Available online at https://www.mmpubl.com/

International Journal of Histopathological Interpretation

Original Article

Diagnostic accuracy and replicability of Frozen section diagnosis in Ovarian Masses- A Tertiary health care institutional experience

Gowthami N [1], Bushra Siddiqui [2], Veena Maheshwari[3], Mahboob Hasan[3]*

1Junior Resident, 2Assistant Professor, 3Professor, Department of General Pathology, Jawaharlal Nehru Medical College, Aligarh

How to cite: Gowthami N., Diagnostic accuracy and replicability of Frozen section diagnosis in Ovarian Masses- A Tertiary health care institutional experience. Int J Histopathol Interpret 2023; 12(2); 17-25

DOI: ***https://doi.org/10.56501/intjhistopatholinterpret.v12i2.909***

Received 24/09/2023: *Accepted: 29/11/2023* *Web Published: 02/12/2023*

ABSTRACT:

Introduction: Ovarian neoplasms are a composite group of tumors including surface epithelial, germ cell and sex cord stromal tumors. A subgroup of neoplasms having low malignant potential that is, borderline tumors are also present. The surgical management of each group of neoplasm is varied. Since preoperative diagnosis is arbitrary, the role of the intraoperative frozen section has become beneficial.

Purpose: In our study, we aimed to evaluate the diagnostic accuracy of the frozen section by comparing it with the definitive histopathological report.

Methods: This was a 5 years retrospective study (June 2018 to June 2023). Data of the patients have been retrieved from archives of Histopathology from the Department of Pathology. The specimens received, after gross examination, a few blocks have been prepared on the frozen section. After frozen section reporting, the specimen was fixed in 10% BNF and processed for routine paraffin sections for the final histopathological report. Then the results of the frozen section and H&E sections were compared and categorized as benign, borderline and malignant to get the accuracy of the frozen section.

Results: Out of 75 frozen section diagnoses included in our study, benign contributed 58.7%, borderline- 13.3% and malignant- 28%. The final paraffin sections revealed benign tumours- 57.3%, borderline- 10.7% and malignant- 32%. There were 7 discordant cases among which 2 were overdiagnosed and 5 were underdiagnosed.

Conclusion: The overall accuracy rate of our study was 93.7% which is within the limit of the accuracy range reported in the literature. Hence, the intraoperative frozen section is an important diagnostic tool for surgeons in determining the treatment of ovarian masses with certain limitations.

Keywords: Ovarian neoplasms, Frozen section, Accuracy

Address for Correspondence:
Dr. Gowthami N
Junior Resident, Department of Pathology, Jawaharlal Nehru Medical College, Aligarh
Email: gowthamiparimala@gmail.com

INTRODUCTION:

Ovarian cancer is the third most common gynecological malignancy, the first and second being cervical and uterine cancers respectively. Ovarian neoplasms are categorized histologically into epithelial, germ cell, and sex cord-stromal tumours. Based on clinical behaviour, epithelial tumours are further classified into benign, borderline and malignant [1-3] In India ovarian cancer contributed to 14.4% of female cancers after breast cancer (44.3%) and cervical cancer (41.5%) [2]

Ovarian tumours can be diagnosed in women of all age groups with peak incidence found in women belonging to the postmenopausal age group between 56-60 years[2,4] Ovarian cancers are often called silent killers due to their vague presentation and non-specific symptoms. Clinicians face trouble in diagnosis because the onset is insidious and is usually asymptomatic in the early stages[3]Although many methods are available to assess the malignant properties of ovarian masses including Ultrasonography, CT scan, MRI and CA125, none of them are specific and accurate[2]

Histopathological diagnosis remains the gold standard technique. An intraoperative frozen section becomes a valuable tool since it provides a primary clue of tumours as benign, borderline and malignant and further guides the surgeon to determine the extent of surgery and further follow-up [3] This study aims to assess the diagnostic accuracy, sensitivity, and specificity of the intraoperative frozen section by comparing it with the final histopathological examination.

