Study To Assess the Accuracy of Frozen Section for Diagnosis of Ovarian Tumors

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Abstract

Introduction: Intraoperative frozen section (IFS) analysis is a vital tool for surgical oncologists, providing immediate histological diagnosis during surgery and guiding both intraoperative and postoperative management. Unlike routine histopathology, which delays results, IFS offers rapid feedback crucial for surgical decision-making. Since the introduction of the cryostat in 1960, IFS has been a reliable method for evaluating specimens intraoperative. In contrast, preoperative evaluation of ovarian masses using imaging and serum markers often suffers from limited sensitivity and specificity, reducing diagnostic accuracy.

Method: A total of 50 cases were received over a period of 19 months from January 2023 to July 2024. Complete clinical and radiological details were collected. Fresh tissue was received from the operation theatre and sections were taken from representative areas with cryostat HM525 NX. H&E and Toluidine blue stained slides were reported by two pathologists. TAT was maintained within 30 minutes using telecom.

Results: A total of 50 cases were studied. Age range between 18-75 years. On frozen section, 33n (66%) were benign, 10n (20%) were borderline and 7n (14%) were malignant. The overall sensitivity was 93.8%, specificity 94.1%, positive predictive value (PPV) 88.2%, and negative predictive value (NPV) 97%. P value was <0.001, indicating a highly significant association between the frozen section diagnosis and the final histopathological diagnosis.

Conclusion: Frozen section analysis has high accuracy in the intraoperative diagnosis of ovarian tumors with high sensitivity and specificity.

Keywords: Intraoperative Frozen Section, Ovarian Neoplasms

Introduction

In this age of advanced medical technology, intraoperative frozen section analysis is vital for guiding surgeons in both the intraoperative and postoperative

management of patients. This procedure is an important tool for surgical oncologists. Unlike the routine histopathology process, which takes time and can delay the final report, the frozen section allows for immediate diagnosis. This immediate feedback is crucial when a surgeon needs to make quick decisions about the line of treatment during an operation, necessitating intraoperative consultation on the tissue being removed. Following the introduction of the cryostat in 1960, intraoperative frozen section (IFS) examination was established as a highly reliable procedure for the rapid histological evaluation of specimens during surgery

The preoperative evaluation of an ovarian mass generally involves imaging studies and serum markers. Unfortunately, these diagnostic tools often have limited sensitivity and specificity, which can affect their ability to accurately identify the characteristics of the mass.

Material and Method

A total of 50 cases were received over a period of 19 months from January 2023 to July 2024. Complete clinical and radiological details were collected. Fresh tissue was sent from the operation theatre in a sterile plastic container in saline (without any fixative) with a requisition form. Gross examination of tissue was done and recorded. Sections were taken from representative

areas with cryostat HM525 NX. After sectioning the tissue was stained with rapid H&E and Toluidine blue stain. Frozen section diagnosis was made by two pathologists. The diagnosis was conveyed to the operating surgeon through telecom. TAT was maintained within 30 minutes. The remaining tissue was processed as paraffin embedded tissue sections.

The statistical data is analyzed by SPSS 20.0 software. In this study for data analysis Chi square test will be applied. P value <0.05 will be considered as significant.

Result

A total of 50 cases were included in the study. The age distribution was between 18-75 years with majority of cases in the range 41-60 years (22n, 44%). The most common symptom was abdominal mass (56%), followed by abdominal pain (40%) and abnormal uterine bleeding (4%). 26 cases (52%) were given clinically as neoplasm and the rest 24(48%) were cystic. Majority cases included right ovary (27n, 54%) followed by left (16n, 32%) and 7n (14%) were bilateral.

On frozen section, 33n (66%) were benign, 10n (20%) were borderline and 7n (14%) were malignant. Table 1 shows the correlation between frozen section and histopathology sections.

Table 1:

Frozen section	Histopathology		
	Benign	Borderline	Malignant
Benign	32 (94.1%)	1 (14.3%)	0
Borderline	2 (5.9%)	6 (85.7%)	2 (22.2%)
Malignant	0	0	7 (77.8%)

