



## Diagnostic Accuracy And Its Discordance In Intraoperative Frozen Consultation Of Surgical Pathology Diagnosis In A Tertiary Care Hospital

<sup>1</sup>Dr. Majunatha Hk , <sup>2</sup>Dr. Sushma TA, <sup>3</sup>Dr. Dharani VC, <sup>4</sup>Dr. Bhargavi Mohan, <sup>5</sup>Dr. Priyadarshini, <sup>6</sup>Dr. Priyanka. K.M, <sup>7</sup>Dr. Akshatha Basavaraju, <sup>8</sup>Dr. Mythri.B.M\*

<sup>1</sup>Professor and Head, <sup>2,3,4</sup>Associate Professor, <sup>5,6</sup>Postgraduate, <sup>7,8</sup>Assistant Professor,  
Department Of Pathology,

<sup>1,3,4,5,6,7,8</sup> BGS Global Institute Of Medical Science, Bangalore, India

<sup>2</sup>Shri Atal Bihari Vajpayee Medical college and Research institute

### \*Corresponding Author:

**Dr. Mythri. B.M**

Assistant Professor, Department Of Pathology,  
BGS Global Institute Of Medical Sciences, Bangalore, India

Type of Publication: Original Research Paper

Conflicts of Interest: Nil

### Abstract

**Background:** Frozen section (FS) is an Intraoperative/Onsite rapid diagnostic procedure performed on surgical tissue. Frozen section helps in categorizing the tissue as benign or malignant, confirming the presence or absence of metastasis and the status of excised margins. Thus, frozen section reporting has important implication on clinical decisions made on the operating table and therefore, it is critical to determine the efficacy of frozen section reporting periodically.

**Aim:** To analyse the diagnostic accuracy of frozen section reporting in comparison to the subsequent histopathology report, and to find the concordance and discordance rate of frozen section reporting.

**Methods:** In this retrospective study 74 cases of frozen section were compared with paraffin section diagnosis in BGS Global Institute of medical science, Bengaluru from June 2021 to May 2022. Sensitivity, Specificity, Positive predictive value, and negative predictive value were calculated using SPSS 23 software.

**Results:** The overall diagnostic accuracy was 96%. Sensitivity, Specificity, Positive predictive value and negative predictive value were 83%,100%, 83% and 100% respectively. Discordant rate in the present study was 4% and the reason for discordance were related to interpretation errors and sampling error.

**Conclusion:** Frozen section is a reliable, accurate and useful technique for rapid on site diagnosis intraoperatively. While it is fraught with many limitations in comparison with paraffin embedded sections, it is nevertheless very helpful in making critical clinical decisions on the operating table. Thus, accuracy of frozen section reporting forms an integral part of quality assurance in surgical pathology laboratory.

**Keywords:** Frozen Section, Cryosection, Histopathology, Snap freeze fixation

### Introduction

A Frozen section (FS) is a rapid diagnostic procedure performed on surgical tissue obtained intraoperatively, hence known as Intraoperative Consultation. Frozen section was introduced first by Welch in 1891 and later evolved by Cullen, Wilson , Mac Carty et al as a diagnostic tool.[1]

The main indication of frozen section is differentiating the suspected lesion as benign or malignant neoplasm.[2,3] Other indications being tissue identification, status of margins, lymph node metastasis in wide lesion excision/radical surgical specimens, etc.[4,5] FS also guides the operating surgeon to decide about the extent/or adequacy of

surgery so that rate of unwarranted repeat surgery could be minimized.

The tissue specimen is taken from the patient intraoperatively and the specimen is examined grossly and microscopically by the pathologist. The Pathologist must arrive at a correct diagnosis in limited time. The report is conveyed to the operating surgeon by a telephonic call which helps the surgeon to make swift, critical clinical decisions.

Even though FS provides rapid diagnosis, it has its own drawbacks like sampling error, technical problems and interpretative errors which affects the diagnosis and leads to diagnostic discrepancies between FS and paraffin sections.[6]

Periodically FS and paraffin section should be compared as an internal quality indicator in Histopathology, hence improving the diagnostic accuracy of FS.[7]

This study aims at evaluating the diagnostic accuracy of frozen section and evaluation of concordant and discordant cases.

