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Original Article

Pathology Section

Role of Frozen Sections in Diagnosing Female Genital Tract Lesions: A Tertiary Centre Study in Chennai, India

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ABSTRACT

Introduction: Female Genital Tract (FGT) malignancies are common with ovarian cancers having high incidence and mortality. The asymptomatic character, difficult location and lack of effective screening methods make Intraoperative Frozen Section (IFS) an effective diagnostic test to guide the surgical decisions.

Aim: To assess the performance of IFS, describe the associated demographic, clinicopathological factors and identify the errors leading to discordance when compared with Permanent Section (PS).

Materials and Methods: A retrospective study of all the consecutive IFS consultations related to FGT lesions received in the Pathology Department between January 2013 to June 2022 was conducted between July 2022 to September 2022 at ESIC Medical College and Hospital, Chennai, Tamil Nadu, India. Cases with IFS deferred until PS section were excluded. The FS and PS reports, demographic, clinicopathological data, Risk of Malignancy Index (RMI), imaging and biochemical records were retrieved. In-depth descriptive analysis of clinicopathological parameters as frequency and percentage, frequency distribution of PS diagnosis, concordant and discordant categorisation, reasons for the discordance were described and the diagnostic accuracy of Frozen Section (FS) tool was calculated. Mean, Frequency (n) and percentage (%) analysis was done for the complete collected data.

Results: Out of the total 35 FGT related IFS consultations received, 32 (91.43%) was for Ovarian Tumours (OT), which included 26 surface epithelial tumours, three sex cord stromal tumours, two germ cell tumours, one Krukenberg tumour. Two cases were deferred due to extensive haemorrhage and infarction. Confirmation of the diagnosis was the most common indication. The mean size of the OT (n=32) was 13 cm and ranged from 2 to 31 cm. RMI was low (<25) in 14 (44%, n=32), intermediate (25-250) in 10 (31%, n=32) and high (>250) in 8 (25%, n=32) of OT. The diagnostic accuracy of FS of all the FGT cases (n=35) was 85.71% (n=35 FGT cases) with an error rate of 14.29% was observed. Five OT cases had discordant FS diagnosis, 3 cases due to sampling error and mis-interpretation error in the remaining 2 cases. Artefacts like poor morphology due to tissue freezing, nucleomegaly, poor sectioning and section folding were observed in the discordant cases.

Conclusions: Correct use of IFS along with careful preoperative work-up will help the surgeon intraoperatively. A good rapport among clinicians, pathologists and laboratory personnel will aid to improve the diagnostic accuracy. Periodic assessment of IFS tool is necessary as a quality check.

Keywords: Diagnostic test, Ovarian cancers, Sampling error

INTRODUCTION

Malignancies of ovaries, adnexae, uterus, cervix and fallopian tubes are the eighth most common tumours among females [1]. The Ovarian Tumors (OT) high mortality and incidence among all gynaecological malignancies [2]. Unlike cervical cancers the asymptomatic character, difficult anatomical location and scarcity of potent screening methods, OT often present at stage III [1,3]. Transvaginal Sonography and tumour marker estimation are effective screening tools for OT but has limitations in discriminating benign, borderline and malignant categories [3]. CA 125 levels are also not specific and can be normal in early OT while elevated in benign conditions like endometriosis and pelvic inflammatory diseases [4]. RMI and Assessment of Different Neoplasias in the adnexa (ADNEX) model are available to predict the malignant risk of OT, nonetheless surgeons may come across OT of suspicious malignant nature, and IFS can help to determine the appropriate course of management [3,5-7].

This diagnostic tool came into use more than 100 years back and the historic centennial occasion was celebrated by Gal AA and Cagle PT in a JAMA article dated 2005 [8]. Studies have identified the shortcomings of IFS especially in borderline and mucinous OT however, correct use of IFS will help to improve its diagnostic accuracy [4,9,10]. The aim of the present study was to assess the performance of IFS in FGT lesions for the first time at ESIC Medical College and PGIMSR, Chennai, Tamil Nadu, India, describe the associated demographic, clinico-pathological factors and identify the errors leading to discordance with the PS examination.