21 cases serous (Fig1 a-d), 19 mucinous (Fig1 e-d), 5 sero-mucinous, 3 endometroid (Fig2 a-b), 1 each of sex cord stromal tumor (Fig2 c-d) and germ cell tumor (Fig2 e-f).
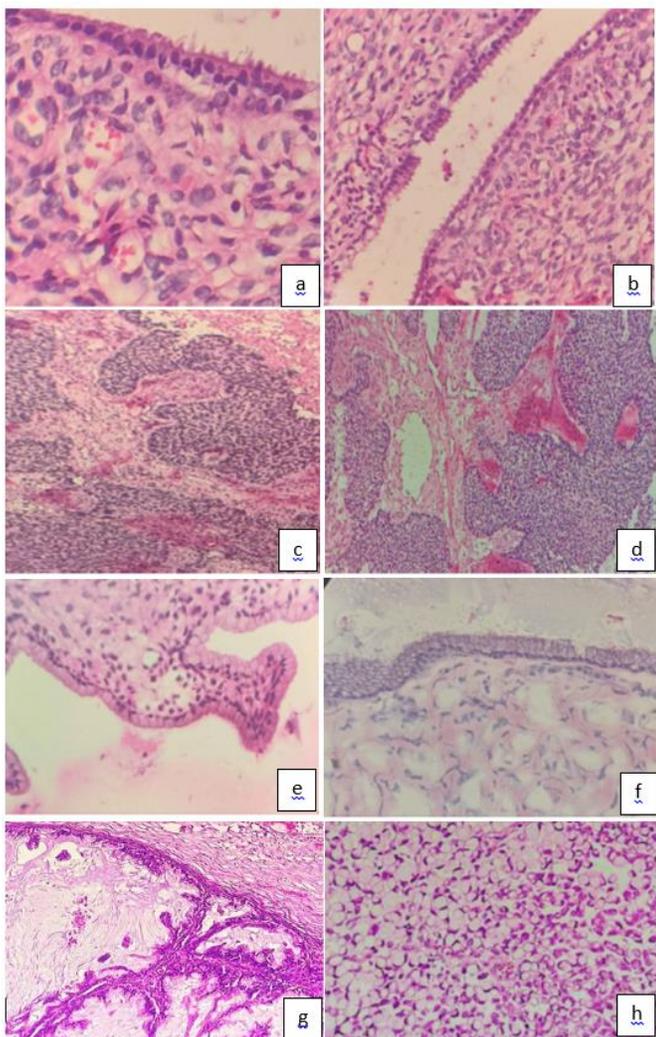
Figure 1:

a- IFS 40X and

b- HP 10X Serous cystadenoma showing ciliated cuboidal and columnar epithelium with ovarian stroma.

c- IFS 10X and

d- HP 10X High-grade Serous carcinoma with SET (solid, pseudo endometrioid or transitional) pattern.

e- IFS 40X and

f- HP 40X Mucinous cystadenoma-Single layer of mucinous epithelium with mucin pool.
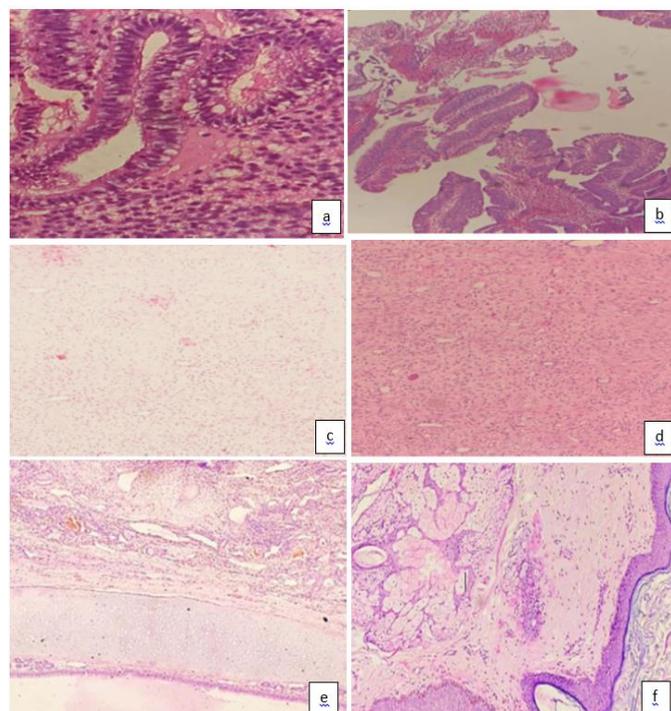
g- IFS 10X and

h- HP 40X Mucinous carcinoma

Figure 2:

a- 40X IFS and

b- HP 10X Endometriotic cyst of ovary showing endometrial glands and stroma.

c- IFS 10X and

d- Fibroma showing Spindle cells with fascicular pattern.

e- IFS 10X and f- HP 10X Mature cystic teratoma

This study showed high diagnostic accuracy for frozen section in ovarian tumors. The overall sensitivity was 93.8%, specificity 94.1%, positive predictive value (PPV) 88.2%, and negative predictive value (NPV) 97%. P value was <0.001, indicating a highly significant association between the frozen section diagnosis and the final histopathological diagnosis.