### Materials And Methods:

This is a Retrospective study carried in the Department of Pathology, Histopathology section at BGS Global Institute of Medical College and Hospital ,Bengaluru, Karnataka, India. Study period was from June 2021- May 2022(One year). All samples received in histopathology section with request for frozen section, from various surgical departments were included. All the clinical and demographic details were retrieved from patient's file. Samples were received without any added fixative. Following gross examination by the pathologist, representative bits were given. Bits were processed in Cryostat machine- Leica CM1520 (snap freeze fixation)and sections were cut at 4-5  $\mu$  thickness and stained with Hematoxylin and Eosin(H&E). The slides were reported by 3 pathologists and the consensus report was communicated to the operating surgeon verbally and also by printed hardcopy as early as possible. Following reporting of frozen section, remaining tissue was fixed in formalin and processed for routine paraffin sectioning. Frozen section diagnosis was compared with paraffin section diagnosis and results were grouped according to anatomical site, further categorized as concordant, discordant and

inconclusive. The diagnostic accuracy, sensitivity and specificity, positive predictive value and Negative predictive value was calculated respectively using SPSS 23 Software.

### Results:

Our study comprised of 74 cases; of which 63 were females and 11 were males. Age range was wide from 10 years to 80 years. Indications for frozen in our institution were:

Primary diagnosis and categorization of the lesion(63cases)

Evaluation of margins (11 cases)

Assessment of nodal status (03 cases)

**Table 1** shows the Distribution of cases according to anatomical sites and indications

**Lesions from the breast** comprised of 24 cases with diagnostic accuracy of 100%.[**Table 2**] Lesions include Infiltrating ductal carcinoma (8cases) (**Figure 1:a,b**), phyllodes (3 cases), fibroadenoma (5 cases), and epidermal inclusion cyst(1 case). Seven cases were sent for margin evaluation.

**Lesions from the ovary** comprised of 14 cases; cases were benign surface epithelial tumour (09cases)(**Figure 2:a,b**), mucinous tumor of ovary (1 case) (**Figure 2:c,d**), Benign cystic teratoma(1 case),fibrothecoma (2 case), and malignant ovarian tumour(1) Diagnostic accuracy of 92.8% was achieved with one discordant case where frozen section diagnosis was given as fibrothecoma and on subsequent paraffin sections, signet ring cells (krukenberg tumor) were seen.[**Table 3**]

**Lesions from thyroid** comprised of 15 cases; cases were Nodular colloid goiter (5 case), nodular colloid with multifocal adenomatoid nodule(3 case), nodular goiter with dominant adenomatous nodule with extensive cystic degeneration(1 case),multinodular goiter(1 case), adenomatoid hyperplasia (2case)(**Figure 3:a,b**) and papillary carcinoma (3 cases)(**Figure 3 :c,d**) with diagnostic accuracy of 100%

**Lesions from GIT** comprised of 9 cases, cases were lipoma (2 case), chronic calculus cholecystitis (1 case), chronic pancreatitis (1 case), pancreatic malignancy (1 case) and one case of adenocarcinoma recto sigmoid junction were encountered, with

diagnostic accuracy of 88.8%, with one case of discordance where frozen section was given as chronic cholecystitis and paraffin section was diagnosed as adenocarcinoma.

**Lesions from Oral cavity** comprised of 3 cases with diagnostic accuracy of frozen section of 100%. Cases were squamous cell carcinoma from buccal mucosa(2 cases)(**Figure 1:c,d**) and tongue.

**Lesions from Soft tissue** comprised of 3 cases with diagnostic accuracy of 100%. Cases were scar

endometriosis, dermatofibrosarcoma protuberance and fibromyxoid neoplasm

One lesion from skin- basal cell carcinoma was diagnosed with accuracy of 100%.

The overall accuracy was 96% with 83% sensitivity and 100 %specificity; Positive predictive value and negative predictive value being 83% and 100% respectively.

