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Correlation of Ultrasonography Findings and CA-125 Level with Histopathological Diagnosis of Ovarian Tumor

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KEYWORDS

Ovarian tumor, CA-125, Ultrasonography, Diagnostic accuracy, Histopathology.

ABSTRACT:

Background: Ovarian tumors encompass a wide spectrum of benign and malignant conditions. Malignant ovarian tumors rank as the second most common gynecologic malignancy and the fifth leading cause of cancer-related death among women. This study aimed to evaluate the diagnostic accuracy of ultrasonographic findings and serum CA-125 levels in differentiating benign from malignant ovarian tumors and to correlate these parameters with histopathological diagnosis.

Methods: An analytical cross-sectional study was conducted in the Department of Gynecology and Obstetrics, Rangpur Medical College Hospital, Rangpur, from January to December 2017. A total

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of 62 patients clinically diagnosed with ovarian tumors were enrolled through purposive sampling. Preoperative assessments included detailed history, clinical examination, ultrasonography, and serum CA-125 testing. Final diagnosis was confirmed by histopathology. Data were analyzed using SPSS version 23, applying appropriate statistical tests.

Results: The mean age was 35.85 ± 11.20 years in the benign group and 49.14 ± 16.59 years in the malignant group ($p < 0.05$). Abdominal distention and significant weight loss were more frequent in malignant cases ($p < 0.05$). Ultrasonography demonstrated 57.42% sensitivity and 89.50% specificity, while CA-125 showed 71.81% sensitivity and 87.32% specificity. Combined evaluation of both parameters improved diagnostic accuracy to 90.32%, with 78.57% sensitivity, 93.75% specificity, 78.57% positive predictive value, and 93.75% negative predictive value.

Conclusion: Preoperative assessment using both ultrasonography and serum CA-125 significantly enhances the diagnostic accuracy for differentiating benign and malignant ovarian tumors.

Introduction

Ovarian tumors represent a diverse group of neoplasms that may arise from epithelial, stromal, or germ cell tissues, exhibiting a broad range of morphological and clinical behaviors [1]. Among these, epithelial tumors constitute the majority, accounting for approximately 90% of malignant ovarian neoplasms [2]. Malignant ovarian tumors rank as the second most common gynecologic malignancy and the fifth leading cause of cancer-related deaths among women worldwide [3]. Globally, over 239,000 women are diagnosed with ovarian cancer each year, with nearly 152,000 fatalities reported annually [4]. The disease represents roughly 7% of all female cancers, with a lifetime risk estimated at 1 in 75, and a 1 in 100 probability of mortality due to the disease [4]. Despite advancements in oncologic care, the five-year overall survival rate for epithelial ovarian cancer remains around 40% in developed nations such as the United Kingdom [5].

A major challenge in ovarian cancer management is its asymptomatic or nonspecific clinical presentation in the early stages. Many patients remain symptom-free, leading to incidental diagnosis during routine pelvic examinations or imaging [6]. Consequently, nearly two-thirds of ovarian cancers are diagnosed at an advanced stage (Stage III or IV), when prognosis is poor and surgical management becomes complex [7]. The stage at diagnosis remains the single most important prognostic factor; the five-year survival rate for Stage I epithelial ovarian cancer ranges between 83% and 90%, while it drops sharply to 19% in Stage IV disease [4]. These statistics underscore the critical need for reliable and accessible tools for early detection and accurate preoperative characterization of ovarian tumors.

Ultrasonography (USG) is the first-line imaging modality for evaluating adnexal masses due to its noninvasive nature, availability, and cost-effectiveness [8]. It provides valuable information regarding tumor morphology, size, and vascularity. Studies report a sensitivity of 82% and specificity of 92% in

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distinguishing benign from malignant ovarian tumors [9]. However, ultrasonography remains operator-dependent and can yield variable diagnostic accuracy when used in isolation [10]. Therefore, adjunctive biochemical markers have been explored to enhance diagnostic precision.