MATERIALS AND METHODS:

The study was a 5-year retrospective study from the period of June 2018 to June 2023 in the Department of Pathology in a tertiary care hospital with a gynecological unit. This study includes all the cases diagnosed clinically and radiologically as ovarian masses.

The preoperative details of the patients have been analysed from the case records including the details of demography, clinical history, age, menopausal status, clinical and radiological diagnosis, serum markers like CA125, frozen section report and final histopathological report. Gross examination of ovarian specimens received for the frozen section was observed and recorded. Representative sections were taken from ovarian tumours, particularly cystic and solid areas. The number of sections depended on the tumour size and the pathologist's decision. These sections were frozen to -27°C. The provisional diagnosis was made based on these sections by pathologists and were informed to the operating surgeon. Frozen sections taken from the female genital tract other than the ovary, the cases with necrosis or haemorrhage only without any epithelial lining were excluded from the study.

The specimen was then fixed with 10% BNF. Paraffin blocks of the frozen section as well as specimens were processed for routine H&E sections. The final histopathological diagnosis was made and classified according to WHO classification. The tumours were also classified as benign, borderline and malignant. Finally, the frozen reports were compared with the final histopathological report in each case. The concordant and discordant cases were isolated.

The parameters like sensitivity, specificity, positive predictive value, and negative predictive values were analysed for various categories i.e., benign, borderline and malignant were calculated by using the standard 2x2 method. The diagnostic accuracy was the number of concordant cases between the frozen section and the final H&E diagnosis out of the total number of cases. The cases with the discordant diagnosis were reviewed.

RESULTS:

This study included 76 cases with ovarian masses who underwent intraoperative frozen section, among which one case showed only necrosis without any epithelium or cyst. So, the study was conducted in 75 cases. These tumours were classified according to WHO classification as shown in Table 1 & Figure 1. The most common type was epithelial tumours which comprised 60% of all cases. Among the epithelial tumours, serous tumours (benign, borderline, malignant) were more common that accounted for 36/75 followed by mucinous tumours comprising 9/75 of the total cases of the study.

Out of 75 cases, the frozen section diagnosis of this study included 44 (58.7%) benign tumours, 10 (13.3%) borderline tumours, 21 (28%) malignant tumours. The permanent paraffin section diagnosis showed 43 (57.3%) benign cases, 8 (10.7%) borderline cases, 24 (32%) malignant cases as depicted in Table-2.
The concordant and discordant cases were evaluated. (Figure 2 & Figure 3). Among the 44 benign cases, concordant cases were 41 whereas the discordant cases i.e., underdiagnosed cases were 3. Among the 10 borderline cases, 7 cases were concordant and 3 cases were discordant in which 1 was over diagnosed and 2 were underdiagnosed. Among the 21 malignant cases, 20 were concordant and 1 was discordant which was over diagnosed (Table-3)
The statistical parameters like sensitivity, specificity, positive predictive value, and negative predictive values for benign, borderline, and malignant tumours were calculated (Table-4)

The overall accuracy of the frozen section in the diagnosis of ovarian tumours in our study is 93.7%. The accuracy of our study is compared with that of others in the literature in Table-5.

WHO type	Histologic type	Type of tumour	Number of cases	Percentage
Epithelial (45)	Benign	Serous	20	60%
		Mucinous	4	
	Borderline	Serous	4	
		Mucinous	4	
	Malignant	Serous	12	
		Mucinous	1	
Sex cord stromal tumour (4)	Benign	Fibroma	2	5.3%
		Sclerosing stromal tumour	1	
	Malignant	Sertoli Leydig cell tumour	1	
Germ cell tumour (9)	Benign	Mature teratoma	5	12%
	Malignant	Yolk sac tumour	3	
		Immature teratoma	1	
Metastatic (3)	Malignant	Endometrioid carcinoma	2	4%
		Invasive breast carcinoma	1	
Others (14)	Benign	Simple cyst	3	18.7%
		Endometriotic cyst	3	
		Endometriosis	2	
		Leiomyoma	4	
	Malignant	Non-Hodgkins Lymphoma	1	
		Leiomyosarcoma	1	
		Grand Total	75	100%

