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Original Research Article

Intraoperative frozen section study of ovarian tumours

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Abstract

Background: Ovarian neoplasms are a heterogenous group of tumours with diverse treatment for different tumours. Intraoperative frozen section (IFS) is an important diagnostic tool for differentiating benign from malignant ovarian tumours. The precision of diagnosis of ovarian neoplasms by frozen section was observed to vary in various studies and this study attempts to evaluate the diagnostic accuracy of IFS in identifying different ovarian tumours. It helps in guiding the optimal surgical procedure in the management.
Aim and Objective: This study aims to assess the diagnostic performance of IFS in the diagnosis of various ovarian tumours.
Materials and Methods: A retrospective study was undertaken between 2015 to 2020. Sensitivity, specificity and accuracy of IFS were calculated. In discordant cases, the slides were re-evaluated to determine the possible factors for erroneous diagnosis.
Results: Out of 95 cases, majority were epithelial tumours which accounted 87.3%. The diagnostic accuracy was 88.4% and the sensitivity of IFS was 67.9%, 53.85% and 100% for malignant, borderline and benign tumours respectively. The corresponding specificity was 91.04%, 97.56% and 95.9%. All the germ cell tumours were accurately diagnosed. The sensitivity and specificity for sex cord stromal tumours was 100% and 96.6% respectively. The IFS and formalin sections had an 88.4% concordance.
Conclusion: IFS is a reliable technique in the evaluation of patients with ovarian neoplasms. It is most valuable for high accuracy and specificity in diagnosis of ovarian malignancies but caution must be taken when dealing with borderline malignancies. Pathologists should be aware of the pitfalls to avoid inappropriate surgery.

Keywords: Intraoperative Frozen section; Ovarian neoplasms; Diagnostic accuracy.

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1. Introduction

Ovarian tumours constitute a diverse group that requires different treatments depending on the type of tumour.[1] Ovarian cancer accounts for roughly a quarter of all gynaecological cancers and half of all female genital cancer fatalities globally.[2] The estimated number of new cases was 313959 (1.6%) with 207252 deaths (2.1%) of all cancers worldwide in 2020, while in India, the incidence was expected to be 43,886 cases with a crude rate of 6.41 and a cumulative risk of 1 in 133.[2,3]

In suspected ovarian malignancies, pre-operative imaging and tumour marker evaluation are performed. However, they are only marginally useful in differentiating benign from borderline and malignant lesions.[4,5]

Intraoperative consultation in gynecology is utilized frequently for the assessment and diagnosis of pelvic masses, which helps to plan surgical care.[6] A correct intraoperative FS diagnosis might thus reduce both over treatment and under treatment, which would otherwise result in adjuvant chemotherapy and second operation respectively.[7] The precision of diagnosis of ovarian neoplasms by frozen section was observed to vary in various studies.[1,4,7]

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The study's aim was to assess the accuracy of intraoperative frozen section (IFS) in the diagnosis of various ovarian tumours.

2. Materials and Methods

A retrospective hospital-based analytical study of all successive IFS of ovarian lesions was conducted from 2015 to 2020 at a tertiary care hospital in Mysuru, India. The Institutional Ethical Committee clearance was obtained. All ovarian neoplasms were included in the study. Non-neoplastic abnormalities such as torsion, endometriosis, and infection were excluded from the study. During the study period, a total of 108 cases were retrieved. 95 cases were analysed after omitting 13 non-neoplastic abnormalities. The clinical information was taken from database.

The specimens were grossed and bits were given from cyst wall, papillary and solid areas. For each case, an average of 2-5 sections was obtained. The slides were stained with Hematoxylin and Eosin after being cut in a cryostat machine at -20 °C. The entire procedure took about 20 minutes on an average following the receipt of samples. When there were questionable pathologic characteristics that were not certainly diagnostic on IFS, the diagnosis was adjourned for final histology. The ovarian specimens were preserved in 10% formalin overnight and sampled for routine histologic sections (Haematoxylin and Eosin) after the frozen section was reported. The IFS diagnoses were compared to the final histopathological diagnoses, which were considered as the gold standard, in every case. The WHO Classification was used to determine the histologic diagnosis of ovarian tumours.[8]

The slides were re-evaluated in discordant cases to establish the likely causes of erroneous diagnosis and interpretation problems. Discordant cases (when IFS and final histopathological diagnosis were in different groups-benign/borderline/malignant) were categorised as underdiagnosed and over diagnosed. When the final histology diagnosis was malignant but the tumour was benign or borderline on IFS, or if the tumour was borderline in the end but benign on IFS, the tumour was underdiagnosed. When the final diagnosis was benign but the IFS diagnosis was borderline or malignant, or when the final diagnosis was borderline but the IFS diagnosis was malignant, over diagnosis was taken into consideration.

