International Journal of Clinical and Diagnostic Pathology

ISSN (P): 2617-7226
ISSN (E): 2617-7234
www.patholjournal.com
2023; 6(1): 11-15
Received: 12-10-2022
Accepted: 16-11-2022

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Diagnostic accuracy of intra-operative frozen section at tertiary care center

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DOI: https://doi.org/10.33545/pathol.2023.v6.i1a.504

Abstract
Introduction: Frozen section is a valuable technique for immediate diagnosis in intraoperative management of patients. It helps the surgeon in the surgical management of the patient by helping in the intraoperative diagnosis of tumors, margins and lymph node assessment, and organ identification. Accuracy and limitation of frozen sections vary according to different anatomical sites. Study objective was to evaluate the diagnostic accuracy of frozen sections.
Aims: Aim of this study was to analyze the frozen section results and compare it with final paraffin sections and evaluate the diagnostic accuracy.
Material and methods: A retrospective study of 201 specimens of intra operative FS were carried out in histopathology section of B.J. Medical College, Ahmedabad. The diagnoses given on frozen section were compared with the final diagnosis given on permanent paraffin sections. The results were categorized into concordant and discordant.
Results: The diagnostic accuracy of frozen section was found to be 86.6%. Discordant rate is 13.4%. Most common frozen section analysis was primary diagnosis or typing of neoplasms (97.5%). Discordant rate or false negative diagnosis was because of technical and interpretative error.
Conclusion: Frozen section is a rapid diagnostic process which helps surgeons to choose best therapeutic approach. It confirms various benign and malignant lesions. When unexpected disease process is found and require a definite diagnosis and to take a definite decision on extent of surgery frozen section is very much helpful. However one needs to be aware of its limitations. By avoiding its limitation diagnostic accuracy can be improved.

Keywords: Frozen section, histopathological diagnosis, accuracy

Introduction
Intraoperative "frozen section" (FS) also termed as fresh tissue diagnosis, quick section, cryogenic sectioning, cryosection, cryoultramicrotomy, intraoperative pathologic diagnosis and intraoperative consultation is an investigation which helps in guiding the surgeon to plan for further management at the time of operation [1, 2]. The technique was first used by William H Welch from John Hopkins Hospital in 1891 for intra operative consultation.2 Later on 1905 this technique was further developed by Wilson and Mc carty for immediate evaluation of frozen tissue.(3) Since then in 1959 after the development of cryostat frozen section become much easier and pathologist began to play a critical role in assisting and determination of the best approach during surgery [4, 5].
The criteria's for requesting an intraoperative diagnosis vary but the major criteria include the following: (i) if intraoperative management will be influenced by the diagnosis (ii) if an unexpected lesion is seen at surgery which is different from what was suspected clinically (iii) if the main aim is to obtain a biopsy diagnosis (iv) to assess margins if radical excision is planned [6, 7, 8] (v) Other indications are enzyme histochemistry, immunohistochemistry and immunofluorescence [4]. Intraoperative FS diagnosis can be done by use of cryostat equipment and Other methods such as squash smear cytology; fluid cytology and imprint cytology.1) Frozen sections are mainly useful for the more firm, rubbery neoplasms such as meningiomas, ependymomas, and most metastatic tumors in which it is difficult to prepare good cytology smears [7, 10, 11]. In our center, we use a combination of squash smear cytology and cryostat equipment technique whenever we get an intraoperative consultation in a suspected case of neoplasm.

Aim

The aim of this study was

a. To analyze the frozen section results and compare it with final paraffin sections and evaluate the diagnostic accuracy.
b. To assess the discrepancies in our cases.

