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ORIGINAL ARTICLE

Diagnostic Accuracy of Ultrasound for Malignant Ovarian Cancer Taking Histopathology as Gold Standard

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ABSTRACT

Background: Ovarian cancer is the fifth most common and the most aggressive gynaecological malignancy. Ultrasound is the initial and important imaging method for ovarian cancer detection and is an accurate technique for diagnosis and follow up of ovarian cancers.

Objective: To find out the diagnostic accuracy of ultrasound for malignant ovarian cancer taking histopathology as gold standard

Study Design: Cross Sectional Study

Place and Duration: Department of Diagnostic Radiology and Intervention, Sir Ganga Ram Hospital, Lahore in collaboration with the Department of Gynecology and Obstetrics during from the period 11th Jan, 2019 to 11 th July, 2019.

Materials and Methods: All referred patients fulfilling the selection criteria was included in the study. After obtaining informed consent, the patients were undergone ultrasound using convex probe of 3.5 MHz frequency using Toshiba NEMIO XG ultrasound machine. Few days after ultrasound, each patient had ultrasound guided biopsy of the lesions in department of Diagnostic Radiology and histopathological data was collected. The above mentioned information was recorded on the patient proforma.

Results: Total 225 patients were included according to the inclusion criteria of the study. Mean age (years) in the study was 35.33+6.36 average BMI of the patients was 21.15+2.35. The sensitivity, specificity, PPV, NPV and diagnostic accuracy of ultrasound for malignant ovarian cancer taking histopathology as gold standard was 76.56%, 14.43%, 54.14%, 31.82% and 49.78% respectively.

Conclusion: The study concluded that the sensitivity of ultrasound for malignant ovarian cancer taking histopathology as gold standard is substantial. Hence supporting the effectiveness of conventional abdominal ultrasound which can diagnose malignant ovarian cancers and characterization of ovarian masses.

Keywords: Ovarian Cancer, Diagnostic Accuracy, Ultrasound

INTRODUCTION

Ovarian cancer is the fifth most common and the most aggressive gynaecological malignancy. The documented five year survival rate is almost 40%.[1] The overall incidence of ovarian tumors was 7.1% with a rate of malignancy 18%.[2] One more study reported 18% of ovarian malignancy in females presenting with ovarian pathology.[3] Risk factors for ovarian cancers include nulliparity, early menopause, gonadal dysgenesis, family history and endometriosis[4] while oral contraceptives and breastfeeding have some protective effect. Various serological tests are available among which CA-125[5] is the most commonly used.

Differentiating benign from malignant ovarian masses is very important for decision making regarding adoption of treatment option. For instance benign ovarian lesions need only close follow up or simple surgery while malignant masses need referral to a tertiary center.[6] Various imaging modalities are available for diagnosis, staging and characterization of ovarian cancers including ultrasound (US), CT scan, magnetic resonance imaging, positron emission tomography (PET)/CT.[7]

The median age of diagnosis of ovarian cancer associated with BRCA1 mutation is mid-40s, compared with mid-60s for BRCA2. This can shape the timing of surgical preventive measures or influence index of suspicion. Prophylactic BSO is effective for reducing the risk of ovarian, fallopian tube, and peritoneal cancers in women with BRCA mutations. If 36 women with BRCA mutations undergo a BSO, one case of associated ovarian cancer will be prevented in 3.5 years.[8]

There is variation in diagnostic accuracy of conventional ultrasound for malignant ovarian cancers, moreover, there is not enough local data available. Therefore, the rationale of this study is to determine the effectiveness with which conventional abdominal ultrasound can diagnose malignant ovarian cancers and to determine if ultrasound alone is accurate enough for detection and characterization of ovarian masses in order to avoid further costly investigations and invasive procedures like biopsy and their associated complications. Present study was conducted to find out the diagnostic accuracy of ultrasound in for malignant ovarian cancer taking histopathology as gold standard

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MATERIAL AND METHODS

This cross sectional study was conducted in Department of Diagnostic and Interventional Radiology, Sir Ganga Ram Hospital, Lahore in collaboration with Department of Gynecology and Obstetrics during from the period 11th Jan, 2019 to 11th July, 2019. Sample size of 225 cases has been calculated with 95% confidence level, 4.21% precision, prevalence 18%[2], sensitivity 92% and specificity 86%[9]. With 7% and 12% margin of error respectively. Patients were selected by non-probability consecutive sampling

