

**Diagnostic Accuracy of Frozen Section Samples of Ovarian Tumors with Histopathology of Surgical Specimens.**Nataraj Y Sannappanavar<sup>1</sup>, Basavaraj Ankalkoti<sup>2</sup>, Savitha G<sup>3</sup>, A Sravan Reddy<sup>4</sup>, Vishrutha KC<sup>5</sup>, Vijaya C<sup>6</sup>, Veerendra Kumar K V<sup>7</sup><sup>1</sup>Assistant Professor, Dept. of Surgical Oncology.<sup>2</sup>Dept of General Surgery, S. Nijalingappa Medical College And RC, Bagalkot.<sup>3</sup>Assitant Professor, Dept. of Obg.<sup>4</sup>Senior Resident, Dept. of Surgical Oncology.<sup>5</sup>Junior Resident, Dept of Obg.<sup>6</sup>Professor and Head of the Department of Pathology.<sup>7</sup>Professor and Head of the Department of Surgical Oncology Saphthagiri, Institute of Medical Sciences and Research Institute.

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**Abstract:****Background:** A pre-operative diagnosis of the nature of early ovarian masses either clinically, imaging or with tumour markers is not always reliable. Intraoperative frozen section is a valuable diagnostic tool in rapid categorization of early ovarian masses limited to the ovaries and thereby helps in planning the surgical management.**Objective:** To categorize ovarian neoplasms into benign, borderline and malignant on frozen sections. To determine the accuracy of the frozen diagnosis with that of surgical specimens. Materials and Methods: Frozen sections done on 46 clinically and radiologically diagnosed ovarian tumours were compared with final histopathologic diagnosis from January 2019 to December 2020 in the Department of Pathology.**Results:** Frozen section diagnosis of 46 ovarian specimens, showed 40(86.9%) benign tumors, 4 (8.6%) borderline tumors and 2(4.34%) as malignant tumors. The final histopathologic diagnosis revealed 39 (as benign tumors, 1 as borderline tumors and 2 as malignant tumors. The sensitivity and specificity for benign, borderline and malignant tumors on frozen section were 100%, 85.7%,66.6% and 95.3%, 40%, 100%, respectively. The positive and the negative predictive value for benign, borderline and malignant tumors were 97.5%, 100%, 50% and 97.6%, 100%,93.18%, respectively. The overall accuracy was 97.6%. There were no false-positive cases but 1 case was false negative on frozen. The 1 discordant case was serous borderline ovarian neoplasm.**Conclusion:** With an overall accuracy of 97.6% frozen section is valuable for intraoperative diagnosis of ovarian tumors but has limitations in serous borderline ovarian neoplasm in our study.This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.**Introduction**

Ovarian neoplasms are a significant cause of female morbidity and mortality [1]. Ovarian malignancy accounts for nearly 25% gynecological cancers and 50% of all deaths from female genital cancers [2]. In early stages, it is important to distinguish between malignant and benign pathology before and during surgery to ensure optimal management of the patient with an adnexal mass i.e., the extent of surgery. Since 1891, this method i.e., frozen section, has been known, but studies on its diagnostic accuracy were performed just two decades ago [3].

Frozen section is commonly used for intraoperative assessment of patients with ovarian tumors in order to provide instructions for effective surgical administration. The intraoperative records of frozen tissue taken during surgery are appealing,

because the diagnosis can be provided intraoperatively. Such a diagnosis can notify the surgeon not only of the malignant nature of the ovarian lesion, but also of the potential for metastasis [4]. Diagnostic problems can arise especially in mucinous and borderline tumors due to technical limitations [2]. In order to obtain accurate results, and to reduce the number of deferred cases for complete staging, effective interaction between surgeon and pathologists is needed [5]. Preoperative imaging and tumor markers have only limited value in differentiating between benign, borderline and malignant categories [6]. Intraoperative frozen section examination can enable the surgical oncologist/gynae oncologist team to decide on the type of surgery to be performed in patients with

ovarian tumors, especially when there is a concern about fertility. It provides for a single optimal operating staging technique where indicated, and if not necessary, also for a non-staging procedure. Therefore, the current study is aimed at measuring the diagnostic accuracy of the intraoperative frozen section to be used by surgeons to determine the surgical course of benign and malignant tumors.

