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Ultrasonic Assessment of Ovarian Lesions

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الخلاصة..

أربع و سبعون مريضة تم فحصهن بجهاز السونار العادي ، ثم قورنت المشاهدات بنتائج الفحص النسيجي لهن و كانت دقة التشخيص بالسونار لمختلف آفات المبيض هي ٨١.١%

Summary

- During the period from August 2008 to February 2009 seventy four female patients were admitted to Al –Zahra teaching hospital- Kut-Wassit and scanned by pelvic and abdominal ultra sonography for various complaints to assess the cause of the pelvic pathology and to determine the ovarian status .

- All these patients were subjected to surgery and after that their histopathological findings were studied and analyzed for sonographic accuracy.

- The diagnostic accuracy of ultra sound in this study was 81.1% in the characterization and proper description of the ovarian lesions.

- Thus it seems to be ultra sound is a good tool as being the primary imaging modality in a patient with suspected pelvic mass by identifying the origin and the nature of the pelvic mass. .

Introduction :

The clinical uses of U/S in ovarian tumors :

1) Documentation of the presence or absence of suspected pelvic mass.
2) Localization of the site of origin of pelvic mass.
3) Characterization of the nature of the pelvic mass such as internal texture; margination and wall contents.
4) Distinguish between cystic, complex and solid pelvic masses.
5) Analysis of the features suggestive of benign or malignant ovarian tumors.
6) To detect ascites , lymphadenopathy and distant metastasis .[1,2,3,4,5]

Historical introduction to gynecological ultrasound in the diagnosis of the ovarian lesions:

The clinical acceptance of the U/S in the diagnosis of the gynecological disorders has lagged behind that of obstetrical U/S because of the lack of the specificity of the sonographic finding.

Using cross dimensional imaging:

- **In 1967 Thompson.et al pointed out that U/S. could differentiate between cysts and solid masses.(5)**
- **In 1970 Morley and Barnett suggest the correct diagnosis in 44% and U/S. was helpful in 79%according to histopathological results.(6)**
- **In 1974 Cochrane and Thomas achieved 82% accuracy in assessing site; size and consistency of the pelvic masses with their inability to detect cysts less than 3cm in diameter at that time and now can be seen even one centimeter. (7)**
- **In 1975 Queen et al reported that U/S was diagnostic in 21%;confirmatory in 74% and misleading in 5%.(8)**
- **In 1976 Levi and Delval reported accuracy of 82% for ovarian lesions where as 89% for uterine lesions because many solid ovarian Neoplasm were described as fibroids.(9)**
- **In 1976 Curran et al noted 93% accuracy in confirming presence; site and internal structure of pelvic masses and stated that it was impossible to make specific histopathological diagnosis.(10)**

Clinical evaluation :

Suggestive Sonographic Features of Benign Ovarian Tumors:

- **Simple ovarian cyst.**
- **Size less than 7 cm.**
- **Smooth walls(well-defined outlines)**
- **Unilateral.**
- **Unilocular [if septated the septa should be less than 3mm in thickness].**
- **Not debridinous.**
- **Mobile.**
- **Mass effect only.**
- **Calcification(teeth).**
- **Gravity dependent layering of the cyst contents.[1,2,3,11]**

Suggestive Sonographic Features of Malignant Ovarian Tumors:

- **Fixation to the pelvic side wall or omentum.(1,2,3)**
- **Complex cyst with solid component.(1,2,3)**
- **Thick irregular walls with poor marginal definition.(1,2,3)**
- **Multilocular with thick irregular septa (more than 3mm in thickness).(11)**
- **Complete solidness with necrosis and Hemorrhage.(11)**
- **Peritoneal metastasis; 2-3 mm Lesions can be visualized in the presence of ascites. (12)**
- **Distant metastasis: Liver is the organ most frequently involved by haematogeneous spread from gynecological malignancy showing different sonographic patterns[sonolucent;bull's eye, echogenic lesions or diffuse disarrangement of architectural patterns]. (12)**
- **Ascites is usually indicative of malignant nature the absence of ascites; however , doesn't rule out malignancy.(13)**
- **Size more than 7 cm:**
- **less than 5cm malignant potential 1%**
- **5-10cm Malignant chance 6% , more than 10cm malignant**
- **risk 40% .[1,2,3,14]**
- **Bilateral :2.6 % risk of malignant potential with**
- **bilaterality.(15)**