Material and Method

This was a retrospective study conducted over a period of 27 months (August 2020 – November 2022) on 201 cases received and examined in Histopathology Section of Pathology Department of B.J Medical College and Civil Hospital Ahmedabad, Gujrat, India. Fresh tissues were received in a clean container along with requisition form with complete clinical details from the surgical departments. Gross examination of the specimen was done, then from some part of tissue squash smears were prepared and then tissue sent to cryostat. Cryostat was set at a temperature between -20 to -28 ^{0}C. Sections were frozen and cut by cryostat machine using tissue freezing medium as embedding medium. Sections were cut at a thickness of 4-5µ and were immediately fixed in 95% isopropyl alcohol. After that rapid hematoxylin and eosin staining was done. Frozen section diagnosis was done under light microscope and immediately conveyed to the operating surgeon over phone. The diagnosis given on frozen section were compared with the final diagnosis given on permanent sections (and additional material if received), as indicated on the frozen section and final pathology report.

All cases which were sent from surgical departments for frozen section are included in the study. Inadequate specimens and inconclusive cases were excluded from the study.

Results

In this retrospective study, total 201 cases were received for intraoperative consultation (frozen section) in 27 months. In all cases, cryostat sections (FS) plus squash smears were prepared. The ages of the patients ranged from 1 month to 78 years. Out of 201 cases, 105 were males and 96 were females. Most common frozen section analysis was primary diagnosis or typing of neoplasms (97.5%). Our results showed a reasonably good percentage of accuracy. Out of 201 cases, 174 (86.6%) cases were concordant, 27 (13.4%) cases were discrepant with diagnostic accuracy of 86.6%. Here the reason of discrepancy is mainly interpretation and technical error. In the present study overall diagnostic accuracy of frozen section was 86.6% which is comparable to other studies shown in the table no.3 [1, 3, 4, 9, 14, 15, 16, 17, 21].

Table 1: Distribution of various frozen section specimen according to it's diagnosis.

Histological diagnosis of frozen section		
Diagnosis	**No. of cases**	**Percentage**
Astrocytoma grade II	19	9.5%
Meningioma	20	10%
Glioblastoma	12	6%
Schwannoma	7	3.5%
Medulloblastoma	14	7%
Pilocytic Astrocytoma	8	4%
Pitutary Adenoma	8	4%
Oligodendroglioma	4	2%
Metastatic carcinoma	4	2%
Ependymoma	10	5%
Ductal cancer	6	3%
Tuberculosis	3	1.5%
Low Grade Glioma	6	3%
High Grade Glioma	14	7%
Craniopharyngioma	6	3%
Central Neurocytoma	13	6.5%
Papillary tumor of pineal region	2	1%
Pleomorphic sarcoma	1	0.5%
Fibroadenoma	2	1%
CNS Embryonal tumor	6	3%
Anaplastic Astrocytoma	3	1.5%
Anaplastic Oligodendroglioma	1	0.5%
Choroid plexus papilloma	2	1%
Chordoma	1	0.5%
Central round cell tumor	3	1.5%
Squamous cell carcinoma	1	0.5%
Non-Hodgkin Lymphoma	1	0.5%
Basal cell carcinoma	1	0.5%
Esthesioneuroblastoma	2	1%
Follicular Adenoma of thyroid	2	1%
Aneurysmal Bone Cyst	1	0.5%
Phyllodes	1	0.5%
Pleomorphic Xanthoastrocytoma	2	1%
Chondrosarcoma	2	1%
Solitary Fibrous Tumor	2	1%
Tumor margin	5	2.5%
Cholesteatoma	2	1%
Hemangiopericytoma	1	0.5%
Pilomyxoid Astrocytoma	1	0.5%
Atypical Teratoid/Rhabdoid tumor	1	0.5%
Ossifying fibromyxoid tumor	1	0.5%
Total	201	

Table 2: Comparison of discrepant cases with Biopsy diagnosis.