Inclusion Criteria: Female patients of age 18-45 years, presenting with lower abdominal pain, dysmenorrhea for >3months, diagnosed with unilateral or bilateral ovarian mass on ultrasound and have family history of Ovarian malignancy

Exclusion Criteria: Females with diagnosis of intrauterine malignancy, cervical malignancy, metastasis, already undergone neoadjuvant chemotherapy, who underwent surgery for any gynecological issue in the past

Data Collection: All patients referred to our department from Gynecology and Obstetrics outdoor fulfilling the inclusion and exclusion criteria was included in the study. The patient was informed that the information collected from her was used in a study and that the confidentiality and anonymity related issues were taken care of accordingly. After obtaining informed consent, the patients were undergone ultrasound using convex probe of 3.5 MHz frequency using Toshiba NEMIO XG ultrasound machine.

Few days after ultrasound, each patient had ultrasound guided biopsy of the lesion/sin department of Diagnostic Radiology and histopathological data was collected. The above mentioned information was recorded on the patient proforma. Malignant ovarian cancers was labeled. On conventional ultrasonography, features to predict a malignant ovarian cancer are: irregular solid tumor with/ without ascites, at least four papillary structures, irregular multilocular solid tumor with a largest diameter of at least 10cm. On histopathology, tumors showing metaplasia and/or anaplasia are labeled as malignant.

Data Analysis: The collected data was entered and analyzed accordingly on SPSS version 20. A 2 x 2 contingency table was generated to calculate sensitivity, specificity, PPV and NPV to assess diagnostic accuracy of ultrasound for malignant ovarian cancers using histopathology as gold standard.

RESULTS

The mean age of patients was 35.33+6.36years. The mean BMI of patients was 21.15+2.35kg/m^2. The mean size of ovarian mass was 7.62+2.05mm. Table 1

The sensitivity, specificity, PPV, NPV and diagnostic accuracy of ultrasound for malignant ovarian cancer taking histopathology as gold standard was 76.56%, 14.43%, 54.14%, 31.82% and 49.78% respectively, as shown in Table 2

Table. 1: Demographics of patients

Variables	Mean (SD)
Age (years)	35.33±6.36
Body Mass Index	21.15±2.35
Ovarian Size	7.62±2.05

Table. 2: USG in predicting ovarian cancer by taking Histopathology as gold standard

		Histopathology		Total
		Malignant	Benign	
Ultrasound	Malignant	98 (76.6%)	83 (85.6%)	181
	Benign	30 (23.4%)	14 (14.4%)	44
Total		128	97	225
Sensitivity		76.56%	Specificity	14.43%
PPV		54.14%	NPV	31.82%
Diagnostic Accuracy		49.78%		

DISCUSSION

Ovarian cancer is the most lethal gynecologic malignancy, partly because it is detected late, with greater than 70% of patients presenting at an advanced stage. Five-year survival for all stages is 47%, and for advanced stages, 30%. Early detection is one of the most important strategies for improving patient prognosis.[9]

In the early stage, ovarian cancer is usually asymptomatic, and moreover, only a small number of the relatively common ovarian masses detected by imaging techniques are malignant, which makes it crucial to differentiate benign from malignant ovarian masses. Transvaginal sonography usually is the initial diagnostic modality of choice for assessment of most adnexal masses; however, some masses, especially early-stage ovarian cancer, remain difficult to classify by conventional transvaginal sonography, even in experienced hands.[10]

Solid tumors and their metastases persist and grow through angiogenesis, which is characterized by a neovascular network with irregularly branching vessels derived from pre-existing normal venules that contain numerous arteriolar–venous malformations without an intact basement membrane.[7] Thus, imaging of vessels in tumors may help to assess the risk of ovarian cancer. However, radiologic assessment of tumor vascularity is not yet well established. The lack of screening tests for diagnosis of early-stage ovarian cancer is an important determinant of the mortality rate of this disease.[2]

