

Freezing the moment: A comparative analysis of frozen section and histopathological diagnosis in ovarian neoplasms

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Background: Ovaries are the most common site for neoplasms among women, with 80% being benign and 20% malignant. Ovarian cancer has the worst prognosis and is typically identified in its latter stages. Pre-operative indicators and imaging are limited in distinguishing between malignant, borderline, and benign categories. The CA-125 tumor marker is the most popular, but its sensitivity and specificity are low. The frozen section is an intraoperative diagnostic technique used to differentiate between benign, borderline, and malignant tumors and determine the best surgical approach. Accurate frozen sections help avoid extensive debulking surgery, fertility-sparing surgery, and incomplete surgery and staging. **Aims:** The study aimed to compare the diagnosis of the frozen section with routine histopathology in ovarian neoplasms. **Methods:** This study analyzed 20 cases of ovarian neoplasms diagnosed through frozen section analysis in a 6-month duration. The frozen sections were categorized into benign, borderline, and malignant. The tissue was then processed into paraffin blocks, which were then stained and reported. Accuracy was assessed using 2×2 tables, with false positive cases and false negative cases labeled as discordant. **Results:** The study involved patients aged 21–40 with 20 ovarian tumors. Most tumors were unilateral, with 90% being encapsulated. Frozen section diagnosis identified 60% of the tumors as benign, 25% as malignant, and 15% as borderline. The concordant diagnostic frequency was 95%, with 5% discordant diagnosis. The frozen section demonstrated high sensitivity, specificity, positive predictive value, and negative predictive value for both benign and malignant tumors. **Conclusion:** Frozen section diagnosis in ovarian tumors is highly accurate compared to paraffin section diagnosis, providing rapid, reliable, and cost-effective information for patient care. However, increasing sampling and continuous departmental monitoring can enhance the accuracy and reliability of frozen section diagnoses.

KEY WORDS: Frozen section, ovarian neoplasms, accuracy, intraoperative**Access this article online**Website: www.ijaims.in

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INTRODUCTION

The ovaries are the most common yet complex site for neoplasms among women, globally. Approximately 80% of ovarian tumors are benign and affect young women between the ages of 20 and 45; the remaining 20% are malignant tumors that are typically found in older women with a dismal prognosis between the ages

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of 40 and 65. Due to improper signs, symptoms, and presentation, ovarian cancer has the worst prognosis of all gynecological malignancies and is typically identified in its latter stages. Before beginning a final course of treatment, histopathology is necessary to determine the exact diagnosis of ovarian cancer.^[1]

The utility of pre-operative indicators and imaging in distinguishing between malignant, borderline, and benign categories is limited. The CA-125 tumor marker is the most popular technique for identification and surveillance; yet, its sensitivity and specificity are known to be low. Additional techniques utilized to evaluate the probability of cancer in females presenting with adnexal masses are magnetic resonance imaging, computed tomography, and ultrasound. All of these techniques, however, are unable to correctly identify if an ovarian tumor is malignant.^[2]

The frozen section is an intraoperative diagnostic technique where tissue is frozen, sectioned using a cryostat, stained, and examined under a microscope by a pathologist who has been notified preoperatively. Because the results offer a preliminary diagnosis, they help the operating surgeon make decisions about the type of surgery and other care related to the nature of the mass. As such, it finds widespread application in differentiating between benign, borderline, and malignant tumors as well as in determining the best surgical approach.^[2]

An accurate frozen section is crucial in order to avoid extensive debulking surgery, proceed with fertility-sparing surgery in the event of benign tumors, and prevent incomplete surgery and staging in the case of borderline and malignant tumors.^[3] It is helpful to periodically assess the relationship between the diagnosis of a frozen section and the histopathological diagnosis to identify potential reasons for errors and put preventative measures in place for similar incidents.^[4]

Aim

The study aimed to compare the diagnosis of the frozen section with routine histopathology in ovarian neoplasms.

Objectives

The objectives of the study are as follows:

- To compare the diagnosis of the frozen section with routine histopathology in ovarian neoplasms
- To determine the sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and diagnostic accuracy of frozen section in ovarian neoplasms.

MATERIALS AND METHODS

This is a retrospective study that included 20 cases of histopathologically diagnosed ovarian neoplasms that underwent frozen section analysis in a 6-month duration. All intraoperative tissue samples sent to the department of pathology for frozen section analysis, with pre-operative radiological diagnosis of abdominal mass originating from the ovaries were included in the study, and those with non-ovarian lower abdominal masses were excluded from the study.

