

## Comparative Study of the Utility of Cell Block Technique versus Conventional Smear Cytology in Pleural Fluid Cytology

Kiran Kumari<sup>1</sup>, Pawan Kumar Shah<sup>2</sup>, Sunil Kumar<sup>3</sup>

<sup>1</sup>Assistant Professor, Department of Pathology, Nalanda Medical College, Patna, Bihar.

<sup>2</sup>Assistant Professor, Department of Pathology, Nalanda Medical College, Patna, Bihar.

<sup>3</sup>Associate Professor, Department of Pathology, Nalanda Medical College, Patna, Bihar.

---

Received: 20-09-2023 / Revised: 19-10-2023 / Accepted: 25-11-2023

Corresponding Author: Dr. Pawan Kumar Shah

Conflict of interest: Nil

---

### Abstract:

**Background:** The classification of benign versus malignant pleural effusions frequently leads to a diagnostic conundrum. Evaluation of morphology and clinical findings are frequently necessary for categorization. Cell blocks enhance the chance of a diagnosis when done in addition to standard cytology smears. This will support the medical professionals in managing the patient and assessing the course of the illness. This study compared the cytology of smears with sections of cell blocks from pleural effusions.

**Methods:** For one year, the Department of Pathology at Nalanda Medical College in Patna, Bihar, conducted this hospital-based cross-sectional analytical study.

**Results:** Each technique was evaluated based on four criteria: the quantity of baseline blood, the production of diagnostic cell material, the degree of cellular degeneration, the presence of cellular trauma, and the preservation of architectural elements. When comparing cell block sections to smears cytology, there was more diagnostic material present and appropriate architecture preservation; however, background blood, cellular trauma, and degeneration were less well-appreciated in the cell block sections that scored higher.

**Conclusion:** Cell block technique processing should be done on a regular basis, particularly in cases that are cytologically, radiologically, and clinically suspected to be malignant.

**Keywords:** Cell block technique, pleural fluid cytology examination

---

This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

---

### Introduction

Pleural effusion is the term used to describe the accumulation of excess fluid in the pleural spaces.

[1] A significant anomaly of pleural disease is pleural effusion, which is an abnormal buildup of fluid in the pleural cavity. [2] Patients who have been identified with pleural fluid undergo a procedure called thoracentesis. [3] This process yields pleural fluid, which is transferred to the laboratory section for cytological, microbiological, and biochemical analysis. [4]

Cytological analysis is one of the first regular studies in cases of pleural effusion, especially if there is a suspicion of malignancy. Apart from cytological analysis, pleural fluid can be subjected to additional processing and examination using the cell block approach, hence enhancing its diagnostic usefulness. [5] Diagnostic issues arise when using the standard conventional smear method for pleural fluid to distinguish between reactive atypical mesothelial cells and malignant cells in cytology practice. [6] The cell block approach is a more accurate and

economical diagnostic technique than cytological testing. [7]

### Material and Methods

This cross-sectional study was carried out on patients with pleural effusions who had thoracentesis at the pathology department of Nalanda Medical College in Patna, Bihar, between October 2022 and September 2023. The study was hospital-based. All specimens were submitted for standard pleural fluid cytology analysis, and a portion of the pleural fluid was also investigated histologically using the cell block technique. The final cell block histology diagnoses were compared with the outcomes of cytopathological investigations using reactive mesothelial cells and suspected malignant cases. All bodily fluids other than pleural fluids that were obtained during the study period in the pathology department were not included in the analysis.

Preparations of cell block technique: 2 to 5 ml of pleural fluid was centrifuged at 2,500 rpm for 5 min and supernatant was removed. One part of 40%

formaldehyde (formalin) and nine parts of 95% methanol is used as fixative for formation of cell block method. [8,9] Remaining fixed tissue kept in filter paper (Whatman) and was processed into a paraffin embedded block. A histological slide was cut and hematoxylin and eosin (H & E) staining was performed in cases with reactive mesothelial cells and malignancy. Samples were examined for cytology as well as cell block and scored according to methodology described by scoring system of Thapar M et al and Mair S et al. [9,10] After assigning the appropriate scores, the cases were divided into 3 categories, which consisted of “diagnostically superior” (score 6-9), “diagnostically adequate” (score 3-5), “diagnostically unsuitable” (score 0-2).