Discussion

Ovarian tumors are a significant health concern due to their complex nature, diagnostic challenges, and potential for malignancy. Accurate preoperative diagnosis is crucial for appropriate surgical planning and management. Frozen section analysis is a widely used

intraoperative technique to provide a rapid assessment of the tumor's nature, guiding the surgical approach. This study aims to evaluate the accuracy of frozen section diagnosis in the evaluation of ovarian tumors.

In terms of the distribution of patients according to age, the study found that the majority of patients (44%) were in the 41-60 years age group. This aligns closely with other studies in the field, such as Kennedy NT et al. (44.9 ± 14.2 years), Goel P et al. (46.8 ± 14.8 years), and Shahmoradi F et al. (45 ± 6 years). The consistency in mean age across these studies supports the epidemiological data on ovarian tumors, which suggests that these neoplasms are most common in middle-aged women. The slight variations in mean age across studies could be attributed to differences in study populations or regional variations.

Regarding the clinical presentation, in our study the most common symptoms were abdominal pain (40%) and abdominal mass (56%), which is consistent with the systematic review by Shaaban et al. which also identified these as the predominant clinical features associated with ovarian tumors.

In the current study, 66% of tumors were benign, 20% were borderline, and 14% were malignant. This distribution varies somewhat from other studies presented in the table. For instance, Kennedy NT et al. reported a lower percentage of benign tumors (36.3%) and higher percentages of borderline (40%) and malignant (23.7%) tumors. On the other hand, Shahmoradi F et al. found a much higher percentage of benign tumors (80.3%) and lower percentages of borderline (5.2%) and malignant (14.5%) tumors. These variations could be due to differences in study populations, referral patterns, or diagnostic criteria used in different healthcare settings.

As a tool used during surgery to help the surgeon make critical decisions, frozen sections should be dependable enough to prevent incorrect intervention due to overdiagnosis or under diagnosis. The analysis of frozen section diagnosis in the current study revealed an overall sensitivity of 93.8% and a specificity of 94.1%, which is comparable to the results reported in other studies. A meta-analysis by Geomini et al. reported a sensitivity varied between 65% and 97% and a specificity between 97% and 100% for frozen section analysis

Frozen section diagnosis showed a statistically significant correlation with final histopathology (p < 0.001). Reported accuracy rates vary across studies: Bige et al. (97.1%), Ilker et al. (96.5%), and Fatemali et al. (benign 98%, borderline 80.3%, malignant 67.2%). Ratnevelu et al.'s Cochrane review (38 studies) found pooled sensitivity of 90% (71–100%) and specificity of 89.5% (58–99%) for malignant/borderline tumors, and sensitivity of 96.5% (83–100%) with specificity of 89.5% (58–99%) for benign tumors. Another epithelial tumor study reported sensitivity/specificity of 97.9%/95% for benign, 67.2%/100% for malignant, and 91%/88.4% for borderline lesions. Variability is attributed to sampling error, technical limitations, and histological variants. Overall, frozen section is highly accurate for benign tumors, moderately reliable for borderline, and less sensitive for malignant lesions, though specificity remains high.

Our study demonstrated that frozen section analysis has high overall specificity, with perfect specificity for malignancy. Sensitivity varied, being highest for borderline tumors and lowest for benign lesions. Positive predictive value was excellent for malignant and borderline cases but lower for benign, while negative predictive value remained high across all categories. For

benign tumors, most studies reported sensitivity of 85.7–100% and specificity of 82.2–97.2%, confirming strong diagnostic accuracy. Borderline tumors showed greater variability (sensitivity 50–89%, specificity 90.3–99%), reflecting their overlapping features with benign and malignant lesions. Malignant tumors had sensitivity of 72.5–93.3% and consistently high specificity (95.1–100%), indicating reliable detection with minimal false positives. Overall, frozen section is a dependable diagnostic tool for ovarian tumors, though challenges remain in accurately classifying borderline cases.

Conclusion

Frozen section analysis has high accuracy in the intraoperative diagnosis of ovarian tumors with high sensitivity and specificity. Positive predictive value was excellent for malignant and borderline cases but lower for benign, while negative predictive value remained high across all categories.

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