- **Debridinous .**
- **Nodularity of the tumor.**
- **Papillary vegetation on the inner side of the cyst wall.(15)**
- **Lymphadenopathy.**
- **A patient having sonographic picture suggestive of dermoid showing the growth rate of more than 2cm/year on serial follow up[normal growth rate of Dermiod is up to 1.8cm/year] or the dermoid size more than 6 cm there is potential risk of malignant transformation (16)**

Sonographic Presentation of Ovarian Tumors:

- A large complex pelvic mass showing irregular thick multiloculations with abundant papillary projections and solid component arising from cyst wall or septa and assuming the shape of the spoke wheel appearance with poor marginal definition and fixation to the pelvic side walls is highly suggestive of malignant tumor of the ovary especially when associated with ascites , lymphadenopathy , peritoneal implants and liver metastasis. The differential diagnosis of such lesion includes cystadenocarcinoma , Krukenberg tumor and granulosa cell tumor. [1,2,3,12,17]
- Solid predominantly hypoechoic adnexal mass producing marked sound attenuation is seen in: ovarian fibroma , ovarian thecoma , lymphoma and subsereous pedunculated fibroid if degenerates.[1,2,3,12,17]
- Solid adnexal mass with areas of necrosis and hemorrhage is seen in: malignant ovarian neoplasm [such as endometroid carcinoma] metastatic carcinoma; dysgerminoma and granulosa cell tumor. [1,2,3,12,17]
- Solid adnexal mass associated with ascites and matted bowel loops is highly suggestive of malignant ovarian neoplasm Krukenberg tumor or Meig’s syndrome in which pleural effusions is another sonographic criteria.[1,2,3,12,17]

- **Thin smooth walled predominantly cystic pelvic mass with smooth thin linear or curvilinear echogenicities or septa suggest the sonographic picture of benign ovarian tumor mostly cystadenoma which also presented the same picture of simple ovarian cyst especially serous type.(2,3)**
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- **Complex adnexal mass with sonolucent and echogenic areas distorting tissue planes and filling potential anatomical space suggest the sonographic criteria of endometrioma or pelvic inflammatory disease. (12)**
- **Complex predominantly cystic adnexal mass showing organized area attached to the boundary wall is either due to blood after clot retraction suggesting. hemorrhagic corpus luteal cyst , hemorrhagic ovarian cyst , hemorrhagic cyst adenoma and endometrioma or this echogenic area is due to crust of debridinous pus in pelvic abscess or layered fat in**
- **dermoid cyst.(12)**
-
- **Complex adnexal mass showing clumps of echogenic solid materials along irregular thick septa is indicative of potential malignancy especially if associated with ascites.(12)**
-
- **Anechoic adnexal mass with well defined smooth walls and good through transmission of the sound with posterior acoustic enhancement and the absence of any real internal echoes is highly suggestive of simple ovarian cyst especially if the unaffected ovarian tissue is seen adjacent to the cyst.[12,18]**
- **Predominantly cystic adnexal mass with scattered or layered echogenicities showing fluid-debris level is mostly caused by blood , pus or mucin within the mass. This picture is highly suggestive of hemorrhagic ovarian cyst[which has variable sonographic pictures depending on state of blood inside the cyst] , tubo-ovarian abscess and cytadenoma , especially the mucinous type. (17)**
- **A large predominantly cystic mass with smooth wall and prominent smooth septa showing pin-point echogenicities with layering of low level internal echoes material during changing posture. suggest the possibility of benign ovarian tumor mostly cystadenoma of mucinous type. (17)**