Fresh specimens were sent for frozen section, and after gross examination – considering factors such as tumor size, capsule integrity, and the presence of solid and cystic areas – frozen blocks were prepared and sectioned. These sections were stained with hematoxylin and eosin and then immediately reported to the concerned surgeon. The frozen section diagnoses were categorized into three groups: Benign, borderline, and malignant.

After reporting the frozen section, the tissue was fixed in 10% formalin and routinely processed to create paraffin blocks. These blocks were then stained with hematoxylin and eosin the following

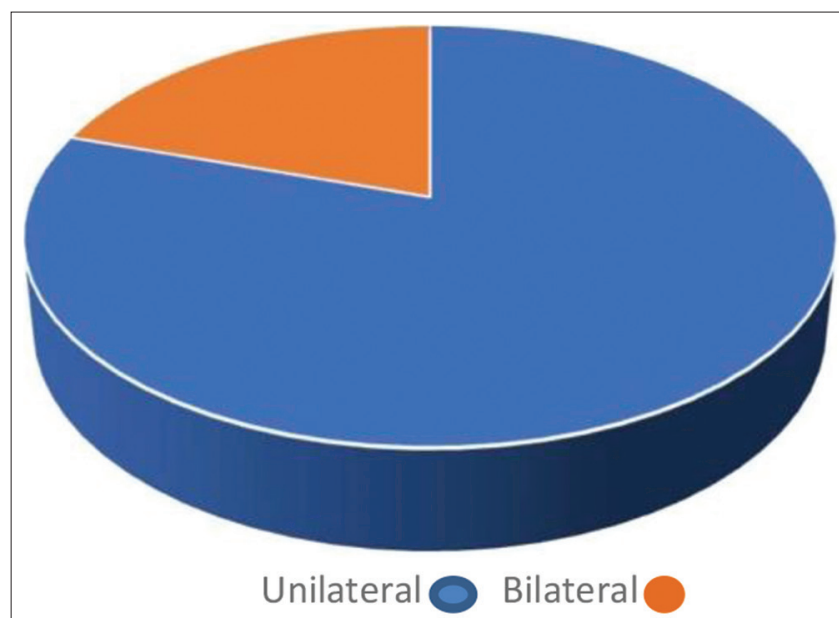


Figure 1: Laterality of cases

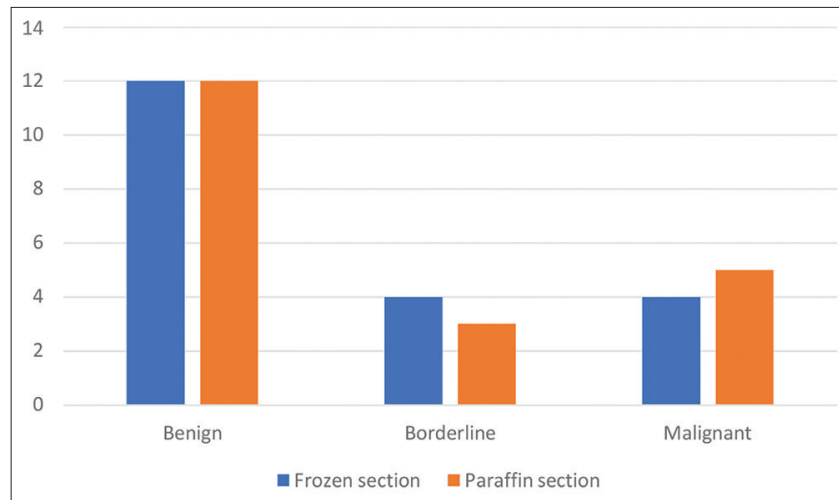


Figure 2: Distribution of cases according to diagnoses on frozen section and routine paraffin sections

Table 1: Demographic and pathological profile of tumors

Parameter	Subcategories	Frequency (%)
Age (years)	11–20	2 (10)
	21–40	10 (50)
	41–60	6 (30)
	>60	2 (10)
Tumor size (cm)	<10	7 (35)
	11–20	10 (50)
	>20	3 (15)
Capsule	Intact	18 (90)
	Ruptured	2 (10)
Cut section	Solid	1 (5)
	Solid and cystic	15 (75)
	Cystic	4 (20)

Table 2: Distribution of cases according to diagnoses on frozen section and routine paraffin sections

Category	Frequency (%)	
	Frozen section	Paraffin section
Benign	12 (60)	12 (60)
Borderline	4 (20)	3 (15)
Malignant	4 (20)	5 (25)

day, followed by further reporting. The impressions from histopathology and frozen sections were compared to determine accuracy. The diagnosis of paraffin sections was similarly categorized into benign, borderline, and malignant. Accuracy was assessed using 2×2 tables, considering the final paraffin sections as the gold standard. If the frozen section diagnosis was in concordance with the paraffin section diagnosis, those cases were considered true positive, while discordant cases were labeled as false negative or false positive. Statistical analysis was performed using Med Calc’s Diagnostic test evaluation online calculator.