Data were entered in excel. Data was analysed using Statistical Package for the Social Sciences (SPSS) version 23.

### Results

A total of 144 pleural fluids were submitted for cytological analysis over the course of a year. Of the 144 patients that were part of the study, 66 cases (45.8%) and 78 cases (54.2%) were female. The average age of patients with pleural effusion was  $49.4 \pm 29.4$  years. The lowest age was 7 years old, while the highest was 89 years old.

As shown in Table 1, the majority of cases 29 (20.1%) were in the age range of 61 to 70 years, with a predominance of males.

**Table 1 : Age distribution according to gender**

Age group	Gender		Total
	Female	Male	
0-10	0	3	3
11-20	7	3	10
21-30	12	17	29
31-40	9	5	14
41-50	7	2	9
51-60	12	14	26
61-70	7	22	29
71-80	9	9	18
81-90	3	3	6
Total	66	78	144

Out of 144 patients in total, 13 cases (9%) had cytology results that included just mesothelial cells and were classified as negative for malignancy. Using standard cytological methods, cancer was suspected in two patients (1.4%). The pleural effusion in the remaining 129 patients (89.6%) exhibits inflammatory cells.

Three instances (2%) of eosinophilic pleural effusion, 23 cases (16%) of neutrophilic pleural effusion, and 103 cases (71.5%) of lymphocytic

pleural effusion were among the 129 cases of inflammatory pleural effusion.

35 pleural fluid cytology cases out of 144 cases that showed reactive mesothelial cells and were suspected of being malignant were further processed for cell block analysis. Two instances with superior morphology in cell block preparation that were suspected of being malignant in cytology turned out to be positive cases.

**Table 2 : Distribution of cases in cytology and cell block**

	Cytology Diagnosis	CELL BLOCK				Total
		Eosinophilia	Lymphocytosis	Neutrophilia	Positive for malignancy	
Eosinophilia	3	0	0	0	0	3
Lymphocytosis	76	0	27	0	0	103
Negative for malignancy	13	0	0	0	0	13
Neutrophilia	17	0	0	6	0	23
Suspicious for malignancy	0	0	0	0	2	2
Total	109	0	27	6	2	144

The quality of 35 cases' worth of cytological smears that showed reactive mesothelial cells and cases that were suspected of being malignant and further processed for cell block procedures was compared using a point grading system with reference to Thapar M and Mair et al.<sup>9,10</sup> Out of 35 cases, it was found that 3% of the cytological smears and none of

the cell blocks scored zero, making them inappropriate for a conclusive diagnosis. The final diagnosis in cytology and cell block examination was reported to be lymphocytosis (Table 3). Table 4 shows that 29% of the cell blocks and 34% of the smears were deemed to have outstanding diagnostic quality.

**Table 3 : Background blood in smears and cell blocks**

Criteria	Score	Cell blocks	Number	Cytology smears	Number
Minimal: Diagnosis easy.	2	26%	7	42%	15
Moderate amount: Diagnosis possible	1	74%	26	54%	19
Large amount of blood and clot: diagnosis greatly compromised	0	0	0	3%	1

**Table 4 : Amount of diagnostic material present in smears and cell blocks**

Criteria	Score	Cell block	Number	Smears	Number
Abundant: Diagnosis simple	2	34%	12	29%	10
Sufficient for diagnosis	1	66%	23	71%	25
Minimal or absent: Diagnosis not possible	0	0%	0	0%	0

**Table 5 : Amount of diagnostic material preservation in smears and cell blocks**

Criteria	Score	Cell block	Number	Smears	Number
Minimal: Good preservation	2	37%	13	29%	10
Moderate: Diagnosis possible	1	63%	22	71%	25
Marked: Diagnosis impossible	0	0%	0	0%	0