- Cystic adnexal mass showing wall thickening with reflective curvilinear echoes from the boundary associated with fluid collection in the pouch of Douglas suggest the possibility of twisted ovarian cyst. (19)
-
- **A predominantly anechoic mass with low level internal echoes suggesting the sonographic picture of endomertiomas (80%);Hemorrhagic ovarian cyst tubo-ovarian abscess; cyst adenoma or ectopic pregnancy. (20)**

- **Cystic adnexal mass containing echogenic focus with posterior acoustic shadowing is suggestive of dermoid cyst-tip of iceberg sign - this picture is seen in 33% of cases of dermoid and its demonstration reduces the possibility of false negative interpretation with bowel gases.**

- **Highly echogenic smooth walled adnexal mass with clusters of highly reflective echoes [due to hair, fat and cartilage] with evidence of layering of the content inferiorly and causing picture of fat-fluid level and might cause indentation of the filled urinary bladder is suggesting the sonographic criteria of ovarian dermoid. [21,22,23]**

- A well defined predominantly cystic adnexal mass with slightly thickened walls and low levels internal echoes demonstrating the appearance of cyst within cyst is highly suggestive of chocolate cyst and pathgnomonic when associated with uterine enlargement and sonolucent defects in the myometrium suggesting the picture of adenomyosis. (24)

The aim of this study

Was to assess the accuracy
of ultrasound in the diagnosis of the ovarian lesions

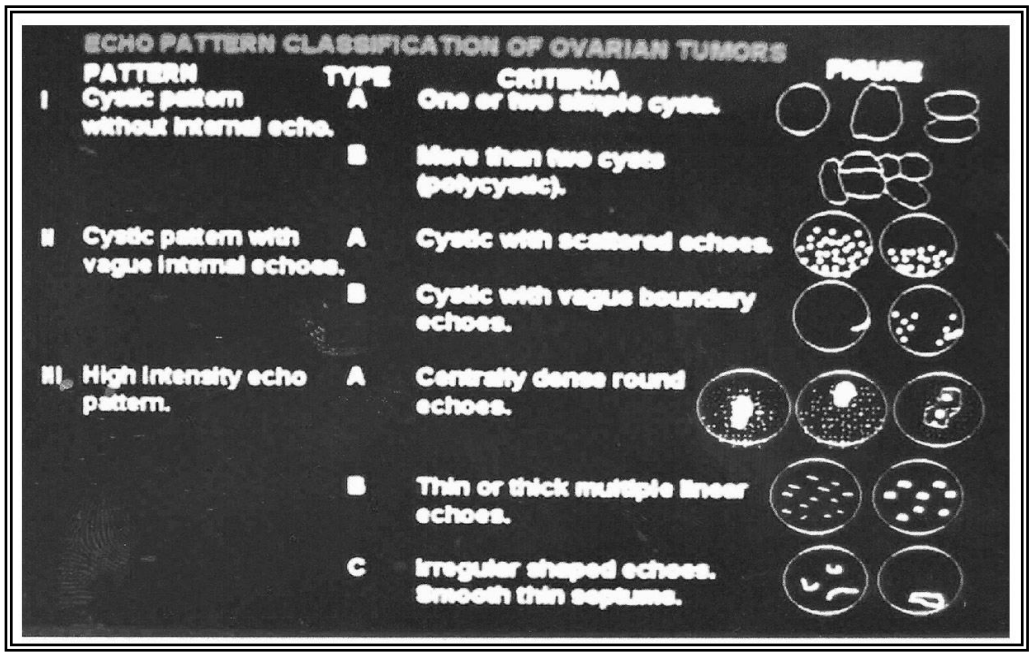
Patients and Methods :