MATERIALS AND METHODS

The retrospective study was conducted between July 2022 to September 2022 for the first time including all the IFS consultations requested with respect to FGT lesions that were received between January 2013 to June 2022 in the Department of Pathology at ESIC Medical College and hospital, Chennai, Tamil Nadu, India. Cases which were deferred from IFS examination and were proceeded to PS examination were excluded. The Institutional Ethics Committee approval (IEC Number: IEC/2022/1/24) was obtained.

Procedure

The FS and PS reports, demographic, clinicopathologic data, imaging, biochemical data were retrieved. RMI {calculated from scores of Ultrasonography (USG) findings, menopausal status and absolute serum Cancer Antigen (CA) 125 levels (normal value 0 to 35 U/mL)}, number of IFS blocks and Turnaround Time (TAT) was also noted [5,6,11]. The USG findings included solid areas, bilaterality, multilocularity, ascites and intra-abdominal metastasis.

RMI scores was categorised into.

- Low (<25),
- Intermediate (25 to 250)
- High (>250) risk of ovarian malignancy [5,6].

Unfixed tissue samples were sent in a clean container properly labelled along with requisition form carrying necessary details and time of receipt noted. Gross examination and sections from representative areas were processed. Cryostat (Leica, CM1850, Germany) was used and 4-micron thick sections were cut at temperature between -18°C to -24°C. Sections were taken on albuminised glass slide, fixed and stained with Haematoxylin and Eosin (H&E). The consensus regarding diagnosis was reached by a team of pathologists and conveyed to operating surgeon and Turnaround Time (TAT). was noted down. The FS remains were then formalin fixed and processed with paraffin embedding. The results of FS and PS were compared considering the latter as gold standard.

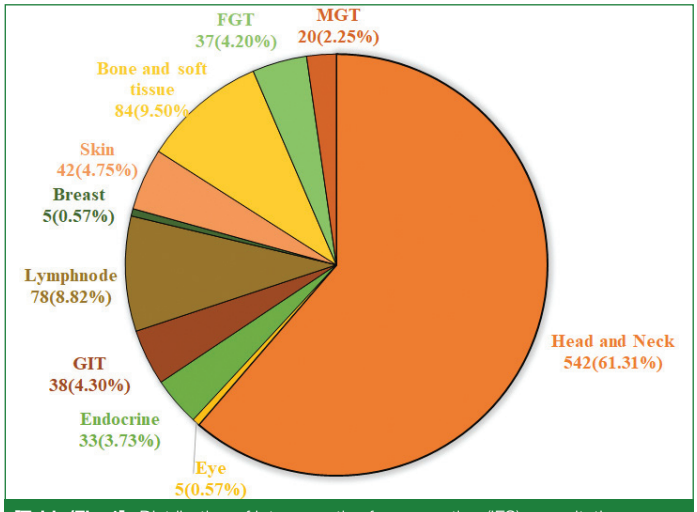
The number of IFS requests related to FGT lesions was noted and the frequency of different PS diagnosis was tabulated. The results were categorised into concordant (FS diagnosis was in accordance with the PS diagnosis) and discordant (FS diagnosis was not in accordance with the PS diagnosis). Discordant cases were considered under-diagnosed if PS diagnosis was malignant but IFS diagnosis was benign or borderline (ovarian cases), or if PS diagnosis was borderline (ovarian cases) but FS diagnosis was benign. It was overdiagnosed if PS diagnosis was benign but FS diagnosis was borderline (ovarian cases) or malignant, or if the final diagnosis was borderline but the IFS diagnosis was malignant. The reasons for discordance were discussed in detail.

