Section: Pathology

Original Research Article

DIAGNOSTIC UTILITY OF FROZEN SECTION IN OPERATIVE SURGICAL SPECIMENS

Deepa Janghel[1], Shende Pranali Kisandas[2]

[1]*Assistant Professor, Department of Pathology, SBDMSMC Government Medical College GMC, Korba, Chhattisgarh, India*
[2]*Assistant Professor, Department of Pathology, KMSK Government Medical College GMC, Chandrapur, Maharashtra, India.*

Received *: 02/01/2026*
Received in revised form *: 25/01/2026*
Accepted *: 13/02/2026*

Corresponding Author:
Dr. Deepa Janghel,
Assistant Professor, Department of Pathology, SBDMSMC Government Medical College GMC, Korba, Chhattisgarh, India.
Email: deepajanghel@gmail.com

DOI: 10.70034/ijmedph.2026.2.124

Source of Support: Nil,
Conflict of Interest: None declared

Int J Med Pub Health
2026; 16 (2); 723-726

ABSTRACT

Background: Intraoperative consultation by frozen section technique is an invaluable tool for immediate diagnosis. Its accuracy and limitations vary with different anatomical sites. The correlation of intraoperative frozen section diagnosis with final diagnosis on routine histopathological sections is an integral part of quality assurance in surgical pathology.
Materials and Methods: 106 tissue specimens from 64 cases were studied over a period of one year. Diagnostic accuracy of frozen section and its morphological quality and reliability in comparison to histopathology was evaluated for overall morphology. The turnaround time and limitations in section preparation and problems encountered were assessed.
Results: Diagnostic accuracy of frozen section was 98.43%. The intraoperative consultation using Frozen section added an addendum to 29.68% cases.
Conclusion: Intra-operative frozen section diagnosis is very useful, highly accurate and provides rapid, reliable, cost effective information necessary for optimum patient care.
Keywords: Frozen section, Oncopathology, Surgical pathology.

INTRODUCTION

Frozen section technique was first used by William H Welch from John Hopkins Hospital in 1891 for intra-operative consultation. It was further developed by Wilson and McCarty in 1905 at Mayo Clinic. This practice has since then evolved especially after development of cryostat in 1959.[1,2] The classic indication for frozen section examination is the need for an immediate decision during a surgical procedure in differentiating between benign and malignant neoplasms to guide intra or perioperative patient management.[3,4] The correlation of intraoperative frozen section diagnosis with final diagnosis on routine histopathological section is an integral part of quality assurance in surgical pathology.[5] The aim of the study was to assess the diagnostic utility of frozen section in operative surgical specimens.

MATERIALS AND METHODS

This was a prospective cross-sectional study comprising of frozen section examination and routine histopathological examination of tissues received in Department of Pathology, over a period of one year in tertiary health care centre in Chhattisgarh. 64 samples were studied. All surgical specimens freshly collected in normal saline processed for frozen section examination and tissues not freshly collected (delay in sending the specimen) and tissues collected in 10% formalin were rejected. 106 fresh tissue specimens from 64 consecutive cases received from Surgical Departments for intraoperative consultation in a clean plastic container without any fixative or with saline (to avoid fixation artefacts / degenerative changes) along with requisition form with complete clinical details. Gross examination was done, specimen dissected and sections were taken from representative areas. Frozen sectioning was done on Cryostat (Leica CM 1860S). Optimum cooling temperature (OCT) compound (CRYOMATRIX, thermoscientific) was the freezing medium used. The ideal temperature for cutting Cryostat sections varied with amount of matrix and lipid content of the tissue. The Cryostat was set at a range between -180C to -240C depending upon the nature of the tissue. Freezed tissue was initially placed on back freezing rails and gradually moved to Peltier element (4 rapid freezing rails) to avoid rapid freezing and subsequent

artefacts and sections were of 4-5µ thickness and were immediately fixed in 95% isopropyl alcohol. Rapid Haematoxylin & Eosin (H&E) staining was performed. Frozen section diagnosis was made by consensus of 2 pathologists in correlation with appropriate clinical details. It was immediately conveyed to the operating surgeon through intercom. Clinical-frozen diagnosis concordance was analyzed. The turnaround time (TAT) of entire procedure from receipt of specimen to delivery of report was recorded. All procedures performed in the current study were approved by institutional Ethics committee. Informed consent was obtained from all individual participants included in the study.