**Table 1: Distribution of cases according to anatomical sites and indications**

Anatomical Sites	Total Cases	Diagnosis of lesion	Evaluation of margins
Breast	24	17	07
Ovary	14	14	00
Thyroid	15	15	00
GIT	09	09	00
Oral Cavity	03	00	03
Salivary gland	02	02	00
Soft tissue	03	03	00
Skin	01	00	01
Lymph node	03	03	00
<b>Total</b>	<b>74</b>	<b>63</b>	<b>11</b>

**Table 2: Diagnostic accuracy of frozen section according to anatomical site**

Anatomical site/organ	Number of cases	Concordant cases	Discordant cases	Accuracy (%)
Breast	24	24	00	100%
Ovary	14	13	01	92.8%
Thyroid	15	15	00	100%
GIT	09	08	01	88.8%
Oral cavity	03	03	00	100%
Salivary gland	02	01	01	50% %
Soft tissue	03	03	00	100%
Skin	01	01	00	100%
Lymph node	03	03	00	100%

<b>Total</b>	<b>74</b>	<b>71</b>	<b>03</b>	<b>96%</b>
--------------	-----------	-----------	-----------	------------

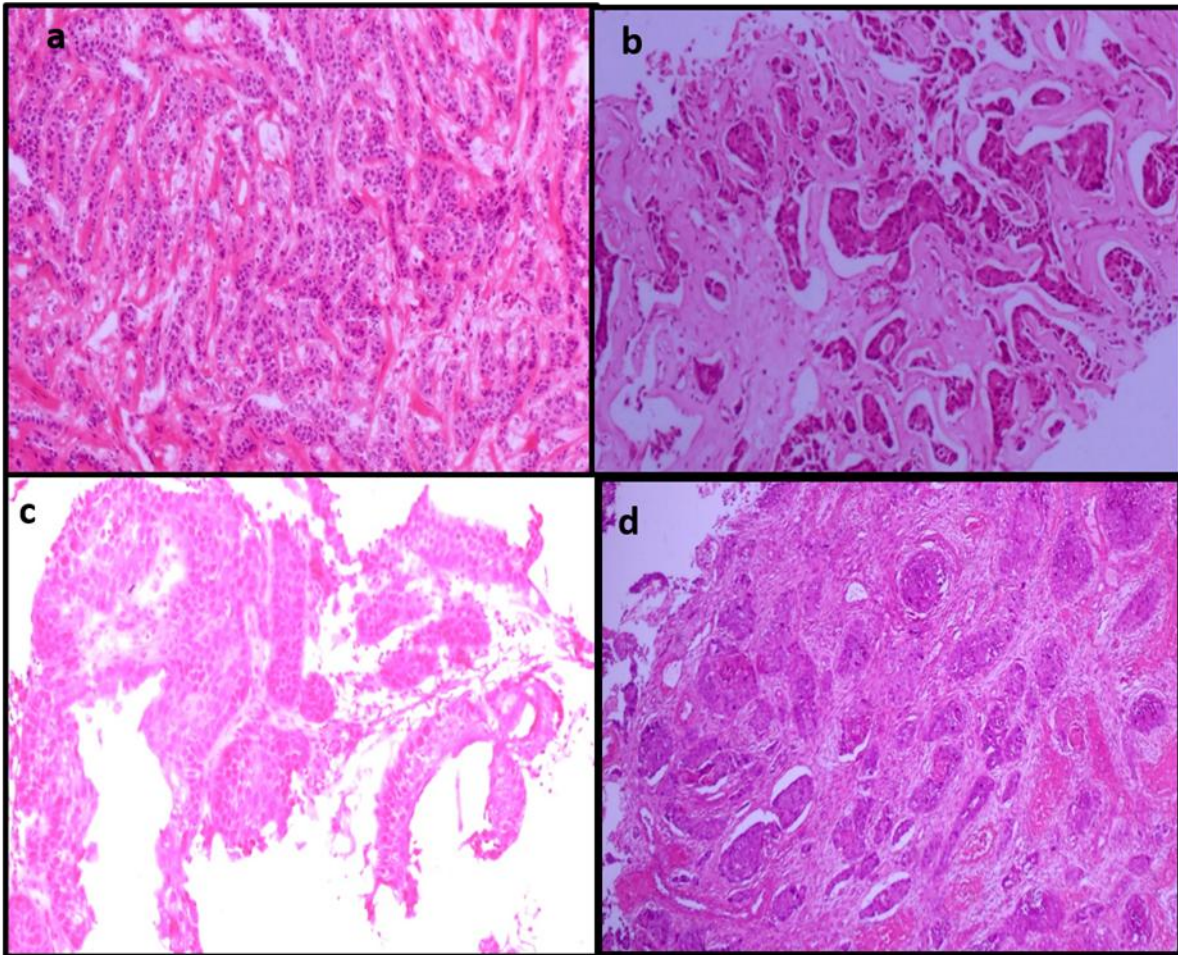
**Table 3: Details of Discordant cases**

