# Validity of ultrasound in detecting benign and malignant ovarian cysts

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## ABSTRACT

*Background:* Ovarian tumors are the second most common gynecological malignancy and the fourth most common cancer death in women, which is characterized by few or late symptoms, often called the silent killer. Early detection of ovarian carcinoma could be a formidable challenge and an elusive task.

*Objectives:* To Study sonographic features of benign and malignant ovarian cysts, to find the incidence of benign and malignant ovarian tumours and to determine the accuracy of ultrasound in differentiating benign from malignant ovarian cysts comparing with histopathology results.

*Patients and methods:* This was a cross sectional study. Convenient sample taken from a population consists of 65 women in reproductive age, scheduled for surgery because of ovarian cysts. They underwent preoperative ultrasound examination, done in the Radiology Department of Maternity and Rizgari Teaching Hospitals, Erbil city, North of Iraq. The mean patient age was 30.25 years ranging from 14-46 years.

*Results:* Out of 65 cases, 60 (92.3%) were benign, and 5 cases (7.7%) were malignant. Using sonographic morphological scoring, scores equal or more than 3 was regarded as malignant (the scoring system included wall thickness, shadowing, septa and echogenicity). The accuracy, sensitivity and specificity of ultrasound were 91%, 100% and 90% respectively.

*Conclusion:* Gray scale and Doppler ultrasound yield high diagnostic accuracy in discrimination between benign and malignant cysts. Benign cysts are more common than malignant cysts in female at reproductive age. Mature cystic teratoma (dermoid) is the commonest type of ovarian tumors. Cysts more than 10 cm in maximum diameter, multilocular cysts are more likely to be malignant. The presence of ascites also favors malignancy.

*Keywords:* Ovarian cyst, Doppler ultrasound, pelvic mass.

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## فائدة الفحص بالأمواج الصوتية في تشخيص أورام المبيض الحميدة والخبيثة والتفريق بينهما

### الخلاصة

**الخلفية:** تعد أورام المبيض ثاني أكثر الأورام النسائية شيوعا وواحدة من الأسباب المهمة المؤدية للوفاة بسبب الأمراض السرطانية النسائية. و نظرا لقلة أو تأخر ظهور الأعراض المرضية فإن التشخيص المبكر ليس بالأمر السهل ويحتاج الى خبرة في العلامات التشخيصية للتفريق بين الحالات المختلفة.

**الأهداف:** للتفريق بين أكياس المبيض الحميدة والخبيثة بواسطة الفحص بالأمواج فوق الصوتية ومعرفة مدى دقة الأمواج فوق الصوتية في هذا المجال.

**طريقة الدراسة:** دراسة مقطعية عرضية العينات أجريت في أقسام الأشعة في مستشفيات النسائية والتوليد وفي مستشفى رزكاري التعليمي في أربيل للفترة من حزيران ٢٠١٠ الى كانون الاول ٢٠١٠ . شملت ٦٥ مريضة مجدولة لإجراء عمليات كيس المبيض تراوحت أعمار المريضات بين ١٤- ٤٦ وكان معدل أعمارهن ٣٠,٢٥ عاما. إستخدم تقرير الفحص النسيجي كمعيار للتشخيص النهائي.

**النتائج و الخلاصة:** أثبت الفحص بالأمواج فوق الصوتية بضمنها الدوبلر دقة عالية في التفريق بين أكياس المبيض الحميدة والخبيثة. كانت دقة وحساسية وخصوصية الفحص بالأمواج فوق الصوتية ٩١% ، ١٠٠% ، ٩٠% على التوالي.

An ovarian cyst is a sac filled with liquid or semi-liquid material arising in an ovary which is most common cause of pelvic masses in women, frequently asymptomatic and often resolves spontaneously or present as ovarian cyst accidents include cyst rupture, hemorrhage and torsion, however, ovarian cysts can herald an underlying malignant process. They can develop from the neonatal period to post menopause [1]. Incidence of ovarian cysts in the general population is difficult to be estimated. Certain cysts are functional and generally not operated, estimated that 7% of premenopausal women have ovarian cyst and it is important to realize that the majority of adnexial masses particularly in premenopausal women are benign [2]. Different scoring systems based on morphological and Doppler indices can be used to differentiate benign from malignant ovarian cysts. Large cyst size more than 10 cm, thick more than 3 mm, nodular septations, central rather than peripheral vascularity and papillary formation are ultrasonic morphological features that favor malignancy. Resistant index less than 0.6 and pulsatile index less than one considered as malignant, while resistant index of more than 0.6 and pulsatile index of greater than one regard as benign [3].

The aim of this study was to evaluate the diagnostic accuracy of preoperative ultrasound in differentiating benign from malignant ovarian cysts, to study the ultrasonic features of benign and malignant cysts and to study the incidence of different ovarian cysts particularly in our locality because data about this incidence is limited.