Table-1: WHO distribution of various histologic types of ovarian neoplasms in our study

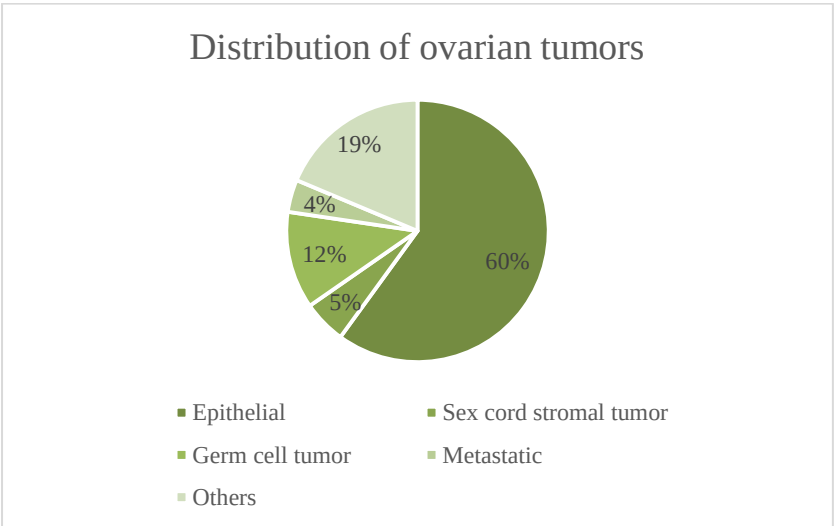

Figure-1: Distribution of ovarian neoplasms in pie chart

Type of section	Benign (%)	Borderline (%)	Malignant (%)	Total cases
Frozen	44(58.7)	10(13.3)	21(28.0)	75
Histopathology (Paraffin section)	43(57.3)	8(10.7)	24(32.0)	75

Table-2: Ovarian tumour distribution in the frozen section and paraffin sections in the study of 75 cases

	Permanent paraffin section			
Frozen	Benign	Borderline	Malignant	Grand total
Benign	41	1	2	44
Borderline	1	7	2	10
Malignant	1	0	20	21
Grand total	43	8	24	75