RESULTS

The maximum number of cases 42 cases fall in the age group of 41-60 years followed by 12 cases in age group of 21-40 years then 8 cases in age group of 61-80 years and 2 cases in age group of 0-20 years in descending order respectively. In our study maximum number of cases 36 (56.25%) had indication of assessment of margin status, minimum number of case 1 had indication of benign or malignant & tissue identification and benign or malignant & margins status respectively, 2 cases had indication of benign or malignant and 19 cases had indication of metastasis. Out of 64 patients, maximum number of cases 30 (46.88%) were of oral cavity and minimum number of case 1 (1.56%) was of brain biopsy and retinoblastoma. In the present study out of 64 patients, maximum number of cases i.e. 30 were of oral cavity in which 6 (20%) cases were positive for malignancy and minimum number of case 1 was of brain biopsy and retinoblastoma which was positive for malignancy (100%). In this study out of 64 patients, 63 (98.44%) cases of frozen section had concordance with Routine Histopathology Examination while 1 case had discordance between frozen section and Routine Histopathology Examination because it is positive in frozen section but not in Routine Histopathology (False positive) due to interpretation error (Freezing artifact). In the present study a total of 19 (29.68%) cases were positive for malignancy, out of which 12 cases had extension of surgery, 4 cases were given chemotherapy after surgery, 1 case was given radiotherapy after surgery and 2 cases were given combined extended surgery and chemotherapy. In the present study a total of 64 patients were included, out of which in Frozen section maximum number of cases 43 (67.18%) had excellent grading while no case had poor and fair grading and in Routine Histopathology Examination maximum number of cases 34 (53.13%) had excellent grading while no case had poor and fair grading. Sensitivity of Frozen Section was 100% from Routine Histopathology examination. Specificity of Frozen Section was 97.82% from Routine Histopathology examination. AUC (Area Under Curve) was 0.989, the Frozen Section would be consider to be very good at separative Positive for malignancy from Routine Histopathology examination. Positive predictive value (PPV) of Frozen Section was 94.73% from Routine Histopathology examination. Negative predictive value (NPV) of Frozen Section was 100% from Routine Histopathology examination. Diagnostic Accuracy of Frozen Section was 98.43% on the basis of Routine Histopathology examination.

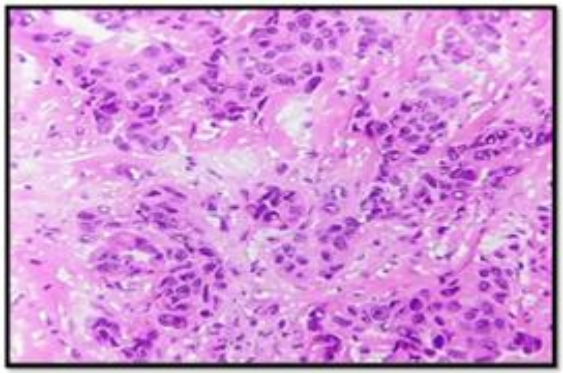

Figure 1: Photomicrograph of Frozen section of Breast margin: showing positive for malignancy of Invasive Ductal Carcinoma: (Rapid H&E, 400X)

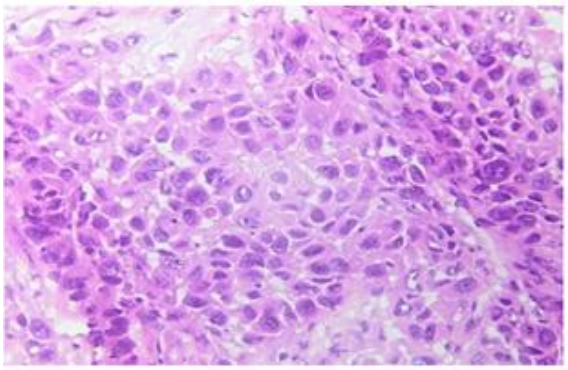

Figure 2: Photomicrograph of Frozen section from margin of Mandibulectomy specimen of oral cancer patient: showing positivity for malignancy (Squamous Cell Carcinoma) (Rapid H&E, 400X)