2.1. Statistics

The accuracy, sensitivity and specificity of IFS for epithelial, sex cord stromal and germ cell tumours were estimated with corresponding 95% confidence intervals (CI). Concordance of IFS and Histopathological examination (HPE) were calculated.

To compare the IFS and final histopathological diagnoses, results of this study were calculated using the Shreffler and Huecker method.[9] This method was chosen for accuracy calculation in this study because it offers comprehensive diagnostic metrics that are well-suited for both binary and multi-class evaluation. It emphasizes clinical applicability, ensuring that the diagnostic measures are meaningful in real-time surgical decision-making. The method supports confidence interval estimation, enhancing the statistical validity of findings. Widely recognized in evidence-based practice, it promotes transparency and reproducibility, making the results reliable and easily interpretable by clinicians and researchers alike.

TP- true positive; FP- false positive
TN- true negative; FN- false negative
Sensitivity = TP/TP+FN x 100
Specificity = TN/ TN+FP x 100

3. Results

The study involved 95 patients aged between 19 and 87 years, with the median age being 47.9 years. Ovarian surface epithelial tumours were the most common, accounting for 87.3% (83 cases) of all cases, followed by 07 cases of sex cord stromal tumours (7.3%), and 05 cases of germ cell tumours (5.3%). (**Table 1**) In our study, no cases of metastasis were identified.

Table 1: IFS and final diagnosis

Tumours	IFS	Paraffin Section
Benign epithelial tumours	48	46
Borderline epithelial tumours	13	09
Malignant epithelial tumours	19	28
Germ cell tumours	5	5
Sex cord stromal tumours	10	7
Total	95	95

Overall, IFS had a diagnosis accuracy of 88.4% (84/95). For benign epithelial tumours, frozen section diagnosis demonstrated very high accuracy (97.9%), with a narrow confidence interval (93.6% to 99.7%), indicating a highly reliable diagnostic capability. The sensitivity was 100%, showing that all benign epithelial tumour cases were correctly identified, and the specificity was 95.9% (CI: 86.0% to 99.3%), indicating minimal false positives.

In borderline epithelial tumours, the FS diagnostic accuracy was slightly lower at 91.6% (CI: 84.25% to 95.67%). The sensitivity was relatively low at 53.85% (CI: 29.14% to 76.79%), suggesting a moderate rate of missed diagnoses in this group. However, the specificity was high at 97.56% (CI: 91.54% to 99.33%), indicating strong performance in ruling out other ovarian tumours.

For malignant epithelial tumours, FS diagnosis yielded an accuracy of 84.21% (CI: 75.6% to 90.2%), with a sensitivity of 67.9% (CI: 48.9% to 83.2%), which is moderate

and suggests that a notable proportion of malignant cases could be missed. The specificity remained strong at 91.04% (CI: 81.4% to 96.3%).

For germ cell tumours, frozen section diagnosis achieved 100% accuracy (CI: 96.2% to 100%) and 100% sensitivity (CI: 47.8% to 100%), reflecting excellent diagnostic precision with no missed cases, though the wider CI for sensitivity is due to the smaller sample size. The specificity was also high at 100% (CI: 96.0% to 100%), indicating perfect performance in correctly identifying patients without the disease.

Lastly, the overall diagnostic performance for sex cord stromal tumours, calculated separately, showed 96.8% accuracy (CI: 91.1% to 99.3%), 100% sensitivity (CI: 59.0% to 100%), and 96.6% specificity (CI: 90.2% to 99.3%), all pointing to excellent reliability of the frozen section in identifying these rare tumours. (**Table 2**)

The frozen section diagnosis shows robust diagnostic accuracy for benign epithelial, germ cell and sex cord stromal tumours, with some limitations in sensitivity for borderline and malignant epithelial tumours. The high specificity across all tumour types supports its clinical utility in intraoperative decision-making.