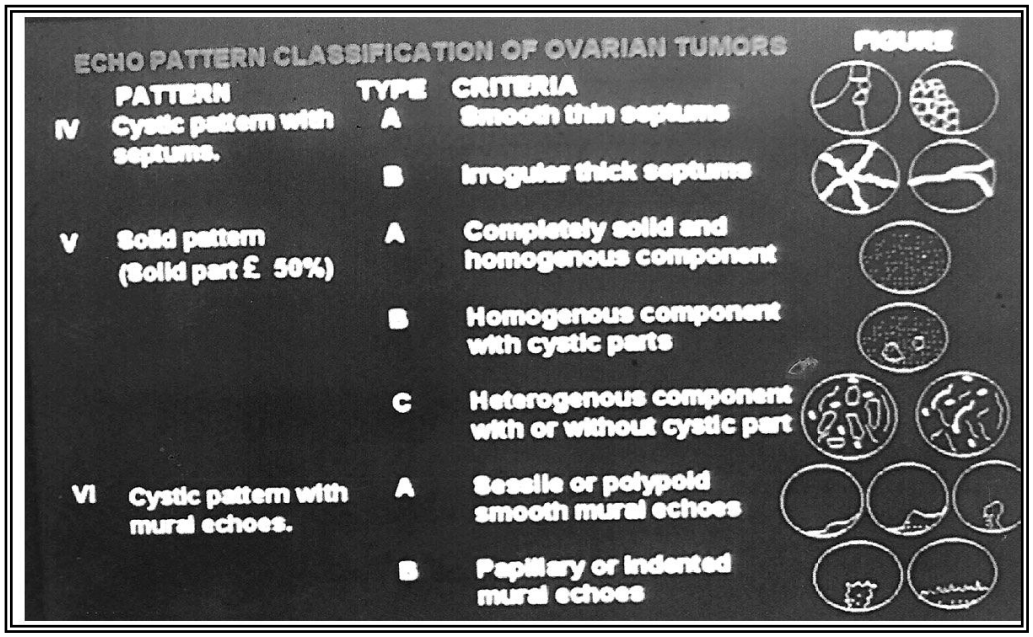
Between August 2008 and February 2009 seventy four patients were admitted to Al –Zahra teaching hospital- Kut- Wassit and were referred because of different complaints to the ultrasound department for pelvic ultrasound examination using 3.5 MHz convex probe (shimadzu S.D.U.450XL) diagnostic ultrasonic system . All the examinations were done by me only (Specialist Sonologist) with full bladder transversely . the number of the lesions and two measured diameter of each were determined and approach to sonographic differential diagnosis of the pelvic mass based on their size , location, internal consistency , definition of borders , the presence of any associated pelvic or abdominal pathology and the detection of pelvic collection or ascites is helpful in narrowing the wide differential diagnosis of pelvic masses.

Diagnostic schemes were derived from correlating the sonographic features with histopathological results of total seventy four surgically proved pelvic pathology .

In our series ultrasound was very useful in separating pelvic masses into cystic , complex and solid and subcategorizing them into more useful differential diagnosis.

Table (I) .. (13)


ECHO PATTERN CLASSIFICATION OF OVARIAN TUMORS
PATTERN
TYPE
CRITERIA
FIGURE
I Cystic pattern without internal echo.
A One or two simple cysts.
B More than two cysts (polycystic).
II Cystic pattern with vague internal echoes.
A Cystic with scattered echoes.
B Cystic with vague boundary echoes.
III High intensity echo pattern.
A Centrally dense round echoes.
B Thin or thick multiple linear echoes.
C Irregular shaped echoes. Smooth thin septums.


