



INTRAOPERATIVE FROZEN SECTION: COMPARATIVE STUDY WITH ROUTINE HISTOPATHOLOGICAL DIAGNOSIS IN A TERTIARY CARE HOSPITAL, WAYANAD

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ABSTRACT

Aim: To compare frozen section (FS) diagnosis with routine histopathological diagnosis using paraffin-embedded sections. **Materials And Methods:** This retrospective analytical study included 42 FS specimens and corresponding paraffin-embedded sections from June 2018 to Nov 2020. FS reports were compared with paraffin section reports for diagnostic accuracy, considering paraffin section diagnosis as the gold standard. Discordant cases were analyzed to identify reasons for disparity. **Results:** The accuracy rate was 89.18%, with 10.2% discordance. Sensitivity, specificity, positive predictive value, and negative predictive value were 91.4%, 71.4%, 94.1%, and 62.5%, respectively. The average turnaround time (TAT) was 25 minutes. **Conclusion:** FS remains a reliable intraoperative diagnostic tool. Measures such as thorough tissue sampling, clear pathologist-surgeon communication, and second pathologist review in challenging cases can limit diagnostic discrepancies.

KEYWORDS : Frozen section, intra-operative, histopathology, paraffin section.

INTRODUCTION:

The FS technique, introduced by William H. Welch in 1891, became popular for intraoperative consultation in the 1920s and was simplified by the cryostat in the 1960s. FS is used to establish lesion nature, look for metastasis in lymph nodes, assess surgical margins, and identify unknown pathological processes. Despite being less accurate than routine histopathological studies, FS provides valuable intraoperative guidance. Limitations include restricted sampling, suboptimal section quality, and freezing artifacts. Despite being the gold standard, routine histopathological study, FS is a valuable intraoperative tool guiding surgical decisions and reducing the risk of overtreatment or the need for secondary surgeries.^{1,2,3,4,5}

The present study aims to correlate the frozen section diagnosis with routine histopathological diagnosis to evaluate the diagnostic performance of frozen sections.

MATERIALS AND METHODS

This retrospective study was conducted in the Department of Pathology, Dr. Moopen's Medical College, Wayanad, on 42 frozen section (FS) cases over 2.5 years (June 2018 to November 2020). A requisition form containing the patients' clinical details was obtained in advance for all cases. FS tissues were sent in a clean plastic container without any fixative. After thorough gross examination, specimens were dissected and sections taken from representative areas. Sectioning was performed using a Leica CM 1850 cryostat with tissue freezing medium, set at -18°C to -24°C. Sections, 5-7 thick, were stained with rapid hematoxylin and eosin (H&E). FS diagnoses were dispatched to the operating surgeon within a turnaround time (TAT) of 25 minutes from receipt of the specimen.

For routine histopathological sections, specimens were fixed in 10% formalin overnight. The next day, gross descriptions were noted, and sufficient representative bits were taken and stained with H&E according to standard guidelines.

Diagnoses given during FS were compared to that of the paraffin embedded sections, to assess the accuracy of the procedure.

Statistics

The accuracy rate, rate of discordance, sensitivity, specificity, positive predictive value and negative predictive value was

evaluated between the two procedures using the standard 2x2 contingency table.

RESULTS

The present study included 42 FS cases studied over a period of 2.5 years from (June 2018 to Nov 2020). Most of the cases were from the female genital tract, mainly the ovary (27/42). Distribution of the FS specimens are highlighted in Fig 1.

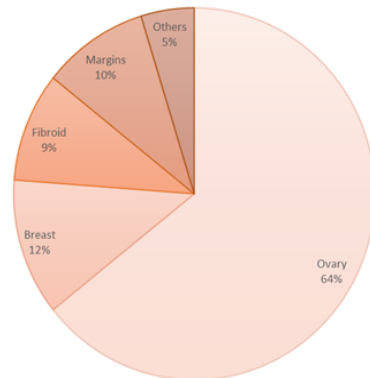


Fig 1: Distribution of the FS specimens.

The common ovarian lesions were primarily benign cystadenomas (14/27), followed by borderline serous tumors (3/27), and one serous cystadenocarcinoma. There were also 2 cases each of teratoma and yolk sac tumor, one fibrothecoma, and 4 non-neoplastic ovarian lesions. The main indication for FS was to assess the nature of the lesion (37/42), followed by evaluating margin adequacy (4/42).

Concordant diagnoses between FS and paraffin section reports were observed in 37 out of 42 cases, yielding a diagnostic accuracy of 89.18%. There were 5 discordant cases, with 2 false positives and 3 false negatives. The primary reasons for discrepancies were interpretation errors and sampling errors. The discordant cases involved ovarian and fibroid lesions, detailed in Table 1.

Table 1: Discordant cases.

