International Journal of Research in Medical Sciences
*Saifi SGA et al. Int J Res Med Sci. 2022 Oct;10(10):2156-2162*
www.msjonline.org
pISSN 2320-6071 | eISSN 2320-6012
DOI: https://dx.doi.org/10.18203/2320-6012.ijrms20222360

**Original Research Article**

# Role of sonography in the assessment of pelvic masses in women and its histopathological correlation

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**Received:** 24 August 2022
**Accepted:** 14 September 2022

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## ABSTRACT

**Background:** Abnormal growth of tissues in gynecologic pelvic organs like uterus, cervix or uterine adnexa are termed as female pelvic masses. Pelvic masses can be benign or malignant in nature. An efficient non-invasive treatment modality is essential for effective management and efficient treatment of pelvic masses. Current investigation is aimed towards estimating the sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) of ultrasonography in diagnosing pelvic masses and differentiating benign and malignant pelvic masses.

**Methods:** A descriptive study was conducted on 100 volunteers for 12 months at ultrasound department of radio-diagnosis in a tertiary care center. Patients were examined through transabdominal ultrasonography, covering entire pelvis. Morphology of pelvic lesions were examined in longitudinal and transverse planes through Doppler coupled with ultrasonography. Post-surgery histopathological examination reports were correlated with pre-operative imaging findings.

**Results:** Majority of patients included in current study belonged to <40 years of age group and exhibited benign pelvic masses. Sensitivity and specificity of ultrasound in diagnosing benign masses was observed to be 87.5 and 70 respectively with PPV of 92.1 and NPV of 58.3. Majority of benign lesions were hypoechogenic, whereas malignant lesions were of mixed echogenicity. Most of the malignant lesions showed echogenic focus significantly different from malignant lesions.

**Conclusions:** Ultrasonography was concluded to be primary modality and best screening tool for evaluation of pelvic masses with high sensitivity and specificity for correctly diagnosing and differentiating benign and malignant pelvic lesions. Ultrasonography coupled with color Doppler was efficient in determining the morphological characteristics of pelvic masses.

**Keywords:** Pelvic masses, Diagnostic modality, Ultrasonography, Histopathology, Benign, Malignant

## INTRODUCTION

A common clinical presentation represented by abnormal growth of tissue in the lower abdomen or pelvis is referred as pelvic mass.[1,2] The term mass is used to describe an abnormal area observed during routine physical examination or during imaging testing.[3,4] The term mass can be inferred to benign cyst, an enlarged ovary or a tumor that can be cancerous or non-cancerous.[2-4] Pelvic masses may be of gynecologic origin and originate from gynecologic organs such as uterus, cervix and uterine adnexa or it can be of non-gynecologic origin and may originate for pelvic organs like bladder, intestines, ureters and renal organs. For treatment and management efficiency in pelvic masses, it is necessary to determine whether the mass is benign or malignant.[5,6] Also, if surgery is preferred as treatment strategy in pelvic masses, then the method of surgery is usually decided on the basis of nature of the mass.[7] Most benign cysts require minimally invasive surgery with a shorter duration of hospital stay and rehabilitation.[8] But in patients with malignant tumors extensive staging and

debulking procedures are needed, thus an accurate diagnosis of masses by a non-invasive diagnostic modality like ultrasound will aid in deciding efficient treatment strategy to be employed on patients.[9]