Among these markers, cancer antigen 125 (CA125) remains the most widely used serum biomarker in the evaluation of ovarian tumors. First identified by Bast et al. in 1981, CA125 has been extensively investigated as a diagnostic and prognostic indicator in epithelial ovarian cancer [11]. Elevated serum levels (>35 U/mL) are frequently associated with malignant ovarian tumors; however, they may also occur in benign conditions such as endometriosis, pelvic inflammatory disease, and menstruation, thereby reducing diagnostic specificity [12,13]. When used alone, CA125 demonstrates a sensitivity of approximately 83% but an overall diagnostic accuracy of only 60.8% [14].

Several studies have emphasized that combining ultrasonography with serum CA125 testing improves diagnostic confidence. Concurrent use of these modalities increases sensitivity to 80.36% and diagnostic accuracy to 86.75% [3]. This integrated approach enhances the preoperative differentiation between benign and malignant ovarian lesions, guiding appropriate surgical planning and improving patient outcomes. Moreover, correlation of these findings with histopathological examination—the diagnostic gold standard—provides an evidence-based framework for refining diagnostic algorithms in clinical practice.

Given the high mortality associated with ovarian malignancy, especially when diagnosed at an advanced stage, there remains a pressing need to strengthen early diagnostic strategies, particularly in low-resource settings where advanced imaging modalities and molecular testing are often unavailable. Ultrasonography and serum CA125 assays are readily accessible in most tertiary care hospitals, making them practical tools for screening and preoperative assessment. However, institutional data correlating these diagnostic methods with histopathological outcomes remain limited in many regions, including the current study setting.

Therefore, this study seeks to evaluate the diagnostic correlation between ultrasonographic findings, serum CA125 levels, and histopathological diagnosis of ovarian tumors. Establishing this relationship may contribute to the development of cost-effective, locally adaptable diagnostic pathways that facilitate timely management and improve prognostic outcomes for women with ovarian tumors.

Methodology & Materials

This analytical cross-sectional study was conducted in the Department of Gynecology and Obstetrics, Rangpur Medical College and Hospital, Rangpur, Bangladesh. The study period was extended from January 2017 to December 2017. The study population consisted of all female patients admitted to the Gynecology and Obstetrics ward during the study period who were clinically or radiologically diagnosed with ovarian tumors. Based on histopathological diagnosis, the study population was categorized into two groups:

- **Group I:** Patients with benign ovarian tumors
- **Group II:** Patients with malignant ovarian tumors

A purposive (non-randomized) sampling technique was used to select participants. The total sample size was 62 patients who met the study criteria and provided informed consent.

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Inclusion Criteria

Patients were included in the study if they met the following criteria:

1. Diagnosed with a suspected ovarian tumor based on clinical history and physical examination.
2. Diagnosed with an ovarian tumor through imaging modalities such as ultrasonography (USG) and/or computed tomography (CT) scan.
3. Underwent preoperative ultrasonography and serum CA125 level assessment.
4. Provided informed written consent to participate in the study.

Exclusion Criteria

Patients were excluded from the study if they met any of the following conditions:

1. Previously diagnosed and treated cases of ovarian tumors (recurrent cases or patients undergoing chemotherapy).
2. Lack of preoperative ultrasonography or serological CA125 testing.
3. Absence of histopathological confirmation post-surgery.
4. Declined or withdrew consent to participate in the study.

Data Collection

Data were collected prospectively over one year using a structured questionnaire designed to record demographic, clinical, biochemical, and histopathological parameters. Information was obtained through patient interviews, clinical examinations, imaging reports, laboratory results, and surgical records. Each participant was counseled before inclusion, and written informed consent was obtained from the patient or her legal guardian. Data collection included variables such as age, family history, oral contraceptive use, use of ovulation-inducing drugs, clinical presentation, ultrasonographic findings, serum CA125 levels, and histopathological reports.

Study Procedure

After enrollment, each participant underwent detailed history taking and thorough clinical examination. Transabdominal ultrasonography was performed to assess ovarian morphology, focusing on parameters such as cyst wall consistency, septations, papillary projections, and the presence of ascites. The presence of two or more suspicious sonographic characteristics was considered indicative of a positive sonographic finding suggestive of malignancy.