#### Materials and Methods:

This retrospective diagnostic accuracy study was conducted in the Department of Surgical Oncology, Department and Obstetrics and Gynecology Department, Sathagiri Institute of Medical Sciences And Research Institute, after being approved by the ethics committee. The case records of patients with ovarian mass who underwent surgery and intraoperatively frozen section assessments between January 2019 to December 2023 were analyzed in this study.

#### Procedures:

Demographic, frozen section and final histopathology Examination (HPE) were reviewed from the medical records. In our hospital, we have facility for frozen section for suspected ovarian cancer cases. The Surgical Oncology surgical team in collaboration with OBG department, informs the laboratory in advance of the need for frozen section. The specimen, once removed, is transported hospital porter directly to the laboratory and handed over to the laboratory staff. The pathologist assigned for frozen section inspects the specimen and, after describing it, takes representative pieces of tissue for frozen section analysis. These are then processed and, after hand staining, are given to the duty pathologist for reporting. The average time taken for the entire procedure (after specimen being received) was approximately 15 minutes. The frozen section diagnosis was deferred, when there

were some suspicious pathologic features of borderline or malignant tumor which were considered not definitely diagnostic.

After the frozen section diagnosis was reported, the ovarian specimens were fixed in 10% formalin overnight and sampled for routine histologic sections. Frozen section diagnoses were compared to the final histologic diagnoses in each case, which were considered as the gold standard. The diagnoses were categorized as benign, borderline and malignant. Agreement of both frozen section and final diagnoses was considered when both diagnoses were identical or were within the same subgroup of malignancy.

#### Statistical Analysis:

The data was entered in MS Excel and analyzed using SPSS version 2.0. The results were expressed in the form of descriptive statistics. Diagnostic parameters including accuracy, sensitivity, specificity, positive and negative predictive values of frozen section for the diagnosis was calculated.

#### Results:

A total of 46 cases of ovarian tumors were examined by intraoperative frozen section and final HPE in this study. Out of these cases of ovarian tumor, 40 were benign, 4 borderline, and 2 malignant tumors after intraoperative frozen section evaluation (Table 1). Among 40 cases of benign tumors reported by intraoperative frozen section, 39 were confirmed in the final HPE. One case confirmed borderline serous cystadenoma tumor in the final HPE. Among 4 cases of borderline detected on frozen section, 2 were malignant on final HPE. In comparison, 2 cases of malignant tumors during frozen section evaluation were confirmed malignant at the final HPE (Table 1).

**Table 1: Comparison between frozen section diagnosis and final histopathological examination**

Frozen section	Final histopathological examination			
	Benign	Borderline	Malignant	Total
Benign	39	1	0	40
Borderline	0	2	2	4
Malignant	0	0	2	2
Total	39	3	4	46

The overall accuracy of intraoperative frozen section diagnosis was 97.6%. The sensitivity of frozen section diagnosis was 100% for benign, 66.6% for borderline and 40% for malignant category, whereas the specificity was 85.7%, 95.3%, and 100%, respectively. The positive

predictive value was 97.5% for benign, 50% for borderline, and 100% for malignant group, and the negative predictive values were 100% for benign, 97.6% for borderline and 93.18% for malignant (Table 2).

**Table 2: Diagnostic value of intraoperative frozen section reporting as benign, borderline and Malignant**

**lesions are compared with final histopathological examination.**

<b>Diagnostic Value</b>	<b>Benign</b>	<b>Borderline</b>	<b>Malignant</b>
Sensitivity %	100	66.6	40
Specificity %	85.7	95.3	100
Positive predictive value %	97.5	50	100
Negative predictive value %	100	97.6	93.18
Accuracy %	97.8	93.4	93.47

**Discussion**

We performed a diagnostic accuracy study on the accuracy of frozen section diagnosis in the assessment of the ovarian masses. Final histopathologic diagnosis used as the gold standard. The diagnostic accuracy indices were estimated for frozen section. In the present study, the overall accuracy of frozen section diagnosis of ovarian masses was 97.6%. The high precision of the frozen section helps surgical oncologist/gyn-oncologists make reasonable intraoperative decisions, and thus in the vast majority of benign cases, prevent unnecessary morbidity of the procedure. The accuracy of the frozen section for ovarian tumors varies across different institutions [13]. Subbian et al. found an overall accuracy of 84.2% in a study involving 135 cases of ovarian tumors [13]. Several studies have shown that frozen section diagnosis of ovarian tumors is a robust technique with overall accuracy ranging from 71.9-97% [10,14]. In this study, the overall accuracy of the frozen section diagnosis by intraoperative ovarian mass was 97.6%, which is consistent with previous reports (90-97%) [1,6,15-18].