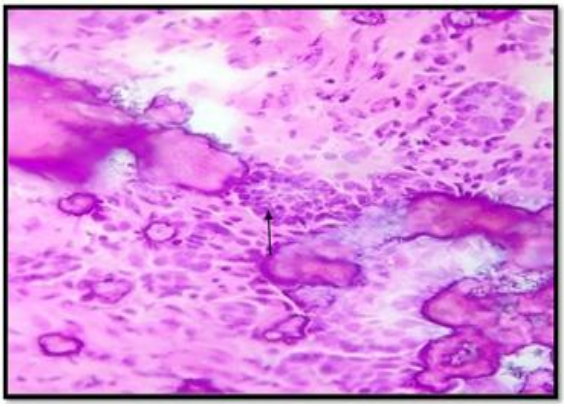

Figure 3: Photomicrograph of Frozen section for metastasis: showing Peritoneal deposits with calcification and clusters of malignant cells (↑) (Rapid H&E, 400X)

Table 1: Distribution of cases according to the basis of modification in patient's management who found positive for malignancy (19 cases / 29.68%)

Sr.no.	Management	Cases
1.	Surgery (Extended)	12
2.	Chemotherapy	4
3.	Radiotherapy	1
4.	Surgery And Radiotherapy	2
	Total	19

Table 2: Comparison of statistical analysis with other studies

Authors	Accuracy	Sensitvity	Specificity	PPV	NPV
Shrestha S et al. (2009)[1]	94.6	-	-	-	-
Ozdamar SO et al. (2006)[2]	97.47	-	-	-	-
Pragati Prabhakarrao Phulgirkar et al (2018)[5]	90.7				
Parikshit Patil et al. (2015)[10]	-	97.22	96.30	98.59	92.86
Saumya Mishra, et al. (2016)[11]	96.2	-	-	-	-
Ambreen Moatasim et al. (2013)[12]	96	90	100	100	94.1
Hossein Hatami et al. (2015)[15]	-	92.95	99.55	98.50	97.80
Mourouguessine Vimal et al. (2015)[16]	92-98	-	-	-	-
Pranati Misra et al. (2018)[17]	90.68	-	-	-	-
Present Study	98.43	100	97.82	94.73	100

*All values in %

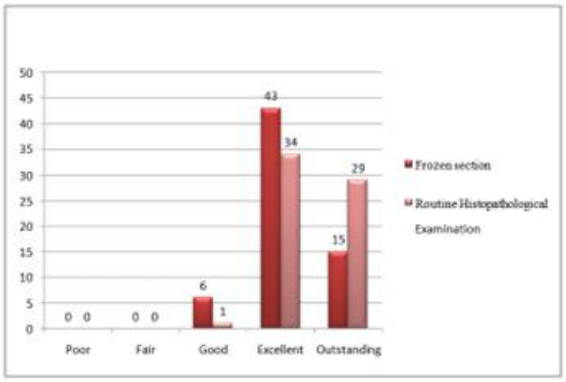

Figure 4: Qualitative Histologic Grade of Frozen section in comparison with Routine Histopathological Examination *All values in %.