For biochemical evaluation, 3 mL of venous blood was collected from each patient for serum CA125 testing, performed preoperatively. A cut-off value of 35 U/mL was used to distinguish between normal and elevated levels. Following clinical, radiological, and biochemical evaluation, patients underwent surgical intervention as indicated. Postoperative histopathological examination served as the gold standard for final diagnosis.

The diagnostic performance of ultrasonography and serum CA125 was then evaluated by comparing their results with the corresponding histopathological findings. Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and overall diagnostic accuracy were subsequently calculated for each modality.

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Ethical Considerations

The study protocol was reviewed and approved by the Ethical Review Committee of Rangpur Medical College and Hospital before initiation. Permission for data collection was also obtained from the Department of Gynecology and Obstetrics. Participants were fully informed about the objectives, procedures, potential risks, and benefits of the study. Confidentiality of all patient data was strictly maintained, and personal identifiers were removed from data files. Participation was entirely voluntary, and patients were informed of their right to withdraw at any point without affecting their treatment. Written informed consent was obtained from every participant or their legal guardian before inclusion in the study. The study ensured that any complications arising in relation to the study procedures were appropriately managed.

Statistical Analysis

All collected data were compiled, tabulated, and analyzed using the Statistical Package for the Social Sciences (SPSS), version 23.0. Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as frequencies and percentages. The Chi-square test (χ^2) was used to assess associations between categorical variables, and the student's t-test was applied for continuous variables, where appropriate. Diagnostic performance metrics—sensitivity, specificity, PPV, NPV, and accuracy—were calculated for both serum CA125 and ultrasonographic findings, using histopathology as the reference standard. A p-value < 0.05 was considered statistically significant for all analyses.

Results

Table -1: Distribution of risk factors in group I and group II study population

Risk factors	Group I (N=48)	Group II (N=14)	t / X2	P-value
Age (Mean ± SD)	35.85 ± 11.20	49.14±16.59	3.48	0.001
Oral pill users	22(45.8%	6(42.8%)	0.03	>0.05
Ovulation inducing drugs	5(10.40%)	1(7.14%)	0.13	>0.05
Family history	1(2.08%)	1(7.14%)	0.89	>0.05

Group I= Benign ovarian tumor

Group II= Malignant ovarian tumor

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Table -2: Distribution of clinical presentations in group I and group II study population

Clinical presentation	Group I (N=48)	Group II (N=14)	t / X2	P-value
Abdominal lump	32(66.63%)	10(71.41%)	0.11	>0.05
Abdominal distention	12(25.0%)	8(57.14%)	5.12	<0.05
Abdominal pain	6(12.5%)	2(14.28%)	0.03	>0.05
Significant weight loss	6(12.5%)	5(35.7%)	4	<0.05
Dyspepsia	22(45.83%)	7(50.0%)	0.08	>0.05

Group I= Benign ovarian tumor

Group II= Malignant ovarian tumor

Table 3: USG findings of the group I and group II study population

Parameters		Group I (N=48)	Group II (N=14)	X^2	P value
Consistency	Purely cystic	40(83.4%)	0(0.00%)	32.8	<0.001
	Cystic + Solid	8(16.6%)	14(100%)		
Septation	Absent	38(79.2%)	0(0%)	28.6	<0.001
	Present	10(20.8%)	14(100%)		
Ascites	Absent	44(91.67%)	4(28.57%)	24.68	<0.001
	Present	2(4.13%)	9(64.28%)		
Papillary projection	Absent	48(100.0%)	6(42.86%)	31.5	<0.001
	Present	0(0.0%)	8(57.14%)		

Group I= Benign ovarian tumor

Group II= Malignant ovarian tumor

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Table 4: Distribution of serum CA 125 level in Group I and Group II study population

Serum CA 125(u/ml)	Group I (N=48)	Group II (N=14)	X^2	P value
(Cut off value 35)				
Mean ± SD	29.29 ± 15.98	434.56 ± 82.32	17.6	<0.001