## PATIENTS AND METHODS

**Study design:** This was cross sectional study. Convenient sample taken from a population consists of 65 women in reproductive age scheduled for surgery because of ovarian cysts. They were recruited for the study and underwent preoperative ultrasound examination done in Radiology Department of Maternity and Rizgari Teaching Hospitals, Erbil, North of Iraq. The mean patient age was 30.25 years ranging from 14-46 years.

**Period of the study:** From June 2010 to December 2010.

**Methods:** Patients underwent ultrasound examination preoperatively regardless to menstruation days. The machines used were ultrasound machine Fukuda (denshi uf 850 xtd) for gray scale and color Doppler transabdominal examination and Siemens Adara sonoline for transvaginal ultrasound examination.

**Technique of examination:** For transabdominal examination, the patient was examined with bladder adequately distended. A 3.5 MHz probe frequency was used with the patient in supine position. For transvaginal sonography, an empty bladder was preferred using 7 MHz transducer, and patients were examined in supine position, with knees gently flexed and hips slightly elevated. The transducer was prepared with ultrasound gel, fitted with a condom, then a small amount of lubricant gel applied to allow easy insertion of the probe, then the probe was advanced approximately seven to ten cm into vagina directing the sound beam by rotation and angling the probe from anterior to posterior and sliding in and out.

The following morphologic characteristic of the cyst were studied:

- Size (maximum diameter of cyst).
- Septum: it is a strand of tissue running across the cyst cavity from one internal surface to contra lateral side.
- Locularity: unilocular cyst is without septa, multilocular with at least one septum.
- Echogenisity: recorded as (sonolucent or low-level echo or echogenic core) or mixed echogenisity.
- Shadowing: presence of acoustics shadowing.
- Solid component: when the cyst contains echogenic material and reported absent or not.
- Ascites defined by any fluid in pouch of Douglas was measured in a sagittal plane and recorded as present or absence.
- Wall thickness: inner wall of the cyst: either smooth or irregular if there is any papillary projection regarded as irregular. Papillary projection defined as any solid projection from the cyst cavity with height equal to or greater than three mm [4].

Cysts less than five cm in married women examined by vaginal ultrasound for better characterization of morphology.

Data from wall structure, shadowing, septa, and echogenecity entered into scoring system seen in **Table 1**. Scores equal or more than three regarded as malignant and score less than three regarded as benign [5].

Table 1. Morphologic Scoring. Lerner et al [5].

| Morphology | 0 | 1 | 2 | 3 |
|---|---|---|---|---|
| Wall Structure | Smooth or small irregularities <3 mm | - | Solid or not applicable | Papillarities ≥ 3 mm |
| Shadowing | Yes | No | - | - |
| Septa | None or thin (< 3 mm) | Thick (≥ 3 mm) | - | - |
| Echogenicity | Sonolucent or low-level echo or echogenic core. | - | - | Mixed or high |

After visualization of cyst by B mode sonography color Doppler sonography and pulsed wave Doppler were used for detection of blood flow, visualization of the waveform and blood flow indices of the ovarian artery (the pulsatility index and the resistance index). Resistant index less than 0.6 and pulsatile index less than one regarded as malignant; resistant index of more than 0.6 and pulsatile index of greater than one regarded as benign [3]. The results of the ultrasound examination were compared with those of histological examination of the resected specimens.

**Statistical analysis:** Statistical package for social sciences SPSS version 18 was used for data entry and analysis. Parametric tests (Chi square) and t test were used for normally distributed data. P value less than 0.05 was considered significant. Each entry was double checked to avoid any possible mistakes. Graphs and tables were drawn to summarize and present the results.

**Ethical consideration:** After ethical approval was obtained for this study by scientific committees of Hawler Medical College and Maternity and Rizgari Teaching Hospitals, the verbal consent was taken from all the enrolled patients, all of them informed about the purpose and the procedure of the study.

## RESULTS

Out of 65 cysts 60 (92.3%) were benign and 5 (7.7%) were malignant. Dermoid cyst was the commonest benign cyst, forming 25%, serous cystadenocarcinoma was the commonest malignant and mucinous adenocarcinoma was the least common malignant cyst, **Figure 1** shows the frequency of tumour types according to the histopathological results.

Sixty percent of malignant cysts showed maximum diameter of more than 10 cm, while only 23.3 % of benign cysts showed maximum diameter more than 10 cm (**Table 2**)

Eighty percent of malignant cysts showed multilocularity, while only 30% of benign cysts showed multilocularity (**Table 3**).