DISCUSSION

The other indications of frozen section are - identification of tissue and unknown pathological processes, evaluation of margins, identification of lymph node metastasis, confirmation of presence of representative samples for paraffin section diagnosis and to determine the nature of a lesion.[3,4] Diagnostic discrepancies between frozen and permanent section are commonly observed in tissue from skin, breast, uterine cervix and thyroid.[6-9] Diagnosis should be deferred when situation warrants.[10] Studies comparing the morphological quality of frozen section and formalin fixed paraffin embedded (FFPE) tissue sections have not been widely reported in literature. Also, as frozen section is subject to various pitfalls, this study aims to highlight the diagnostic utility, qualitative morphological comparison between both the techniques, to establish diagnostic accuracy in different anatomical sites and determine various limitations of frozen section.[5,11] The maximum number of cases 42 cases fall in the age group of 41-60 years followed by 12 cases in age group of 21-40 years then 8 cases in age group of 61-80 years and 2 cases in age group of 0-20 years in descending order respectively. The mean age involved in study was 47.78 ± 12.41 years. Ambreen Moatasim et al. (2013),[12] and Mona P tan et al. (2014),[13] showed that the mean age of cases were 49.81 ± 11.1 years and 48.8 ± 9.8 years respectively which is nearly equal to our study. In the present study, the indication for assessment of margins was 56.25%; in maximum number of cases. [Figure 1 & 2] The studies of Somak Roy et al,[14] Hossein Hatami et al,[15] Parikshit Patil et al,[10] Mourouguessine Vimal et al,[16] and Saumya Mishra et al,[11] had indication for assessment of margins were 31%, 32.7%, 34%, 14.3% and 13.46% respectively. In present study, 29.68% cases had indication for metastasis. [Figure 3] Other studies had same indication were Somak Roy et al,[14] Parikshit Patil et al,[10] and Mourouguessine Vimal et al,[16] with 03%, 11%, and 20% respectively. In present study, 7.81% cases had indication for primary diagnosis and margins. Somak Roy et al,[14] had same indication with 7%. In present study, 3.12% cases had indication of Primary diagnosis whether benign/ malignant. Other studies had same indication were Somak Roy et al,[14] Hossein Hatami et al,[15] Parikshit Patil et al,[10] Mourouguessine Vimal et al,[16] and Saumya Mishra et al,[11] with 59%, 63.7%, 55%, 57.1% and 84.61% respectively. In the present study, 1.56% cases had indication of differentiation of benign or malignant & tissue identification and differentiation of benign or malignant & margins status respectively. No studies were found similar findings to the present study. In the present study maximum number of cases 30 (46.88%) were of oral cavity. Parikshit Patil et al (2015),[10] and Pranati Misra et al (2018),[17] showed most common organ as Oral cavity with 23% and 32.91% respectively which were similar to the present study. In the present study 2nd most common organ was breast 7 (10.94%). The study of Parikshit Patil et al (2015),[10] found 2nd most common organ was breast which was similar to the present study. In the present study 3rd common

organ was Lymph node 6 (9.38%). Ambreen Moatasim et al. (2013),[12] had 100% cases of lymph node which was higher than the present study. In the present study out of 64 patients, maximum number of cases i.e. 30 were of oral cavity in which 6 (20%) cases were positive for malignancy and minimum number of case 1 was of brain biopsy and retinoblastoma which was positive for malignancy (100%). Out of total 64 cases 19 cases were positive for malignancy (29.68%). Study of Shrestha S et al. (2009),[1] showed variable organ and positivity for malignancy (68.8%) which was higher than the present study. In the present study out of 64 cases, 63 (98.44%) cases of frozen section had concordance with routine histopathology examination while 1 (1.56%) case had discordance between frozen section and routine Histopathology Examination because it is positive in frozen section but not in routine Histopathology Examination (False positive) due to interpretation error (Freezing artifact). Study of Ozdamar SO et al (2006),[2] and Mourouguessine Vimal et al (2015),[16] showed concordance between frozen section and routine Histopathology Examination of 97.47% and 97.47% respectively which were slightly lower than present study. Study of Shrestha S et al (2009),[1] found that the false positive rate of 1.5% which was similar to our study. In the present study a total of 19 (29.68%) cases were positive for malignancy, out of which 12 cases had extension of surgery, 4 cases were given chemotherapy after surgery, 1 case was given radiotherapy after surgery and 2 cases were given combined extended surgery and chemotherapy. [Table 1] Study of Mona P tan et al (2014),[13] did 85.7% successful breast conserving therapy with the help of Frozen section and 2.48% cases required second operation. This study was in the favour of present study.

