

## Diagnostic role of cell block method in serous effusions: A comparative study with conventional smear cytology

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### Abstract

**Background and Objectives:** Cytological examination of body cavity effusions is important in diagnosing neoplastic and non-neoplastic conditions. Study of conventional smear of effusions is a rapid method of analyzing the part of fluid. However, the residual material may be evaluated by cell block preparation. Hence, the present study is undertaken to assess diagnostic efficacy of cell block preparation (CB) by combined approach of conventional smear (CS) cytology and cell block preparation in serous effusion.

**Methods:** Serous fluid samples were analyzed from January 2012 to December 2014. Conventional smears and cell block sections were prepared as per the standard procedure and were interpreted separately noting the cellularity, obscuring background, cellular architecture and cytomorphological details. Statistical significance was determined by Chi-square test. Diagnostic accuracy, sensitivity and specificity of conventional smear cytology and cellblock study was calculated.

**Results:** A total of 110 samples were analysed, of which pleural, peritoneal and pericardial fluids were 49%, 46% and 5% respectively. By conventional smear cytology benign, suspicious and malignant cases were 76%, 14.5% and 9.5% respectively. By cell block study benign and malignant cases were 75.5% and 24.5% respectively. Additional 15.5% of cases were diagnosed as malignant by cell block study.

**Conclusion:** Cellular yield, architectural pattern and morphological features were better appreciated in cell block preparation than in conventional smear cytology which increased sensitivity of diagnosis. Hence cell block serves as useful adjuvant to conventional smears.

**Key words:** Serous effusions, Conventional Smear, Cell block

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### Introduction

Cytological examination of body cavity effusions is of paramount importance in diagnosing neoplastic and non-neoplastic conditions. Careful preparation and study of conventional smear of effusions leaves behind a large residue, that is not investigated, which may contain valuable diagnostic material. The residual material may be evaluated by cell block preparation.<sup>1,2</sup> Cell block study along with conventional smear cytology may improve the sensitivity of diagnosis. Hence, the present study is undertaken to assess diagnostic efficacy of cell block preparation (CB) by combined approach of conventional smear (CS) cytology and cell block preparation in serous effusion.

### Materials and Methods

A prospective study was conducted in department of Pathology, Navodaya Medical College and Research

Centre, Raichur Karnataka, from January 2012 to December 2014 after obtaining clearance from Institutional Ethics Committee for human subjects' research.

Fresh samples of serous (pleural, peritoneal and pericardial) fluids received at pathology department were included in the study and the details of clinical, laboratory and radiological findings were collected in available cases.

Physical examination of fluid was done, followed by conventional smear and cell block preparation. The fluid was divided into two equal volumes. The first volume of fluid was used for conventional smear cytology. The fluid is centrifuged at 1500rpm for 15 minutes and two smears were prepared from the sediment and stained with Papanicolou and Giemsa stain.

The second volume of fluid was used for cell block study. Equal volume of Nathan Alcohol Formalin was mixed and fixed for 1 hour, followed by centrifugation at 1500 rpm for 15 minutes. The sediment pellet was removed after decanting supernatant and processed for obtaining Hematoxylin and Eosin stained histopathology sections.

Cytopathological diagnosis was derived separately by studying cellular details (cellularity, cellular arrangement, cytoplasmic and nuclear details) in conventional smear, cellblock section and combined

study of conventional smear & cellblock section. The morphological criteria such as cellularity, architectural pattern (singly scattered cells, cell balls, cell clusters, papillae, glands, and sheets) cytoplasmic and nuclear features and details of background using point scoring system as described by Thapar et al,<sup>2</sup> were used for giving cytological diagnosis. Based on cytomorphological features & available clinical data fluids were categorized as benign, suspicious and malignant lesions.<sup>2</sup>

The cellular material in conventional smear was considered to be mild when there were 5 – 50 nucleated cells per high power field, moderate when there were 50 – 200 cells per high power field & marked when there were more than 200 cells per high power field.

The cellular material in the cellblock section was considered to be mild when there were 5-200 nucleated cells per high power field, moderate when there were 200-1000 cells per high power field, marked when there were more than 1000 cells per high power fields & inconclusive when there was no cellularity was observed on cellblock preparation. The reason for lack of cellularity may be due to technical errors such as inadequate sampling (less than 5 ml of fluid was sent to the laboratory) or degenerated samples.

