



## Diagnostic Accuracy of Fine Needle Aspiration Cytology in Ovarian Malignancies: A Correlation with Histopathology

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### KEYWORDS

Ovarian malignancy, Fine Needle Aspiration Cytology, Histopathology, Diagnostic accuracy.

### ABSTRACT:

**Background:** Ovarian cancer is often diagnosed at advanced stages, necessitating reliable, minimally invasive diagnostic methods. Fine Needle Aspiration Cytology (FNAC) offers a rapid alternative to histopathology, but its diagnostic accuracy remains debated. This study aimed to evaluate the diagnostic accuracy of FNAC in ovarian malignancies by correlating cytological findings with histopathology.

**Methods:** A cross-sectional analytical study was conducted at Department of Gynecological Oncology and Pathology, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh, from March 2015 and February 2016. Forty patients with suspected advanced ovarian malignancy underwent FNAC under imaging guidance. Cytological results were compared with histopathological diagnoses obtained from surgical or biopsy specimens. Diagnostic performance parameters were calculated using histopathology as the gold standard.

**Results:** The mean patient age was 51.4 years. FNAC detected adenocarcinoma in 52.5% of cases, with papillary serous cystadenocarcinoma being the most frequent histological diagnosis (37.5%). FNAC correctly identified 36 of 37 malignant cases. Sensitivity, specificity, PPV, NPV, and overall accuracy were 97.3%, 100%, 100%, 75%, and 97.5%, respectively.

**Conclusion:** FNAC demonstrates high diagnostic accuracy in ovarian malignancies and represents a safe, minimally invasive diagnostic tool. Its integration into institutional practice can aid in rapid diagnosis and treatment planning, particularly in patients unsuitable for primary surgery.

### Introduction

Ovarian cancer is a significant contributor to global gynecologic cancer-related mortality, often diagnosed at advanced stages due to vague or nonspecific symptoms. It accounts for nearly 4% of all female malignancies but ranks as the leading cause of death among gynecological cancers because of its late presentation and aggressive nature [1]. The majority of patients are diagnosed at stage III or IV disease, where treatment outcomes are suboptimal despite advances in surgery and chemotherapy [2].

Fine Needle Aspiration Cytology (FNAC) has emerged as a minimally invasive diagnostic technique capable of providing rapid and reliable preliminary assessment of ovarian masses. Traditionally, definitive diagnosis has relied on histopathology following surgical resection. However, histopathology is resource-intensive and requires invasive surgery, which is not always feasible in advanced-stage disease or in patients unfit for surgery. FNAC offers a practical alternative, particularly when guided by imaging modalities such as ultrasonography (USG) or computed tomography (CT), by allowing cytological assessment with minimal morbidity [3].



The diagnostic role of FNAC in ovarian malignancies remains controversial due to concerns regarding sampling errors, tumor heterogeneity, and the potential for false-negative results. Nonetheless, numerous studies have reported high sensitivity and specificity of FNAC when interpreted in conjunction with clinical and radiological findings. For example, Gupta et al. reported FNAC sensitivity of 85.7% and specificity of 98% in ovarian tumors, while Uguz et al. documented sensitivity and specificity exceeding 90% [4,5]. These findings underscore FNAC's potential as an adjunct diagnostic tool, especially in low-resource settings.

The diagnostic value of FNAC lies not only in its ability to confirm malignancy but also in guiding clinical decisions such as initiation of neoadjuvant chemotherapy, selection of patients for cytoreductive surgery, and recognition of recurrent or metastatic disease [6]. When correlated with histopathology, FNAC findings can serve as an accurate predictor of tumor type, although limitations exist in distinguishing certain subtypes, particularly high-grade serous carcinoma from endometrioid variants [7].

In the context of Bangladesh and other developing countries, where healthcare resources are limited and access to advanced diagnostic modalities may be restricted, FNAC provides a cost-effective and rapid diagnostic option. Its minimally invasive nature reduces patient morbidity, making it suitable for fragile patients often encountered in advanced disease. Furthermore, FNAC can be performed in outpatient settings with limited equipment, thereby improving accessibility [8].

Despite its benefits, FNAC is underutilized in ovarian malignancy diagnosis due to concerns of tumor cell spillage, misdiagnosis of cystic lesions, and reluctance to accept cytological diagnosis without histological confirmation. Recent institutional studies, however, have demonstrated comparable diagnostic accuracy between FNAC and histopathology, reaffirming its role in selected clinical settings [9]. Furthermore, studies evaluating combined approaches, such as FNAC with Tru-cut biopsy, have reported improved diagnostic adequacy, further supporting the use of FNAC in routine practice [10].

The present study aims to evaluate the diagnostic accuracy of FNAC in ovarian malignancies by

correlating cytological findings with histopathological diagnoses.