Table 3: Correlation of frozen section and paraffin section diagnoses

Frozen section diagnosis	Routine paraffin section diagnosis			
	Benign	Borderline	Malignant	Total
Benign	12	0	0	12
Borderline	0	3	1	4
Malignant	0	0	4	4
Total	12	3	5	20

Table 4: Diagnostic accuracy of frozen section diagnosis

Parameters	Benign (%)	Borderline (%)	Malignant (%)
Sensitivity	100.00	100.00	80.00
Specificity	100.00	80.00	100.00
PPV	100.00	75.00	100.00
NPV	100.00	100.00	93.75
Accuracy	100.00	87.50	95.00

PPV: Positive predictive value, NPV: Negative predictive value

RESULTS

Over 6 months, a frozen section was performed on 20 cases for detection of ovarian neoplasms.

Sociodemographic Profile

The study group included patients ranging from the second to the seventh decade of life, with the majority of patients falling within the 21–40 years age group (Table 1).

Gross Characteristics

Among the 20 cases, 10 (50%) measured between 11 and 20 cm in size, 7 (35%) were 10 cm or less, and 3 (15%) were 20 cm or more. Most tumors (80%) were unilateral (as shown in

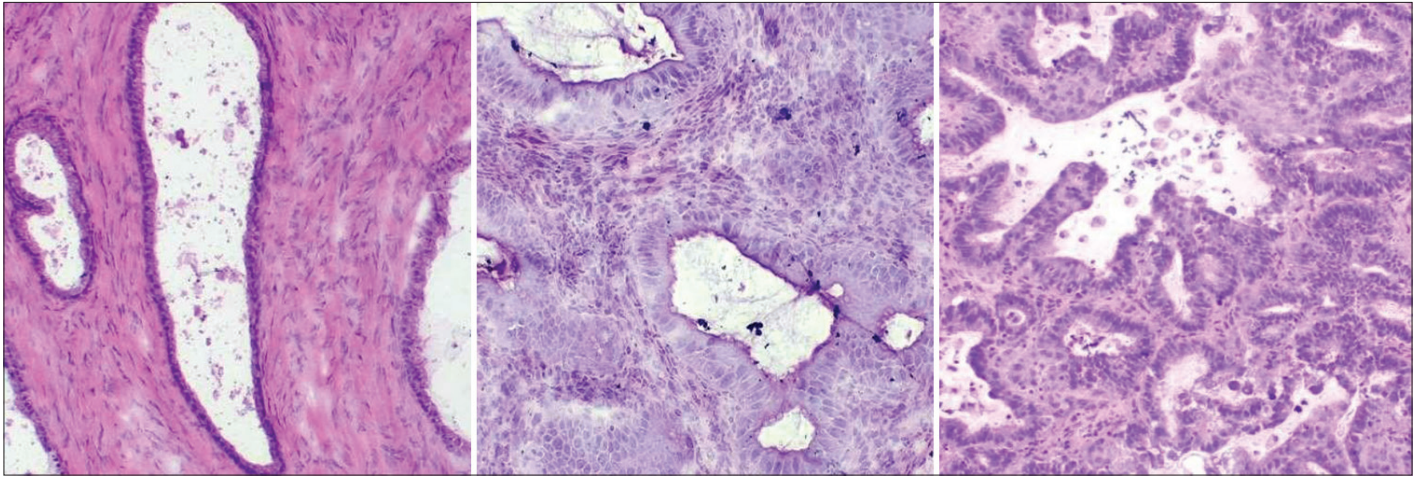


Figure 3: Histopathological spectrum of ovarian neoplasms (benign, borderline, and malignant) on frozen section, H and E; $\times 100$