Architectural pattern was said to be, excellent when architectural pattern was closely reflecting histology, there by diagnosis was obvious, moderate when some preservation architecture was noted e.g. follicles, papillae, acini, syncytiae and single cell pattern & minimal to absent when non diagnostic.

The volume of obscuring background was said to be, mild when less than 10% of the smear/ section was obscured & diagnosis was easy, moderate when 10-50% of the smear/section was obscured & diagnosis was possible & large when more than 50% of the slide/section was obscured & diagnosis was greatly compromised.

Statistical significance was determined by Chi-square test. Diagnostic accuracy, sensitivity and specificity of conventional smear cytology, cellblock study and combined conventional smear cytology and cellblock study was calculated.

## Results

A total of 110 body cavity fluid samples were studied of which 49% were pleural, 46% were peritoneal and 5% were pericardial fluids. Male: Female ratio was 2.3:1. Predominant (29.1%) cases belonged to the age 41- 50 year age group.

In conventional smear cytology moderate and marked cellularity was noted in 40.9% and 6.4% respectively, whereas in cell block study it was 53.7% and 25.6% respectively. The difference was statistically significant ( $p < 0.001$ ).

Predominant cell population observed was lymphocytes in 50% samples in conventional smears whereas in 27% samples showed lymphocytes in cellblock preparation.

The architectural pattern was better appreciated in cell block preparation (Table 1) and the difference was statistically significant.

**Table 1: Distribution of architectural pattern in conventional smear and in cell block preparation**

Architectural Pattern	Conventional Smears		Cell Block Preparation	
	No.	%	No.	%
Singly scattered cells	55	50	27	25
Cell balls	18	16	00	00
Cell clusters	22	20	40	36
Papillae	02	2	03	3
Glands	00	0	08	7
Sheets	13	12	32	29
Total	110	100	110	100

( $\chi^2=26$ ;  $p < 0.001$  HS)

Background obscuring the cells was not seen in cell block preparation whereas it was seen in 57% of the cases in conventional smears. The difference was statistically significant ( $p < 0.001$ ).

The distribution of cytological category is shown in the Table 2. A case that was cytologically categorised as benign in conventional smear cytology, was turned out be malignant in cell block study. Cytological category i.e. 'suspicious for malignancy' was not seen in cell block study. The diagnosis of malignancy was statistically significant in cell block study compared to conventional smear study.

**Table 2: Distribution of Cytological category**

Cytological category	CS Cytology		CB Preparation	
	No.	%	No.	%
Benign (inflammatory)	84	76	83	75
Suspicious	16	15	00	00
Malignancy	10	9	27	25
Total	110	100	110	100

( $\chi^2=10.3$ ;  $p<0.001$  HS)

Out of 27 malignant cases diagnosed by cellblock preparation 13 were pleural and 12 peritoneal and 2 pericardial fluids. Out of 27 cases of malignant effusions, for 13 cases (48%) primary was known & for 14 cases (52%) primary was unknown. The most common primary site was lung in 4 cases (15%) (Table 3).

**Table 3: Distribution of primary sites for metastatic effusions**

Sl No.	Primary Site	Male	Female	Total	Percentage
1	Ovary	00	02	02	7%
2	Breast	00	01	01	4%
3	Lung	04	00	04	15%
4	GIT	03	00	03	11%
5	Liver	03	00	03	11%
6	Unknown	11	03	14	52%
7	Total	21	06	27	100%

Statistical analysis showed that sensitivity and specificity of cellblock study in diagnosing malignant lesions were 100% and 83% respectively (Table 4).

**Table 4: Comparison of diagnosis between conventional smear and cellblock preparation**

Cellblock Preparation	Conventional smear		Total
	Positive For Malignancy	Negative For Malignancy	
Positive for malignancy	10	17	27
Negative for malignancy	00	83	83
Total	10	100	110

Additional 17 cases (15.5%) of malignant fluids were diagnosed by cellblock preparation when compared to conventional smear study.