Table-3: Comparison of the frozen section and final histopathological diagnosis

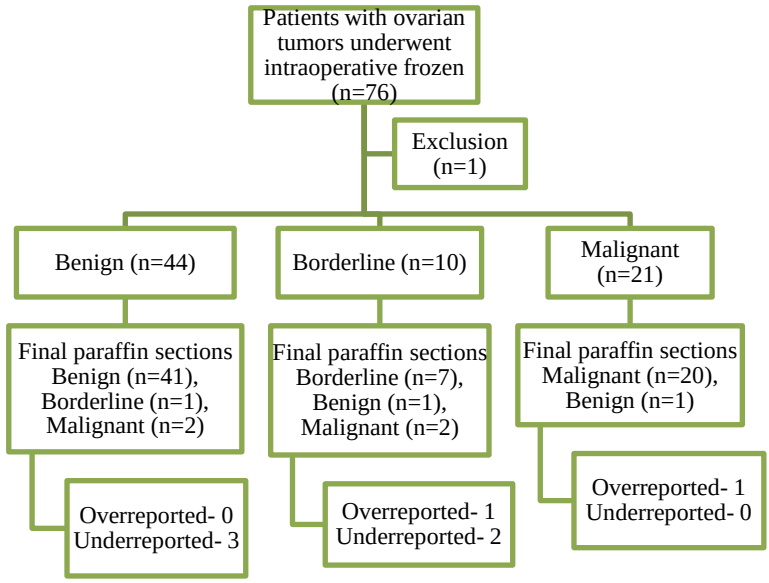

Figure-1: Flow chart showing Frozen section and permanent paraffin section cases

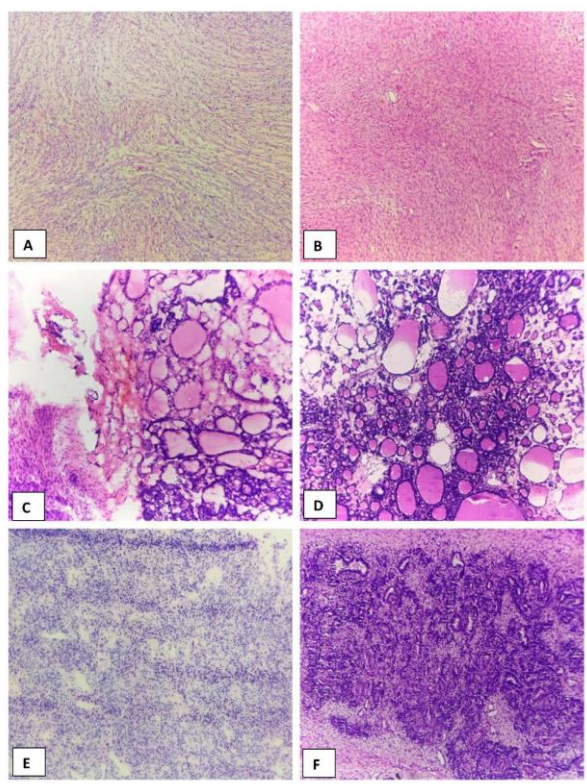

Figure-2(Concordant cases): Intersecting fascicles of spindle cells (**A**- Frozen; **B**- H&E- 10X); Variable-sized thyroid follicles, filled with colloid (**C**- Frozen; **D**- H&E- 10X); **E**- sheets of atypical cells in frozen; **F**- Yolk sac tumor showing glandular pattern (H&E- 10X)

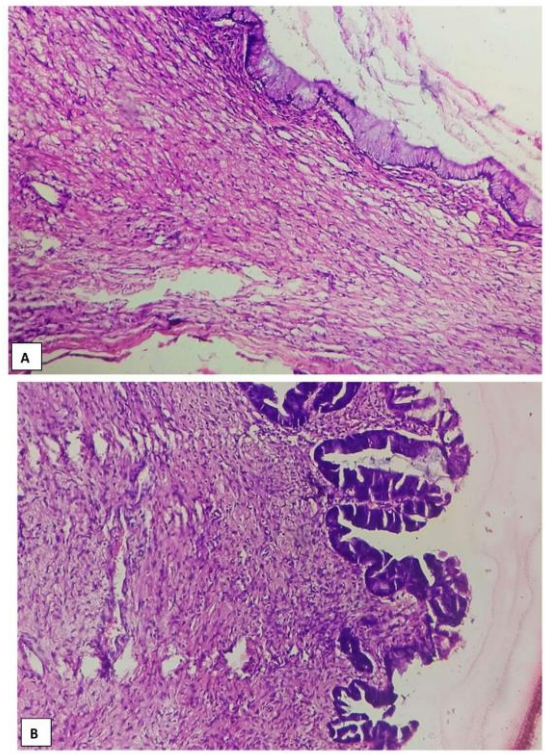

Figure-3 (Discordant case): A- Frozen section showing cyst wall lined by columnar cells with mucin (mucinous cystadenoma); **B**- Paraffin section showing a small focus of micro invasion- H&E-10X (borderline mucinous tumor)

Statistical Value (%)	Benign (%)	Borderline (%)	Malignant (%)
Sensitivity	95.3	87.5	83.3
Specificity	90.6	95.5	98
PPV	93.1	70	95.2
NPV	93.5	98.4	92.5

