvic masses is of particular importance in gynaecologic practice. The main challenge to the sonologist is to detect the site and size of lesion, to characterize the lesion and to differentiate benign from malignant lesions.

Thus Ultrasound is the primary modality used for detection and characterization of female gynaecological masses. Improved detection and characterization of female gynaecological pelvic masses contribute to better diagnostic accuracy and consequently reduction of false positive findings and invasive procedures, which leads to a significant reduction of morbidity and mortality from female gynaecological pelvic masses. This modality is the diagnostic test of choice in evaluating pelvic masses and may diagnose > 90% of pelvic masses (However it is highly operator dependent).

REFERENCES

1. Sayasneh A, Ekechi C, Ferrara L, Kaijser J, Stalder C, Sur S, Timmerman D, Bourne T. The characteristic ultrasound features of specific types of ovarian pathology (Review). International journal of oncology. 2015 Feb 1; 46(2):445-58.
2. Howlader N, Noone AM, Krapcho M, Neyman N, Aminou R, Waldron W, Altekruse SF, Kosary CL, Ruhl J, Tatalovich Z, Cho H. SEER cancer statistics review, 1975–2008. Bethesda, MD: National Cancer Institute. 2011 Nov; 19.
3. Zafar, Nadah, and Sanja Kupesic Plavsic. "Role of Ultrasound in the Evaluation of Acute Pelvic Pain in Nonpregnant Reproductive Age Patients." Donald School Journal of Ultrasound in Obstetrics & Gynecology 6.2 (2012): page no. 207-217
4. Ljubic A, Bozanovic T, Vilendecic Z. Sonographic Evaluation of Benign Pelvic Masses. Donald School Basic Textbook of Ultrasound in Obstetrics & Gynecology. 2014 Nov 30:372.
5. Varras M. Benefits and limitations of ultrasonographic evaluation of uterine adnexal lesions in early detection of ovarian cancer. Clinical and experimental obstetrics & gynecology. 2003 Dec; 31(2):85-98.
6. Abbas AM, Zahran KM, Nasr A, Kamel HS. A new scoring model for characterization of adnexal masses based on two-dimensional gray-scale and colour Doppler sonographic features. Facts, views & vision in ObGyn. 2014; 6(2):68.
7. Testa A, Kaijser J, Wynants L, Fischerova D, Van Holsbeke C, Franchi D, Savelli L, Epstein E,

Czekierdowski A, Guerriero S, Fruscio R. Strategies to diagnose ovarian cancer: new evidence from phase 3 of the multicentre international IOTA study. British journal of cancer. 2014 Aug 12; 111(4):680-8.
8. Valentin L, Hagen B, Tingulstad S, Eik-Nes S. Comparison of 'pattern recognition'and logistic regression models for discrimination between benign and malignant pelvic masses: a prospective cross validation. Ultrasound in Obstetrics and Gynecology. 2001 Oct 1; 18(4):357-65.
9. Valentin L. Pattern recognition of pelvic masses by gray-scale ultrasound imaging: the contribution of Doppler ultrasound. Ultrasound in Obstetrics and Gynecology. 1999 Nov 1; 14(5):338-47.
10. Diagnostic Ultrasound, 3rd ed.C. M. Rumack, S. R. Wilson, J. W. Charboneau, J. M. Johnson, editors. St Louis, MO: Elsevier Mosby, 2005, page no, 527-587.
11. Timor-Tritsch IE, Monteagudo A. Scanning techniques in obstetrics and gynecology. Clinical obstetrics and gynecology. 1996 Mar 1; 39(1):167-74.
12. Clinical Ultrasoun, 3rd Edition Paul Allan, & Grant Baxter, Michael Weston. Churchil Livingstone;2011:p.645-46.
13. Levi CS,Holt SC,Lyons EA,Lindsay DJ,Dashefsky SM. Normal anatomy of the female pelvis and Transvaginal sonography.In: Peter W.Callen,MD. Ultrasonography in Obstetrics and Gynecology, 5th edition. Philadelphia: WB Saunders; 2008; 887-918.
14. Grunfeld L. The uterus and endometrium. Clin Obstet Gynecol 1996; 39(1):175-87.
15. Ameye L, Valentin L, Testa AC, Van Holsbeke C, Domali E, Van Huffel S, Vergote I, Bourne T, Timmerman D. Scoring system to differentiate benign from malignant masses in specific subgroups of adnexal tumors.
16. Sharma C, Sharma M, Raina R, Soni A, Chander B, Verma S. Gynecological diseases in rural India: A critical appraisal of indications and route of surgery along with histopathology correlation of 922 women undergoing major gynecological surgery. Journal of mid-life health. 2014 Apr; 5(2):55.
17. Neena Y, Honey B. Clinico-pathological correlation of hysterectomy specimens for abnormal uterine bleeding in rural area. J Evol Med Dent Sci. 2013 Sep 30; 39(2):7506-12.
18. Jyothi, G. S., et al. "Mass per Abdomen: A Diagnostic Dilemma." Journal of South Asian Federation of Obstetrics and Gynaecology 4.3 (2012): 161-163.
19. Eze JC, Ugwu AC, Ohagwu CC. The Value of Ultrasonography in the Diagnosis of Leiomyomas in Southeast Nigeria. Journal of Asian Scientific Research. 2013 Feb 1; 3(2):151.
20. Barber HR. Ovarian cancer. CA: a cancer journal for clinicians. New York, Masson Publishing USA, Inc, 1986 May 1; 36(3):149-84.
21. Timmerman D, Testa AC, Bourne T, Ameye L, Jurkovic D, Van Holsbeke C, Paladini D, Van Calster B, Vergote I, Van Huffel S, Valentin L. Simple ultrasound-based rules for the diagnosis of ovarian cancer. Ultrasound in obstetrics & gynecology. 2008 Jun 1; 31(6):681-90.
22. Ultrasound and assessment of ovarian cancer risk.Diane M. Twickler, Elysia Moschos AJR Am J Roentgenol. 2010 February; 194(2): page no. 322–329.
23. Yasmin S, Yasmin A, Asif M. Clinicohistological pattern of ovarian tumours in Peshawar region. J Ayub Med Coll Abbottabad. 2008; 20(4):11-3.