STATISTICAL ANALYSIS

The diagnostic accuracy was calculated using percentage accuracy/ percentage error method {IFS diagnosis as the observed value (V1) and PS diagnosis as the accepted true value (V2), percent error is= (V1-V2)/V2 x 100 and percent accuracy is 100 minus percent error}. The clinico-pathological parameters were dealt with detailed descriptive data analysis as frequency and percentages.

RESULTS

During the study period, an overall IFS consultation of 884 for various organs were received, of which 37(4%) were related to FGT lesions [Table/Fig-1]. Two of the 37 cases were deferred to PS; in one case it was due to presence of extensive haemorrhage and infarction while the other was due to absence of any discrete lining. Out of the 35 FGT consultations. 32 (91.42%) were requested for OT, while 3 (8.58%) cases, 1 each for examination of endometrial atypia, leiomyoma, and pelvic lymph node examination was consulted [Table/Fig-1].



[Table/Fig-1]: Distribution of intraoperative frozen section (IFS) consultations received (Total=884).
GIT: Gastrointestinal system; FGT: Female genital tract; MGT: Male genital tract

Clinicopathological features [Table/Fig-2]: The present study group had OT patients (n=32) from the third to the seventh decade. The youngest was 26-year-old while eldest was 67-year-old. The mean age was 40.5 years with maximum number of patients belonged to the 25-45 years age group. Twenty-three (72%) patients with OT were pre-menopausal while 9 (28%) had achieved their menopause. The most common presenting symptom for the ovarian lesion was pain abdomen observed in 23 (72%) cases. The other major complaints were, mass abdomen, loss of weight and appetite, in the descending order of frequency. Majority 27 (84.4%) of OT were unilateral in location and 5 (15.6%) cases were bilateral.

S. no	Parameters	Categorisation	Frequency
1.	Age	25 to 45	22 (69%)
		46 to 65	9 (28%)
		66 to 85	1 (3%)
2.	Menopausal status	Pre-menopausal	23 (72%)
		Post-menopausal	9 (28%)
3.	Presenting symptoms	Pain abdomen	23 (72%)
		Mass abdomen	7 (22%)
		Loss of weight and appetite	2 (6%)
4.	Laterality	Unilateral	27 (84%)
		Bilateral	5 (16%)
5.	Ascites	Yes	29 (91%)
		No	3 (9%)
6.	Risk of Malignancy Index (RMI)	Low (<25)	14 (44%)
		Intermediate (25-250)	10 (31%)
		High (>250)	8 (25%)
7.	Tumour size (cm)	2 to 4.9	6 (19%)
		5 to 14.9	17 (53%)
		>15	9 (28%)
8.	Solid/cystic	Purely cystic	21 (65.6%)
		Cystic with solid areas	11 (34.4%)
9.	Loculations	Uniloculated	23 (71.9%)
		Multiloculated	9 (28.1%)
10.	Turnaround time (TAT)	20 to 30 minutes	27 (84%)
		30 to 40 minutes	5 (16%)

[Table/Fig-2]: Clinicopathological parameters of frozen section consultations for ovarian tumours n=32 lesions.

Ascites was present in 3 (9.4%) patients of which 2 (6.3%) were malignant and the remaining one was fibrothecoma. In the present study, CA 125 levels were raised above 35 U/ml in all 3 (3/32, 9.38%) of borderline tumours and 3 (9.38%) out of 4 malignant OT. RMI was low (<25) in 14 (44%) of the OT while it was intermediate (25-250) in 10 (31%) and high (>250) in 8 (25%) of the tumours. Out of the 32 OT, majority, 17 (53.13%) were between 5 to 14 cm in maximum dimension. In 9 (28.13%) patients the tumour size was more than 14 cm while 6 (18.75%) cases had tumour size in the range of 2 to 4 cm. The mean size of OT (n=32) was 13 cm and ranged from 2 to 31 cm. It was observed that 21 (65.6%) were purely cystic and 11 (34.4%) showed evidence of solid portions. Among the 4(12.5%) malignant ovarian neoplasms, 2(6.3%) had solid areas while the other 2(6.3%) were purely cystic. Multiloculations were noted in 23(71.9%) of the OT while the rest 9(28.1%) were uniloculated. All the 4(12.5%) malignant tumours showed multilocualtions with solid cum cystic areas on the cut section. The TAT was 20 to 30 minutes in 27 (84%) cases while the remaining 5 (16%) cases it was 30 to 40 minutes.