The IFS and formalin sections had an 88.4% concordance (11 cases were discordant). (**Table 3**) On IFS, two borderline epithelial tumours, one serous and one mucinous, were misdiagnosed as benign. (**Figure 1**) Borderline ovarian tumours were a prominent source of diagnostic discrepancy. Frozen section evaluation identified thirteen cases as borderline tumours. On final histology, six of these were categorized as malignant tumours (4 mucinous and 2 serous). (**Figure 2**) Due to an interpretive error, three malignant epithelial tumours were identified as granulosa cell tumours on IFS. (**Figure 3**)

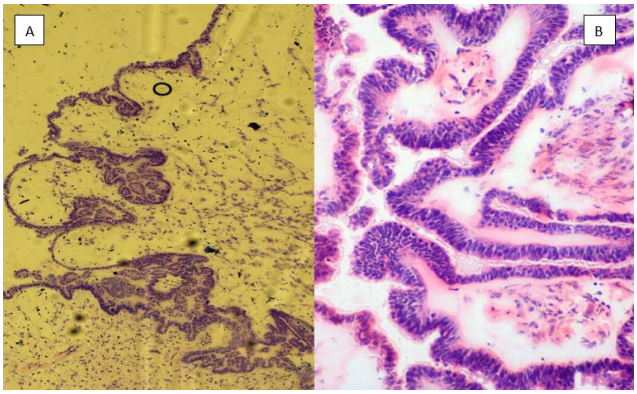

Figure 1: A): Diagnosed as Benign serous cystadenoma on IFS: Sections show a cyst wall lined by cuboidal to columnar epithelium overlying edematous stroma. (H&E, x100); **B):** Areas of Borderline serous cystadenoma on paraffin section: Sections show papillae with fibro vascular core lined by pseudostratified columnar epithelium displaying mild atypia. No evidence of invasion seen. (H&E, x200)

Table 2: Diagnostic accuracy of frozen section diagnosis

	Epithelial Tumours			Germ cell tumours (CI)	Sex cord stromal tumours (CI)
	Benign (CI)	Borderline (CI)	Malignant (CI)		
Accuracy	97.9% (93.6%, 99.7%)	91.6% (84.25%, 95.67%)	84.21% (75.6%, 90.2%)	100% (96.2%, 100%)	96.8% (91.1%, 99.3%)
Sensitivity	100% (93.5%, 100%)	53.85% (29.14%, 76.79%)	67.9% (48.9%, 83.2%)	100% (47.8%, 100%)	100% (59.0%, 100%)
Specificity	95.9% (86.0%, 99.3%)	97.56% (91.54%, 99.33%)	91.04% (81.4%, 96.3%)	100% (96.0%, 100%)	96.6% (90.2%, 99.3%)

Table 3: Discordant cases (11 cases- 11.6%)

Number of cases	IFS Diagnosis	Paraffin Section Diagnosis
1	Serous Cystadenoma	Serous Borderline tumour
1	Mucinous Cystadenoma	Mucinous Borderline Tumour
4	Mucinous Borderline tumour	Mucinous Carcinoma
2	Serous Borderline tumour	Serous Carcinoma
3	Granulosa cell tumour	Serous Carcinoma

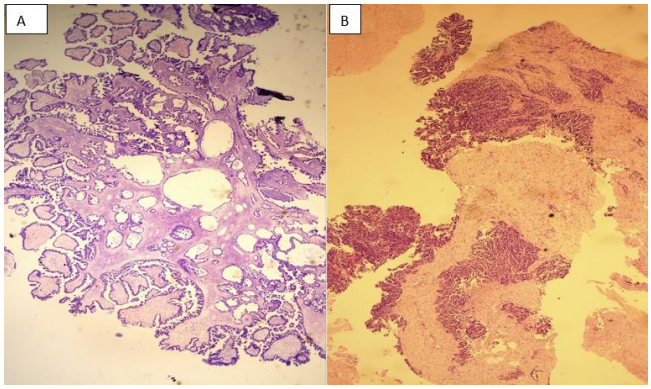

Figure 2: A): Borderline serous cystadenoma diagnosed on IFS: Sections show hierarchically branching papillae with fibro vascular core lined by columnar epithelium showing mild nuclear atypia. No evidence of invasion seen. (H&E, x100)**; B):** Borderline serous cystadenoma with invasion diagnosed on paraffin section: Sections show branching papillae with fibro vascular core lined by pseudostratified columnar epithelium showing mild nuclear atypia. Areas of invasion into the underlying stroma are noted. (H&E, x100)