<b>Anatomical site</b>	<b>Frozen section diagnosis</b>	<b>Paraffin section diagnosis</b>	<b>Reason for Discrepancy</b>
Ovary	Fibrothecoma	Krukenberg tumor	Interpretative error
GIT	Chronic Cholecystitis	Adenocarcinoma	Sampling error
Salivary Gland	Spindle cell lesion	Chronic sialadenitis	Interpretative error

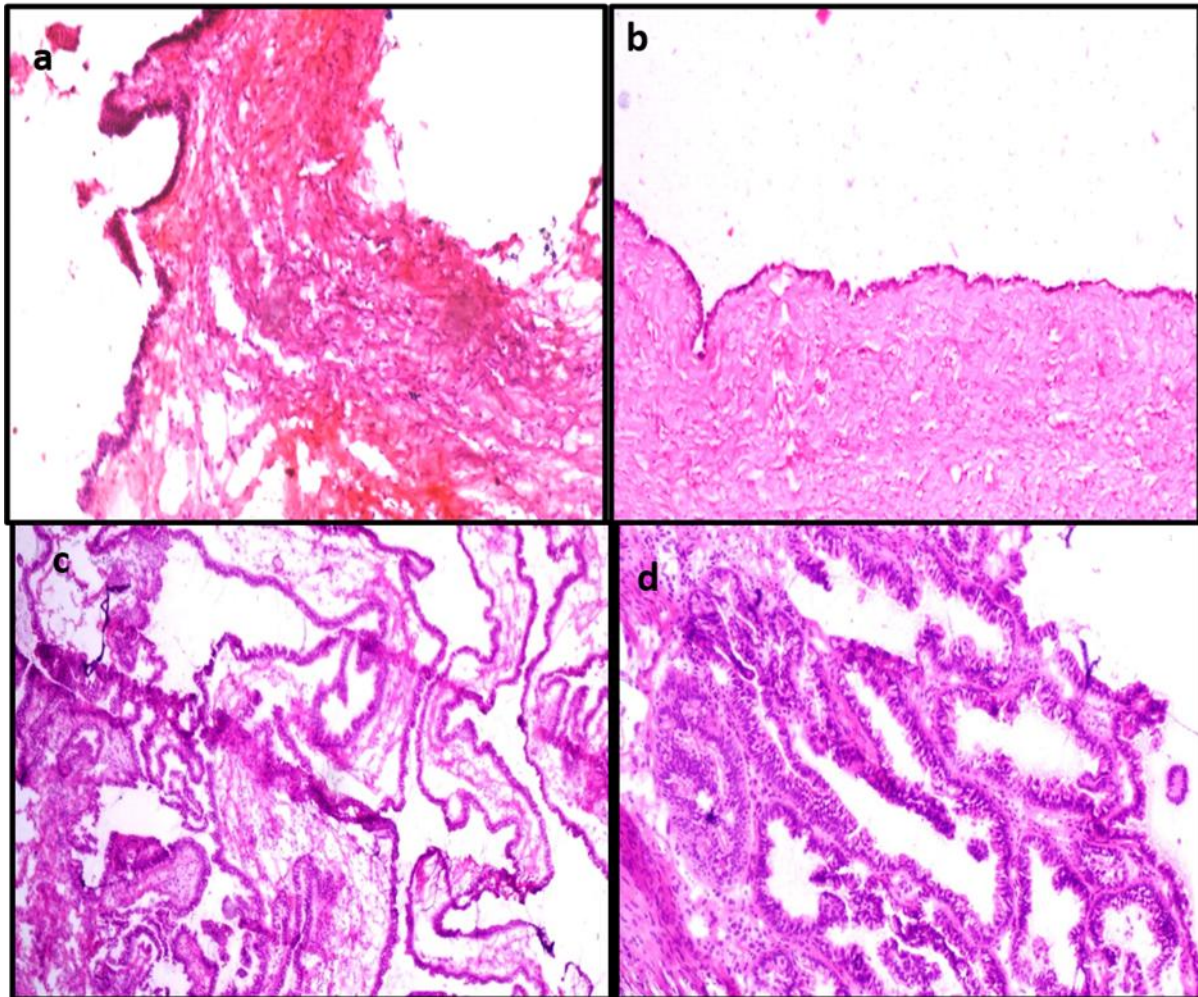
**Table 4: Comparative table showing the accuracy, sensitivity and specificity of various studies**