Distribution of diagnosis and diagnostic accuracy of FS [Table/Fig-3]: The distribution of the various FGT diagnosis (n=35) as per PS examination were 26 (74.29%) ovarian surface epithelial

tumours, 3 (8.57%) sex cord stromal tumours, 2 (5.71%) germ cell tumours, 1 (2.86%) Krukenberg tumours due to signet ring cell adenocarcinomatous deposits, 2 (5.71%) uterine lesions composed of endometrial atypia and leiomyoma confirmation and finally a lymph node examination for staging [Table/Fig-3]. The consultations from other FGT areas included 2 (5.71%) uterine lesions (one for hyperplastic endometrium to rule out atypia and one for leiomyoma which was radiologically suggested as malignant tumour due to its increased vascularity and 1 (2.86%) lymph node consultation for intraoperative staging purpose [Table/Fig-3]. Out of the 26 (74.29%) ovarian surface epithelial tumours, 12 (34.29%) were benign serous, 8(22.86%) benign mucinous, 2 (5.71%) borderline mucinous, 1(2.86%) borderline serous, 2 (5.71%) malignant mucinous adenocarcinomas and 1 (2.86%) clear cell carcinoma of ovary [Table/Fig-3].

Histopathology diagnosis			Number (n=35)	Frequency
Epithelial tumours	Serous	Benign	12	34.29%
		Borderline	1	2.86%
	Mucinous	Benign	8	22.86%
		Borderline	2	5.71%
		Malignant	2	5.71%
	Clear cell carcinoma		1	2.86%
Sex-cord stromal tumours	Fibroma		1	2.86%
	Fibrothecoma		2	5.71%
Germ cell tumours	Teratoma		2	5.71%
Krukenberg tumour			1	2.86%
Uterine lesions			2	5.71%
Lymphnode for staging			1	2.86%

[Table/Fig-3]: Distribution of Permanent Section (PS) diagnosis of FGT cases (n=35).

The FS diagnosis of 32 OT were 27(84.4%) benign, 3(9.4%) borderline and 2(6.3%) malignant in nature, which was corrected to 25(78.1%) benign, 3(9.4%) borderline and 4 (12.5%) malignant on PS examination [Table/Fig-4]. The FS diagnostic accuracy and percent error was calculated as follows, using the formula (V1-V2)/V2x100 where V1 is the observed discordant IFS cases (V1=5) and V2 is the PS diagnosis as the accepted true value, being the gold standard (V2=35), therefore the percent error is= (V1-V2)/V2 x 100, 14.29% and percent diagnostic accuracy is 100 minus percent error, 85.71%. Out of the 5 discordant cases, two were diagnosed as benign mucinous tumour on FS section which was correctly diagnosed as borderline mucinous tumour on PS examination. This underdiagnosis was attributed to the sampling error during FS processing and a similar error due to tissue sampling was observed in a case of Krukenberg tumour. Interpretation error was noted in a case of mucinous cystadenocarcinoma which was incorrectly reported as borderline mucinous cystadenoma. A borderline serous cystadenoma on FS was re-classified on permanent histopathological examination as benign serous tumour [Table/Fig-5,6].