The standard strategy for evaluating pelvic masses includes history observations, physical examination, ultrasound evaluation, utilizing tumors markers and final confirmation through biopsy.[9,10] Other imaging techniques used for diagnosing pelvic masses includes computerized tomography and magnetic resonance imaging.[10] The management and diagnosis of pelvic masses is difficult, but with advent of time new imaging modalities like gynecological ultrasonography and ovarian scanning are widely techniques used for effectively diagnosing female pelvic masses.[11] Ultrasonography is currently considered to be the primary and most widely used imaging modality utilized for identifying and characterizing pelvic masses.[12] Transvaginal ultrasonography aids in better characterization and resolution of pelvic masses and also helps in detecting and localizing number, structure of origin and position of pelvic masses.[11-13] Ultrasonography helps in determining the origin of mass in terms of uterine or adnexal and also in determining whether the pelvic mass is cystic solid or mixed.[14] Solid component within a cystic mass is the most important predictor of malignancy, and conversely, malignancy is very unlikely in the absence of a solid component.[15] Terminology to describe the solid component varies and also includes papillary projections, excrescence, vegetation and nodules. It has been suggested that small solid areas that protrude 3 mm or more from the cyst wall are considered as papillary projections.[16] Solid components are mostly observed in benign, as well as borderline and malignant neoplasms.[15,16] Thus, these solid components which are considered as important predictors in differentiating benign and malignant masses can be efficiently identified by ultrasonography. Some of the other added advantages of ultrasonography are; ease in availability, accessibility and simplicity of examination, economic, safer due to no radiation exposure.[17] Septa in a cystic ovarian mass are strong evidence of a neoplasm and are indicators of malignancy if they are greater than 2-3 mm in thickness.[18] Septas have detectable flow observed in Doppler US scans. In addition to above listed advantages one of the major limitations of ultrasonography is its limited field of view.[17-18]

Ultrasonography coupled with color Doppler adds efficacy to the ultrasonography in identifying vascularity within a mass. Also, spectral Doppler ultrasound demonstrates high or low resistance flow which can suggest whether a mass is benign or malignant efficiently.[19] The current investigation was carried out to identify the nuances of ultrasound and the typical features of the malignant masses on ultrasound imaging which can aid in increasing the sensitivity and specificity of imaging modality in diagnosing the malignant lesion.

### *Aim and objectives*

Aim of current investigation was to correlate the ultrasound findings with histopathology reports with patient in female pelvic masses. The primary objectives of current study were; to study the spectrum of pelvic masses in female patients at tertiary center, to describe the sonographic characteristics of various pelvic masses, to compare with histopathology reports with ultrasound findings and to find out sensitivity, specificity, PPV and NPV of ultrasound in diagnosing benign and malignant pelvic masses.

## METHODS

### *Study design, location and duration*

Current study is a descriptive study, conducted at ultrasound department of radio-diagnosis in tertiary care centre for a duration of twelve months.

### *Sample size and sampling technique*

In current investigation 100 volunteers were included as study subjects and sampling was done through convenience sampling technique.

### *Inclusion criteria*

Inclusion criteria for current study were; female patients with more than 18 years of age referred for pelvic USG from gynecology and surgical services, with histopathological report on follow up and patients who incidentally found pelvic masses while undergoing sonography for other complaints, with histopathological report on follow up.

### *Exclusion criteria*

Exclusion criteria for current study were; uterine pregnancy, patients not consenting for study and patients in which USG report was normal.

### *Procedure*

Clinical assessment was done after assessing patient's clinical record from the history and examination sheet provided by the referring clinician. Patients were included in the study after providing prior information and receiving a valid written consent from the patients in duly filled requisition form after explaining the procedure to patients, examination was done in supine position. The study investigations were performed with Wipro GE machine-LOGICQ P9 R2.5. Examination was started on patients with full bladder through transabdominal ultrasonography, covering entire pelvis and transvaginal ultrasound after which bladder voiding was done if required. Serial longitudinal and transverse scans of the pelvic organs were obtained. The mass was then studied in detail with angled and additional scans. Doppler was

activated and pelvic lesions were examined in the longitudinal and transverse planes. If required elastography and contrast enhanced ultrasound were performed. After delineating uterus, ovaries, adnexa and pouch of Douglas, any masses in the adnexa were considered abnormal. Once pelvic lesion was observed and morphology was evaluated by ultrasonography as per the parameters in the case record form. Ultrasound diagnosis was made. Following surgery, specimen was sent for histopathological examination by the operating surgeon and the reports were followed up and correlated with pre-operative imaging findings.