Site	FS diagnosis	Paraffin section diagnosis	Type of error
Ovary	Yolk sac tumour	Endometriosis	Misinterpretation

Ovary	Borderline serous tumour	Serous cystadenofibroma	Misinterpretation
Ovary	Borderline ovarian tumour	Papillary serous cystadenocarcinoma	Sampling error
Ovary	Serous cystadenoma	Borderline serous tumour	Sampling error
Fibroid	Leiomyoma	Smooth muscle tumour of undetermined malignant potential (STUMP)	Sampling error

Sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy of frozen section in comparison with permanent section is depicted in Table 2.

Table 2: Statistical data.

Statistics	Value
Sensitivity	91.4%
Specificity	71.4%
Positive Predictive Value	94.1%
Negative Predictive Value	62.5%
Accuracy	89.18%

The TAT for FS diagnosis in our study was maintained at 25 min for all cases. It was calculated from the time the specimen was received at the Pathology Department to the time the FS report was communicated to the operating surgeon.

DISCUSSION

Frozen section (FS) is an accurate and reliable tool for intraoperative management, helping surgeons categorize lesions as non-neoplastic, benign, or malignant. Its accuracy improves with proper clinicoradiological information, thorough gross inspection, meticulous sampling, and effective consultant collaboration, reducing diagnostic dilemmas.⁶

This study showed a diagnostic accuracy rate of 89.18%. Accuracy of FS diagnosis falls in the range between 90-98% as seen in various studies. (Table 3)

Table 3: Comparison of various studies on overall accuracy

	Diagnostic accuracy
Devi J ⁷	96.2%
Patil P et al. ³	96.96%
Mishra S et al. ⁸	96.2%
Shah HS et al. ⁹	97.3%
Vaheni G et al. ¹⁰	91%
Phulgirkar PP et al. ¹¹	90.7%
Present study	89.18%

None of the cases in our study was deferred. Deferral rate in various studies is between 0.04-6.7%. This can depend on various factors like clinical competence, type of tissue received and duration of study.¹²

The most common indication for frozen section in the present study was to determine the presence and nature of a neoplasm (88%). Most common tissue sent for FS analysis in our study was ovary (64%). After comparing with different studies, the common specimens sent for FS study are from the oral cavity, breast and ovary. (Table 4)

Table 4: Common tissues sent for FS in various studies.

Study	Nature of specimen
Patil P et al. ³	Oral cavity 23/100
Devi J ⁷	Ovary 13/40
Phulgirkar PP et al. ¹¹	Breast 44/72
Adhikari P et al. ¹³	Gynecological 17/41
Bharadwaj BS et al. ²	Gallbladder/biliary tract 45/200
Present	Ovary 27/42

Discordant rates in literature range from 1.4% to 12.9%, depending on the specimen type. Studies by Hatami et al.¹⁴

and Patil P et al.³ reported discordance rates of 2.03% and 3.04%, respectively, with misinterpretation accounting for 66.6% of discordant cases and sampling error for 33.3%. Literature shows interpretation error as the primary cause of discordance.^{6,7,9,14}

These discrepancies underscore the challenge of reduced sampling in FS due to time constraints, particularly in large tumors where capturing multiple sections is impractical and would prolong the turnaround time. Pathologists must be aware of the potential consequences and legal implications of misdiagnoses, advocating for careful consideration and, when necessary, deferral of a diagnosis to ensure accuracy.^{3,4,9,13}

Similar misinterpretations of borderline tumors versus invasive carcinoma in ovarian tumors during FS have been documented in other studies. As Jena M et al. noted, using the term "at least borderline" in FS opinions acknowledges diagnostic uncertainty but allows the surgeon to proceed with staging operations, potentially avoiding a second surgery.

In another sampling error case, ovarian serous cystadenoma diagnosed by FS was later identified as a serous borderline tumor on paraffin sections. The diagnostic areas of epithelial stratification and atypia were missed during FS due to limited sampling. Such focal areas necessary for diagnosing borderline tumors can be overlooked if not enough tissue is sampled.

Two additional discordant cases involved misinterpreting a non-neoplastic ovarian lesion as malignant and a borderline smooth muscle lesion as benign. These errors could be due to freezing artifacts, suboptimal sectioning and staining, or the rarity of the lesions. This highlights the fact that FS slide quality is inferior to paraffin-embedded sections, which remain the gold standard for histopathological diagnosis.^{4,5,6,7,11,14}

Sensitivity and specificity were studied considering the prevalence of positive for malignancy in frozen sections as 21%.¹⁴

The average turn-around time required for entire frozen section procedure varies from 20 to 25 minutes.³ The TAT in our study was kept at 25 mins for all cases which is comparable to that seen in other studies.^{6,9,12}

CONCLUSION

Despite advances in histopathological reporting with immunohistochemistry and molecular tools, the frozen section remains a reliable test for intraoperative diagnosis and management. Although generally precise, it has its shortcomings. These limitations can be mitigated by interpersonal discussion and communication with the surgeon regarding the clinical and radiological details of the patients, in-depth tissue sampling, particularly in cases of suspected malignancy, and avoiding technical errors in sectioning and staining. Additionally, re-assessment by a second pathologist in debatable cases can help reduce the discordant rate.

Conflict Of Interest

None

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