Site	Frozen Section (FS) diagnosis	Final histopathological diagnosis (Paraffin embedded) Ovary n=32 (91.4%)		
		Benign	Borderline	Malignant
Ovary n=32 (91.4%)	Benign (n=27)	24 (CD)	2 (DD)	1 (DD)
	Borderline (n=3)	1 (DD)	1 (CD)	1 (DD)
	Malignant (n=2)	0	0	2 (CD)
	Total (n=32)	25	3	4
Other FGT frozen section consultations n=3 (8.6%)	Benign (n=3)	3 (CD)	0	
Overall diagnostic accuracy-85.71% (n=35)				

[Table/Fig-4]: Concordant (CD) and discordant (DD) cases of all the FGT related frozen section consultations (n=35) in comparison with Permanent Section (PS) final diagnosis with overall diagnostic accuracy (n=35).

DISCUSSION

The IFS histopathological reporting is a great boon for the surgeons as it paves way to select the best possible surgical management and avoid both under and over-treatment [3]. Benign lesions, some borderline lesions and rarely malignant OT are managed conservatively especially if the patients are young and wish to preserve their fertility [3]. Nonetheless, majority of the borderline and malignant tumours are surgically managed through pelvic clearance, omentectomy and appropriate staging procedure [3] Hence, the judicious use of IFS is warranted to discriminate between the benign, borderline and malignant ovarian lesions, to confirm normal ovarian histology in doubtful cases, staging purpose, identification of metastatic lesions or infectious aetiology [3,12]. The present study shares the experience of the IFS usage in FGT lesions.

The patients under study with ovarian lesions were in the third to the seventh decade with bulk of them being in the age group of 25 to 45 years 22 cases (69%). The youngest patient in the present study was 26-year-old and the eldest was of 67-year-old [Table/Fig-2]. The mean age for benign, borderline and malignant OT was 41 years, 40 years and 47 years, respectively.

Sonological characteristics [Table/Fig-2]: In the present study, majority (17/32, 53%) of the OT were in the size range of 5 to 14.9 cm with 9/32, 28% of them >15 cm and 6/32, 19% were between 2 to 4.9 cm in maximum dimension. Features such as irregular contour, ascites, presence of atleast four papillary structures, multilocularity, largest diameter of atleast 10 cm and a high colour content on colour doppler have been used in the analysis for their value in predicting the malignant nature of ovarian lesions [13]. All borderline (3/32, 9.4%) and malignant tumours (4/32, 12.5%) were more than 15 cm in maximum dimension with multilocularity and focal presence of solid areas. Ascites was present in three (3/32, 9.4%) cases of which two were malignant mucinous cystadenocarcinomas and one fibrothecoma. OT which were greater that 9 cm in size, bilateral, multilocular with solid areas were found to have increased risk of malignancy in a study conducted by Minaretzis D et al., 1994 [14].