## Methodology & Materials

This cross-sectional analytical study was conducted in the Department of Gynecological Oncology and Pathology, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh, over one year (March 2015 – February 2016). A total of 40 patients with suspected advanced ovarian malignancy were included in this study.

### Inclusion criteria:

- Female patients with clinically or radiologically suspected advanced ovarian malignancy.
- Patients presenting with large abdominal or pelvic masses, ascites, or metastatic deposits.

### Exclusion criteria:

- Patients with ovarian tumors associated with other gynecological problem.
- Patients with significant medical comorbidities preclude participation.
- Cases with inadequate FNAC samples or inconclusive cytology.

### Data Collection Procedure

Detailed clinical history and examination were undertaken for all patients. FNAC was performed under USG or CT guidance, depending on lesion accessibility, using a 22-gauge needle attached to a 10 mL syringe. Aspirated material was smeared, fixed in alcohol, and stained with Papanicolaou and H&E stains. Cytological findings were recorded and subsequently compared with histopathological diagnoses obtained after interval debulking or biopsy. Ethical approval was obtained from the Institutional Review Board, and informed consent was secured from all participants, ensuring confidentiality and voluntary participation.

### Statistical Analysis

Data were analyzed using SPSS version 20.0 (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean  $\pm$  standard deviation, while categorical variables were presented as frequencies and percentages. Diagnostic parameters (sensitivity, specificity, PPV, NPV, and accuracy) were calculated using histopathology as the gold standard. A p-value  $<0.05$  was considered statistically significant.



## Results

**Table 1: Age group distribution of the study population (n=40)**

Age group (years)	Number	Percentage
31–40	8	20
41–50	13	32.5
51–60	15	37.5
>60	4	10
<b>Total</b>	<b>40</b>	<b>100</b>
<b>Mean ± SD</b>	51.4 ± 8.9 (Range: 32–66)	

Table 1 shows that the mean age was 51.4±8.9 years, the minimum age was 32 years, and the maximum age was 66 years.

**Table 2: FNAC findings of the study population (n=40)**

FNAC findings	Number	Percentage
Adenocarcinoma	21	52.5
Malignant cells present (NOS)	6	15
Mucinous cystadenocarcinoma	2	5
Papillary serous cystadenocarcinoma	2	5
Malignant cells absent	3	7.5
Metastatic adenocarcinoma/serous ca.	6	15
<b>Total</b>	<b>40</b>	<b>100</b>

Table 2 shows FNAC findings where 21 (52.5%) were Adeno Carcinoma, 6 (15.0%) were malignant Cell Present, 2 (5.0%) was Mucinous Cystadenoma, and Papillary Serous Cystadenoma Carcinoma each. 3 (7.5) malignant cells absent were found, metastatic adeno carcinoma/serous was found in 6 (15.0%).

**Table 3: Histopathological findings of the study population (n=40)**

Histological type	Number	Percentage
Papillary serous cystadenocarcinoma	15	37.5
Serous cystadenocarcinoma	10	25
Endometrioid adenocarcinoma	5	12.5
Mucinous cystadenocarcinoma	4	10
High-grade serous adenocarcinoma	3	7.5

Secondary metastatic carcinoma	2	5
Other (e.g., granulomatous inflammation)	1	2.5
<b>Total</b>	<b>40</b>	<b>100</b>

Table 3 shows histological types Papillary Serous Cystadeno Carcinoma were 15 (37.5%), Serous Cystadno Carcinoma were 10 (25.0%), High Grade Serous Adeno Carcinoma 03 (7.5%), Mucinous Cystadeno Carcinoma were 4 (10.0%), Secondary Metastatic Ductal Carcinoma was 2 (5.0%), Endometroid Adeno Carcinoma 05 (12.5%).

**Table 4: Correlation between FNAC and histopathology findings (n=40)**

FNAC result	Malignant (Histopathology)	Benign/Negative (Histopathology)	Total
Malignant	36	0	36
Negative	1	3	4
<b>Total</b>	<b>37</b>	<b>3</b>	<b>40</b>

FNAC accurately identified 36 of 37 malignant cases. One false negative occurred.

**Table 5: Performance of diagnostic test (FNAC vs. Histopathology)**

Parameter	Value
Sensitivity	97.30%
Specificity	100%
Positive Predictive Value	100%
Negative Predictive Value	75%
Accuracy	97.50%

Table 5 shows that the sensitivity of FNAC findings was 97.30%, specificity 100%, accuracy 97.50%, and the positive and negative predictive values were 100% and 75%, respectively.