ECHO PATTERN CLASSIFICATION OF OVARIAN TUMORS
FIGURE
PATTERN
TYPE
CRITERIA
IV Cystic pattern with septums.
A Smooth thin septums
B Irregular thick septums
V Solid pattern (Solid part £ 50%)
A Completely solid and homogenous component
B Homogenous component with cystic parts
C Heterogenous component with or without cystic part
VI Cystic pattern with mural echoes.
A Sessile or polypoid smooth mural echoes
B Papillary or indented mural echoes

^

Results :

The results of total number of 74 female patients with various types of pelvic lesions examined by U/S and proved histopathologically. Were as following:

- They had an age range of (16-69) years
- Two patients were pregnant and the operations for these patients were done for acute appendicitis and the simple ovarian cysts were found coincidently during examinations of these patients for acute abdominal pain .
- Eight patients were menopause.
- Three patients with multiple ovarian lesions.
- The minimum dimensions of the lesions were (3.3 x 4.3)cm.
- The maximum dimensions of the lesions were (14 x 25)cm.
- 46 lesions (62%) with dimensions ranging from (4-10)cm.
- Correlation with histopathological results:
- The diagnostic accuracy of U/S in the detection and proper characterization of ovarian lesions in this study was 81.1%
- The sensitivity of U/S in the diagnosis of ovarian lesions in this study was 100% regarding presence , origin , location , size and differentiation of internal structure as cystic , complex or solid .
- There was a significant difference in the age groups between benign and malignant lesions with P value of less than 0.0005
- The mean age for those patients proved histopathologically to have benign ovarian lesions was 30.82 ± 8.4.
- The mean age for those patients proved histopathologically to have malignant ovarian lesions was 57.75 ± 8.0

Table (II)

Sonographic findings of total number of 74 patient

U/S findings	NO.	%
1) Cystic Lesion .	14	19%
2) Complex Lesion .	42	57%
3) Solid lesions .	4	5%
4) Highly Complex with non specific echo – pattern	14	19%
5) Unilateral lesion .	64	86%
6) Bilateral lesions	10	14%

Table (III)

Histopathological results of Total Number 74 patients; examined by U/S:

66 Lesions (89%) were Benign. 8 Lesions (11%) were malignant

	Histopathologically proved lesion	No.	%
1)	Simple ovarian cyst	2	2.7%
2)	Haemorrhagic ovarian cyst	4	5.4%
3)	Serous cyst adenoma	12	16.21%
4)	Serous cystadeno fibroma	4	5.4%
5)	Mucinous Cyst adenoma	10	13.51%
6)	Ovarian teratoma	6	8.1%
7)	Haemorrhagic corpus Luteal cyst	6	8.1%
8)	Endometriotic [chocolate] cyst	6	8.1%
9)	Ovarian fibroma	2	2.7%
10)	Ovarian thecoma	2	2.7%
11)	Endometroid carcinoma	4	5.4%
12)	Scrous cystadeno carcinoma	1	1.35%
13)	Metastatic adeno carcinoma of colon	1	1.35%
14)	Metastatic maligment epithelial mesothelioma	1	1.35%
15)	Retroperitoneal malignant fibrous Histiocytoma	1	1.35%
16)	Tubo-ovarian abscess	2	2.7%
17)	Ectopic pregnancy	2	2.7%
18)	Caseating granuloma.	4	5.4%
19)	Suppuration and non specific inflammation of peritoneum and peritoneal fat	4	5.4%

Discussion :

- Cochrane and Thomas(1974) achieved 82% accuracy when assessing a pelvic mass as to its size, location and differentiation of internal structure as cystic , complex or solid.

- Levi and Deval (1976):their study in 370 histopathologically proved pelvic masses the sonographic findings were correct in 80% as to the presence of a mass , its size, location and internal consistency.

- James D,B(1977): proved that sonographic diagnosis was correct in 85% and found that the indefinite borders of uterus was the largest source of error.

- Thomas L.L and Judith N.A (1977): Their retrospective analysis 251 surgically proved gynecologic pelvic masses U/S accuracy of 91% in determining existence, size, location and consistency of pelvic masses. Error was primarily due to misinterpretation of bowel loops , small lesions(<2cm) and poor technique.

- Walsh J.W.; Tylor K.J.W; Wasson J,F.M et al (1979): reported Diagnostic accuracy of 79-91% in the evaluation of pelvic masses where size, consistency and location were regarded as useful screening information. Specific histological diagnosis was possible in selected cases. A non specific Sonographic pattern was common with tubo-ovarian abscesses.