Histological discrepant cases in our study (Total-27)		
Frozen Diagnosis	**Final diagnosis**	**No of cases**
Central Neurocytoma (WHO Grade II)	Small cell type glioblastoma	1
Low Grade Glioma	Cryptococcus	1
Metastatic Adenocarcinoma	Metastatic Squamous cell carcinoma	1
Medulloblastoma (WHO Grade IV)	Ependymoma	1
High Grade Glioma	Diffuse Astrocytoma (WHO Grade II)	1
Meningioma	Ependymoma	2
Diffuse Astrocytoma (WHO Grade II)	Atypical Teratoid/Rhabdoid Tumor	1
Fibroadenoma	Phyllodes	1
Aneurysmal Bone Cyst	Mammary Analogue Secretory Carcinoma	1
Medulloblastoma	High Grade Glioma	1
Spindle cell Tumor	Medulloblastoma	1
Choroid Plexus Papilloma	Ependymoma	1
Astrocytoma	Oligodendroglioma	1
Low Grade Glioma	Pleomorphic Xanthoastrocytoma	1
Medulloblastoma	Anaplastic Oligodendroglioma	1
Low Grade Glioma	Glioblastoma (WHO Grade IV)	1
Metastatic Carcinoma	Anaplastic Ependymoma	1
Ependymoma	Anaplastic Oligodendroglioma	1
Meningioma	Schwannoma	1
Diffuse Astrocytoma (WHO Grade II)	Glioblastoma	1
Metastatic Carcinoma	Microcystic Meningioma	1
Craniopharyngioma	Pilomyxoid Astrocytoma	1
Anaplastic Oligodendroglioma	Glioblastoma	1
High Grade Glioma	Pleomorphic Xanthoastrocytoma	1
Ependymoma	Low Grade Astrocytoma	1
Pleomorphic sarcoma	Ganglioneuroblastoma	1

Table 3: Comparison of diagnostic accuracy of different studies

Authors (Studies)	Diagnostic accuracy
Nageswar Sahu [4]	90.68
Saumya Mishra *et al*. [3]	96.2
Patil P *et al*. [14].	96.9
Ahmad Z *et al*. [15]	97.1
Shrestha S *et al*. [17]	94.6
Agarwal Preeti *et al*. [1]	94.2
RDP Silva *et al*. [21].	93.3%
Present Study	86.3%

Discussion

Surgeons often depend upon rapid intra-operative diagnosis for immediate surgical management. Fluid cytology may be used for cystic lesions but squash cytology and frozen sections are the two main techniques used for intra operative frozen section, the choice depending on individual experience and preference. Squash cytology is mainly used in intra-operative consultation of neurosurgical specimens. Frozen section is an intraoperative procedure to guide the surgeon in taking the decision about the extent of resection in various surgical procedure. Accuracy of frozen section should be high so that the surgeon can have confidence over it [4]. FS helps a surgeon to plan or even terminate a surgery having a direct impact on the patient's management [1, 12]. FS test is a technically demanding one, which requires the necessary equipment (CRYOSTAT), sufficient staff with the necessary skills and expertise and experienced pathologist [13]. Intra-operative histology is indicated for confirmation of an intra-operative impression, confirmation of malignancy and assessment of surgical margins at vulnerable sites where the extent of removal directly influences the surgical outcome.

According to various studies the accuracy of Intra-operative histology diagnosis ranges from 87% to 97%. The studies with higher accuracy had a different study design in terms of type of specimen and inclusion of different categories. We included squash smears in addition to frozen section and only for tumors, whereas in others, the authors included tumors or tumors plus infections and or other miscellaneous lesions. In our cases, the reason for seeking intraoperative consultation was primary diagnosis. All types of primary neoplasms including astrocytoma (including pilocytic astrocytoma and glioblastoma), ependymomas, oligodendrogliomas, meningiomas, medulloblastomas, metastatic carcinomas, fibroadenoma and phyllodes were diagnosed. In some cases, a diagnosis of high-grade glioma was given. Non-neoplastic diagnoses such as granulomatous inflammation including Tuberculosis, were also given. 27 discrepant cases in our current series of 201 cases: 7(26%) cases involved errors in Differentiating astrocytomas from medulloblastoma, oligodendrogliomas and ependymoma. 2(7%) cases involved errors in differentiating meningioma from ependymoma and in 1(3.5%) there is an error in differentiating meningioma from schwannoma.