Table-4: Diagnostic value of frozen section in terms of sensitivity, specificity, PPV, NPV
PPV- Positive Predictive Value; NPV- Negative Predictive Value

Studies in literature	Number of cases included	Accuracy (%)
Obiakor et al.	311	93.8
Rose et al.	383	92.7
Twaalhoven et al.	176	86.3
Wang et al.	299	96
Maheshwari et al.	217	91.2
Madhusmita et al.	49	89.7
Subbian et al.	135	84.2
Our study	75	93.7

Table-5: Analysis of the accuracy of our data with available literature [7-12]

DISCUSSION:

The intraoperative or preoperative determination of the nature of ovarian tumors as benign, borderline and malignant is crucial since it plays a huge role in the plan of management. The preoperative clinical diagnosis, radiological investigation, or tumor markers like CA125 cannot definitely determine the nature of ovarian masses. However intraoperative frozen section is vital in deciding the management [1-3]

Benign tumors are managed conservatively by simple cystectomy or oophorectomy. Borderline tumors require pelvic lymph node dissection and limited omental sampling, whereas fertility-sparing surgeries are done for young women. For malignant tumors, surgical staging laparotomy is advised [1]

In our study, among 44 benign cases on frozen section, 41 were benign, 1 was borderline and 2 were malignant on final paraffin sections i.e., 3 were underdiagnosed. Among 10 borderline tumors, 7 were borderline, 1 was benign and 2 were malignant on the paraffin section i.e., 1 was over diagnosed and 2 were underdiagnosed. Whereas among 21 malignant tumors on the frozen section, 20 were malignant and 1 was benign on the paraffin section i.e., 1 was over diagnosed. Over diagnosis and under diagnosis were identified in 2.6% and 6.7% of cases respectively.

The expertise of pathologists is important in frozen section diagnosis. Over diagnosis leads to unnecessary extensive surgery whereas under diagnosis leads to suboptimal surgery.[1-4]The accuracy of the frozen section ranges from 71.9% to 97% [4-6]. Our study has a diagnostic accuracy of 93.7% which is within the limits reported in the literature. The sensitivity of the frozen section for a benign tumor ranges from 92.8% to 100% [7-11] whereas in our study the sensitivity is 95.3%. In our study, two malignant cases were reported as benign on the frozen section[12-14] One Yolk sac tumor of microcystic type was reported as a Benign surface epithelial tumor. Diagnosis of germ cell tumors and sex cord stromal tumors on frozen sections is difficult since they resemble surface epithelial tumors [5].The other one was a case of Leiomyosarcoma reported as a benign spindle cell lesion on a frozen section.

In our study, the sensitivity of frozen sections in borderline ovarian tumors is 87.5%. Similar studies of the literature revealed that frozen sections in borderline tumors have low sensitivity and positive predictive value [2, 6] The main limitation of the frozen section lies in the diagnosis of borderline ovarian tumors, particularly the mucinous type.

The sensitivity of frozen sections in malignant ovarian tumors ranges from 71% to 100%. In our study, the sensitivity is 83.3% [2] All the discordant cases were collected and re-evaluated which revealed that adequate sampling particularly from solid and firm areas & adequate knowledge of frozen sections for pathologists are needed to avoid these discordances.

Although frozen is a pivot tool, it has certain limitations that surgeons and pathologists should remember. Some of them are sampling error, freezing artifacts, time limitations, technical problems, lack of ancillary studies, interobserver variation and experience of pathologists [1-3, 13] few studies in the literature suggest that at least one frozen section should be taken for every 10cm diameter of the tumor. However, this is practically not possible due to limited time [2, 14]

CONCLUSION:

In conclusion, the diagnostic accuracy of the frozen section in the diagnosis of ovarian masses is 93.7% and has high sensitivity and specificity. Hence intraoperative frozen section is considered an eye-opener for gynecological surgeons to decide on surgical management. However, certain limitations of the frozen section have also been discussed that every surgeon and pathologist should be aware of.