- Herrmann U.J; Jocher. G.W. and Goldhirsch –A-their series from 1981-1985 included 312 proved surgical pelvic masses and they achieved 82.6% correct preoperative diagnosis sonographically, with predictive value of 59.6% for benign and 73% predictive value for malignant ovarian tumor and concluded that detection of ovarian malignancy requires further improvement as diagnostic tool it continues to present a challenge.

- In our series the diagnostic accuracy of U/S in the detection and proper characterization of the ovarian lesions was 81.1%.

- The sensitivity of U/S in the diagnosis of ovarian lesions in this study was 100% in the detection of pelvic mass whether ovarian or non ovarian in origin .

- The specificity is defined as the proportion of disease- free patients who are reported as negative i.e.

- _____ true negative _____
  total number of final diagnosis negative

There were no cases diagnosed sonographically as negative and no proved surgically of any true negative cases so we could not determine the specificity of U/S in the diagnosis of ovarian lesions in this study. This is meaning that ultrasound study is sensitive but not specific in the detection of pelvic mass .
*In this study correlation of the sonograpgic findings with the histopathological results had been resulted in the separation of our 74 patients into two groups:

Groups I [With suggestive sonograpgic feature of their correct diagnosis]This group was composed of 60 patients.

The sonogrphic analysis of the presence, origin, size and borders of the lesions with their internal characterization into cystic, complex and solid lesions and sonographic description of their benign or malignant nature and any associated ascites, lymphadenopathy and distant metastasis.
Those patients had been subjected to sugary and the proper study of their histphathological results had been proved that these lesions were all ovarian in origin and U/S was highly suggestive of their correct preoperative diagnosis.

Group II (with Error U/S diagnosis)

- The cause of error in this group were these lesions highly complex and showing the most non specific echo patterns , distorting the pelvic anatomy with no special sonographic criteria to put them in the proper differential diagnosis so they were diagnosed as being ovarian tumors but proved histopatholgically to be of non ovarian origin and completely different from what could be expected from

there sonographic pictures , the error was also because of lack of other modalities like C.T. and M.R.I. .

- This group was composed of 14 patients.
- The lesions had been categorized as having high sonographic suspicion of being ovarian tumors but proved histopathologically to be of non ovarian origin and so misdiagnosed by ultrasound.
- To review the suggestive sonographic criteria in group I which had been resulted in the correct diagnosis of 60 patients.
- 2 Lesions had the sonographic pictures of simple ovarian cyst and their diagnosis proved to be correct and the operations were done for acute appendicitis in these two patients coincidently
- 26 Lesions were characterized to be of benign nature with well defined borders and thin septa suggesting the sonographic pictures of cystadenomas proved histopathologically to be correct.
- 16 Lesions were characterized sonographically as simulating Benign complicated ovarian cysts and the differential diagnosis was that of Hemorrhagic ovarian cysts , hemorrhagic corpus Luteal cysts and chocolate cysts. Histopathologically diagnosis of these 16 lesions , although two lesions had pathognomoic pictures of Hemorrhagic corpus luteal cysts and another two had pathognomonic pictures of chocolate cysts , it was better to limit these lesions in this narrow sonographic differential diagnosis of hemorrhagic complicated ovarian cysts for better diagnosis .
- 6 Lesions had suggestive sonographic pictures of teratoma ranging from being complex highly reflective with echogenic foci and acoustic shadowing due to the presence of teeth and calcifications in some of these lesions .
- Histopathological results proved that U/S was highly suggestive and correct in the diagnosis of teratoma .
- 8 Lesions were characterized sonographically as being highly suggestive of malignant ovarian tumors from their complexity and fixity together with the association of ascites in six lesions . Histopathological results proved that U/S was correct in detection of the ovarian origin of six lesions . Two lesions were misdiagnosed by U/S . and proved histopathologically to be of non ovarian malignant origin , and to be specific we need other

modality like M.R.I. or C.T. which were not available in this study .