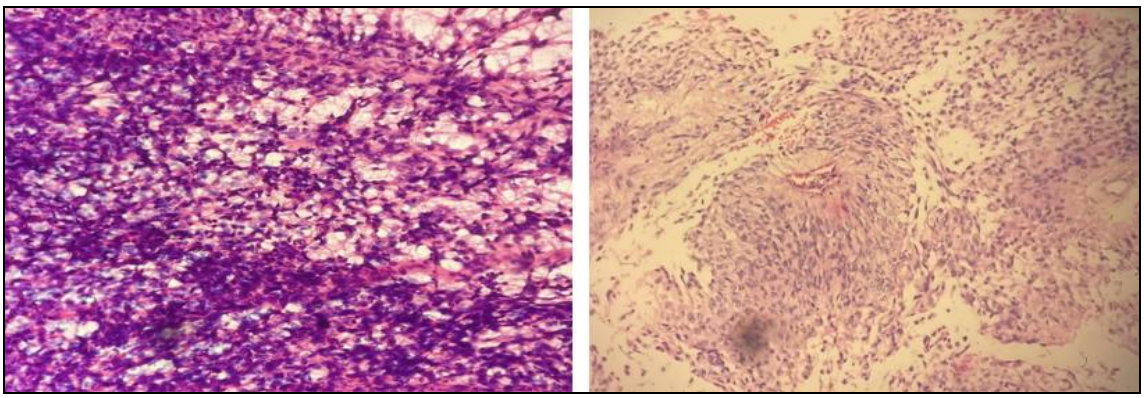

Fig 1: Frozen section diagnosed as Meningioma while Biopsy diagnosed as Ependymoma

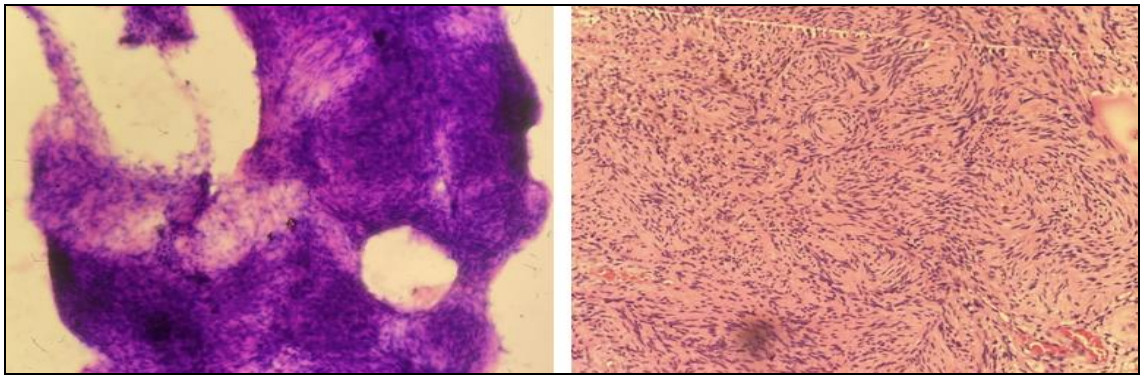

Fig 2: Frozen section diagnosed as Meningioma while Biopsy diagnosed as Benign Nerve Sheath Tumor

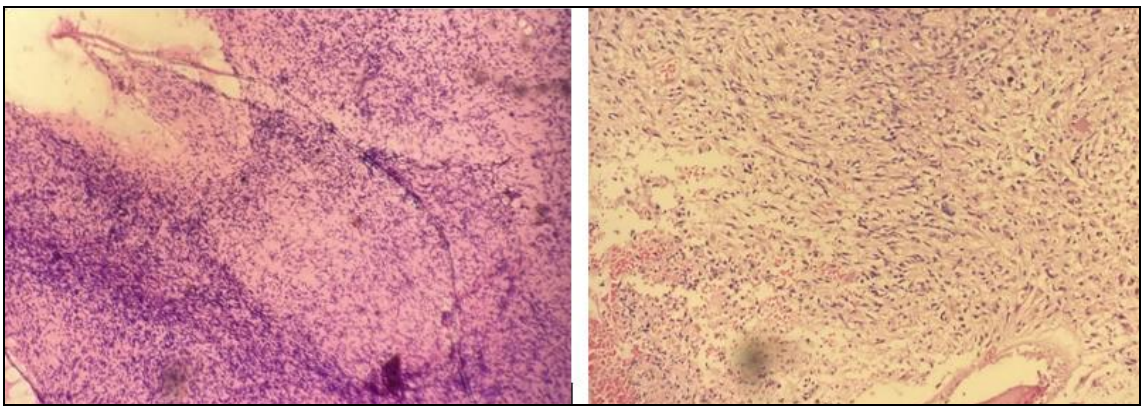

Fig 3: Frozen section diagnosed as anaplastic oligodendroglioma while Biopsy section diagnosed as Glioblastoma

