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# Comparative Study of Frozen Section with Permanent Section at a Tertiary Care Centre in Southern Rajasthan

Pawan Nikhra<sup>1</sup>, Kavita Gupta<sup>1</sup>, Quresh Bambora<sup>2</sup>, Vardan Maheshwari<sup>3</sup>

<sup>1</sup>Assistant Professor, Department of Pathology, American International Institute of Medical Sciences, Udaipur, Rajasthan, India; <sup>2</sup>Associate Professor, Department of Surgery, American International Institute of Medical Sciences, Udaipur, Rajasthan, India; <sup>3</sup>Associate Professor, Department of Dentistry, American International Institute of Medical Sciences, Udaipur, Rajasthan, India.

## ABSTRACT

**Introduction:** Frozen section diagnosis helps the surgeon to make an intraoperative decision regarding further management. Comparison of frozen section diagnosis and final histopathology report aids in assessing the degree of diagnostic accuracy of frozen section and also helps to identify the potential pitfalls.

**Objective:** To assess the degree of diagnostic accuracy of frozen section in a tertiary hospital in southern Rajasthan and to identify the potential causes of the discrepancy.

**Methods:** In this study total 197 frozen section cases were identified in 2 years. The intraoperative consultation results were compared with final histopathology diagnosis. Data were analyzed and concordance rate, discordance rate, sensitivity and specificity were calculated.

**Results:** The age group of the cases received ranged from 12-80 years with a male to female ratio 1.3:1. Of the 197 cases received, the majority of intraoperative consultations were sought from the head-neck region followed by breast and ovary. The common indications for frozen sections in our hospital were margin status, primary diagnosis and lymph node status. Out of the 66 (33%) cases received for primary diagnosis, 31 (15.7%) cases were diagnosed as benign and 35 (17.7%) cases as malignant on frozen section. The frozen section report was concordant with final histopathology in 190 (96.4%) cases and was discordant in 7 (3.5%) cases with an overall diagnostic accuracy of 96.4%.

**Conclusion:** The frozen section diagnostic performance at our centre appears satisfactory and is comparable with most other similar studies published in the literature. Discrepancies can be prevented by acquiring prior clinical information of the cases and more accurate sampling.

**Key Words:** Frozen section, Intraoperative consultation, Accuracy, Concordance, Permanent section, Margin assessment

## INTRODUCTION

Frozen section was first introduced by William H. Welch at John Hopkins hospital in the year 1891.<sup>1</sup> Frozen section diagnosis has become a routine practice over the past 60 years. The principle of the frozen section is when the tissue is frozen; the water within the tissue turns into ice and acts as an embedding medium.<sup>2</sup> Frozen section provides rapid diagnosis during surgery that allows the surgeon to make an intraoperative decision regarding further management. The intraoperative consultations are required for various reasons such as primary diagnosis (benign vs malignant), margin status, lymph node status (positive or negative for metastasis), assess adequacy for biopsy and various ancillary techniques.

The frozen section should not be used for surgeon curiosity or a preliminary report to the family in the recovery room. It is important to periodically review the frozen section report and compare it with the final paraffin section report so that potential causes of error can be identified and measures can be taken to rectify them. Long term monitoring of frozen section report helps pathologist to improve the quality of reporting.

The present retrospective study aims to assess the degree of diagnostic accuracy of frozen section in a tertiary hospital in southern Rajasthan and to identify the potential causes of the discrepancy.

### Corresponding Author:

**Kavita Gupta**, Assistant Professor, Department of Pathology, American International Institute of Medical Sciences, Udaipur, Rajasthan, India; Email: [drkavita0307@gmail.com](mailto:drkavita0307@gmail.com)

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## MATERIALS AND METHODS

The present study was carried out in the Department of Pathology at American International Institute of Medical Sciences, Udaipur after approval of the institutional ethical committee (AIIMSUDR/2020/IEC/03). A total of 197 cases were identified in the duration of 2 years (2017-2019). For frozen section diagnosis fresh tissue was received from operation theatre without preservative. Representative areas from the tissue were sampled and were embedded on chuck using freezing media. Sections were cut under controlled temperature in a modern cryostat machine (Yorko; YSI-121). Slides were stained by rapid haematoxylin and eosin method. The remaining tissue was fixed in 10% buffered formalin and submitted for routine paraffin sectioning. The frozen reports were compared with the final histopathology reports available. If the frozen report was in agreement with the histopathology report then was considered as concordant or else was categorised as discordant. In all the discordant cases, causes for discrepancy were noted. The number of cases deferred was also noted with the reason for deferral.