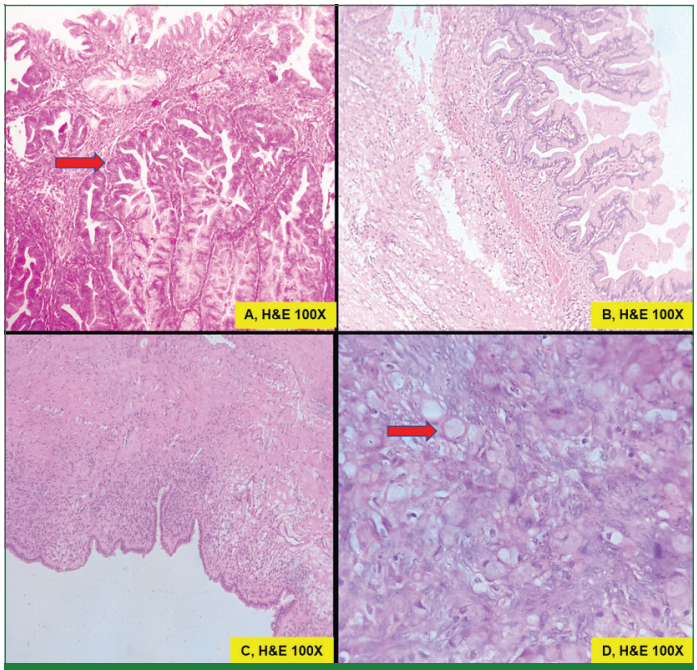
Tumour marker-CA-125 [Table/Fig-2]: The CA-125 is a membrane-bound protein at cell surface that go through metaplasia into Müllerian-type epithelium or are also released into body fluids [15]. It is used for the early detection and disease monitoring in ovarian cancer [15]. It is also elevated in breast cancer, mesothelioma, non Hodgkin lymphoma, gastric cancer, leiomyoma and leiomyosarcoma of gastrointestinal origin [15]. In benign conditions like endometriosis, pregnancy, ovulatory cycles, liver diseases, congestive heart failure and infectious disease such as tuberculosis the marker is elevated [15]. Elevated CA-125 has been observed in about 50% of patients with Stage I OT [16]. In the present study, CA-125 levels were raised above 35 U/ml in all 3(3/32, 9.38%) of borderline tumours and 3(9.38%) out of 4 malignant OT. Its level was found raised above 35U/ml in 22% of benign and 78% of malignant ovarian masses in the study conducted by Vasilev SA et al., [17]. In the present study, the authors observed 45% of the benign epithelial tumours also had a raised CA-125 level and for this reason, it cannot be used with certainty to distinguish between a malignant and a benign OT [3,15]. The common indications for IFS are identifying the nature and extent of lesion, surgical margins evaluation, ascertaining tissue adequacy for diagnosis and help the surgeon to choose the suitable surgical treatment thereby decreasing the need for reintervention [18]. In the present study, the most common indication was to identify the nature of the OT.

Accuracy and causes of discordant of FS diagnosis:

Five OT had discordant FS reports with the PS diagnosis [Table/Fig-4-6]:

S. no	Sample type	Frozen section report	Final histopathology report	Cause of the error	Over/Under diagnosis
1.	Ovarian tumour for primary diagnosis	Borderline mucinous tumour	Mucinous adenocarcinoma	Interpretation error	Underdiagnosis
2.	Ovarian tumour for primary diagnosis	Benign mucinous tumour	Borderline mucinous tumour	Sampling error	Underdiagnosis
3.	Ovarian tumour for primary diagnosis	Benign mucinous tumour	Borderline mucinous tumour	Sampling error	Underdiagnosis
4.	Ovarian tumour for primary diagnosis	Borderline serous tumour	Simple serous cystadenoma	Interpretation error	Overdiagnosis
5.	Ovarian tumour for primary diagnosis	Benign stromal tumour	Krukenberg tumour	Sampling error	Underdiagnosis

[Table/Fig-5]: Discordant frozen section Ovarian Tumour (OT) cases with cause of the error.



[Table/Fig-6]: A) Mucinous cystadenocarcinoma, showing expansile invasive fronds with crowded back-to-back arrangement of glands (red arrow) (H&E, 100x); B) Bor-derline mucinous tumour showing intestinal type of mucinous epithelium with mild cytological atypia, proliferative changes and lacks destructive stromal invasion. (H&E, 100X); C) Serous cystadenoma showing cyst wall lined by ciliated cuboidal to columnar epithelium with focal hob nailing and underlying spindle cell stroma.(H&E 100X); D) Krukenberg metastatic tumour showing signet ring cells (red arrow) (H&E 400X). H&E- Haematoxylin and Eosin

Case 1: An underdiagnosis (false negative) of borderline mucinous tumour in FS examination was confirmed as mucinous adenocarcinoma on PS examination. [Table/Fig-6a]. This could be attributed to the interpretation error arising due to FS morphology.