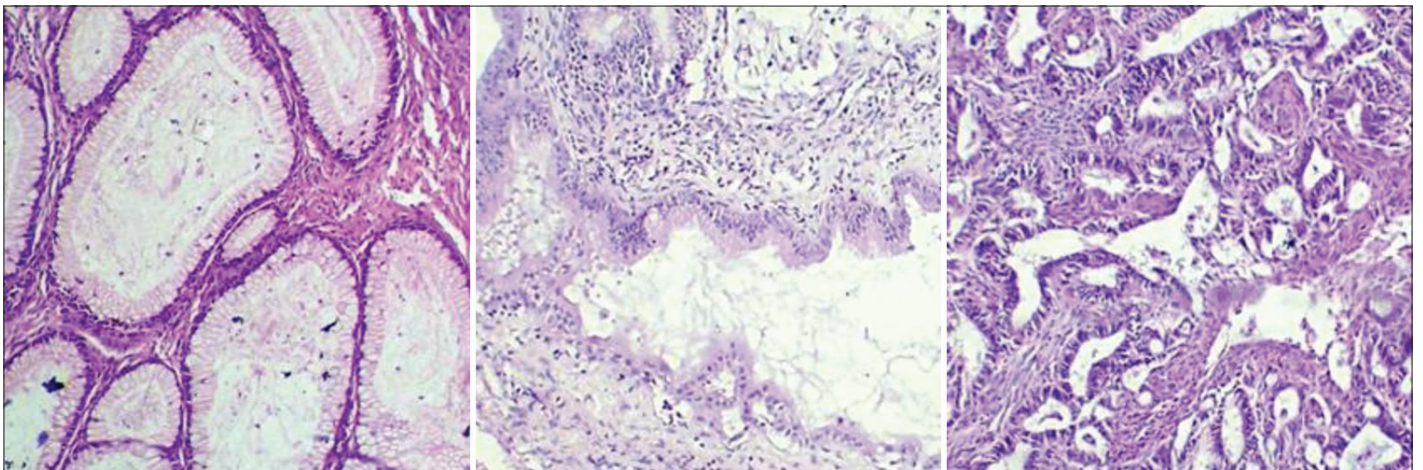


Figure 4: Histopathological spectrum of ovarian neoplasms (benign, borderline, and malignant) on paraffin section, H and E; $\times 100$

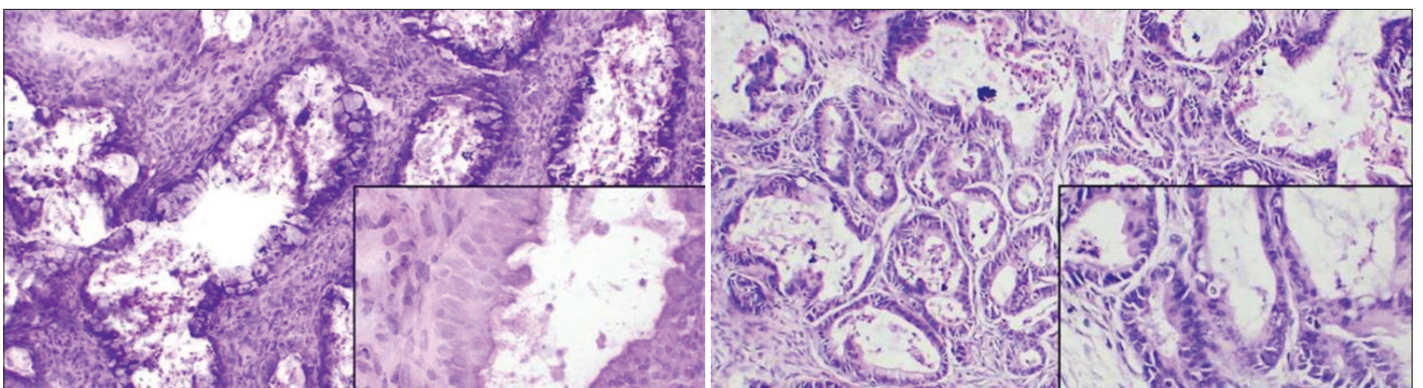


Figure 5: Histopathological comparison of discordant case on frozen section and paraffin section, H and E; $\times 100$ (Inset - H and E; $\times 400$)

Figure 1). On gross examination, 18 (90%) were encapsulated, while 2 (10%) had ruptured capsule. On cut section, 15 (75%)

were mixed solid-cystic, 4 (20%) were purely cystic, and 1 (5%) was purely solid.