Name of study	Country	Study period	Number of cases	Accuracy	Sensitivity	Specificity
Chandramouleshwari k et al. <sup>(8)</sup>	India	1 year	51	92%	-	-
Anupama Dayal et al. <sup>(9)</sup>	India	1.5 year	170	95.30%	93.40%	98.44%
Shrestha S et al. <sup>(10)</sup>	india	5year	404	94.6%	94.56%	94.55%
Patil P et al. <sup>(11)</sup>	India	1year	100	96.96%	97.23%	98.44%
Chbani et al <sup>(12)</sup>	Morocco	01 year	261	95%	-	-
Hatami H et al <sup>(13)</sup>	Iran	06 year	306	97.96%	92.95%	99.55%
Farah-Klibi F et al <sup>(14)</sup>	France	03 year	1207	97.5%	84.6%	99.8%
<b>Present study</b>	<b>India</b>	<b>01year</b>	<b>73</b>	<b>96%</b>	<b>83%</b>	<b>100%</b>

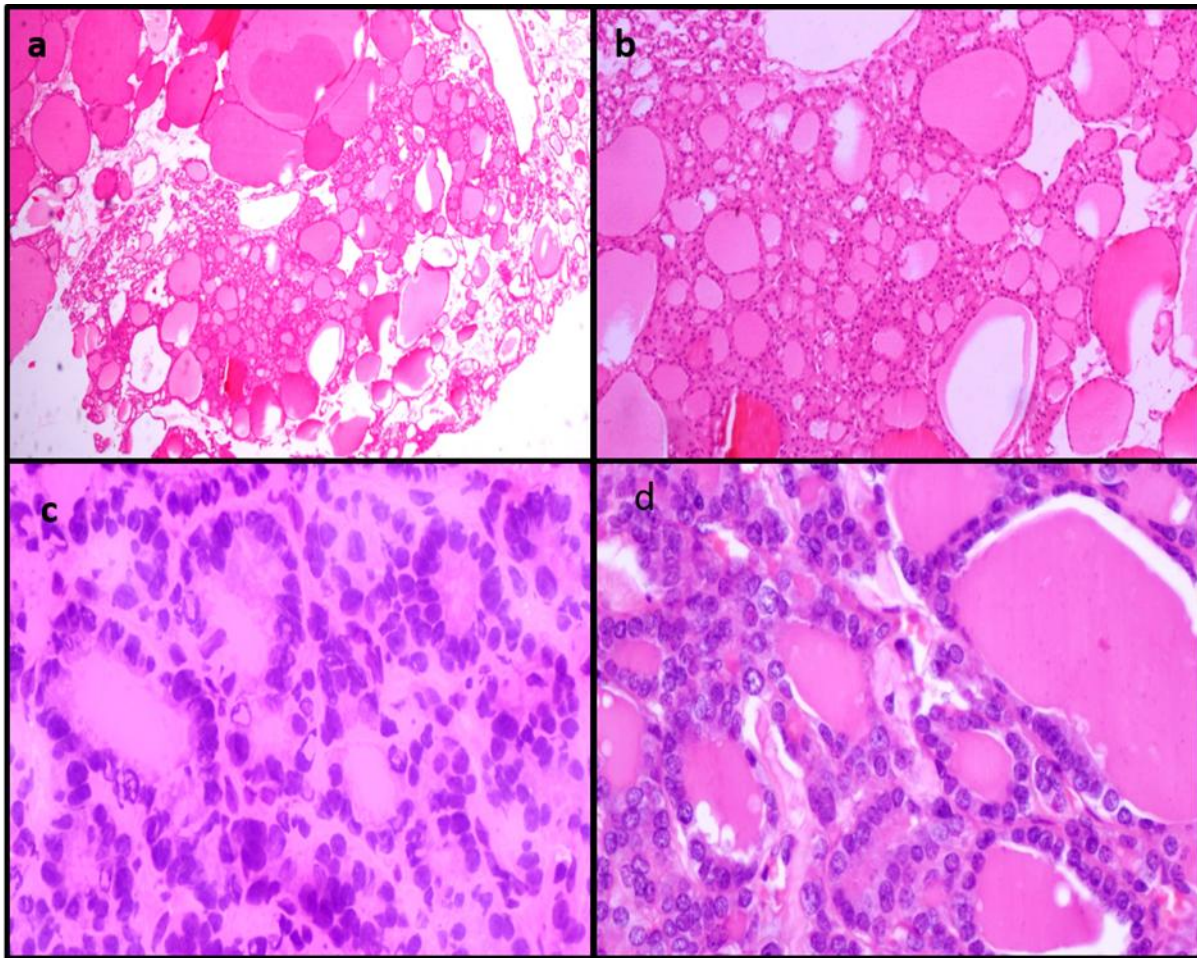
**Figure 1: Infiltrating Ductal Carcinoma Breast on frozen section(a) & on Paraffin section(b). Squamous cell carcinoma of buccal mucosa on frozen section(c)& on Paraffin section(d).H&E stain 10x**