## RESULTS

Out of total 100 participants with pelvic masses included in current study a majority; 19% patients were observed with fibroid, 17% of patients had ovarian malignancy, hemorrhagic cyst accounted for 10% of total cases, whereas adenomyosis accounted for 9% of the total patients. 7% of the patients had endometriosis and 6% of them had functional cyst in the ovary, cervical cancer was observed in 4% patients and endometrial polyp in other 4% of patients, ectopic pregnancy, ovarian torsion and tubo-ovarian abscess were each observed in 3% cases and corpus lueteal haematoma, dermoid, para-ovarian cyst and secondary ovarian malignancy were observed in 2% of total cases, only one patient was observed with polycystic ovarian disease (PCOD) (Figure 1).

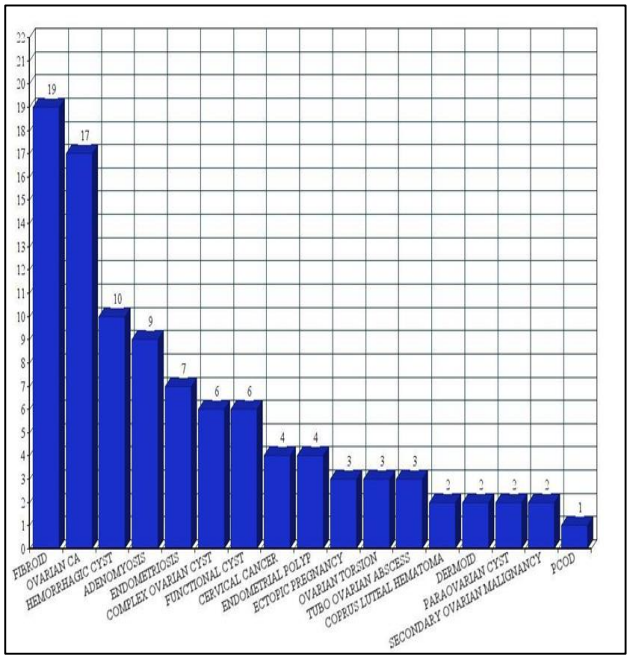


**Figure 1: Sonographically diagnosed spectrum of pelvic mass.**

Majority of patients included in current study belonged to <40 years of age group. Total 28% of current study participants exhibited bleeding per vagina as the predominant symptom (Table 1). Majority of patients (76%) exhibited benign pelvic masses (Table 2).

**Table 1: Age and symptoms-based distribution of patients with pelvic mass.**

| Variables | N | Percentages (%) |
|---|---|---|
| **Age (years)** | | |
| <40 | 54 | 54 |
| ≥40 | 46 | 46 |
| Total | 100 | 100 |
| **Predominant symptoms** | | |
| Bleeding PV | 28 | 28 |
| Pain in abdomen | 26 | 26 |
| Mass in abdomen | 14 | 14 |
| Menstrual irregularity | 12 | 12 |
| Back ache | 7 | 7 |
| Amenorrhea | 5 | 5 |
| Weight loss | 1 | 1 |
| Asymptomatic | 7 | 7 |
| Total | 100 | 100 |

Current study findings revealed that sensitivity of ultrasound in diagnosing benign masses was 87.5 and specificity was 70. PPV of ultrasound in diagnosing benign masses was observed to be 92.1 and NPV of ultrasound in diagnosing benign masses was 58.3 (Figure 2 and 3). It was observed that majority (59 of 80) of benign lesions were seen predominantly in premenopausal age group. It was also observed that majority (31) of benign lesions were uterine lesions, whereas majority (16) of malignant lesions were ovarian in location.

**Table 2: Sonographically diagnosed benign vs. malignant tumors.**

| USG | N | Percentages (%) |
|---|---|---|
| **Benign** | 24 | 24 |
| **Malignant** | 76 | 76 |
| **Total** | 100 | 100 |