The data was then analysed using SPSS software, Version 20.0 and parameters such as accuracy, sensitivity, specificity, positive predictive value and negative predictive value were determined.

## RESULTS

In 2 years, the frozen section was performed on a total of 197 cases and was compared with the final conventional histopathology report (Figure 1&2). The age group of the cases received ranged from 12-80 years with a male to female ratio 1.3:1. Of the 197 cases received, the majority of intraoperative consultations were sought from the head-neck region which contributed to 53.8% followed by breast (35.5%) and ovary (9.6%) (Table 1). Common indications for frozen sections in our hospital were margin status (122 cases, 61.9%), primary diagnosis (66 cases, 33.5%) and lymph node status (9 cases, 4.5%). Out of the 66 (33.5%) cases received for primary diagnosis, 31(15.7%) cases were diagnosed as benign and 35 (17.7%) cases as malignant on frozen section. The frozen section report was concordant with final histopathology in 190 (96.4%) cases and was discordant in 7 (3.5%) cases (Table 2) with an overall diagnostic accuracy of 96.4%. The incidence of false-positive diagnosis was 0.5% and false-negative was 3.0%. The frozen section technique in our hospital was 93.4% sensitive and 99.04 % specific with a positive predictive value of 98.8% and a negative predictive value of 94.5% (Table 3). Of the two cases deferred, one was from the ovary and the other was from the oral cavity. Cause for deferral in ovary specimen was difficult interpretation due to poor morphology and freezing artefacts. Oral cavity specimen was deferred as it was sent in formalin.

## DISCUSSION

Frozen section is a well-established procedure to assist the surgeon in determining the extent of surgery. However, it is technically challenging and has sampling issues; therefore not all institutes provide the facility for the same. When done with maximum accuracy can be a boon to the surgeon. The pathologist should be aware of the limitations of frozen reporting and should not hesitate to communicate with the surgeon in case of doubt.<sup>3-5</sup> It is better to defer reporting in a difficult situation than to commit errors. In the present study, margin status was the most common indication for frozen section followed by primary diagnosis and lymph node status. However, some studies showed that the most common indication for the frozen section was primary diagnosis.<sup>3,6,7</sup> In our institute, we receive many head and neck malignancies in which the surgeon's area of maximum concern is adequate margin clearance. Adequate margin clearance is necessary not only to minimise the risk of recurrence but also to decide the further radiation protocols.

The overall diagnostic accuracy in our case was 96.4% which was comparable to various other studies in which accuracy ranged from 92.0% - 98.6% (Table 4).<sup>8-10</sup> The accuracy of frozen section in head and neck malignancies was found to be 98.1% which was equivalent to that reported by DiNardo et al (98.3%) in a series of 420 cases.<sup>11</sup>

In this study discordance rate was 3.5% in which 7 cases were incorrectly diagnosed. The false-negative diagnosis was given in 6 cases, however, one case was diagnosed false positive (Table 1). We find in literature; a discordant diagnosis rate ranging from 1.7-4.9%.<sup>12</sup> Out of 7 discordant cases 2 were from the oral cavity, 2 were from the ovary, 2 from lymph nodes and 1 belonged to the gastrointestinal tract. The reason for discordance as either sampling error or misinterpretation (Table 2). To avoid misinterpretation, the case must be thoroughly discussed with the surgeon before surgery.<sup>11,12</sup> The pathologist should know the clinical, biochemical and radiological parameters of the patient; so that the findings of the frozen specimen can be correlated and the correct decision can be made. In case of any discrepancy or doubt; help of co-pathologist can be sought for. To prevent sampling error more sections can be taken from the specimen. But the limitations are its effect on specimen integrity during final grossing, delay in reporting and increase in expenses. Other potential causes of error in reporting may be due to tissue sectioning and staining which depends upon the method used for freezing, type of specimens received, quality of cryostat machine used and nature of the lesion.<sup>13-15</sup> In the present study; the prevalence of deferred diagnosis (1.0%) was comparable with other similar audits (0.09-6.7%).<sup>8</sup> Two cases were deferred; one from oral cavity sent for margin status and other from ovary sent for primary diagnosis. The oral cavity frozen section was deferred as the specimen was

sent in formalin and ovarian frozen section was deferred because of difficulty in diagnosing the nature of lesion due to poor morphology and freezing artefacts. The final paraffin diagnosis in this case was well-differentiated Sertoli Leydig cell tumour.<sup>16</sup> Deferral rate in various centres may vary due to technical expertise, type of specimen received and diagnostic acumen of the pathologist. Other parameters such as sensitivity (93.4%), specificity (99.04%), positive predictive value (98.8%) and negative predictive value (94.5%) were consistent with similar other studies (Table 3).<sup>3,16</sup>

## CONCLUSION

Assessment of results of frozen section and final histopathology helps in monitoring the quality of the laboratory reports and also to assess the diagnostic capabilities of the pathologist. It is important to maintain the turnaround time for the frozen report which can be done by prior information of clinical details of the patient and good communication with the surgeon.