**Table 6 : Retention of appropriate architecture and cellular architecture in smears and cell blocks**

Criteria	Score	Cell block	Number	Smears	Number
Excellent architectural display closely reflecting histology	2	20%	07	17%	06
Moderate: some preservation e.g. follicles, papillae acini, syncytia or single cell pattern	1	80%	28	83%	29
Minimal to absent: Nondiagnostic	0	0%	0	0%	0

Cell block sections had higher scores than smear cytology because they had more diagnostic material and had retained their architecture more appropriately. In contrast, cellular degeneration, cellular trauma, and background blood were less well-appreciated in the cell block sections. The diagnostic adequacy of cell block and cytological smear procedures was evaluated, and cell blocks demonstrated diagnostically superior smears when compared to cytological smears. In addition to cytological specimen evaluation, cell block techniques improved the diagnostic yield. When compared to a cytological smear alone, the cell block approach improved the diagnostic yield.

Similar diagnostic yields were obtained with conventional cytological smear and cell block methods. However, compared to cytological smear alone, the combination of cytological smear and cell block yielded a larger yield of diagnostic material, particularly in malignant patients.

## Discussion

All pleural effusion samples were included in the current investigation, regardless of the patient's clinical or radiological results. In cytology and cell block, more benign and inflammatory pleural effusions were found. Similar outcomes are also found in studies conducted by Joshi A. et al. and Miachio N. et al. [11,12]

Thirteen (9%), out of the 144 patients in the current investigation, had cytology results that were negative for malignancy. Similar results were noted by Thapar M et al. Out of 190 patients, 26 (37.2%) had cytology characteristics that were negative for malignancy. [9] Out of 144 pleural fluid specimens, 2 cases (1.38%) had a documented cancer.

The results of malignant cellular alterations in cytological smears stained with giemsa and Papanicolaou technique are sufficient. Cell blocks, in addition to cytological smears, are useful when cytological results are deceptive, particularly in cases of malignancy and reactive mesothelial cells

smears obscured by blood and inflammatory cells. [13]

The sediment from centrifuged pleural fluid can be treated as a cell block for histology in order to support and improve the diagnosis made by cytohistology. Despite being a well-established procedure among pathologists, doctors continue to prescribe cell block technology insufficiently. Thus, the purpose of this study was to determine the advantages of cell block when evaluated as a component of pleural fluid investigation in standard clinical practice. After preparing the cell block with alcohol formal fixative, basic paraffin processing was carried out; Nathan NA et al. employed a similar technique. [14] In addition to smears, cell blocks extracted from residual fluids help in more conclusive cytopathologic diagnosis. [12]

The pleural effusion patients' ages ranged from 7 to 89 years old. This age range matched that of the Davidson B et al. study. [15] The patients were mostly in their sixth decades of life. The patients under study had a male to female ratio of 1.18:1. Similar findings on male predominance were made by Shivakumarswamy U et al. [16] In cases of malignancy, both cytological and cell block methods demonstrated good cellular architecture; however, the general results obtained from cell block methods about cellular structures such as acini, cell balls, and papillary patterns also provided insight into the main tumor's genesis. Mulkalwar M et al. research yielded similar results. [17]

One of the issues with reactive effusion is that certain cells may imitate cancerous growths or seem abnormal, making diagnosis more challenging. In cytology, we have seen two such cases that were determined to be suggestive for cancer. Upon examining the slides and doing a cell block, it became evident that the morphology was malignant. Studies conducted by Santwani PM et al and Pal M et al. [18,19] yielded similar findings.

### Conclusion

In pleural fluid cytology, lymphocytosis is the most commonly diagnosed condition. Cases where a malignancy is suspected are verified using the cell block approach. Based on the results, it can be said that the cell block approach in cytology can confirm a suspicion of cancer. Cell block approach should be frequently processed, especially in cases that are clinically, radiologically, and cytologically believed to be malignant. Cell block preparation is a quick, easy, and affordable method for pleural fluids that allows for the reliable detection of malignant cells, preventing needless intrusive procedures during patient care. Medical professionals treating patients with pleural fluid cytology or any other fluid cytology should think about using the cell block method as a standard practice, along with a cell block histopathological diagnosis.

