Diagnostic Accuracy of Ultrasonography in the Diagnosis of Ovarian Masses of the Admitted Patients in a Tertiary Care Hospital

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Abstract

Background: Adnexal mass has multidimensional diagnosis that may related to fallopian tube, ovary etc. These mass may be benign, borderline and malignant. The ability of clinical approach to diagnose the exact pathology of adnexal mass is still a question.

Objective: To evaluate the diagnostic accuracy of ultrasonography in the diagnoses of ovarian masses by correlating sonographic findings with their histopathology reports.

Methods: This study was done in the department of Obstetrics & Gynecology, BSMMU from November, 2016 to April, 2017. Sixty eight patients were selected by purposive sampling. Thereafter, the subjects were scrutinized according to the selection criteria and 50 patients were selected for the study purpose. All the patients were diagnosed as ovarian mass clinically with the help of sonography. All the patients underwent surgical intervention as well as tissue diagnosis of specimen. The data regarding patients' demographic profile, clinical findings, sonological findings, preoperative findings and histopathological report were recorded through a semi structured data collection sheet. Data were compiled, edited and prepared in tabular and figure form. Categorical data were analyzed by chi square test. P value was determined as significant when it was <0.05.

Results: Among the 50 cases, more than 50% were from 18-30 years age group. The mean age was 26.59±5.16 years (age range: 18-69 years).90% of the subjects were pre-menopausal. 70% had unilateral and 30% had bilateral mass. Fifty four percent of the subjects were clinically diagnosed as endometriosis, 24% as benign ovarian cyst and 2% as malignant ovarian tumour. The sensitivity, specificity, positive and negative predictive value of transabdominal ultrasonography were 66.67%, 97.14%, 90.09% and 87.17%.

Conclusion: High resolution abdominal ultrasonography is an effective method in diagnosis of adnexal mass and differentiation between malignant tumors from benign tumors can be done on 70% of patients .

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Introduction

Adnexal mass is a lump in tissues of the adnexa of uterus (ovaries, fallopian tube, or any other surrounding connective tissue structure). Ovarian masses can be a risk factor for ovarian malignancy, however most masses are often not malignant and go away on their own without treatment within a few menstrual cycle. Most of the adnexal masses are arised from ovary. Ovary is the multidimensional female specific organ that can produce multidimensional neoplasm like benign, borderline and malignant throughout life. Histopathological findings of the specific neoplasm are also quite different among case to case due to complex ovarian structure.[1] Among the neoplasms, ovarian cancer is the most devastating of all gynaecological cancers, presents late and response poorly to treatment.[2] Ovarian carcinoma is ranked as 4th commonest cause of death in women.[3] Approximately 4.24% of all adnexal masses in pre-menopausal women ad 39-63% in post menopausal women are malignant.[4] The age adjusted incidence in different parts of subcontinent rates of ovarian cancer very between 5.4 to 8.0/100,000 population.[5] Common ovarian masses may be classified as cystic, complex or solid. Common cystic masses include follicular cysts, corpus luteum cysts, cystic teratomas, parovarian cyst. Complex massess are mainly cystadenomas (serous or mucinous), hemorrhaegic cyst, endometrioma, ectopic pregnancy, teratoma (dermoid), abscess. Adenocarcinomas, solid teratomas, arrhenoblastomas, fibromas and dysgerminomas are examples of solid masses.[6,7]

The diagnosis of ovarian cancer is not easy because of the multitude of clinical and histopathological aspects, lack of precursor lesion and their evolution. So, early discrimination between benign and malignant tumors results in more women being appropriately referred for gynecological oncology care and more women with suspected ovarian benign conditions can be treated with conservative surgical treatment.[8]

Ultrasonography is the primary imaging tool that can detect easily the ovarian masses. It is, whether transabdominal or endovaginal, relies on morphological assessment of the tumor to distinguish between benign and malignant disease. Morphologic features such as, thick, irregular walls and septa, papillary projections and solid, moderately echogenic loculi, have been described as suggestive of malignant tumor.[7] Other morphologic scoring systems have been proposed and are based on the wall thickness, inner wall structure, septal characteristics, and echogenicity of the lesion.[9]

The advent of high frequency endovaginal probes allowed high resolution imaging of pelvic organs in general and of the ovaries in particular. Endovaginal ultrasonography is the most practical modality for assessment of ovarian tumors because it is readily available and has a high negative predictive value.[9]