**Figure 2: Serous cystadenoma of ovary in frozen section(a) and on paraffin section(b). Mucinous tumour of ovary on frozen section(c)& on Paraffin section( d). H&E stain 10x.**



**Figure 3: Adenomatoid Hyperplasia of thyroid on frozen section(a) and on Paraffin section(b) and follicular variant of papillary carcinoma on frozen section(c) and on paraffin section(d).H&E stain 40x.**



### Discussion:

The technique of frozen section was first introduced by William H Welch, pathologist in 1891. Later in 19th century, Frozen section was used for intraoperative consultation by use of cryostat, a cabinet with -20 to -30 degree Celsius cooling and enclosed microtome blade.[8]

Frozen section is a rapid diagnostic tool for intraoperative management of patient. The correlation between intraoperative diagnosis and histopathological diagnosis is an important quality assurance in surgical pathology.

The diagnostic accuracy can be improved by using “STANDARDS FOR REPORTING OF DIAGNOSTIC ACCURACY STUDIES (STARD)” which has been incorporated in the Present study.[9]The overall accuracy was 96% with 83% sensitivity, 100% specificity. Positive predictive

value and negative predictive value being 83% and 100% respectively. **Table 4** shows the comparative table of diagnostic accuracy, sensitivity and specificity of various studies

Though FS provides rapid diagnosis it has its own drawbacks like sampling error, technical problems and interpretative errors which affects the diagnosis and leads to diagnostic discrepancies between FS and paraffin sections.[15,16]

Sampling errors include poor sampling and poor selection of the tissue, and samples from necrotic area.

Technical problems can be freezing artifacts, poor quality sections, bloated cell morphology, and poorly stained sections.

Interpretative errors can be seen in mixed tumors and biphasic tumors, tumors with variable degree of

differentiation and also the inexperience on part of the pathologist.[6]

Discordant rate in the present study was 4% and the causes were: Interpretative errors and sampling errors which was also seen in Zarbo et al,Novis et al and Ahmed Z et al.[17-19]

Interpretative errors were encountered in two cases, one case was in ovary were Krukenberg tumor was reported as Fibrothecoma on frozen section, and one more case was in salivary gland were chronic sialadenitis was misinterpreted as spindle cell lesions[Table 3].

In one case in GIT, adenocarcinoma of gall bladder was reported as chronic cholecystitis in frozen section and it was due to sampling error[Table 3].

### Conclusion:

Frozen section is a reliable, accurate and useful technique for rapid diagnosis intraoperatively. Methodical examination of gross specimen, proper sampling, staining and good interdepartmental communication helps in improving the accuracy and making critical clinical decisions on the operating table. Continuous monitoring with quality assessment by the laboratory helps in maintaining good quality reports and reducing errors.