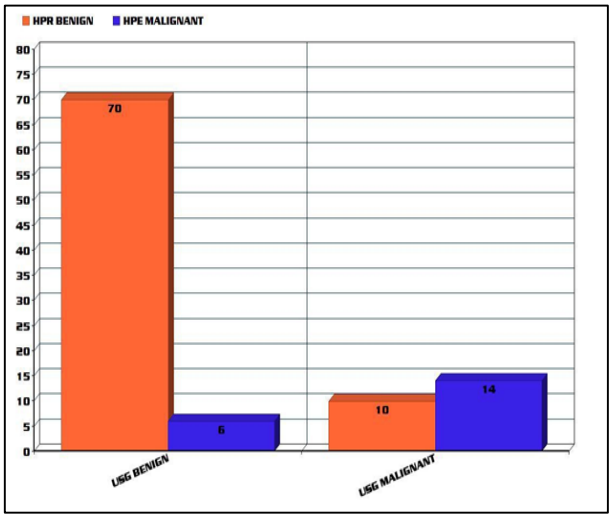


**Figure 2: Comparative role of USG and histopathology in differentiating benign and malignant masses.**

**Table 3: Correlation of varied parameters with benign and malignant masses.**

| Parameters* | Benign masses | Malignant masses | Total |
|---|---|---|---|
| **Menopausal status** | | | |
| Pre-menopausal | 59 | 17 | 76 |
| Post-menopausal | 21 | 03 | 24 |
| Total | 80 | 20 | 100 |
| **Wall structure** | | | |
| Irregular | 24 | 08 | 32 |
| Smooth | 56 | 12 | 68 |
| Total | 80 | 20 | 100 |
| **Echogenicity** | | | |
| Hypoechogenic | 31 | 07 | 38 |
| Hyperechogenic | 19 | 02 | 21 |
| Mixed | 30 | 11 | 41 |
| Total | 80 | 20 | 100 |
| **Echogenic focus** | | | |
| Yes | 35 | 18 | 53 |
| No | 45 | 02 | 47 |
| Total | 80 | 20 | 100 |
| **Calcific focus** | | | |
| Yes | 25 | 03 | 28 |
| No | 55 | 17 | 72 |
| Total | 80 | 20 | 100 |

*p<0.05.

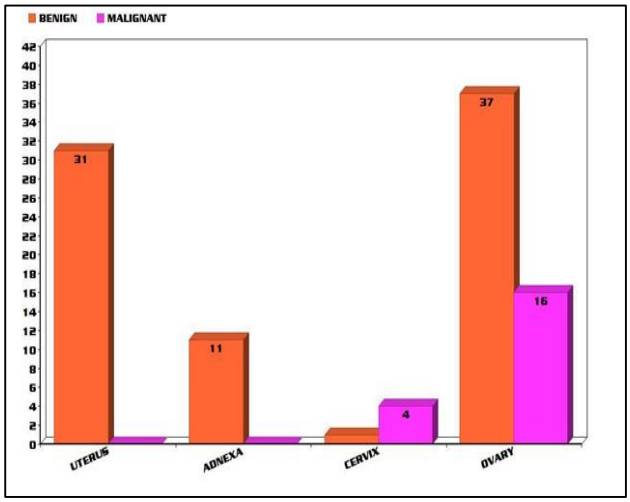


**Figure 3: Localization of pelvic masses in benign and malignant lesions.**

Irregular wall structure was seen in 66.6% of malignant lesion whereas smooth wall structure was observed in 70% of benign lesions the difference of which was not statistically significant (Table 3). Majority of benign lesions (38%) were hypoechogenic, whereas majority of malignant lesions (55%) were mixed in echogenicity difference of which was statistically not significant (Table 3). Most of the malignant lesions (90%) showed echogenic focus which was significantly varying from malignant lesions (Table 3). Total 31% of benign lesions and 15% of malignant lesions did not exhibit calcific focus which was statistically not significant (Table 3). Statistically significant (75%) of malignant lesions had papillary projection, compared to 2.5% of benign lesions (Table 4). Also, statistically significant (10 of 20) amount of ascites were observed in malignant lesions, whereas acites were absent in 73 of 20 benign lesions (Table 4). Benign lesions predominantly showed peripheral vascularity (56.2%), whereas malignant lesions showed central and peripheral vascularity (45%) (Figure 4).