Color doppler ultrasound of ovarian masses helps to identify vascularized tissue and can assist in differentiating solid tumor tissue from non-vascularized structures in complex adnexal masses.[10] Benign lesions tend to initiate new tumor blood vessel formation peripherally from pre-existing host vessels, whereas malignant tumors tend to initiate new tumor blood vessel formation centrally.[11]

Ovarian tumor has long list of diagnostic possibilities and should be correlated with history and laparotomy findings.[12] Histopathology and laparotomy are important gold standards used to confirm the result of ultrasound diagnoses.[13] Several studies compared ultrasound results with histopathological findings. In a study to

access the value of ultrasonography in the diagnosis of ovarian neoplasms, positive correlation between the result of ultrasonographic diagnosis with histopathologic diagnosis and follow up examinations when surgery was not indicated was obtained in 74.5% of the patients studied.[14] A higher diagnostic accuracy of 87.3% had been obtained in a related study to evaluate the accuracy, sensitivity and specificity of combined clinical assessment, gray scale abdominal ultrasound and serum CA 125 assay in predicting malignant status of pelvic masses.[13] The main aim of this study is to determined the accuracy of transabdominal ultrasonography by correlating sonographic findings with histopathology results in the diagnosis of ovarian masses.

Methods

Place of study

Department of Obstetrics & Gyneacology, Bangabandhu Sheikh Mujib Medical University**.**

Period of study

November, 2016 to April, 2017.

Study population

This study was conducted among the patients who were admitted with ovarian masses and was undergone laparatomy in the department of Obstetrics & Gyneacology in BSMMU, Dhaka.

Study design

Hospital based prospective cross sectional study.

Sample size and statistical basis of it

Sample size determination depends on time and resources. Estimated population was calculated by using the following statistical formula:

According to Okapia MS[15]

N=480

$$n = \frac{N}{1+Ne^2}$$

$$= \frac{480}{1+480\times(0.05)^2} = 218$$

Where 'n' is the sample size, 'N' is the population and 'e' is the accepted tolerance error of 0.05.

So, assuming this sample size as 218 in this study which was enrolled from the admitted patients of Department of Obstetrics & Gynaecology of BSMMU, Dhaka. But due to time constrains 50 cases where selected for this study

Sampling Methods

The sampling technique was purposive sampling.

Inclusion Criteria

All patients sonographically diagnosed as adnexal mass.

Exclusion Criteria

- Adnexal masses that was be conservatively treated.
- Adnexal masses diagnosed as ectopic pregnancy, functional cyst, endometrioma.
- Patients not interested in laparatomy.
- Patients with multiple co-morbidity.
- Elderly patients not fit for laparatomy.

Main outcome variables

- Biochemical marker CA - 125.
- Sonographic findings.
- Per operative findings
- Histopathologic findings.

Selection bias

Selection bias may be act as a confounding factor here

Procedures of preparing and organizing materials

A questionnaire and a consent form was prepared, sample was selected on the basis of inclusion and exclusion criteria, questionnaire was filled with informed written consent, interview was taken. Data was gathered, edited, decorated in SPSS version 16. Data was analyzed. The observations were plotted into tabular and figure form.

Equipment used

Questionnaires

Procedures of collecting data

- Patient was collected by inclusion and exclusion criteria.
- Complete pre-operative clinical evaluation including history, physical examination, laboratory and radiologic investigation.
- The morphologic findings of tumor recorded in data collection sheet and evaluation of operation note and USG findings.
- Finally histophathologic findings were compared with those of USG findings by appropriate statistical analysis.

Professional assistance from experts

Expert opinion was taken from specialists of the Department of Obstetrics &Gynecology, Radiology & Imaging, Pathology, Biochemistry of BSMMU and Biostatistician.

Procedures of data analysis and interpretation

- All data was checked and edited after collection.
- Chart by spreadsheet of Windows 7.
- Frequency distribution and normal distribution of all continuous variables were calculated.
- Cross tabulation was prepared and a comparison was made between the respondents from different age, parity, clinical features.
- Chi-square analysis (Qualitative data).
- Student's t test (Quantitative data).
- Validity of ultrasonography was tested by determining the specify, sensitivity,positive predictive value,negative predictive value and accuracy of the test
- P' values <0.05 was considered as statistically significant.

Quality assurance strateg

- Caution was taken during data collection and data processing.
- Data was analyzed cautiously.