- One lesion proved to be malignant retroperitoneal fibrous histiocytoma and another lesion proved to be malignant epithelial mesthelioma .
- All these malignant ovarian tumors associated with age groups above 50 years with the exception of malignant epithelial mesothlioma which had been occurred in female of 45 years .
- 4 Lesions were predominantly solid two hypoechoic and two with acoustic shadowing , sonographically these 4 lesions were characterized as benign ovarian lesions because
- of the proper identification of uterine borders together with the detection of the mobility of these 4 lesions after full and post voiding bladder technique suggesting their benign nature .Histopathologically they were proved to be : (2) as fibromas of the ovary and (2) as thecomas of the ovary .
- Group 2 composed of 14 patient with Error U/S Diagnosis:
- Songraphically, these lesion were highly complex and showing the most non specific echo patterns, destroying the pelvic anatomy with no special sonographic criteria to put them in the proper differential diagnosis , so they were being ovarian tumors but proved histopathologically to be of non ovarian origin and completely different from what could be expected from their sonographic pictures , these patients were typically should be evaluated by C.T. or M.R.I. to get better results.

Their histopathological results were :

1. one lesion : malignant retroperitoneal fibrous histocytoma .
2. one lesion malignant mesothelioma .
3. two lesion ectopic pregnancy .
4. two lesion pelvic abscesses .
5. four lesion granuloma .
6. four lesion chronic non specific inflammation of the peritoneum and peritoneal fat .

- In this study the patients were referred because of different complaints : 70 % with pelvic and or lower abdominal pain ; 57 %

with disturbed menstrual cycle , 14 % with pelvic mass and 6% were incidental .

- about six patients had past concurrent or subsequent recurrent ovarian cyst while in oksana study it was proved to be 26% . this was because of difficulty to follow up those patient.
- koonings p.p et al found that U/S findings that bilateral ovarian tumors had 2.6% folds risk of malignancy and found that of 8 proved histopathologically to be malignant , 6 of the malignant ovarian tumors were bilateral and two malignant ovarian tumors were uni lateral .

- The incidence of ovarian malignancy increased with age and was predominantly of peri-and post menopausal women , in this study, it started from the age of 50 years and increased steadily.
- In our study, we found that the proved ovarian malignant tumors were presented sonographically late with advanced disease , because of insidious nature of the disease , unreliability of clinical examination and the lack of an effective early sonographic screening technique. The U/S differentiation of ovarian cancer from fluid filled bowel loops was that ovarian cancer showed incompressibility , fixity and lack of peristalsis.
- Ascites was usually indicative of malignant disease and the lack of ascites did not rule out malignancy.

- In this study all unilocular cysts proved to be benign; and malignant ovarian tumors were complex with large solid components.
- Unilocular ovarian cyst seems to carry slight chance of malignancy (3%) , multilocular cyst (8%) , multilocular solid tumor (36%) and solid tumor 39%- papillary vegetations on the inner side of the cyst wall seems to be serious sign of malignancy.
- In this study two patients with surgically proved to have dermoid and one subsequent follow up , dermoid cysts were characterized by U/S on the contratlateral ovary and proved by subsequent surgery to be bilateral dermoid.
- Pathologically , more than half of malignant ovarian tumors arise within or from pre-existing benign ovarian tumor.

- This malignant transformation necessitate U/S follow up especially with sonographic picture of ovarian dermoid. If the rate of growth of ovarian dermoid is more than 2 cm / year or its size more than 6 cm sonographically malignant transformation is highly suspicious.

Conclusion :

1) This study has revealed that real-time U/S is a valuable non invasive procedure to screen patients with possible pelvic masses and to evaluate them in relation to their pathology.
2) U/S serves as the primary imaging modality in a patient with a suspected pelvic mass by identifying the possible diagnosis of a pelvic mass.
3) Sonographic findings correlate well with the macroscopically findings but some times can't be correlated with the histopathological results.

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