**Table 4: Correlation of papillary projections and ascites with benign and malignant masses.**

| Parameters | Benign masses | Malignant masses | Total |
|---|---|---|---|
| **Papillary projection*** | | | |
| Absent | 78 | 05 | 83 |
| Present | 02 | 15 | 17 |
| Total | 80 | 20 | 100 |
| **Ascites** | | | |
| Yes | 17 | 10 | 27 |
| No | 63 | 10 | 73 |
| Total | 80 | 20 | 100 |

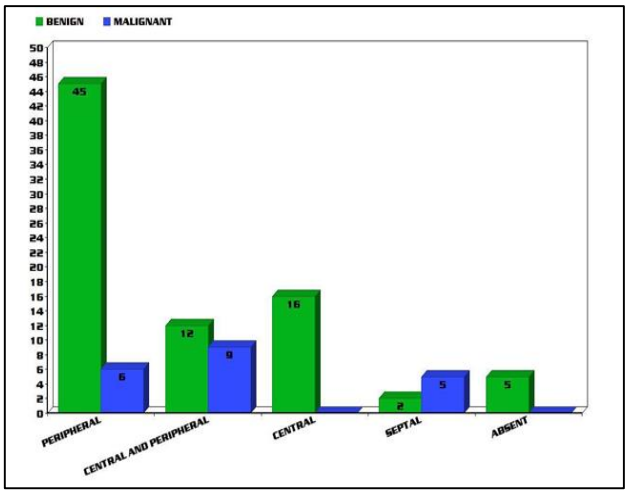


**Figure 4: Ultrasound correlation of Doppler findings in benign and malignant masses.**

## DISSCUSSION

Current investigation was conducted on a total of 100 participants having pelvic masses. These masses were diagnosed on ultrasound and the findings were confirmed on histopathology and the efficacy of ultrasound was calculated and compared. USG is the most commonly employed technique for examination of suspected gynecological disease due to its non-invasive nature, lower cost and relative safety.[11-13] USG is especially important for preoperative evaluation of pelvic masses for determining the course of treatment.[11-15] Yashi et al concluded through their study that although the sonographic features of a pelvic mass frequently do not permit a specific histopathological diagnosis, but can

establish the existence of a suspected pelvic mass.[20] Sonographic features like size, consistency, shape, probable origin and relationship of the mass to the other pelvic structures can be valuable information in determining the treatment strategy.[12-14] A pelvic mass may be gynecologic in origin or it may arise from the urinary tract or gastrointestinal system. Current study findings were in accordance to published reports of Yashi et al which revealed that maximum number of pelvic masses were found to be leiomyomas followed by ovarian carcinomas.[20] In a study done by Anant et al for evaluation of adnexal masses, they concluded that the maximum number of masses were found to be those of endometriotic cysts.[21] This difference could be attributed to the large number of reproductive age group patients that were included in the study.

In current study maximum number of pelvic masses were found to be fibroids followed by adenomyosis the results were in accordance to the reports published by Mishra et al. The prominent complaints of patients with pelvic masses were observed to be abdominal pain, followed by lump in abdomen and bleeding P/V, thus results of current investigation thus depicted that pain or lump in lower abdomen can be considered as one of the most important complaints that should prompt a clinician to suspect a pelvic mass. The results were in accordance to the literature reports published by Usmani et al, Mishra et al, Anant et al and Hartman et al.[21-24] A report published by Brown et al revealed that pelvic ultrasonography (US) remains the most frequently used imaging modality to detect and characterize adnexal masses, Brown et al also observed that majority of adnexal masses are benign and about 90% of adnexal masses can be adequately characterized with US alone.[25] Sonography allows a more elaborate assessment of morphologic and topological features of an adnexal mass. With a benign appearing adnexal mass on sonography, the need for any further diagnostic tests is obviated. In accordance to current study Yashi et al reported 70% sensitivity and 80% specificity of USG in diagnosing pelvic masses and also revealed the PPV of 53.8% and NPV of 88.8%.[20] Munir et al in their study concluded that ultrasound evaluation results were matching with the final histopathological diagnosis in approximately 80% of the cases with a positive predictive test value of 66.65% and negative test value of 97.9%, which was similar to findings of current study. Madan et al showed a sensitivity of 92.5%, specificity of 55.36%, PPV of 54.3% and NPV of 92.8% in detecting malignant pelvic masses by ultrasound.[26,27] Similar findings were seen in our study indicating ultrasound is good modality for screening of malignant pelvic masses. Priya et al investigated the ultrasound correlation of ovarian masses with histopathological findings and found that the presence of a solid component/ an echogenic focus and papillary projections on ultrasound findings of ovarian masses had statistically significant correlation with malignant ovarian masses.[28] This was consistent with the findings of current study.