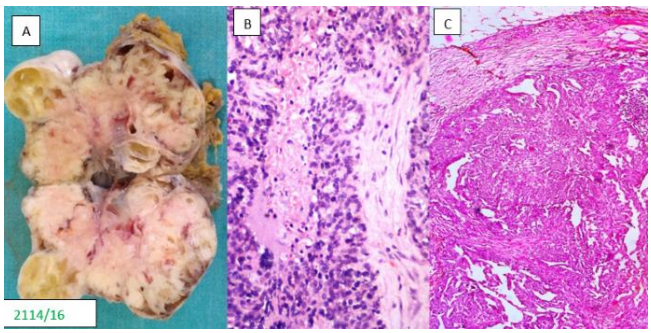

Figure 3: A): Gross specimen of serous cystadenocarcinoma: Solid cystic ovarian mass with papillary excrescences; **B):** Underdiagnosed as Granulosa cell tumour on frozen section: Sections show tumour cells predominantly in solid pattern with low grade bland nuclei with acinar structures resembling call exner bodies. (H&E, x200)**; C):** Serous cystadenocarcinoma on paraffin section: Sections show tumour cells predominantly in solid pattern with low grade bland nuclei. (H&E, x100)

4. Discussion

Ovarian cancer is a leading cause of death and morbidity in women around the world.[4] Differentiating benign from malignant neoplasms is of prime importance, as it ensures proper management of the patient.[10] Imaging and tumour markers are marginally useful in distinguishing them preoperatively.[5] As a result, IFS of ovarian neoplasms may be useful for surgeons in selecting an adequate surgical strategy and avoiding both under and overtreatment.[5,10]

IFS is a technique that helps in diagnosis and has been used to guide surgical treatment decisions for more than a century. However, only two decades ago, tests on its diagnostic accuracy were conducted. In gynaecological oncology, the most prevalent indication for IFS is the assessment of ovarian masses.[7]

The overall diagnostic accuracy of IFS has been reported to range from 83.7% to 98.9% in various studies, and it was 88.4% (84/95) in the current study.[1,5,7,10,11] (**Table 4**)

According to our study, benign neoplasms had a sensitivity of 100% and specificity of 95.9%. It is consistent with the majority of studies, with sensitivity and specificity ranging from 95% to 100% and 85% to 100%, respectively.[1,5,10,11-15] The diagnostic accuracy for benign neoplasms was 97.9%. Among the benign neoplasms, epithelial tumours were most frequently encountered, comprising 48.4% of the cases. They included serous cystadenoma, mucinous cystadenoma, and Brenner tumour. In IFS, sex cord stromal tumours, such as fibrothecoma were accurately identified. The detecti on of mature cystic teratoma and struma ovarii assisted in performing the surgery to a minimum. Frozen section examination has a high precision in diagnosing benign conditions. The macroscopic features of these neoplasms were apparent and proved to be extremely useful in IFS interpretation.

A diagnostic difference was noted in two of the 48 cases that were described as benign on frozen section. In both cases, along with the primary benign element, there were isolated borderline areas and were underdiagnosed as benign due to sampling error, which contributed to the low specificity (**Figure 1**).

For malignant neoplasms, the diagnostic accuracy was 84.21%. We found that IFS is best at distinguishing benign from malignant tumours, since sensitivity and specificity was high for benign and malignant tumours, respectively.