Spindle Cell Lesions

Distinguishing meningiomas, peripheral nerve sheath tumors, and other spindled cell proliferations can be challenging at FS, particularly with limited submitted tissue or tissue distorted by crush artifact or cautery. Both meningiomas and schwannomas commonly arise in the cerebellopontine angle region and can show a predominantly benign, spindled cell appearance, thick-walled vessels, abundant collagen, and perivascular whorling. Although degenerative atypia ("ancient" change) is classically characteristic of schwannomas, meningiomas can demonstrate prominent nuclear pleomorphism at times. In addition, some meningiomas lack whorling, psammoma bodies, or cytoplasmic protrusions features that are typically used in making the diagnosis [18].

Astrocytoma v/s Oligodendroglioma v/s medulloblastomas v/s ependymoma:

Distinguishing astrocytoma from Oligodendroglioma intraoperatively is difficult because of the degree of overlap of nuclear and cytoplasmic features. A diagnosis of "glioma" along with indication of the differential diagnosis and some indication of grade is usually adequate at FS. There are some differences regarding grading thresholds between the 2 glioma types that might present a challenge if one is not sure of the tumor lineage. In most instances, stratifcation into "low grade" (WHO grade II) versus "high grade" (WHO III or IV) is sufficient at FS. Histologically, oligodendrogliomas tend to be more cellular and less pleomorphic than astrocytomas. Oligodendroglial tumor nuclei appear round and uniformly hyperchromatic; however, freezing tissue often produces irregularities in the nuclear contours of an Oligodendroglioma, making it look similar to an astrocytoma [18]. Medulloblatoma show sheets of cells, sometimes with rosettes or nodular areas of more differentiated cells which might get misdiagnosed as ependymoma [19].

Tumor over grading

Frozen section can introduce changes that are not typically

seen in paraffin-embedded, permanent sections, making it difficult to accurately assess cellularity and pleomorphism. The most important differentiating features at FS in distinguishing a high-grade glioma from a low-grade glioma are the presence of mitotic figures (especially atypical), tumor cell necrosis, and vascular proliferation.

Breast lesions

Breast carcinoma is the second most common malignant tumor among rural Indian women after carcinoma cervix, whereas in urban Indian women, breast carcinoma overcomes the incidence of carcinoma cervix [20]. In our study, a total of 9 cases were studied including 6 cases of malignant and 3 cases of benign breast lesions as diagnosed on paraffin embedded, H & E sections.

Conclusion

Our results show a reasonably good percentage of accuracy in the intraoperative diagnosis of lesions. However, there are limitations and some lesions pose a diagnostic challenge. Careful observation, skill of the pathologist and knowledge of limitations help in improving the overall diagnostic utility of frozen section. Despite the advancements in histological and molecular techniques; this investigation, clearly remains a valuable tool during operative procedures. Hence, there is a need to improve our own diagnostic skills and establish better communication with neurosurgeons.