Result

Table I shows that maximum adnexal mass were diagnosed in age group 18-30 years (58%) followed by 31-40 years (26%). So, it can be assumed from this table that maximum patients (84%) of adnexal mass in our research were in reproductive age group (18-40 years). The mean age was 26.59±11.16 years (age range: 18-69 years).

Figure 1 shows that 90% of the patients among 50 subjects were pre-menopausal whereas rest 10% were post menopausal women.

Figure 2 shows that 43(86%) patients in this study presented with subacute symptoms in OPD whereas 7(14%) patients presented with acute symptoms in emergency department.

Table II shows that maximum patients presented with abdominal lump (100%) Vaginal bleeding was the presenting symptoms in 50% of patients. All the patients were diagnosed clinically as adnexal mass.

Table III shows that 16.67% benign ovarian mass were diagnosed peroperativel yas functional cyst and 58.33% were neoplastic cyst. Among the neoplastic cyst 8.33% clinically diagnosed benign ovarian mass

found endometriosis and about 25% cases were dermoid cyst. No malignancy is detected in preoperative findings of adnexal mass.

Table IV shows the correlation between size and neoplasticity. The mean size of functional cyst, other mass and neoplastic cyst were 3.10±2.36 cm, 3.97±3.04 cm and 4.36±3.28 cm respectively. Neoplastic cyst was significantly greater in size than non-neoplastic mass, including functional cyst, but statistically it was not significant

Table V shows that comparison of result as assessed by pathology and sonography. Sonography &Pathlogy both result positive that is true positive was 10. Sonography & Pathology both result negative that is true negative was 34. Furthermore, false positive was 1 and false negative was 5.