### References

1. Karkhanis SV, Joshi MJ. Pleural effusion: diagnosis, treatment, and management. *Open Access Emerg Med.* 2012;4:31-52
2. Du Q, Fan L, Zhou H. Pleural effusion as an initial manifestation in a patient with primary pulmonary monoclonal B-cell lymphocyte proliferative disease. *Respir Res.* 2018;19:247.
3. Assawasaksakul T, Boonsarnsuk V, Incharoen P. A comparative study of conventional cytology and cell block method in the diagnosis of pleural effusion. *Journal of thoracic disease.* 2017;9(9): 3161-67.
4. Mohammed MA, El – Badawi ZH et al. A Comparative Study of Conventional Cytology and Cellblock Method in Diagnosis of Pleural Effusion and their Correlation with Clinicopathological and Radiological Diagnosis. *Med. J.* 2019;87(7):4521-27.
5. Miyoshi S, Sasada S et al. Diagnostic Utility of Pleural Fluid Cell Block versus Pleural Biopsy Collected by Flex-Rigid Pleuroscopy for Malignant Pleural Disease: A Single Center Retrospective Analysis. *PLoS ONE.* 2016;11(11): e0167186
6. Shivakumarswamy U, Arakeri SU, Karigowdar MH, Yelikar B. Diagnostic utility of the cell block method versus the conventional smear study in pleural fluid cytology. *J Cytol.* 2012;29(1):11-5.
7. Shital P, Mirz M, Gondhali G. Pleural fluid 'cell block' analysis in malignant pleural effusion: sensitive, superior over fluid cytology and suitable for immunohistochemistry analysis (IHC), will decrease need for thoracoscopy guided procedures. *European Respiratory Journal* 2017; 50: 4308.
8. Nambirajan A, Jain D. Cell blocks in cytopathology: An update. *Cytopathol.* 2018;29:50 5–24.
9. Thapar M, Mishra RK, Sharma A, Goyal V et al. Critical analysis of cell block versus smear examination in effusions. *Journal of cytology.* 2009;26(2):60-4.
10. Mair S, Dunbar F, Becker PJ, Du Plessis W. Fine Needle cytology: Is aspiration suction necessary? A study of 100 masses in various sites. *ActaCytol* 1989;33:809-13.
11. Joshi A, Mahajan N, Karmarkar PJ, Mahore SD. Diagnostic utility of various techniques used in body fluid cytology. *J Dent Med Sci.* 2014;13:13-8.
12. Miachieo N, Kumar M, Sagar M et al. Diagnostic utility of cytopspin, cell block and immunocytochemistry in pleural effusion cytology. *Int J Res Med Sci.* 2020;8(7):2647-52.
13. Dekker A, Bupp PA. Cytology of serous effusions. An investigation into the usefulness of cell blocks versus smears. *Am J ClinPathol.* 1978;70(6):855-60.

14. Nathan NA, Narayan E, Smith MM, Horn MJ. Cell block cytology. Improved preparation and its efficacy in diagnostic cytology. *Am J ClinPathol.* 2000;114(4):599-606.
15. Davidson B, Nesland J, Risberg B, Kopolovic J. Expression of Membrane-Type 1, 2, and 3 Matrix Metalloproteinases Messenger RNA in Ovarian Carcinoma Cells in Serous Effusions. *Anatomic Pathology* 2011;115:517-24.
16. Shivakumarswamy U, Arakeri SU, Karigowdar MH et al. Diagnostic utility of the cell block method versus the conventional smear study in pleural fluid cytology. *J Cytol.* 2012; 29(1):11-5.
17. Mulkalwar M, Chandrakar J, Kujur P et al. Diagnostic Utility of Cell Block Method versus Cytospin Method in Pleural and Peritoneal Fluid Cytology. *J Med SciClini Res.* 2016; 4:13726- 32.
18. Santwani PM, Vachhani JH. Analysis of diagnostic value of cytological smear method versus cell blocks method in body fluid cytology: Study of 150 cases. *Ethiop J Health Sci.* 2014; 24(2):125-30.
19. Pal S, Goswami BK. Pleural fluid cytology in suspected malignant effusions with special emphasis on cell block preparation. *J Dent Med Sci.* 2015;14:13-6.