In majority of studies, when malignancies were diagnosed using frozen section, sensitivity and specificity were found to vary between 71–100% and 96–100%, respectively. In the current study for malignant tumours, the sensitivity was 67.9% and the specificity was 91.04%. Low sensitivity of 69.2% and specificity of 89.2% was also recorded by Arshad et al., but the study by Shahmoradi et al. exhibited 93.3% sensitivity and 100% specificity. The excellent specificity of an intraoperative frozen section in identifying ovarian cancer makes it extremely useful. Because of the high specificity, the surgeon will be able to accurately determine the best surgical procedure.[10,12,16] Due to sampling error, freezing artifacts, and a lack of interpretation abilities, the sensitivity was low. Frozen sections have been reported by surgical pathologists with varying degrees of experience, which could also be the cause of the low sensitivity. This is similar to the 43.8 percent underdiagnoses found by Stewart and colleagues, illustrating the difficulty of IFS.[16]

Table 4: Accuracy of IFS diagnosis in comparison with other studies

Authors **No. of cases**		**Present study (95)**	**Arshad et al[12] (92)**	**Palakkan et al.[5] (60)**	**Shahmarodi et al[10] (193)**	**Arora et al[1] (292)**	**Yoshida et al[14] (871)**	**Morton et al[16] (277)**	**Açikalin et al[18] (282)**	**Yazdani et al.[11] (126)**
Place of study		Mysuru, India	Kedah, Malaysia	Malappuram, India	Tehran, Iran	Ahmedabad, India	Tokyo, Japan	Sydney, Australia	Adana, Turkey	Babol, Iran
Accuracy		88.4	83.7	93	98.9	96.2	93.8	-	96.5	94.4
Sensitivity (%)	Benign	100	95.6	95	100	100	99.6	100	97.5	99.1
	Borderline	53.85	76.2	75	89	65	85.6	75.6	95.8	80
	Malignant	67.9	69.2	90	93.3	96.7	93.2	75.9	95.6	66.7
Specificity (%)	Benign	95.9	85.1	100	97	94.3	96.7	88.2	97.5	90
	Borderline	97.56	88.7	94	99	99.3	95.5	91.5	97.6	95.9
	Malignant	91.04	100	97	100	99.4	99.4	100	100	100

The IFS and formalin sections had a 88.4% concordance. On IFS, two borderline epithelial tumours, one serous and one mucinous, were misdiagnosed as benign in the current study. The stratification of the lining epithelium in serous tumour and complex architecture in mucinous tumour were not evident in the frozen section, which was owing to sampling error. In this study, borderline ovarian tumours were a prominent source of diagnostic discrepancy. Frozen section evaluation identified thirteen cases as borderline tumours. On final histology, six of these were categorized as malignant tumours (4 mucinous and 2 serous) (**Figure 2**). Small areas of low-grade serous carcinoma were noted within serous tumours but were not sampled during frozen section evaluation. Due to restricted sampling during frozen section examination, small carcinoma foci may get skipped. Because of the large size of the tumours and the varied histology of malignant, borderline, and benign foci within the given tumour, borderline mucinous tumours are known for diagnostic discrepancies. One of the contributing aspects to the underdiagnoses was the reporting pathologists' lack of experience.

Rigorous gross examination, meticulous sampling from multiple areas (solid areas, areas of necrosis and papillae) in large tumours and reporting of frozen section by experienced pathologists will improve the accuracy in diagnosis of borderline ovarian tumours.

Due to an interpretive error, three malignant epithelial tumours were identified as granulosa cell tumours on IFS. The patients were aged 48, 60, 54 years respectively. The gross specimens showed solid and cystic areas which can be seen in both malignant epithelial tumours and granulosa cell tumours. The low grade bland nuclear characteristics, the acinar structures simulating call-exner bodies and predominant solid pattern in frozen section prevented the detection of invasive epithelial carcinoma, and we believe this to be a pitfall of frozen section (**Figure 3**). These cases, however, were deferred for histological confirmation, and were later classified as serous cystadeno carcinoma. A correlation with tumour markers CA-125 and inhibin may prove to be useful. However, our experience is limited as it was not available in our study.

Utilization of frozen section for diagnosing borderline tumours is challenging but critical, because treatment options vary depending on the patient's age, including hysterectomy and bilateral salpingo-oopherectomy for older patients and fertility-preserving surgery for those in reproductive age. Inspection for the presence of necrosis, hemorrhage, solid/ cystic/ papillary areas, cyst contents, involvement of capsule and size of the tumour can be useful to limit the number of incorrect diagnoses.