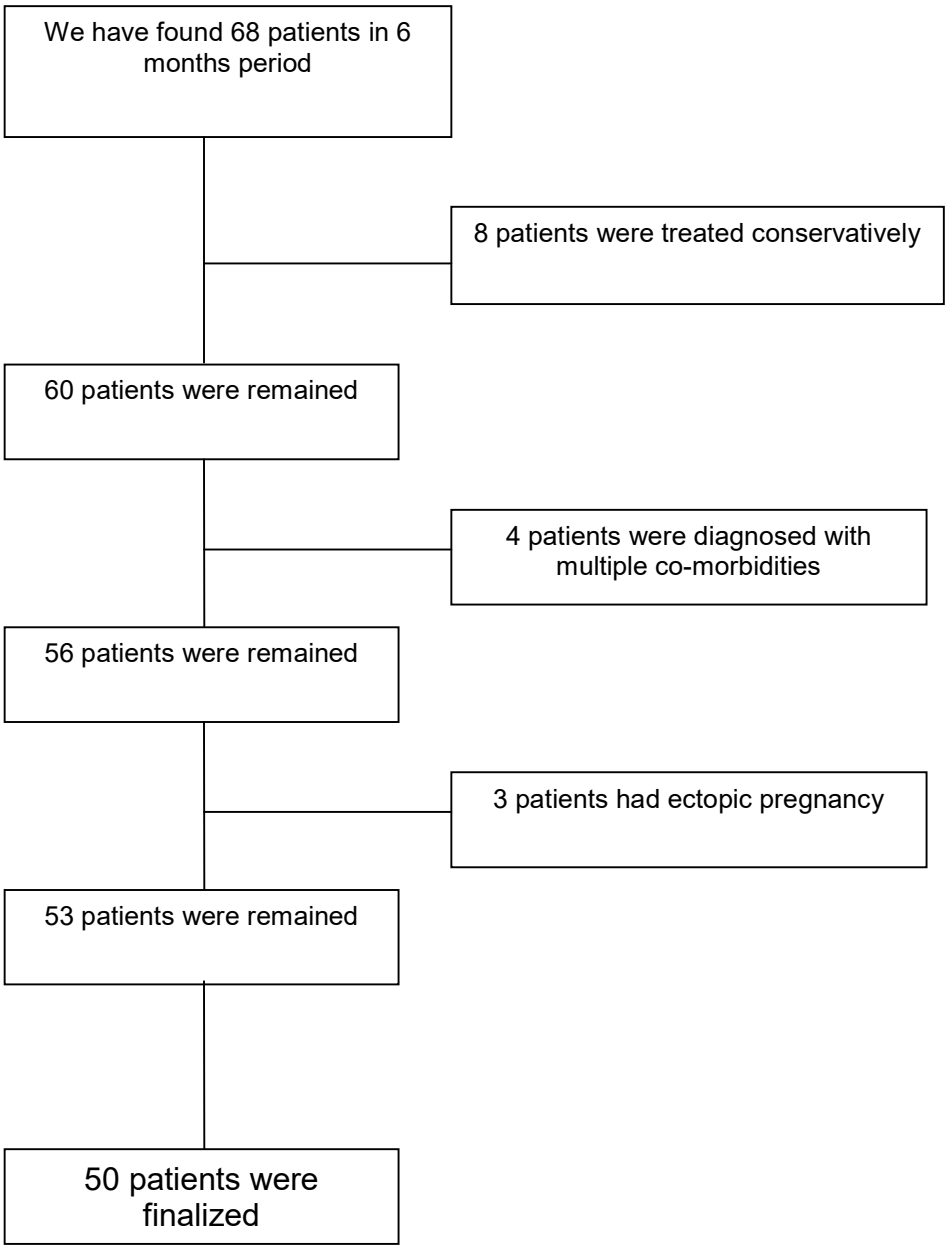

Table I: Age distribution (n=50)

Age group	Frequency (%)
18 – 30 years	29 (58%)
31 – 40 years	13 (26%)
41 – 50 years	2 (4%)
51 – 60 years	5 (10%)
>60 years	1 (2%)
Total	50 (100%)
Mean age (in years)	26.59±5.16
Age range (in years)	18 – 69

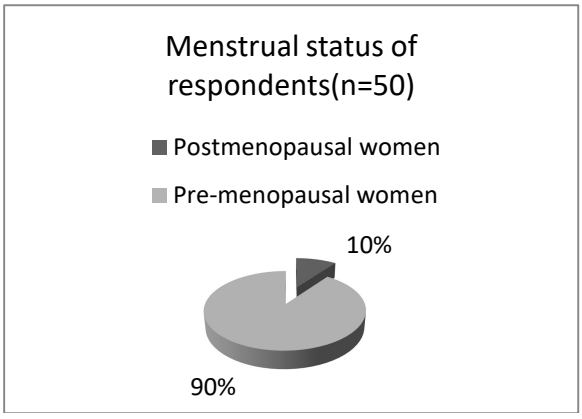

Figure 1. Distribution of patients with menstrual status (n=50)

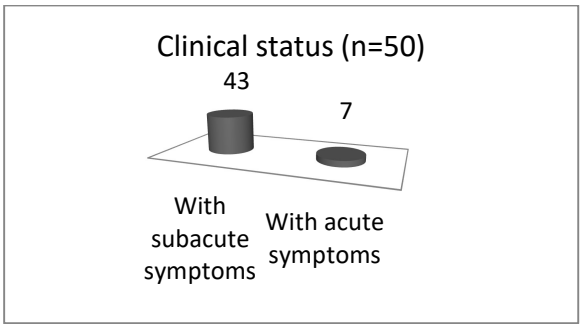

Figure 2. Distribution of patients according to clinical status (n=50)

Table II: Distribution of clinical features (n=50)

Clinical Features	Frequency (%)
Abdominal lump	50 (100%)
Per vaginal bleeding	25 (50%)
Abdominal discomfort/pain	16 (32%)
Nausea/vomiting	7 (14%)

Table III: Distribution of operative findings of benign ovarian tumor (n=13)

Pre-operative benign ovarian tumor	Frequency (%)
Functional cyst (n=2)	
Follicular cyst	1 (8.33%)
Corpus luteum cyst	1 (8.33%)
Other masses (n=4)	
Parovarian cyst	2 (16.66%)
Paratubal cyst	1 (8.33%)
Hydrosalpinx	1 (8.33%)
Neoplastic cyst (n=7)	
Dermoid cyst	3 (25%)
Serous cystadenoma	2 (16.67%)
Mucinous cystadenoma	1 (8.33%)
Endometrioma	1 (8.33%)
Total mass	13(26%)

Table IV: Correlation between the size and neoplasticity (n=50)