### References:

1. Tangde, A., Shrivastava, V., & Joshi, A. (2019). Analysis of frozen section in correlation with surgical pathology diagnosis. *International Journal of Research in Medical Sciences*, 7(6), 2312–2317. <https://doi.org/10.18203/2320-6012.ijrms20192519>
2. altzstein SL, Nahum AM. Frozen section diagnosis: accuracy and errors; uses and abuses. *Laryngoscope*.1973;83(7):1128-43
3. Makay O, Icoz G, Gurcu B, Ertan Y, Tuncyurek M, Akyildiz M, et al The ongoing debate in thyroid surgery: should frozen section analysis be omitted ? *Endocr J*.2007; 54(3):385-90.
4. Dehner LP, Humphrey PA, Pfeifer JD. Chapter 52. In: Hull ME, Humphrey PA,Pfeifer JD editors. *Washington manual of surgical pathology*. 2nd edition. Missouri:Lippincott Williams and wilkins; 2012..
5. Susan CL .*Manual of Surgical Pathology*. Second edition. Elsevier; 2006, p 49-69
6. Jaafar H. Intra-operative frozen section consultation: concepts, applications and limitations. *Malays J Med Sci*. 2006 Jan;13(1):4-12. PMID: 22589584; PMCID: PMC3347896.
7. Geramizadeh B, Larijani TR, Owji SM, Attaran SY, Torabinejad S, Aslani FS, et al., Accuracy of intraoperative frozen section consultation in south of Iran during four years. *Indian J of Pathol & Microbiol*. 2010;53(3):414-17.
8. Chandramouleeswari K, Yogambal M, Arunalatha P, Bose JC, Rajendran A.Frozen and paraffin sections- Comparative study highlighting the concordance and discordance rates in a tertiary care centre. *IOSR Journal of Dental and Medical Sciences*. 2013;12(5):26-30.
9. Anupama Dayal et al., Diagnostic Accuracy of Frozen Section in Surgical Diseases with Critical Evaluation of Discordant Reports. *National Journal of Laboratory Medicine*. 2019 Apr, Vol-8(2): PO11-PO15
10. Shrestha S, Basyal R, Pathak TSS, Lee M, Dhakal H, Pun C, et al. Comparative Study of Frozen Section Diagnoses with Histopathology. *Post Graduate Medical of NAMS*. 2009;9(02):01-05
11. Patil P, Shukla S, Bhake A, Hiwale K. Accuracy of frozen section analysis in correlation with surgical pathology diagnosis. *Int J Res Med Sci*.2015; 3:399-04
12. Chbani L, Mohamed S, Harmouch T, El Fatemi H, Amarti A. Quality assessment of intraoperative frozen sections: An analysis of 261 consecutive cases in a resource limited area: Morocco. *Health*. 2012;4(7):433-35
13. Hatami H, Mohsenifar Z, Alavi SN. The diagnostic accuracy of frozen section compared to permanent section: A single center study in Iran. *Iran J Pathol*.2015;10(4):295-99
14. FarahKlibiF, NejiO, FerjaouiM, ZaoucheA, KoubaaA, SfarR,etal. Accuracy of frozen section diagnosis: an analysis of 1695 consecutive cases. *TunisMed*. 2008; 86 (7):693-7
15. AckermanLV,RamirezGA.The indications for and limitations of frozen section diagnosis. A review of 1269 consecutive frozen section diagnoses.*BrJSurg*.1959;46(198):336-50.
16. SusanC.Lester.*Operating Room Consultations.Manual of Surgical Pathology*.Philadelphia:ChurchillLivingstone,2001:3940.



17. ZarboRJ,HoffmanGG,HowanitzPJ.Interinstitutional comparison of frozen section consultation: A College of American Pathologists Q-Probe study of 79,647 consultations in 297 North American institutions. Arch Pathol Lab Med. 1991;115:1187-94.
18. NovisDA,GephardtGN,ZarboRJ.College of American Pathologists. Interinstitutional comparison of frozen section consultation in small hospitals: A College of American Pathologists Q-probe study of 18,532 frozen section consultation diagnoses in 233 small hospitals. Arch Pathol Lab Med. 1996;120(12):1087-93.
19. AhmadZ, BarakzaiMA, IdreesR, BhurgriY. Correlation of intra operative frozen section consultation with the final diagnosis at a referral center in Karachi, Pakistan. Indian J Pathol Microbiol. 2008;51(4):469 .