Ascites was positive in 60% of malignant cysts while it was positive in only 8.3 % of benign cases (**Table 4**). Ascites in benign ovarian masses was seen in fibromas and in large tumors irritating the endometrium and also in endometriotic cysts.

Relationship of Doppler indices with malignancy: there was significant statistical association between malignant status (malignant and benign) with resistive index (t=10.90, p-value, <0.001) and pulsatile index (t=24.350, p-value <0.001) shown in **Table 5**.

The sensitivity, specificity and accuracy of ultrasound in differentiating benign from malignant cysts were 100%, 90% and 91% respectively and this is shown in **Table 6**.

**Figures 2 (A-F)** shows the different sonographic features of benign and malignant ovarian cysts: **A**: hyperechoic fat fluid level, diagnosis was mature cystic teratoma. **B**: plug with posterior acoustic shadowing inside smooth wall cyst, diagnosis was dermoid cyst. **C**: thin septation less than 3 mm, diagnosis was mucinous serous cystadenoma. **D**: thick more than 3 mm irregular septation. **E**: thin wall cysts, no papillary projection diagnosis were corpus luteal cyst. **F**: cystic mass with internal echoes and multiple papillaries diagnosis was serous cystadenocarcinoma.

Table 2. Relationship between malignancy and tumor size.

| | Size | | | Total | P value |
|---|---|---|---|---|---|
| | < 5cm | 5-10 cm | > 10cm | | |
| Benign | 8 (13.3%) | 38 (63.3%) | 14 (23.3%) | 60 (100%) | 0.1 |
| Malignant | 0 | 2 (40%) | 3 (60%) | 5 (100%) | 0.1 |
| Total | 8 (12.3%) | 40 (61.5%) | 17 (26.2%) | 65 (100%) | 0.1 |

P Value = 0.1statistically not significant.

Table 3. Relationship between malignancy and locularity.

| Locularity | Malignany | | Total | P value |
|---|---|---|---|---|
| | **Benign** | **Malignant** | | |
| Multilocular | 18 (30%) | 4 (80%) | 22 (33.8%) | 0.02 |
| Unilocular | 42 (70%) | 1 (20%) | 43 (66.2%) | 0.02 |
| Total | 60(100%) | 5 (100%) | 65 (100%) | 0.02 |

P value = 0.02 statistically significant.

Table 4. Relationship between ascites and malignancy.

| Ascites | Ovarian cysts | | Total | P value |
|---|---|---|---|---|
| | **Benign** | **Malignant** | | |
| Positive | 5 (8.3%) | 3 (60%) | 8 (12.3%) | 0.001 |
| Negative | 55 (91.7%) | 2 (40.0%) | 57 (87.7%) | 0.001 |
| Total | 60 (100%) | 5 (100%) | 65 (100%) | 0.001 |

P value = 0.001 statistically significant.

Table 5. Relationship between malignancy and Doppler indices.

| Index | t-test | | | | | | |
|---|---|---|---|---|---|---|---|
| | **T** | **Df** | **P value** | **Mean difference** | **Std.error difference** | **95% confidence interval of the difference** | |
| | | | | | | **Lower** | **upper** |
| R1 | 4.263 | 15.722 | 0.001[*] | 0.479 | 0.116 | 0.249 | 0.744 |
| P1 | 3.228 | 20.138 | 0.004[*] | 0.409 | 0.127 | 0.145 | 0.674 |

* Statistically significant, Df= degree of freedom, std= standard error.

Table 6. Sensitivity, specificity and accuracy of ultrasound.

| Total ultrasound score | Histopathology | | Total |
|---|---|---|---|
| | **Malignant** | **Benign** | |
| Malignant | 5 | 6 | 11 |
| Benign | 0 | 54 | 54 |
| Total | 5 | 60 | 65 |