Acknowledgement

Not available

Author's Contribution

Not available

Conflict of Interest

Not available

Financial Support

Not available

References

1. Agarwal Preeti, Gupta Sameer, Singh Kulranjan, Sonkar Arun Abhinav, Rani Preeti, Yadav Sunita, *et al*. Intra-Operative Frozen Sections: Experience at A Tertiary Care Centre. Asian Pac J Cancer Pre. 2016;17(12):5057-5061.
2. Anthony AG. The Centennial Anniversary of the Frozen Section Technique at the Mayo Clinic. *Arch* Pathol Lab Med. 2005 December;129(12):1532-1535.
3. Saumya Mishra, *et al*. Qualitative Comparative Study of Frozen section with Routine Histological Technique. National journal of laboratory medicine. 2016;5:44-50.
4. Nageswar Sahu *et al*. Evaluation of intraoperative Frozen sections: Experience in a Tertiary Care Hospital. IOSR Journal of Dental and Medical Science. 2018;17:24-28.
5. Rafael Denadaj Pigozzi Da Silva, *et al*. Diagnostic accuracy of Frozen section test for surgical diseases. Rev.col Bras Cir. 2011;38:149-154.
6. Colbassani HJ, Nishio S, Sweeney KM, *et al*. CT assisted stereotactic brain biopsy: value of intraoperative frozen section diagnosis. J Neurol Neurosurg Psychiatry. 1988;51(3):332-41.
7. Folkerth RD. Smears and frozen sections in the intraoperative diagnosis of central nervous system lesions. Neurosurg Clin N Am. 1994;5(1):1-8.
8. Shah AB, Muzandar GA, Chitale AR, Bhagwati SN. Squash preparation and frozen section in intraoperative diagnosis of central nervous system tumors. Acta Cytol, 1998, 42.
9. Agarwal P, Gupta S, Singh K, Sonkar AA, Rani P, Yadav S, *et al*. Intra- Operative Frozen section: Experience at A tertiary care centre: Asian Pac J cancer Prev. 2016;17(12):5057-5061
10. Adams HJ, Grahan DI, Doyle D. The Smear Technique for Surgical Biopsies. London: Chapman and Hall; c1981.
11. Moss TH, Nicoll JAR, Ironside TW. Intraoperative diagnosis of nervous system tumours. London: Arnold; c1997.
12. Arikan Ilker, Barut Aykut, Harma Muge, Harma Mehmet Ibrahim, Ozmen Bayar Ulku, Gezer Sener, *et al*. Accuracy of intra-operative frozen section in the diagnosis of ovarian tumours. J Pak Med Assoc. September 2011;61(9):856-858.
13. Khoo JJ. An Audit of Intraoperative Frozen Section in Johor. Med J Malaysia. 2004 March;59(1):50-55.
14. Patil P, Sukla S, Bhake A, Hiwale K. Accuracy of Frozen section analysis in correlation with surgical pathology diagnosis. Int J Res Med Sci. 2016;3(2):300-404.
15. Ahmad Z, Barakzai MA, Idrees R, Bhurgri Y. Correlation of intraoperative frozen section consultation with the final diagnosis at a referral centre in Karachi,Pakistan. Indian journal Pathology Microbiol. 2008;51(4):469-473.
16. Roy S, Parwani AV, Dhir R, Yousem SA, Kelly SM, Pantanowitz L. Frozen section diagnosis is there discordance between what pathologist say and what surgeons hear? Am J clin Pathol. 2013;140(3):363-369.
17. Shrestha S, Lee MC, Dhakal H, Pun CB, Pradhan M, Basyal R, *et al*. Comparative study of frozen section diagnosis with histopathology. Postgraduate medical journal of NAMS. 2009;29(9):1-5.
18. Burger PC. Use of cytological preparations in the frozen section diagnosis of central nervous system neoplasia. Am J Surg Pathol. 1985;9(5):344–354.
19. Lippincott, Williams & Wilkins. Biopsy Interpretation: The Frozen Section 2nd edition CNS 15-368.
20. Kaira V, Gupta AK, Agarwal A, Kala S, Kaira P. Frozen Section versus Paraffin Section in Diagnosis of Breast Lesions: A Comparative Study. Clin Cancer Investig J. 2018;7(2):70-73.
21. De Silva RD, Souto LR, Matsushita Gde M, Matsushita Mde M. Diagnostic accuracy of frozen section test for surgical diseases. Rev. Col. Bras. Cir. 2011;38:149-154.

How to Cite This Article

Chavda CI, Shah AM, Goswami HM, Vaghani JA. Diagnostic accuracy of intra-operative frozen section at tertiary care center. International Journal of Clinical and Diagnostic Pathology. 2022;5(4):11-15.