CONCLUSION

Frozen section is subject to various limitations which both surgeon and pathologist should keep in mind when ordering and performing the procedure. Gross inspection, sampling and interpretation by experienced pathologist, frozen complemented with cytological and histological review and communication between surgeon and pathologist can avoid certain limitations and provide rapid, reliable, cost effective information necessary for optimum patient care. Frozen section is helpful in the beginning to plan further patient's management.

REFERENCES

1. Shrestha S, Lee MC, Dhakal H, Pun CB, Pradhan M, Basyal [1] R et al. Comparative study of frozen section diagnoses with histopathology. Postgraduate medical journal of NAMS. 2009;9(2):1-5.
2. Ozdamar SO, Bahadir B, Ekem TE, Kertis G, Dogan B, Numanoglu [2] G, et al. Frozen section experience with emphasis on reasons for discordance. Turkish journal of cancer. 2006;36(4):157-61.
3. Hull ME, Hunphrey PA, Pfeifer JD. Washington manual of surgical pathology. Elsevier 2006; First Edition: Chapter51.
4. Susan CL .Manual of Surgical Pathology. Elsevier 2006;Second Edition: 49-69
5. Pragati Prabhakarrao Phulgirkar et.al. The Diagnostic Accuracy of Frozen Section Compared to Routine Histological Technique- A Comparative Study International Journal of Science and Healthcare Research Vol.3; Issue: 3; July-Sept. 2018
6. Mahe E, Ara S, Bishara M, Kurian A, Tauqir S, Ursani N, Vasudev P, Aziz T, Ross C, Lytwyn A. Intraoperative pathology consultation: error, cause and impact. Canadian Journal of Surgery. 2013 Jun;56(3):E13-18 .
7. Coffey D, Kaplan AL, Ramzy MI. Intraoperative consultation [4] in gynecologic pathology. Arch Pathol Lab Med. 2005; 129(12):1544–57.
8. Hull ME, Humphrey PA, Pfeifer J. Frozen sections and other [5] intraoperative consultations. In: Humprey P, Dehner L, editors. The Washington Manual of Surgical Pathology. 2nd ed. India: Lippincott Williams and Wilkins; 2012.p.832-37.
9. Rosai J. Introduction. In: Rosai J. editor. Rosai & Ackerman's [6] Surgical Pathology. 10th ed. India: Elsevier; 2011.p.1-12
10. Patil P, Shukla S, Bhake A, Hiwale K. Accuracy of frozen section [8]analysis in correlation with surgical pathology diagnosis. Int J Res Med Sci. 2015;3(2):399-404.
11. Mishra S, Gupta M, Bharat V, Bansal R. Qualitative Comparative Study of Frozen Section with Routine Histological Technique. Nat J Lab Med. 2016 Apr;5(2):44-50.
12. Moatasim A, Mujtaba S, Faridi N. Intraoperative frozen section analysis of sentinel lymph nodes in breast carcinoma patients in a tertiary hospital in Pakistan. International Journal of Surgery. 2013 Apr 1;11(3):253-8.
13. Tan MP, Sitoh NY, Sim AS. The value of intraoperative frozen section analysis for margin status in breast conservation surgery in a nontertiary institution. International journal of breast cancer. 2014 Jan 1;2014.
14. Roy S, Parwani AV, Dhir R, Yousem SA, Kelly SM, Pantanowitz L. Frozen section diagnosis: is there discordance between what pathologists say and what surgeons hear?. American journal of clinical pathology. 2013 Sep 1;140(3):363-9.
15. Hatami H, Mohsenifar Z, Alavi SN. The diagnostic accuracy of frozen section compared to permanent section: a single center study in Iran. Iranian journal of pathology. 2015;10(4):295.
16. Vimal M. A study on accuracy of frozen section diagnosis and turnaround time. Int J Health Sci Res. 2015;5(12):138-42
17. Misra P, Sahu N, Senapati U. Evaluation of Intraoperative Frozen Sections: Experience in a Tertiary Care Hospital. Breast.;12(9).