## Discussion

Cytological examination of serous fluids has increasingly gained acceptance in clinical practice to such an extent that a positive diagnosis often is considered the definitive test there by avoids unnecessary exploratory surgery.<sup>1</sup> Reactive mesothelial cells, abundance of inflammatory cells and paucity of representative sample contribute to majority of difficulties in making conclusive diagnosis on conventional smears.<sup>1,2</sup>

In the present study, in comparison with conventional smear cytology, cell block preparation have shown statistically significant increase in cell yield i.e. cellularity. Similar findings were noticed in Bista et al<sup>3</sup> & Udasimath et al.<sup>4,5</sup> Increase in cellular yield is contributed by utilization of entire fluid remained after preparation of conventional smear, for preparation of cell block. The architectural pattern like glandular pattern, cell balls, three dimension clusters with intact cell membranes and papillae is important in identification of differentiation of the lesion. In the present study, architectural pattern was best retained and appreciated in cell block preparation than in conventional smear cytology. Similar findings were also observed in other studies.<sup>3-5</sup>

The background elements like hemorrhage, necrosis and presence of degenerating cells may add hint to the diagnosis. In contrary it may also hinder the

diagnosis by obscuring the cellular details. In the present study, background elements obscuring the cellular details were significantly reduced in cell block preparation than in conventional smear cytology. In Udasimath et al<sup>4,5</sup> the findings were similar to our study whereas in Bista et al<sup>3</sup> obscuring background was more seen in cell block preparation.

In the present study, diagnostic categorization into suspicious for malignancy was significantly reduced in cell block preparation in comparison with conventional smear cytology. Similarly there was statistically significant increase in identification of malignant lesions in cell block preparation than in conventional smear cytology. Bhanvadia et al<sup>6</sup> & Grandhi et al<sup>7</sup> showed similar findings. This is attributed to increase in cellular yield and better appreciation of cellular details and architecture in cell block preparation.

The details of primary in metastatic effusions in comparison with other studies is given in Table 5.

**Table 5: Comparison of primary sites for metastatic effusions in male and female patients in various studies**

Sl. no.	Primary site	Udasimath et al <sup>4</sup>			Present study 2014		
		M	F	Total	M	F	Total
1	Ovary	00	05	05 (22%)	00	02	02 (7%)
2	Breast	00	03	03 (13%)	00	01	01(4%)
3	Lung	01	01	02 (09%)	04	00	04 (15%)
4	GIT	01	02	03 (13%)	03	00	03 (11%)
5	Liver	00	01	01 (4%)	03	00	03 (11%)
6	Others	01	01	01(4%)	00	00	00 (00%)
7	Unknown	03	04	07 (31%)	11	03	14 (52%)
	Total	06	17	23 (100%)	21	06	27 (100%)

**Table 6: Comparison of diagnostic yield of CS versus CB in various studies**

Diagnostic Category	Grandhi et al <sup>7</sup>	Sujathan et al <sup>8</sup>	Present study
Inflammatory	183	63	84
Positive for malignancy on smears	12	19	10
Negative/ suspicious on smears	15	2	16
Positive for malignancy on cell blocks	27	21	17
No cellularity on cell blocks	7	1	14

In the present study of 110 cases (Table 6), on conventional smear cytology, 10 cases were positive for malignancy, 16 cases were suspicious for malignancy. On cellblock preparation 17 cases were positive for malignancy. Similar findings were noted in studies by Grandhi et al<sup>7</sup> and Sujathan et al<sup>8</sup>

**Table 7: Comparison of additional yield of malignancy by cellblock preparation in various studies**

Study	(%)
Dekker et al <sup>1</sup> 1978	38%
Grandhi et al <sup>65</sup> 2014	5%
Bhanvadia et al <sup>66</sup> 2014	10%
Present study 2014	15.5%

In the present study by combined approach of conventional smear cytology and cell block preparation, diagnostic yield for malignancy was significantly increased by cellblock preparation. The present study (Table 7) identified additional 17 cases (15.5%) of malignant fluids by cellblock preparation when compared to conventional smear study. Similar findings were noted in studies by, Dekker et al<sup>1</sup> Bhanvadia et al<sup>5</sup> & Grandhi et al.<sup>7</sup>

According to various studies additional diagnostic yield for malignancy was noted if conventional smear technique is supplemented by cellblock method. The present study also concludes that cellblock serves as useful adjunct to traditional Conventional smears.

A major disadvantage of the cellblock is more turnaround time as compared to conventional smears. Lack of cellular material in cellblock maybe observed due to technical errors such as inadequate sampling or degenerated sample.

## Conclusion

Cell block preparation is a simple and inexpensive method. It is good adjuvant to conventional smear cytology in obtaining better cellularity, cellular details and cellular architecture. Thus, increasing diagnostic yield for malignancy in serous effusions.

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