Histopathological Diagnosis

As shown in Figures 2-4, of the 20 ovarian tumors, frozen section diagnosis revealed that 12 (60%) were benign, 4 (20%) were malignant, and 4 (20%) were borderline. The final histopathological diagnosis identified 12 (60%) tumors as benign, 5 (25%) as malignant, and 3 (15%) as borderline (Table 2).

Accuracy of Frozen Section

Among the 20 cases, the discordant diagnostic frequency was 5%, while the concordant diagnostic frequency was 95%. One frozen section diagnosis was inconsistent with the histopathological diagnosis on the paraffin section (as shown in Figure 5).

In this series, the frozen section demonstrated a 100.00% sensitivity, specificity, PPV, and NPV for benign ovarian tumors. For borderline tumors, frozen section showed 100.00% sensitivity, 80.00% specificity, 75.00% PPV, and 100.00% NPV. For malignant tumors, the frozen section demonstrated 80.00% sensitivity, 100.00% specificity, 100.00% PPV, and 93.75% NPV. The diagnostic accuracy was the highest for benign tumors at 100.00%, followed by 95.00% for malignant and 87.50% for borderline tumors.

DISCUSSION

Frozen section diagnosis plays a crucial role in surgical decision-making, particularly in cases where immediate intraoperative decisions are necessary. This technique allows surgeons to modify the course of surgery in real time, which is especially important for preserving vital structures and fertility in younger patients. The ability to avoid both overtreatment and under treatment is a significant advantage, as it ensures that patients receive the most appropriate level of care based on accurate and timely diagnostic information.

As shown in Table 1, the age distribution in our study revealed that the majority of patients presenting with ovarian tumors were between 21 and 40 years old, a demographic where fertility preservation is often a key concern. The proportion of patients of various age groups in the present series was comparable to the previous studies.^[5,6]

The tumors were predominantly unilateral with intact capsule and exhibited solid cystic areas on cut sections, characteristics that are important for accurate diagnosis and appropriate surgical planning. The tumor size shows concordance with the study conducted by Pujani *et al.*;^[6] however, Pujani *et al.* reported a maximum frequency of purely cystic cases (69%).^[6]

In our study, the frozen section showed impressive diagnostic performance for benign tumors, with a sensitivity, specificity, PPV, NPV, and accuracy of 100.00%, as shown in Tables 3 and 4. This high level of accuracy underscores the reliability of frozen

section analysis in distinguishing non-malignant tumors, which is critical for making informed surgical decisions. For malignant tumors, the sensitivity was lower at 80.00%, while the specificity remained at 100.00%, leading to an overall accuracy of 95.00%. Although the sensitivity for malignancy was not perfect, the high specificity indicates that when a malignant diagnosis was made, it was highly reliable. The lower sensitivity might reflect the challenges associated with diagnosing malignancy in some cases, possibly due to the complex nature of certain tumors or limitations in the sampling process which may cause misinterpretation as borderline grade.

Comparative studies further highlight the effectiveness of frozen section diagnosis. For instance, Krithiga and Priya^[4] analyzed 30 cases to evaluate the correlation between paraffin section and frozen section diagnoses. They found a high concordance rate, with 28 out of 30 cases matching, resulting in an overall accuracy of 93.3%. This study supports the reliability of frozen sections in clinical practice. Similar findings were noted in other studies performed on the same subject, by Sultana *et al.*,^[7] Kung *et al.*,^[8] Arshad *et al.*,^[2] Gorišek *et al.*^[9], and others.^[10,11] In our study, there was one discordant case out of 20, which could be attributed to various factors such as sampling errors, technical issues during the preparation of frozen sections, or intraoperative challenges. The presence of a discordant case underscores the need for careful technique and quality control during the frozen section process to minimize errors.

Overall, our findings reinforce the value of frozen section diagnosis in ovarian tumors, particularly in ensuring accurate and timely treatment decisions that can significantly impact patient outcomes.

CONCLUSION

The overall accuracy of frozen section diagnosis in ovarian tumors was found to be high when compared to paraffin section diagnosis, indicating that frozen section is an effective and accurate method for guiding the extent of management in ovarian tumors. This technique offers rapid, reliable, and cost-effective information that is crucial for optimizing patient care. However, to further minimize errors, it is essential to increase sampling and continuously monitor the procedure within the department. This approach will enhance the accuracy and reliability of frozen section diagnoses, ensuring that patients receive the most appropriate treatment based on precise intraoperative findings.

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