Case 2 and 3: On two occasions an underdiagnosis (false negative) of benign mucinous tumour on FS reporting was corrected as borderline mucinous tumour during further PS examination [Table/Fig-6b]. The reason for underdiagnosis can be ascribed to sampling error where the region showing borderline areas must have not been sectioned during the FS tissue processing.

Case 4: An overdiagnosis (false positive) of borderline serous tumour on FS consultation was rectified to benign serous tumour on permanent tissue study [Table/Fig-6c]. This error can be assigned to interpretation error during FS study.

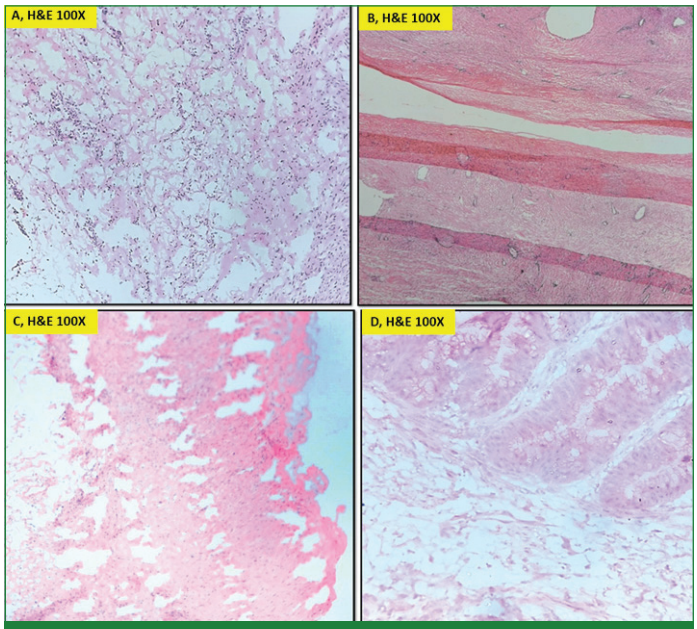
Case 5: The underdiagnosis (false negative) here was due to the FS reporting of the tissue received as benign stromal tumour and finally turned out to be a Krukenberg tumour [Table/Fig-6d]. The cause can be due to the focal tissue sampled by the surgeon intraoperatively and availability of limited history.

The present study had 32 cases of OT with a diagnostic accuracy rate of 85.71% which was comparable to the other studies [Table/Fig-7] [3,6,7,10,19,20,21]. Instructions which suggests to take one section per 10 cm of the mass to overcome sampling errors are available [22-25]. Quality scrutinisation at planned interims by investigating the reason for discordance between FS and the FFPE tissue diagnosis will help the departmental team to recognise the frequent point of fallacies, gauge the existing workload, better the communication level with the surgeons and to get a better idea about the reliability of FS [18]. These checks will help to formulate

S. no.	Study	Diagnostic accuracy of FS tool
1.	Palakkan S et al., 2020, India [3]	93.3%
2.	Kung FY-L et al., 2019, Hong Kong [6]	93.7%
3.	Sukumaran R et al., 2014, India [7]	91.85%
4.	Yarandi F et al., 2008, Iran [10]	93.3%
5.	Subbian A et al., 2013, India [19]	84.25%
6.	Rakshan A et al., 2016, Bangladesh [20]	95.7%
7.	Rose PG et al., 1994, USA [21]	72.7%
8.	Present study 2023	85.71%

[Table/Fig-7]: Comparison of frozen section diagnostic accuracy of the present study with other studies [3,6,7,10,19,20,21].

protocols and take rectifying actions related to lab accreditation [18]. The pre-analytical errors can arise during surgical resection, intraoperative sampling specimen labelling, transportation and sample receiving steps [26]. The analytical errors can occur during tissue grossing, quality of FS, and slide labelling whereas the post-analytical errors depend on the experience of the pathologists and proper report communication [26]. To overcome all the errors at different stages the presence of good communication between the surgical team, FS technical team and the pathologists is of utmost importance [26]. The interpretation errors can be ascribed to factors such as lack/poor quality of morphological details due to freezing of tissue sample enhanced by sectioning artefacts (freezing and folding) [Table/Fig-8]. FS reporting when compared to PS reporting is comparatively more challenging as the general morphology and histological quality is less, which is much more pronounced in oedematous fatty and inflamed tissues [26].