## Discussion

This study demonstrated that FNAC is a highly accurate diagnostic tool for ovarian malignancies, with a sensitivity of 97.3%, specificity of 100%, a PPV of 100%, NPV of 75%, and an overall diagnostic accuracy



of 97.5%. These values are consistent with the global research on FNAC as an adjunctive diagnostic modality. The mean age of the study population was 51.4 years, which is comparable to international reports, where most ovarian cancers occur in peri- and post-menopausal women above the age of 50. Gupta et al. also reported a mean age close to 50 years in their institutional series of ovarian malignancies, which mirrors the demographic profile observed in this study [4].

The diagnostic performance parameters found in this study are in line with previous research. Uguz et al. observed a sensitivity of 95.1% and specificity of 90.4% in their analysis of ovarian lesions using FNAC, while Shahid et al. noted sensitivity and specificity of 95.8% and 96.0% respectively, in a cytology-histology correlation study [5,7]. The slightly higher specificity and PPV obtained in the present study may be explained by the predominance of malignant cases and the expertise of the institutional cytopathologists.

False-negative cases remain an important limitation of FNAC. In this study, only one case was misclassified, which is similar to observations by Nunez and Diaz, who highlighted that cystic ovarian lesions may yield hypocellular samples with degenerative changes, leading to diagnostic errors [11]. This underlines the importance of correlating cytology with imaging and clinical features to mitigate misdiagnosis. Despite this limitation, FNAC reliably detected malignancy in 36 of 37 histologically confirmed malignant cases, demonstrating its robustness in routine practice.

The ability of FNAC to identify common malignant categories such as adenocarcinoma, mucinous carcinoma, and papillary serous carcinoma was also evident in this study. Freedman et al. noted that although FNAC provides an accurate malignant diagnosis, it may struggle to differentiate high-grade serous carcinoma from endometrioid subtypes [6]. The findings in this study support this limitation, as finer subclassification was not always possible. However, the clinical relevance lies more in distinguishing malignant from benign lesions, which FNAC achieved with high accuracy. Goel et al. emphasized that even when cytological subtyping is incomplete, a malignant cytology report is sufficient to initiate neoadjuvant chemotherapy in patients not suitable for primary surgery [8]. The high PPV in this study affirms the utility of FNAC in this context.

Institutional experiences across different regions have similarly validated FNAC's utility. Sengupta et al. reported 87.2% cyto-histological concordance in ovarian lesions [12], while Sood et al. found diagnostic accuracy of 91% in their Indian cohort [9]. Both studies concluded that FNAC is a feasible and effective diagnostic method, particularly in resource-limited settings. The diagnostic accuracy of 97.5% in the present study compares favorably with these reports, reflecting the benefits of imaging guidance and specialized cytopathology expertise.

The clinical implications are significant. Ovarian cancer frequently presents at advanced stages, with many patients unsuitable for extensive surgery. FNAC offers a minimally invasive method to confirm malignancy and guide initiation of neoadjuvant chemotherapy. Bandyopadhyay et al. described FNAC's role not only in initial diagnosis but also in detecting recurrent and metastatic disease, which parallels the findings here, where metastatic carcinoma accounted for 15% of cases [3]. Concerns about tumor spillage with FNAC have been raised, but several studies, including that of Wojcik and Selvaggi, found that this risk is minimal when performed under strict guidance [13].

Comparisons with other studies further highlight FNAC's utility while acknowledging its limitations. Cole et al. reported a lower sensitivity of 50% in cystic ovarian masses, cautioning that FNAC alone may not be sufficient for such lesions [14]. Higgins et al. also observed that false negatives were more frequent in cystic tumors due to low cellularity [15]. The present study's single false-negative case reflects this limitation but reinforces the importance of integrating FNAC with imaging and clinical findings to enhance diagnostic reliability.

Overall, the findings of this study support the use of FNAC as an accurate, minimally invasive, and cost-effective diagnostic modality in advanced ovarian malignancies. When integrated into multimodal assessment, FNAC facilitates timely diagnosis and treatment decisions, especially in resource-limited healthcare systems.

### Limitations of the study

This study had some limitations, which are:

- This was a single-institution hospital-based study with a modest sample size.



- The findings may not represent the broader community prevalence or spectrum of ovarian malignancies. FNAC subtype differentiation was limited, and a few cases suffered from inadequate or low-cellularity aspirates.

### Conclusion

FNAC is a highly accurate diagnostic modality for advanced ovarian malignancies, with excellent sensitivity, specificity, and predictive values when correlated with histopathology. While histopathology remains the gold standard, FNAC offers a safe, minimally invasive, and cost-effective alternative. Its role in guiding neoadjuvant chemotherapy and confirming metastatic disease underscores its clinical importance. Integrating FNAC into institutional protocols can enhance timely diagnosis and improve management strategies for ovarian cancer.

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### Conflicts of interest

*There are no conflicts of interest.*

### Ethical approval

*The study was approved by the Institutional Ethics Committee.*

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