Group I= Benign ovarian tumorGroup II= Malignant ovarian tumor

Table: 5: Different histological types of benign and malignant tumors found in the study population

	Number of Patients	Percentage
Benign ovarian tumors (N=48)		
Serous cystadenoma	23 cases	47.90%
Mucinous cystadenoma	14 cases	29.16%
Dermoid cyst	10 cases	20.83%
Endometrioma	01 case	2.08%
Malignant ovarian tumors (N=14)		
Serous cystadenocarcinoma	06 cases	42.85%
Mucinous cystadenocarcinoma	04 cases	28.57%
Dysgerminoma	02 cases	14.28%
Yolk sac tumor	01 cases	7.14%
Mixed germ cell tumor	01 case	7.14%
Adenocarcinoma	00 cases	0.00%

Table 06: Diagnostic characteristics of USG findings, CA125, combined USG findings and CA125

Tests	Sensitivity	Specificity	Accuracy	PPV	NPV

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USG findings	57.42	89.5	82.17	61.84	87.42
CA 125	71.42	93.75	88.7	76.92	91.43
Combined test	78.57	93.75	91.32	78.73	93.75

Table 7: Area under the curve (AUC) of serum CA125

AUC	Std. Error	p-value	Asymptotic 95% Confidence Interval	
			Lower Bound	Upper Bound
0.931	0.032	<.0001	0.868	0.994

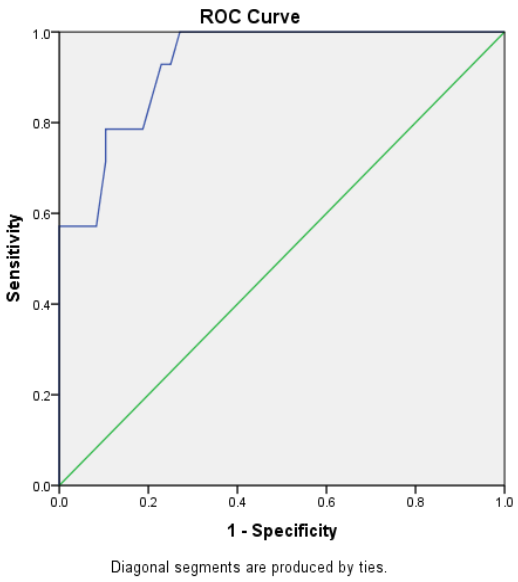

Figure 1: Receiver-operator characteristic curves of serum CA 125 for ovarian tumor

The ROC curve for serum CA125 demonstrates outstanding diagnostic performance for ovarian tumor, with an Area Under the Curve (AUC) of 0.931 (95% CI: 0.868–0.994, p < .0001).

Discussion

This analytical cross-sectional study aimed to evaluate the diagnostic utility of ultrasonographic findings and serum CA-125 levels in differentiating benign from malignant ovarian tumors, using histopathological diagnosis as the gold standard. The findings are discussed below in relation to comparable studies from the existing literature.

The present study demonstrated that patients with malignant ovarian tumors were significantly older (mean age 49.14 ± 16.59 years) than those with benign tumors (35.85 ± 11.20 years; $p < 0.05$). These results align closely with Wasim et al., who reported mean ages of 49.07 ± 18.5 years and 36.95 ± 8.2 years in malignant and benign groups, respectively ($p = 0.001$) [15]. Similarly, Junejo et al. observed mean ages of 45 ± 13.72 years for malignant and 30 ± 10.2 years for benign ovarian tumors [16]. These consistent findings reinforce the well-documented trend that increasing age is a significant risk factor for ovarian malignancy [4].

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A positive family history of ovarian malignancy was more common among malignant cases (7.14%) than benign ones (2.08%), though the difference was not statistically significant ($p > 0.05$). Parazzini et al. and La Vecchia both noted that a family history of ovarian or breast cancer in first-degree relatives increases risk; however, hereditary factors account for only a small proportion (4–5%) of total ovarian cancer cases [17,18]. Hence, while familial predisposition remains an important risk factor, its overall contribution to ovarian cancer burden appears limited in this population.