Sensitivity = 100%, specificity =90%, accuracy = 91%.
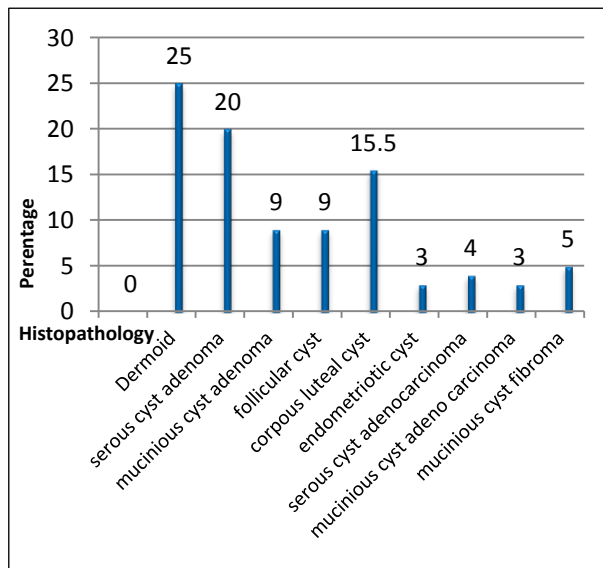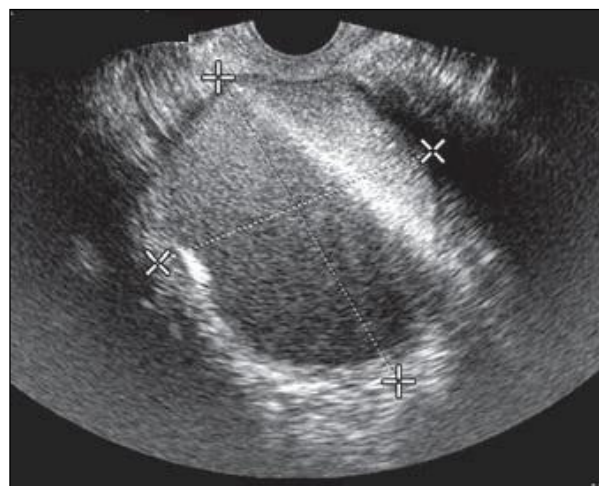


Figure 1. Frequency of types of tumour according to histopathology.



Figure 2.A.



Figure 2.B.

Figure 2.C.

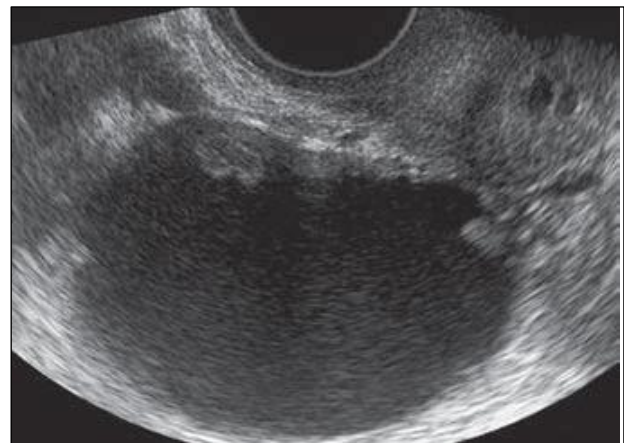

Figure 2.D.



Figure 2.E.



Figure 2.F.

Figure 2. Sonographic features of different ovarian cysts.

## DISCUSSION

The exact nature of the ovarian tumor cannot be confirmed preoperatively just by clinical examination. Ultrasonography has been recommended by the National Institute of Health as a preferred means of diagnosis[2]. Ultrasonography continues to be the primary imaging modality used to identify and characterize adnexal masses. The current study shows most of the cases were benign 60 (92.3%) and few were malignant 5 (7.7%); this goes with study done by Yasmin et al, in which 89.7 % of cysts were benign and 10.29% malignant [6]. Dermoid cyst was the commonest among benign cases (24.6%) and this is in accord with study done by Maged MK [7], also coincident with study done by Paursa etal [8]. Serous cyst adenocarcinoma is the commonest malignant type which goes with a study done by Clarke et al [9]. In this study 60% of malignant cases have size more than 10 cm this agree with the study done by Shah et al, in which 57% of malignant tumors were more than 10 cm [10]. In current study benign tumors were unilateral in 95% and bilateral in 5%, all bilateral cases were dermoid cysts, this constitutes 18.75% of total dermoid cysts, and this is similar to a study done by Hagen-Ansert who found that up to 15% of dermoid cysts are bilateral [11]. Our study shows that there was significant association between multilocularity and malignancy, 80% of malignant tumors were multilocular, and this is coincident with that stated by Kurjak et al: ultrasonic sign of malignant ovarian tumors include multilocular cyst [12]. Ascites found in 60 % of malignant tumors so

there was significant association between ascites and malignancy, this coincident with that stated by Brown et al: ascites is an indirect indicator of malignancy [13], and also a significant association between malignancy and resistive index (t=10.90, p-value, <0.001) and pulsatile index (t=24.350, p-value <0.001) noticed. This is coincident with that stated by Crofton et al: RI less than 0.6 and PI less than one are suggestive of malignancy [3] and that stated by Kurjak et al: PI < 1 is suggestive of malignant disease [12]. The current study showed the sensitivity, specificity and accuracy of gray scale ultrasound 100%, 90% and 91% respectively and this is comparable to studies done by Lerner et al [5] and Valentin et al [14].

## CONCLUSION

Ultrasound showed high diagnostic accuracy of 91% in differentiating between benign and malignant ovarian cysts. Large cysts more than 10cm in maximum diameter, multilocular cysts and ascites are features favoring malignancy. Benign cysts are more common than malignant cysts 92.3% versus 7.7%.

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