Financial Conflict of Interest:

Nil

Sources of funding:

Nil

REFERENCES:

1. Zaiem F, Deirawan H, Kherallah R, Fehmi O, Jang H, Kim S, Bandyopadhyay S, Ali-Fehmi R. Accuracy and Reproducibility of Frozen Section Diagnosis in Ovarian Tumors: A 10-Year Experience at a Tertiary Cancer Center. Archives of Pathology & Laboratory Medicine. 2022 May 1;146(5):626-31.
2. Arshad NZ, Ng BK, Paiman NA, Mahdy ZA, Noor RM. Intra-operative frozen sections for ovarian tumors–a Tertiary Center Experience. Asian Pacific journal of cancer prevention: APJCP. 2018;19(1):213.
3. Jena M, Burela S. Role of frozen section in the diagnosis of ovarian masses: an institutional experience. Journal of Medical Sciences. 2017 Jan;3(1):12.
4. Muruthapongsatorn P, Inploy N, Prommas S, Smanchat B, Bhamarapravatana K, Suwannarurk K. The evaluation of intra-operative frozen section diagnosis accuracy of ovarian tumors; old fashioned not out of fashion. Asian Pacific Journal of Cancer Prevention: APJCP. 2019;20(12):3697.
5. Hashmi AA, Naz S, Edhi MM, Faridi N, Hussain SD, Mumtaz S, Khan M. Accuracy of intraoperative frozen section for the evaluation of ovarian neoplasms: an institutional experience. World journal of surgical oncology. 2016 Dec;14:1-5.
6. Huang Z, Li L, Li C, Ngaujah S, Yao S, Chu R, Xie L, Yang X, Zhang X, Liu P, Jiang J. Diagnostic accuracy of frozen section analysis of borderline ovarian tumors: a meta-analysis with emphasis on misdiagnosis factors. Journal of Cancer. 2018;9(16):2817.
7. Obiakor I, Maiman M, Mittal K, Awobuluyi M, DiMaio T, Demopoulos R. The accuracy of frozen section in the diagnosis of ovarian neoplasms. Gynecologic oncology. 1991 Oct 1;43(1):61-3.
8. Rose PG, Rubin RB, Nelson BE, Hunter RE, Reale FR. Accuracy of frozen-section (intraoperative consultation) diagnosis of ovarian tumors. American journal of obstetrics and gynecology. 1994 Sep 1;171(3):823-6.
9. Twaalfhoven FC, Peters AA, Trimbos JB, Hermans J, Fleuren GJ. The accuracy of frozen section diagnosis of ovarian tumors. Gynecologic oncology. 1991 Jun 1;41(3):189-92.
10. Wang KG, Chen TC, Wang TY, Yang YC, Su TH. Accuracy of frozen section diagnosis in gynecology. Gynecologic oncology. 1998 Jul 1;70(1):105-10.
11. Maheshwari A, Gupta S, Kane S, Kulkarni Y, Goyal LC, Tongaonkar HB. Accuracy of intraoperative frozen section in the diagnosis of ovarian neoplasms: experience at a tertiary oncology center. World journal of surgical oncology. 2006 Dec;4(1):1-4.

12. Subbian A, Devi UK, Bafna UD. Accuracy rate of frozen section studies in ovarian cancers: a regional cancer institute experience. Indian journal of cancer. 2013 Oct 1;50(4):302-5.
13. Ivanov S, Khadzhiolov N. Ovarian tumours--accuracy of frozen section diagnosis. Akusherstvo i Ginekologiia. 2005 Jan 1;44(1):11-3.
14. Suprasert P, Khunamornpong S, Phusong A, Settakorn J, Siriaungkul S. Accuracy of intra-operative frozen sections in the diagnosis of ovarian masses. Asian Pac J Cancer Prev. 2008 Oct 1;9(4):737-40.

Published by MM Publishers
https://www.mmpubl.com/ijhi