In terms of reproductive and hormonal influences, 10.4% of benign and 7.14% of malignant cases reported the use of ovulation-inducing drugs, though this association was not statistically significant. Green noted a slightly increased risk among women using such drugs, particularly those who remained nulliparous [19]. Conversely, the protective role of oral contraceptives was evident: 45% of benign and 42.31% of malignant cases had a history of oral contraceptive use. Although the difference was insignificant, this trend is consistent with the seminal findings of Beral et al., who demonstrated that prolonged oral contraceptive use significantly reduced ovarian cancer risk, with protective effects persisting for decades after cessation [20].

Regarding clinical presentation, an abdominal lump was the most common symptom, observed in 66.63% of benign and 71.41% of malignant cases. Abdominal distention and weight loss were significantly more frequent among malignant cases ($p < 0.05$), consistent with the findings of Wasim et al. and Jaffar et al., who reported these symptoms as strong clinical indicators of malignancy [15,21]. Junejo et al. similarly noted that abdominal distension and gastrointestinal disturbances were significantly associated with malignant ovarian tumors [16]. These findings reaffirm that while symptom overlap exists, progressive abdominal distention and unexplained weight loss may signal malignant transformation.

Ultrasonographic evaluation revealed several key differentiating features. All malignant cases (100%) exhibited septations and mixed solid-cystic patterns, compared with only 20.8% and 16.6% of benign cases, respectively ($p < 0.001$). Ascites was present in 71.43% of malignant and only 8.3% of benign cases ($p < 0.001$). Papillary projections were identified in 57.14% of malignant tumors but absent in benign cases ($p < 0.001$). These results are consistent with Desai et al., who reported that ultrasonographic features such as wall irregularity, septations, papillary projections, and echogenicity strongly correlate with malignancy [10]. Kirubamani et al. and Sinha et al. also observed that papillary projections and complex mass morphology were exclusive to malignant lesions [22,23]. Thus, ultrasonography remains a valuable, noninvasive, first-line tool for preoperative characterization of ovarian masses.

Serum CA-125 levels were significantly higher in malignant tumors (434.82 ± 120.22 U/mL) compared with benign tumors (29.97 ± 15.98 U/mL; $p < 0.001$). This result corroborates the findings of Terzic et al., who reported mean CA-125 levels of 937.13 U/mL and 59.54 U/mL in malignant and benign cases, respectively ($p < 0.0001$) [24]. CA-125 has long been recognized as a useful biomarker for epithelial ovarian cancer, though its specificity is limited since elevated levels may occur in benign gynecological conditions [13]. Nevertheless, when interpreted alongside imaging findings, CA-125 markedly improves diagnostic accuracy.

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Histopathological analysis revealed that 77.41% of tumors were benign and 22.59% were malignant, closely mirroring the distribution reported by Junejo et al. [16]. Among benign tumors, serous cystadenoma was the most common subtype (47.9%), followed by mucinous cystadenoma (29.16%), dermoid cyst (20.83%), and endometrioma (2.08%). Among malignant tumors, serous cystadenocarcinoma predominated (42.85%), followed by mucinous cystadenocarcinoma (28.57%), dysgerminoma (14.28%), mixed germ cell tumor (7.14%), and yolk sac tumor (7.14%). These distributions are consistent with the findings of Hossain et al., Jindal, and Garg et al., confirming that epithelial tumors, particularly serous subtypes, represent the majority of ovarian neoplasms [25,26,27].

Diagnostic performance analysis demonstrated that combining ultrasonographic findings with serum CA-125 levels yielded superior sensitivity, specificity, and overall diagnostic accuracy compared with either modality alone. Similar observations were reported by Hassan et al. and Hartman et al., who noted that integrating imaging and biomarker data significantly enhances differentiation between benign and malignant adnexal masses [14,28]. In the present study, receiver operating characteristic (ROC) curve analysis revealed that CA-125 exhibited a high area under the curve (AUC), suggesting strong diagnostic accuracy for identifying malignancy. Hartman et al. also found CA-125 to have an AUC consistent with high discriminative value, particularly when combined with morphological assessment [28].