[Table/Fig-8]: Artefacts encountered in frozen sections: A) Freezing artefact (H&E,100X); B) Folding artefact, (H&E,100X); C) Sectioning artefact, (H&E,100X); D) Poor quality of the nuclear morphology in a case of Mucinous adenocarcinoma, ovary (H&E,100X).
H&E: Haematoxylin and eosin

The FS errors have to be frequently monitored and can be reduced with sufficient technical training for the technical personnel, better faculty interactions and using standard quality equipment.

Diligent examination with ordering of additional deeper sections when needed helps to overcome the errors [26,27]. Artefacts in morphology due to tissue freezing such as nucleomegaly can cause difficulties mostly in the presence/typing of a neoplasm [Table/Fig-8]. This issue can be bypassed by mindful examination of the sections at different magnifications, along with the available clinical and radiological data [26]. Prior arrangement for FS, better rapport and periodic meetings with the clinicians will aid in acquiring the necessary clinical details and keep the errors to a minimum [28]. Understanding the limitations of FS as a diagnostic tool and making the clinicians to be aware of this fact will help to better the role of this test [26,29].

The role of accurate FS investigation in fertility preserving surgeries especially in young females is crucial and also has an influence on the morbidity and mortality [24]. Features of benign, borderline and malignant findings can be present in the same mucinous tumours unlike the serous tumours [21,30]. Sections taken during FS may not be from the representative areas within the expected TAT [27]. In a study by Yarandi F et al., morphological intricacies of borderline OT was found to the reason for discordance of it FS reporting [10].

An FS consultation can be deferred if the situation warrants and the surgeon should be asked to go ahead with the surgical management in the absence of the report [31]. In the two deferred cases in the present study, diagnosis was made in the in the final complete specimens. TAT banks on aspects like sample processing time and reporting time [31]. Novis DA and Zarbo RJ conducted a study where the FS, TAT of 700 hospitals were compared and it was noted that 90% of TAT was within 20 minutes, the time which would be sustainable for majority of the centres [32]. In the present study, 25 OT cases (24/35, 71.43% n=32) of the consultations had a TAT of around 20 to 30 minutes, whereas in the remaining 10 cases (28.57%) it was between 30 to 40 minutes [Table/Fig-2]. The delay can be due to the complexity of the lesions warranting more/better sections and discussions. An average TAT of around 20 minutes should be the target in FS labs for the best usage of FS as an investigative tool [28,32]. FS reporting must be quick for the effective usage of this valuable investigation [31].

Some previous studies have reported an overall accuracy in the range of 72.7%-95.7% [Table/Fig-7] [3,6,7,10,19,20,21]. Larger size of the OT, multilocularity especially in the mucinous variety, focal presence of the findings is some of the determining factors of diagnostic accuracy of FS [24].

Limitation(s)

The number of IFS consultations was less which may be attributed to the reason that the insured patients and their relatives are treated under the employee state insurance scheme. Specificity, sensitivity, positive and negative predictive value of the technique in relation to the OT categories was not preferred.

CONCLUSION(S)

The analysis of the results of this study showed the reasons for the discordance in FS diagnosis of OT in the department and allowed the team to take necessary precautions to overcome the errors identified. FS has to be always dealt with caution, especially in large borderline OT. The clinicians can use the FS diagnosis along with proper history taking, careful physical examination, biochemical and radiological findings to plan the operative management. A proper consent with detailed counselling of the patient is necessary to take decisions intraoperatively. A good rapport among the clinicians, pathologists and the laboratory technical personnel will reduce the FS errors.

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