Gross diagnostic group	Surgical & pathological diagnosis	Size of mass					p value
		2-3 cm	4-5 cm	6-7 cm	≥8cm	Mean±2SD	
Functional cyst (n=8)							
	Follicular cyst	3	2	0			
	Corpus luteum cyst	1	1	1		3.10±2.36	
Other mass (n=10)							>0.05 NS
	Paraovarian cyst	2	0	0			
	Paratubal cyst	3	1	1		3.97±3.04	
	Hydrosalpinx	1	1	1			>0.05 NS
Neoplastic cyst (n=32)							
	Dermoid cyst	1	2	1	0		
	Serous cystadenoma	0	1	0	0		
	Mucinous cystadenoma	0	1	2	0		
	Fibroma	0	1	1	0	4.36±3.28	
	Endometrioma	5	12	4	1		
	Serous cystadenocarcinoma	0	0	0	1		>0.05 NS
Total		16	22	11	1	50	

Statistics was calculated by chi square test; NS: Not significant; p value was significant if <0.05
SD: Standard deviation

Table V: Comparison of result as assessed by pathology and sonography (n=50)

Pathology Sonography	Positive	Negative	Total
Positive	10	1	11
Negative	05	34	39
Total	15	35	50

Sensitivity 66.67%, specificity 97.14%, Positive predictive value 90.09%, Negative Predictive value 87.17%, Positive likelihood ratio 23.31% and Negative likelihood ratio 0.34.

Discussion

Adnexal mass is a lump in tissues of the adnexa of uterus (ovaries, fallopian tube,or any other surrounding connective tissue structure). Ovarian masses can be a risk factor for ovarian malignancy, however, most masses are often not malignant and go away on their own without treatment within a few menstrual cycle. Most of the adnexal masses arise from ovary. Ovary is the multidimensional female specific organ that can produce multidimensional neoplasm like benign, borderline and malignant throughout life. Ovarian cancer is the second most common female reproductive cancer, preceded only by the cancer of the uterine corpus, more women die from ovarian cancers, as it corresponds to the highest mortality rate in developed countries. As a result, many patients undergo major surgery because of the fear of missing an ovarian cancer. On the contrary, many women with advanced ovarian cancer undergo insufficient primary surgeries at local hospitals, and the suboptimal intervention affects prognosis and increases patient morbidity. Malignant

ovarian tumors are diagnosed at an advanced stage in 75% of cases and are associated with the highest mortality figures of all gynecological cancers.[16]

The clinical diagnosis here was based on history, physical examination, imaging, and tumour marker CA-125. Operative findings were achieved by laparotomy or diagnostic laparoscopy. Tissue diagnosis was done by histopathology of surgical specimen.

The accuracy of diagnostic tests used to evaluate the pelvic mass is of great concern to practicing gynaecologist. In pre-operative evaluation of such a mass, the major initial tests are still clinical impression including ultrasound examination. Hence it is important to obtain a thorough history from patient when developing a comprehensive differential diagnosis. In many symptoms can help to delineate the etiology of mass.[17]

Ovarian cysts are detected in female patients of all ages and can be functional or neoplastic in origin. Neoplastic cysts either benign or malignant are managed surgically. The patient's age, the size of the cyst, and the ultrasound appearances are helpful in determining which ovarian cysts necessitate surgical excision and which need only observation. The combination of benign findings from pelvic examination, a benign ultrasound appearance and a cancer antigen 125 levels within normal limits indicates a benign origin in practically all cases.[18]

Numerous reports legitimized the use of operative laparoscopy to manage suspected benign adnexal masses, the benefit being reduced hospital stay and low morbidity.[19] Laparoscopy was performed in 38(76%) cases in this study whereas rest of the patients 12(24%) underwent laparotomy without any serious complication. Only 3% of these laparoscopy were converted into laparotomy as mass could not be handled comfortably, without disturbing adjacent organ.
Pelvic endometriosis was the commonest pre-operative diagnosis in this study, which was upto 54%. Most of the masses in this group were endometrioma. This is a reason to explain why endometrioma is the commonest mass found in this study; 27/50 in clinical diagnosis and 22/50 in surgical and pathological diagnosis.

Grimes and Hughes reported that ovarian functional cysts were the fourth most common gynecological cause of hospital admission in the United States in the late 1980s.[20] Spontaneous regression of ovarian cysts was noted in 66.6% of children in whom ultrasonography was used to evaluate the ovarian cysts. This percentage is probably a fairly accurate reflection of the actual incidence of functional ovarian cysts in patients in this age group. The exact incidence of functional cysts is difficult to determine in patients younger than 20 years of age. However, Breen and Maxson reported the incidence of functional cyst was 36% in patients in this age group who underwent surgical treatment of an ovarian mass and estimated incidence of ovarian malignant disease is 8.3 to 22%.[20]

In this study, 46 out of 50 cases were ovarian origin which is approximately 92%. There were only 5(10%) cases were post menopausal. Three of 5 cases were ovarian origin, 1 case had no any mass (spontaneous regression of functional cyst), 1 case had endometrioma and the last one had ovarian carcinoma. It might because small number of cases and only suspected benign adnexal masses were evaluated. Thus expectant observation of post menopausal patient is not recommended, an early surgical excision is advisable.