Despite the utility of gross features, frozen section examination has some drawbacks, including examination of restricted sections, thick sections as compared to permanent ones, and freezing artifacts that conceal delicate morphological features. The key sources of differences in diagnosis in our study were heterogeneity of the lesions, faulty sampling, low grade nuclear features, freezing artifacts leading to interpretation errors and lack of experience.

The sensitivity for borderline tumours has been reported to range from 65% to 99.2% in various studies.[1,5,10,12,14] In accordance with previous studies in predicting benign and malignant ovarian tumours, frozen section exhibited good sensitivity, and specificity, but in case of borderline tumours, sensitivity was low.[3,10,12,16]

According to several studies, the diagnostic accuracy of IFS of ovarian cancers ranges from 71.9 to 97%.[1,5,10,12,14,16,18] Ratnavelu et al. found that the concordance rates between FS and final diagnosis were 94%, 79%, and 99% for benign, borderline, and malignant tumours, respectively, in a quantitative systematic analysis of 38 papers published in 2016.[17]

Numerous factors, which include presence of focal areas of invasion in a huge borderline tumour, necessitating multiple frozen section samples for identification have been attributed to the erroneous diagnosis of borderline tumours by frozen section examination. Because borderline tumours of ovary have a low accuracy rate, rigorous gross examination and meticulous sampling are required. Despite this, interpretation errors might occur due to morphological complexity, technical artifacts, and pathologists' lack of experience. In most studies, sampling error was cited as the primary cause of diagnostic discrepancy.

The diagnosis may be influenced by the dimensions of tumour, evidence of solid areas, and pre-operative cancer antigen (CA 125) value. Palakkan et al., on the other hand, discovered elevated CA 125 levels was not statistically linked to ovarian cancer.[5] Because CA 125 levels were not available in all of the individuals in our study, they were not evaluated. Despite its low sensitivity and weak specificity, CA 125 is still the most extensively utilised biological marker for identification and monitoring clinically. Ultrasonography, computed tomography (CT) scan, and magnetic resonance imaging (MRI) are few of the other investigations utilized to determine the probability of malignancy in females with mass in the adnexa. None of these techniques, however, can properly foresee the malignant characteristics of tumour in ovary. An accurate FS diagnosis is critical in benign tumours in order to circumvent large scale debulking surgeries and perform fertility sparing surgeries. It also prevents insufficient surgery and staging in borderline and malignant tumours.[12] Communication of clinical history and intraoperative observations between the physician and the pathologist is necessary to diagnose accurately, especially in difficult cases.

Kung F et al. conducted an extensive cohort study of 1143 patients, which included benign (716), borderline (133), and malignant (294) tumours. 93.7% accuracy was noted

with 1071 concordant and 72 discordant cases. The IFS for benign diagnoses was 97.2% accurate, 100% sensitive, and 92.51% specific. The overall rate of underdiagnoses was 6.1%, and the rate of over diagnosis was 0.2%. In IFS, none of the benign lesions were misdiagnosed as borderline/ malignant. A somewhat decreased sensitivity but outstanding specificity could be attributed to cautious reporting of IFS.[7]

In a retrospective study of 277 patients conducted in Australia, malignancy was diagnosed with 75.9% sensitivity and 100% specificity, but for borderline cases the PPV was barely 75.32%. They took a firm approach, by classifying tumours with a IFS diagnosis of "at least borderline tumour" as borderline, and a large percentage of these cases (24.7%) were upraised to malignant tumours in the eventual diagnosis. Because these cases were dealt alike intraoperatively, they deemed the diagnoses to be congruent when on IFS, borderline or at least borderline with ultimate malignant pathology diagnosis was made.[16]

Kung F, et al. compared the frozen slides of 70 patients who were underdiagnosed, with the paraffin slides and noted sampling errors in 47% (33/70) of the cases, with the main reasons being mucinous tumour heterogeneity and teratomas, interpretation mistakes and technical problems, such as under-exposure of tissue in the IFS slides.[7]