Statistically significant correlation of central and septal doppler pattern with malignant ovarian masses was confirmed on histopathological examination which was in accordance to current study findings. In a study done by Radhamani et al for ultrasound and histopathological correlation of adnexal masses, they reported a significant association of the postmenopausal status of the women with presence of malignant adnexal masses, current study findings however were not in accordance to this report possibly because of exclusion of other pelvic masses, most importantly uterine leiomyomas by Radhamani et al report which very rarely turn malignant.[29] They however, also found a significant difference between the doppler pattern of the masses and their malignant or benign characteristics as confirmed on histopathology, which was consistent with the findings of current study. Yashi et al reports; similar to current study findings found a statistically significant association of presence of ascites with malignant pelvic masses.[20] Predictors of malignancy as revealed in the reports published by Sohaib et al who investigated 163 lesions-94 benign and 69 malignant were presence of solid lesion, presence of papillary projections or vegetations on the wall and the presence of ascites.[30] Out of this ascites and vegetations in these lesions were the features most significantly indicative of malignancy. The reported predictors by Sohaib et al were in accordance to current study findings.[30] Granberg et al revealed that the malignancy rates for unilocular cysts was 0.3%, multilocular cysts was 8%, multilocular solid tumors was 36% and for solid tumors was 39%, they also reported that papillary structure present on the cyst wall was most frequently found in malignant tumors and neither the thickness of the cyst wall nor the thickness of septa inside the tumor seemed to correlate with malignancy.[31] These results were in accordance to current study findings. Granberg et al discovered that wall thickness <3 mm was seen in most of the benign masses but in malignant masses. Granberg also reported that benign masses were either sonolucent or with low echogenicity but most of the malignant masses presented with mixed echogenicity and/or high echogenicity.[31] Current study findings revealed that echogenic focus in the pelvic mass was significant is determining the malignant status of the mass. Current investigation findings along with the published reports revealed that color doppler maximizes the ability to discriminate between benign and malignant entities with respect to pelvic masses. Combining detailed analysis of internal architectural appearance with flow velocity patterns ascertained by pulsed Doppler ultrasonography increases specificity in the diagnosis of adnexal mass. Lesion with presence of papillary projections and solid echogenic elements favors malignancy. Thus, color Doppler sonography can be recommended for differentiating between benign and malignant ovarian masses.

***Limitations***

Limitations of current study were; sample size constrains, estimating correlation of serum CA-125 levels in the

patient with pelvic masses was not done due to absence of required infrastructure and comparison of efficacy of ultrasound with other imaging modalities like CT and MRI was not done.

## CONCLUSION

It was concluded from current study findings that sonography was primary modality and best screening tool for evaluation of pelvic masses. Ultrasound has high sensitivity and specificity for correctly diagnosing benign versus malignant pelvic lesions. Sonography was observed to be best modality to differentiate between solid and cystic pelvic masses. Morphological characteristics of mass can be very well assessed by gray scale ultrasound complemented with color and power Doppler. Most of pelvic lesions occur in reproductive age group, i.e., pre-menopausal age group. Most of benign lesions were hypoechoic and most of the malignant lesions exhibited mixed echogenicity. Papillary projections in a pelvic mass strongly favored malignant etiology of lesion. Thick septa were observed to be the feature of only malignant lesions. Presence of ascites was observed to raise the possibility of malignant pelvic mass. Echogenic focus within lesion representing solid component was observed mostly in malignant pelvic masses.

*Funding: No funding sources*
*Conflict of interest: None declared*
*Ethical approval: The study was approved by the Institutional Ethics Committee*

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**Cite this article as:** Saifi SGA, Karikazi M, Shetty D. Role of sonography in the assessment of pelvic masses in women and its histopathological correlation. Int J Res Med Sci 2022;10:2156-62.