The sensitivity of frozen section to a benign tumor from our observation was 100%. Previous studies also reported a high sensitivity ranging from 92.8% – 100% [5,6,13-15]. In the present study, one borderline tumor was diagnosed as benign by frozen section and that was proliferative serous tumor. Five borderline tumors, diagnosed as benign on the frozen section, were reported by Md Arshad NZ et al [15]. Several explanations have been given for the relative inaccuracy of the frozen section in the diagnosis of borderline tumors. There may be just a few focal points of frank malignancy in a large borderline tumor, which may require a large number of frozen section samples for diagnosis. This is quite labor intensive and typically beyond most laboratory abilities [16]. It is remarkable that for borderline tumor diagnosis, most studies have reported low sensitivity values. Given the low accuracy rate for borderline ovarian tumors, care and attention are required to develop this field [5,6,7,8,12]. Md Arshad et al. observed that, the borderline tumor sensitivity was 76.2% [15]. Subbian et al., on the other hand, recorded the lowest borderline tumor sensitivity (31.2%), especially in the mucinous classification [7]. In a review of 60 patients of ovarian tumors by Palakkan S 6, frozen section had low sensitivity (75%) and PPV (50%) for borderline tumors.

Our results frozen section for Borderline tumors showed 66.6% sensitivity and 50% positive predictive value. In the present study, one discordant case was identified during diagnosis; one case was incorrectly diagnosed as benign serous cystadenoma tumor using a frozen section. It was diagnosed as Atypical proliferative serous tumor on Final HPE. Most studies typically reported a sensitivity of 71–100% for the detection of malignancies by frozen section, and a specificity ranging from 96–100% [6,13,15,17,18,19]. In our study, the sensitivity of malignant ovarian tumor detection was 40% and the specificity was 100%, reflecting that the frozen section examination was highly sensitive and specific to ovarian malignancy. It is very important to correctly detect malignant ovarian tumors, as it determines the type of surgery that should be performed.

A study by Bige O et al [20] indicated that, if the pathologist trained in gynecological pathology, prevention of sampling errors and misinterpretation, along with effective communication could be ensured. If a frozen section is required during surgery, Surgical oncologist/the Gyneoncologist team should be able to communicate preoperatively with the anaesthetist and pathologist. A detailed clinical history and intraoperative observations should be communicated to the pathologist, as they may help the pathologist to get the correct diagnosis, especially in problematic cases. Despite advances in imaging, histological and molecular techniques, frozen section evidently remains an effective tool to be considered during operational procedures.

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Frozen section procedure could reduce the possibilities of doing incomplete surgery for malignant tumors (oophorectomy or cystectomy) or radical surgery for benign conditions. Frozen section is sometimes referred to as intraoperative consultation, as its practice usually involves a liaison between the surgeon and pathologist, rather than the mere provision of a histological diagnosis. Accuracy of frozen section depends on a number of factors such as the number of specimens processed, number of slices of specimen analyzed and nature of tissue. Of note, is that, the report of benign histology on frozen section is only a report of that percentage of tissue analyzed.[18] Therefore, intraoperative frozen section is necessary, both as a quick histologic diagnosis and as a guide for the surgeons in planning an appropriate management at initial surgery.

Besides the nature of the tumor affecting frozen section examination, frozen artifact may also cause misinterpretation of frozen section. The ovarian tumor that was sent to the laboratory is preferably frozen in liquid nitrogen. It is important that the tissue be frozen as soon as possible, to prevent ice crystal formation, resulting in artifact and poor morphological preservation of the tissue, rendering poor slide quality and difficulty to obtain a diagnosis. Another factor that may contribute to misinterpretation is the presence of necrosis. A tumor that has become necrotic following torsion, might have limited tissue available for frozen section evaluation.

### Conclusion

With an overall accuracy of 97.6%, frozen section is valuable for intraoperative diagnosis of ovarian tumors but has limitations in serous borderline ovarian neoplasm in our study.

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