Unilocular cystic tumors of all size are, as a rule, benign. In one study, the incidence of malignant involvement was 2% for cysts larger than 10 cm, whereas all cysts smaller than 10 cm were histologically benign. Thick septa, solid area, irregularities of the inner wall, poorly defined margins and ascites are sonographic findings suggestive of malignant cysts. Solid component, an almost constant feature of ovarian malignant lesion, was noted in 93% of patients with malignant ovarian cysts[13]. However, only one malignant cyst was found in our study, endometrioid carcinoma arising in right unilocular endometriotic cyst. Surprisingly, this malignant case was one of 4 cases of clinically suspected chronic PID and was intra-operatively diagnosed to be severe pelvic endometriosis with 11 cm in diameter of right unilocular endometriotic cyst. After reviewed, she was ever admitted 2 times with misdiagnosis of tubo-ovarian abscess and had good responses of standard medical treatment. Finally, diagnostic laparoscopy was performed because of no regression of a unilocular cyst by ultrasonographic finding after 1-month follow up with suspected pelvic endometriosis by clinical picture. Laparoscopic right ovarian cystectomy, lysis of adhesion and coagulation of endometriotic spots were performed and followed by chemotherapy after 2 weeks of pathologic report. Overall accuracy for detection of ovarian malignant disease did not differ significantly among pelvic examination (76%), ultrasonographic findings (74%) and CA-125 level (77%).[22] A single CA-125 measurement is not helpful in distinguishing between benign and malignant pelvic masses because the positive predictive value is low (10%). When CA-125 is available, this measurement should be used in conjunction with the clinical and ultrasonographic findings to determine whether an ovarian cyst is malignant.[23]

This present study showed that abdominal sonography had a sensitivity of 66.67% and a specificity of 97.14% for predicting adnexal mass. Sassone et al. indicated that the sensitivity of transvaginal ultrasound is around 100; its specificity is around 83% which is higher than the transabdominal ultrasound which has a sensitivity and specificity of over 80%.[24] An initial report by Kurjak et al. found a sensitivity and specificity about 100% and 99%, respectively, in predicting ovarian cancer.[24] Finkler et al. indicated combining advanced ultrasound and measurement of serum CA 125 significantly can effectively detect early ovarian cancer and decrease mortality rate for ovarian cancer.[25]

In this present study transabdominal ultrasonography was performed rather than transvaginal due to availability of transabdominal ultrasonography in almost every centre of our country.

Limitations of study

- It was a cross-sectional study.
- This is single blinded, single centered study.
- Duration is short.
- Sample size is small.
- Does not proclaim the scenario of whole country

Conclusion

The results of this study show that high resolution abdominal ultrasonography is an effective method in diagnosis of adnexal mass and in 70% of patients can differentiate malignant tumors from benign tumors.

Recommendations

- Hospital based comparative study between transabdominal and transvaginal ultrasonography should be done to get a real scenario of outcome that depends upon the expertise of management.

- A multicentered double blinded study in the divisional/ tertiary hospitals of whole Bangladesh can reveal the real picture.
- The study period should be long involving a large sample size.
- Multi disciplinary approach of research work can make a study precise & more authentic in this regard.