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**Table 1: Organ wise analysis of total no. of cases**

Sr No.	Organ/Tissue	Total cases	Consistent diagnosis	False positive cases	False negative cases
1	Breast	38	38	0	0
2	Oral Cavity	106	104	0	2
3	Ovary	19	17	1	1
4	Soft tissue	7	7	0	0
5	Lymph nodes	18	16	0	2
6	Uterus	3	3	0	0
7	GIT	3	2	0	1
9	Others	12	12	0	0
	Total	197	190	1	6

**Table 2: Discordant cases**

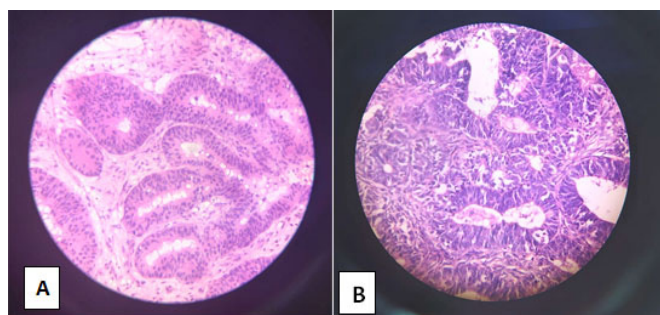
Sr No	Organ	Discordance type	Frozen section diagnosis	Paraffin section diagnosis	Cause of discrepancy
1	Oral cavity	False negative	Margin clear	Positive margin	Sampling error
2	Oral cavity	False negative	Verrucous hyperplasia	Well differentiated squamous cell carcinoma	Misinterpretation
3	Ovary	False negative	Benign ovarian neoplasm	Adenocarcinoma	Misinterpretation
4	Ovary	False positive	Benign ovarian neoplasm favour mature teratoma	Torsion ovary	Misinterpretation
5	Lymph node	False negative	Negative for metastasis	Positive for metastasis	Sampling error
6	Lymph node	False negative	Negative for metastasis	Positive for metastasis	Sampling error
7	GIT-Stomach	False negative	Margin clear	Positive margin	Sampling error

**Table 3: Accuracy parameters in the present study and its comparison with various studies**

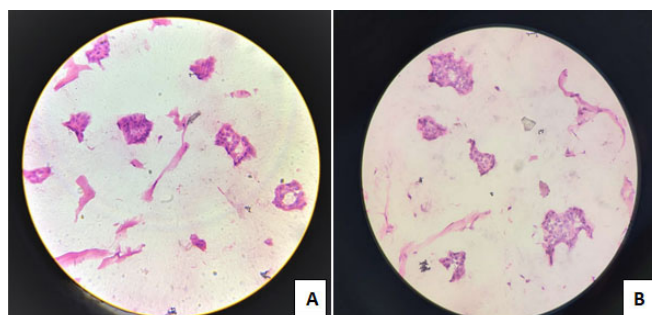
Accuracy parameters	Present study	Hatami et al <sup>3</sup>	Maurya et al <sup>6</sup>
Overall accuracy	96.4%	97.96%	97.16%
Sensitivity	93.4%	92.95%	98.64%
Specificity	99.04%	99.55%	93.75%
Positive predictive value	98.8%	98.50%	97.33%
Negative predictive value	94.5%	97.80%	96.77%

**Table 4: Comparison of concordance and discordance rate in various studies with present study**

Authors	Number of cases	Concordance rate	Discordance rate	Year of study
Ackerman et al <sup>6</sup>	1269	98.0%	2.0%	1959
Novis et al <sup>7</sup>	18532	98.2%	1.8%	1996
White et al <sup>8</sup>	2812	96.75%	3.25%	2007
Shrestha et al <sup>4</sup>	404	94.6%	5.4%	2009
Vikram et al <sup>9</sup>	200	95%	3%	2017
Selvakumar et al <sup>10</sup>	518	94.7%	5.3%	2018



**Figure 1:** X400, H&E. A. Frozen section of Endometrioid carcinoma of ovary, B. Paraffin section of Endometrioid carcinoma of ovary.



**Figure 2:** X400, H&E. A. Frozen section of Mucinous carcinoma of breast, B. Paraffin section of Mucinous carcinoma of breast.