Contrast-enhanced ultrasound (CEUS), with the use of contrast agents consisting of gas microbubbles that are administered intravenously and remain intravascular, has been used to evaluate many tumors in the liver, kidneys, pancreas, breasts and other organs, improving the characterization of tumor angiogenesis and perfusion. In addition, the kinetics of contrast agents in tumors can be evaluated objectively by quantifying time–intensity curve parameters. A few studies have investigated the use of contrast-enhanced sonography in the differential diagnosis of malignant versus benign ovarian masses. Diagnostic accuracy in these published studies varied widely, with the sensitivity ranging from 74% to 100% and the specificity ranging from 42% to 98%, probably as a result of advances in technology, the heterogeneity of patient populations and so on. The overall accuracy of CEUS in the diagnosis of ovarian cancer has never been systematically assessed.[11]

In our study, mean age (years) in the study was 35.33+6.36. Similarly, in a study conducted by Ertas et al,[4] mean age in years was 40.8±13.8. Ovarian cancer has an age-adjusted incidence of 12.5 per 100,000 women. There has been a decline of less than 1 percent in the incidence of ovarian cancer in the previous two decades, and the mortality rate is largely unchanged.[12] The incidence of ovarian cancer and mortality rates increase with age. Most cases of ovarian cancer occur in women older than 50 years, but the diagnosis may be made at any age, including infancy.[13]

The greatest risk factors of ovarian cancer are a family history and associated genetic syndromes.[14] A history of ovarian cancer in one relative raises a woman's lifetime risk to 5 percent; a history in two relatives raises the risk to 7 percent. Women with specific gene mutations are at higher risk of ovarian cancer. Hereditary breast and ovarian cancer syndrome, which occurs in one in every 500 women, is an autosomal dominant mutation in the BRCA1 or BRCA2 gene. Hereditary breast and ovarian cancer syndrome increases the risk of breast, ovarian, pancreatic, and prostate cancers, and is associated with a 23 to 54 percent lifetime risk of ovarian cancer.[15] Ovarian cancer with low malignant potential typically occurs in women 30 to 50 years of age. It presents at stage I in 82 percent of patients and has a survival rate of up to 99 percent.[16]

For women at high risk of ovarian cancer who choose not to undergo prophylactic BSO, the National Comprehensive Cancer Network (NCCN) currently recommends transvaginal ultrasonography and CA 125 measurement every six months during days 1 through 10 of the menstrual cycle.[17]

The association of ovarian endometrioid carcinoma with endometriosis has long been recognized. This association, along with the identification of genetic alterations in endometriotic lesions and the observation of a morphological transition from endometriosis to carcinoma in over one-third of cases have led many to consider endometriosis a likely precursor of endometrioid carcinoma.[18]

Ultrasound is the initial and important imaging method for ovarian cancer detection and is an accurate technique for diagnosis and follow up of ovarian cancers.[19] Various ultrasound techniques are available for ovarian cancer characterization into benign and malignant masses. According to one study, sensitivity and specificity of conventional US was 92 % and 86 %, respectively while that of Doppler US was 93% and 85% respectively.[11] Sensitivity and Specificity of contrast enhanced ultrasound as quoted by other studies is 87%, 92%[9] and for three dimensional ultrasound is 100%, 98%.[20] respectively. CT of the abdomen and pelvis is the investigation of choice for staging and assessing disease response in ovarian cancers[10] however final diagnosis is still made on biopsy and histopathology.

In our study, the sensitivity, specificity, PPV, NPV and diagnostic accuracy of ultrasound for malignant ovarian cancer taking histopathology as gold standard was 76.56%, 14.43%, 54.14%, 31.82% and 49.78% respectively. However, in one study[21] high sensitivity (72.5%), specificity (98.2%), positive predictive value (98.1%), negative predictive value (74.7%) and diagnostic accuracy (84.13%). In another study, one study, sensitivity and specificity of conventional ultrasound was 92% and 86%, respectively while that of Doppler US was 93% and 85% respectively.[11]

CONCLUSION

The study concluded that the sensitivity of ultrasound for malignant ovarian cancer taking histopathology as gold standard is substantial. Hence supporting the effectiveness of conventional abdominal ultrasound which can diagnose malignant ovarian cancers and characterization of ovarian masses in order to avoid further costly investigations and invasive procedures like biopsy and their associated complications.

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