References

1. Terzic M, Stimec B. Primary endometrioid adenocarcinoma of the fallopian tube. Z Onkol 2000; 32(4): 114–7.
2. Jemal A, Bray F, Center MM, Ferlay J, Ward E, Forman D. Global cancer statistics. CA Cancer J Clin. 2011; 61(2):69-90.
3. Boyd C, McCluggage WG Low-Grade Ovarian Serous Neoplasms (Low-Grade Serous Carcinoma and Serous Borderline Tumor) Associated With High-Grade Serous Carcinoma or Undifferentiated Carcinoma: Report of a Series of Cases of an Unusual Phenomenon. Am J Surg Pathol. 2011 Nov; pp 10.
4. Köbel M, Huntsman D, Gilks CB. Critical molecular abnormalities in high-grade serous carcinoma of the ovary. Expert Rev Mol Med 2008; 10: e22
5. Basu P, De P, Mandal S, Ray K, Biswas J. Study of 'patterns of care' of ovarian cancer patients in a specialized cancer institute in Kolkata, Eastern India. Indian J Cancer. 2009; 46:28-33.
6. Roger CS, Thomas CW, Miner SN. Clinical Sonography; a practical guide, (4th edition).New Delhi. Wolters Kluwer Health. 2007; 294 – 301
7. Douglas L, Brown KM, Dudiak FC, Laing M. Adnexal Masses: Ultrasound Characterization and Reporting. Radiology. 2010; 254: 342-54.
8. Ameye L, Valentin L, Testa AC et al. A scoring system to differentiate malignant from benign masses in specific ultrasound-based subgroups of adnexal tumors. Ultrasound Obstet Gynecol .2009; 33:92-101.
9. Yong-Yeon J, Eric KO, Heoun KK. Imaging Evaluation of Ovarian Masses. Radiographics; 2000; 20:1445-70.
10. Kurjak SIM, Schulman H. Transvaginal ultrasound color flow and Doppler waveform of the postmenopausal adnexal masses. Journal of Obstetric Gynaecology. 1992; 80: 917-21.
11. Dock W, Grabenwoger F, Metz V, Eibenberger K, Farres MT. Tumor vascularization: assessment with duplex sonography. Radiology. 1991; 181: 241-4.
12. Bohm-Velez M, Fleicher AC, Andreotii RF, Fishman EK, Horrow MM, Hricak H, Thurmond A, Zelop C. Expert panel on women Imaging; Suspected adnexal masses (2005) (online publication); http://www.guildeline.gov/summary/summary.aspx. Assessed on 22nd April 2016.
13. Eugene WK, Leong VS. A prospective study on 110 pelvic masses by clinical assessment, ultrasound scan and CA-125 – Prediction of malignancy. Singapore Journal of Obstetrics and Gynaecology. 2001; 32(1):34-8.
14. Satosker, P., Deshpande, A. The value of Ultrasonography in the diagnosis of adnexal masses. Journal of Post-graduate Medicine. 1991; 37:35 – 9.
15. PinottiJA, de Franzin CM, Marussi EF, Zeferino LC. Evolution of cystic and adnexal tumors identified by echonography. Int J Gynaecol Obstet 1988; 26: 109-14.
16. Schutter EM, Kenemans P, Sohn C, Kristen P, Crombach G, Westermann R, et al. Diagnostic value of pelvic examination, ultrasound, and serum CA 125 in postmenopausal women with a pelvic mass: an international multicenter study. Cancer 1994; 74:1398-406.
17. Herrmann UJ Jr, Locher GW, Goldhirsch A. Sonographic patterns of ovarian

tumors: prediction of malignancy. Obstet Gynecol. 1987; 69: 777-81.
18. Grover SR, Quinn MA. Is there any value in bimanual pelvic examination as a screening test. Med J Aust. 1995; 162: 408-10.
19. Grimes DA, Huges JM. Useofmultiphasic oral contraceptives and hospitalization of women with functional ovarian cysts in united states. Obstetgynecol. 1989; 73:1037-9.
20. Breen JL, Maxson WS. Ovarian tumor in children and adolescents. Clin Obstet Gynecol 1977; 20:607-23.
21. O'Connel GJ, Ryan E, Murphy KJ, Prefontaine M. Predictive value of CA 125 for ovarian carcinoma in patients presenting with pelvic masses.Obstet Gynecol. 1987; 70:930-2.
22. Sassone AM, Timor-Tritsch IE, Artner A, Westhoff C, Warren WB. Transvaginal sonographic characterization of ovarian disease: evaluation of a new scoring system to predict ovarian malignancy. Obstet Gynecol 1991; 78(1):70-6.
23. Kurjak A, Zalud I, Alfirevic Z. Evaluation of adnexal masses with transvaginal color ultrasound. J Ultrasound Med 1991; 10(6): 295-7.
24. Finkler NJ, Benacerraf B, Lavin PT, Wojciechowski C, Knapp RC. Comparison of serum CA 125: clinical impression, and ultrasound in the preoperative evaluation of ovarian masses. Obstet Gynecol. 1988; 72(4);659-64.