In summary, the findings of this study indicate that ultrasonographic morphology and serum CA-125 levels are complementary diagnostic tools. Their combined use provides a robust preoperative approach for assessing ovarian tumors, thereby facilitating timely and appropriate clinical management.

Limitations of the study

1. The study was conducted in a single tertiary hospital in Rangpur, which may limit the generalizability of the findings to the broader population.
2. The study duration was relatively short, restricting long-term follow-up and data collection.
3. The sample size was small, which may have affected the statistical power of the study; larger studies are recommended in future research.
4. Transabdominal ultrasonography findings were not compared with transvaginal or color Doppler studies due to resource constraints, which could have enhanced diagnostic accuracy.
5. Only serum CA-125 was evaluated as a tumor marker. Other markers such as CEA, α-fetoprotein, and β-hCG were not assessed because of limited laboratory facilities and cost considerations.

Conclusion

This study demonstrated a strong correlation between ultrasonographic findings, serum CA-125 levels, and histopathological diagnosis in differentiating benign from malignant ovarian tumors. The combined use of ultrasonography and CA-125 markedly improved diagnostic sensitivity, specificity, and overall accuracy, making them valuable complementary tools for preoperative assessment. Both modalities correctly identified benign cases in over 90% of instances and provided a high positive predictive value. Integrating

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CA-125 measurement with ultrasonographic evaluation offers a reliable, noninvasive, and cost-effective approach for the early differentiation of ovarian tumors. Future studies with larger sample sizes and advanced imaging modalities are recommended to validate and refine these diagnostic parameters.

Conflicts of interest

There are no conflicts of interest.

Ethical approval

The study was approved by the Institutional Ethics Committee.

References

1. Das C, Mukhopadhyay M, Ghosh T, Saha AK, Sengupta M. Correlation of cytohistlogical expression and serum level of ca125 in ovarian neoplasm. Journal of clinical and Diagnostic Research: JCDR. 2014 Mar 15;8(3):41.
2. Siegel R, Naishadham D, Jemal A. Cancer statistics, 2013. CA: a cancer journal for clinicians. 2013 Jan 1;63(1).
3. Beg M. Role of ultrasound in characterization of ovarian masses. Asian Pacific journal of cancer prevention: APJCP. 2013 Jan 1.
4. Reid BM, Permuth JB, Sellers TA. Epidemiology of ovarian cancer: a review. Cancer biology & medicine. 2017 Feb 1;14(1):9-32.
5. Gabra H, Blagden S. Epithelial ovarian cancer. Dewhurst's Textbook of Obstetrics & Gynaecology. 2012 Jan 10:760-75.
6. Kumar P, Malhotra N. Jeffcoate's principles of gynaecology. Jaypee Brothers Medical Pub.; 2008.
7. Lin HuiWen LH, Tu YingYueh TY, Lin ShiyngYu LS, Su WeiJu SW, Lin WeiLi LW, Lin WeiZer LW, Wu ShenChi WS, Lai YuenLiang LY. Risk of ovarian cancer in women with pelvic inflammatory disease: a population-based study.
8. Jeong YY, Outwater EK, Kang HK. Imaging evaluation of ovarian masses. Radiographics. 2000 Sep;20(5):1445-70.
9. Granberg S, Norström A, Wikland M. Tumors in the lower pelvis as imaged by vaginal sonography. Gynecologic oncology. 1990 May 1;37(2):224-9.
10. Desai D, Desai VA, Verma RN, Shrivastava A. Role of gray scale and color Doppler in differentiating benign from malignant ovarian masses. Journal of Mid-life Health. 2010 Jan 1;1(1):23-5.
11. Cannistra SA, Gershenson DM, Recht A. Ovarian cancer, fallopian tube carcinoma, and peritoneal carcinoma. DeVita, Hellman, and Rosenberg's Cancer: Principles and practice of oncology. DeVita DT, Lawrence TS and Rosenberg SA (eds). 2011;2.
12. Xu X, Wang Y, Wang F, Jia L, Zhou Y, Deng F, Qu J, Zhou B, Meng A, Fu B, Chen X. Nadir CA-125 level as prognosis indicator of high-grade serous ovarian cancer. Journal of ovarian research. 2013 Apr 25;6(1):31.
13. Cambruzzi E, Lima RD, Teixeira SL, Pêgas KL. The relationship between serum levels of CA 125 and the degree of differentiation in ovarian neoplasms. Jornal Brasileiro de Patologia e Medicina Laboratorial. 2014 Feb;50(1):20-5.
14. Hassan L. Serum CA-125 versus ultrasound examination in differentiating between benign and malignant ovarian masses. Journal of Postgraduate Medical Institute. 2012;26(3).
15. Wasim T, Majrroh A, Siddiq S. Comparison of clinical presentation of benign and malignant