According to a meta-analytical study which compared IFS and final histopathology diagnosis of ovarian diseases, sensitivity of IFS for benign tumours varied between 65% and 97% and it stretched between 71% and 100% for malignancy. The specificity, according to the same study, was much higher which ranged from 97% to 100% for benign and 98.3% to 100% for malignant tumours. However, in case of borderline tumours, circumstances were different. The IFS in current study had 65% sensitivity and 86.7% positive predictive value. It is evident that, in comparison to final pathological assessment, time is insufficient to take a significant number of sections during the frozen study, and numerous slices may be required in large tumours, which is impracticable in short duration.[1]

Morton et al. discovered that the discrepancy is linked to tumour size and sample errors. They only looked at mucinous tumours, which were 67.2% and 55.6% sensitive for benign and malignant neoplasms. Tumour size higher than 13 cm and the necessity for four or more frozen sections from the sample were linked to discordant diagnoses. They discovered that IFS is highly accurate and specific for malignant ovarian cancers.[16]

Borderline mucinous tumours (79.3% positive predictive value) and immature teratoma had the lowest positive predictive value, according to Acikalina. They believe pathologists should be acquainted with the technical problems as well as the types of tumours that should be sampled from representative areas. All cases of germ cell tumours, including one case of immature teratoma, were appropriately diagnosed on IFS in this study.[13,18]

Borderline ovarian cancers, in particular were the centre of attention for a handful of authors. Among the 82 cases (borderline) examined by Gultekin et al., 42.7% had a mucinous histology. In 69.5% of instances, there was agreement with the final diagnosis. 1.2% of the cases were over-diagnosed and 29.3% were under-diagnosed. They hypothecated that size of tumour, presence of solid areas, and CA 125 values measured preoperatively could exert influence on the diagnosis.[19]

Analysis by Pongsuvareeyakul et al. revealed that IFS was 67.2% sensitive for borderline mucinous tumours.[20] In a wider retrospective examination of ovarian tumours by Hashmi et al., 52 out of 622 cases were borderline on frozen section, two of whose diagnoses were revised to serous carcinoma in view of presence of focal regions of invasion encompassing area more than 3mm.[13] They emphasised the need of ovarian tumour sampling and recommended taking careful samples from thick walled regions or solid areas.[11] Morton et al. advised using caution when evaluating borderline tumours, especially in older patients and in mucinous tumours.[16]

According to Bige et al. ovarian pathologies had a high accuracy rate. They concluded that IFS for malignant, borderline and benign tumours were highly sensitive and specific when reported by gynaecologic pathologists rather than non-gynaecologic pathologists.[4]

Small sample size, incomplete radiological and serologic data to correlate and lack of follow up of patients were a few limitations of our study.

Some of the common misdiagnoses on IFS and their reasons have been summarized below:

Table 5: Common misdiagnoses and their reasons

S. No.	Common misdiagnoses	Reasons
1.	Borderline epithelial tumours misdiagnosed as Benign.	1. Sampling error- Restricted sampling in large tumours. 2. Morphologic complexity 3. Thicker sections and freezing artefacts on IFS may conceal delicate morphological features 4. Reporting Pathologist's lack of experience
2.	Malignant epithelial tumours misdiagnosed as Borderline.	
3.	Malignant epithelial tumours misdiagnosed as Granulosa cell tumour	1. Low grade bland nuclear characteristics, the acinar structures simulating call-exner bodies and predominant solid pattern in frozen section 2. Unavailability of tumour markers (CA 125 and Inhibin) for correlation.

5. Conclusion

IFS had a good sensitivity and specificity for the diagnosis of benign and malignant tumours of the ovary. Due to technological aberrations, sampling errors, and a conservative approach in interpretation, borderline and malignant tumours were under-diagnosed. We also believe that pathologists' experience has a role in IFS interpretation, which may have contributed to the inaccuracies. Frozen section is a dependable approach, an accurate and a valuable test when evaluating the patients with suspected ovarian neoplasms intraoperatively. Its findings can lead the way to the nature and scope of surgery to be performed. Augmented sampling from solid areas and areas with thickening of the wall in frozen sections may help to avoid the problems.

6. Source of Funding

None.

7. Conflict of Interest

None.

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