ovarian tumours. JPMA. The Journal of the Pakistan Medical Association. 2009 Jan 1;59(1):18.

16. Junejo N, Shaikh F, Mumtaz F. Clinical presentation and treatment outcome of ovarian tumors at gynaecology ward. J Liaquat Uni Med Health Sci. 2010 Jan;9(1):30-2.
17. Parazzini F, Negri E, Vecchia CL, Restelli C, Franceschi S. Family history of reproductive cancers and ovarian cancer risk: an Italian case-control study. American journal of epidemiology. 1992 Jan 1;135(1):35-40.
18. La Vecchia C. Epidemiology of ovarian cancer: a summary review. European Journal of Cancer Prevention. 2001 Apr 1;10(2):125-9.
19. Green AE. Ovarian cancer. *Medscape Reference* [Internet]. 2016 [cited 2025 Oct 18]. Available from: http://emedicine.medscape.com/article/255771-overview
20. Collaborative Group on Epidemiological Studies of Ovarian Cancer. Ovarian cancer and oral contraceptives: collaborative reanalysis of data from 45 epidemiological studies including 23 257 women with ovarian cancer and 87 303 controls. The Lancet. 2008 Jan 26;371(9609):303-14.
21. Jaffer Y, Ehsan N. Ambreen. Clinical presentation of ovarian tumors. Journal of Surgery Pakistan (International). 2013;18(2):82-6.
22. Priya MH, Kirubamani NH. Clinical correlation of ovarian mass with ultrasound findings and histopathology report. International Journal of Reproduction, Contraception, Obstetrics and Gynecology. 2017 Dec 1;6(12):5230-5.
23. Sinha A, Hariharan C, Chaudhary RK. Preoperative evaluation of ovarian tumors in the rural population--clinical features, grey scale ultrasound, colour Doppler, serum CA-125 and Alcazar score in predicting malignancy. Journal of Evolution of Medical and Dental Sciences. 2013 Apr 22;2(16):2598-610.
24. Terzic MM, Dotlic J, Likic I, Ladjevic N, Brndusic N, Arsenovic N, Maricic S, Mihailovic T, Andrijasevic S. Current diagnostic approach to patients with adnexal masses: which tools are relevant in routine praxis? Chinese journal of cancer research. 2013 Feb;25(1):55.
25. Hossain F, Karim MN, Rahman SM, Khan N, Siddiqui M, Hussain R. Preoperative detection of ovarian cancer by color Doppler ultrasonography and CA 125. Bangladesh Med Res Counc Bull. 2010 Aug 1;36(2):68-73.
26. Jindal U. Pattern of ovarian neoplasm in rural population: A five-year study from tertiary care hospital. Journal of evolution of medical and dental sciences. 2014 Feb 24;3(8):2033-40.
27. Garg N, Anand AS, Annigeri C. Study of histomorphological spectrum of ovarian tumours. Int J Med Health Res. 2017 Oct 1;3(10):12-20.
28. Hartman CA, Juliato CR, Sarian LO, Toledo MC, Jales RM, Morais SS, Pitta DD, Marussi EF, Derchain S. Ultrasound criteria and CA 125 as predictive variables of ovarian cancer in women with adnexal tumors. Ultrasound in obstetrics & gynecology. 2012 Sep;40(3):360-6.