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Research Article

Study to Assess the Effectiveness of Cell Block Technique in Analysis of Pleural Fluids Among Pleural Effusion Cases

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Abstract: Background: Cytologic examination of body fluids obtained from the serous cavities is among the most common tasks performed in the practice of cytopathology. It is a relatively simple and non-invasive technique, which helps to conclude on the inflammatory, benign or malignant etiology of effusions. The investigation of serous effusions has an important place in cytopathology because it has diagnostic and prognostic value. The proper identification of the primary tumor with staging and grading has therapeutic and prognostic implications. In the current study, we evaluated the efficacy of two techniques for the diagnosis of malignant serous effusions. **Materials and methods:** This study includes 70 patients clinically and radiologically proven to have pleural effusion in our Hospital between 2022 and 2023. The fluids gathered from the patients were divided to two equal parts, while in one half conventional cytological analysis was done, in the other half the analysis was done with the cell block technique. Half of the specimens were centrifuged for 5 minutes with 2000 rpms. The sediment acquired was applied on the slide and stained with routine Giemsa and Hematoxylin Eosin stains. The other halves of the specimens were centrifuged for 5 minutes with 2000 rpms. The residual fluid over the tube was emptied. The sediment in the bottom was gathered on the blotting paper by turning the tube upside down. The material obtained was fixed with 10% formalin solution and then routine histological follow up was done. After follow up paraffin blocks were formed and paraffin blocks were cut in 4 µ sections. These sections were stained with routine Hematoxylin Eosin. **Result:** Out of the total 50 cases included in this study, males were 50 and female were 20 contributing 71.4% and 28.6% respectively. Males are more than females. Age range of the study participants was from 20-70 years, with the dominant age group being 31-40 years. On physical examination 23/50 (32.9%) were hemorrhagic on appearance. On conventional smear method, benign/inflammatory condition cells are 55.7% which outnumbered malignancy that is only 15.7%, followed by suspicious for malignancy 28.6%. On cell block method, majority of the cases diagnosed were of benign/inflammation (67.1%) and then malignancy (32.9%). **Conclusion:** Morphological features were better identified by Cell block technique, when compared to cytological smear and additional yield of malignancy was more in cellblock method. There is adequate cellularity and delineation of nucleus and cytoplasmic details. Among the inflammatory effusions lymphocytic predominance is noted in majority of cases. Malignant pleural effusion was more common in males; the primary tumor was in the lung. In the present study, 16% were diagnosed as malignancy on cell block and only 10% were diagnosed as positive for malignancy on cytosmears. We conclude that the cell block technique method when used as an adjuvant to routine smear.

Keywords: Congenital hypothyroidism, Thyroid-stimulating hormone, Cord blood.

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1. Introduction

Cytologic examination of body fluids obtained from the serous cavities is among the most common tasks performed in the practice of cytopathology. [1] It is a relatively simple and non-invasive technique, which helps to conclude on the inflammatory, benign or malignant etiology of effusions. [2] A positive diagnosis is always confirmatory; however, a negative result cannot rule out malignant causes. [3] Cell block (CB) can be helpful in diagnosing malignancies, staging of lesions, and prognosis. The information regarding various non-infectious and infectious conditions, such as bacterial, viral fungal, and parasitic infections of the serous membrane, can also be assessed. [4] Accurately, diagnosing cells as either malignant or reactive mesothelial cells in serous effusions is a common diagnostic problem. The lower sensitivity of cytodiagnosis of effusions is mainly attributable to overcrowding or overlapping of cells, cell loss, and changes due to different laboratory processing methods. [5]

The serous effusion is representative of a much larger surface area than that obtained by needle biopsy. The existence of reactive mesothelial cells, abundant inflammatory cells, and sometime paucity of representative cells are the issues in making the conclusive diagnosis in conventional smear (CS) preparations (4). The CB technique is another method of cytological diagnosis for serous effusions. It is one of the oldest methods for the evaluation of serous effusions. [6] Due to cellular overlapping, delaying artifact, suboptimal processing, preparative cytotechnique, and leaving behind useful material causes lower diagnostic yield in the CS method. The residual material can be very useful in increasing the diagnostic yield by the CB method. The CB technique increases the sensiti vity of detecting malignancies and can reduce false-positive interpretations. [7]

A recent method of CB preparation by using a 10% alcohol-formalin combination as fixative has shown to increase the cellularity and morphological details of cells. [8] It is a simple, reproducible, and cost-effective method, which requires no extra material compared to other methods. The CB technique has many advantages over conventional cytology in improving the sensitivity of diagnosis, including preservation of tissue architecture like cell balls and papillae and three-dimensional clusters, excellent nuclear and cytoplasmic details and individual cell characteristics, and obtaining sections from the same material for special stains and immunohistochemistry. [9] Hence, the present study emphasizes the role of the CB technique over CS technique in the cytodiagnosis of serous effusions.

The present study demonstrates that the pleural fluid cytology cell block techniques are the most useful tests in establishing the diagnosis of pleural effusion. Cytological examination of body fluids is a complete diagnostic modality which aims at pointing out the aetiology and prognosis of effusion. But, with the help of cell block technique and it helps in reaching at a near accurate diagnosis. Cell block technique by using 10% alcohol- formalin as fixative is simple, inexpensive and does not require any special training or instrument.

2. Material and methods

This study includes 70 patients clinically and radiologically proven to have pleural effusion in our Hospital between 2022 and 2023. The fluids gathered from the patients were divided to two equal parts, while in one half conventional cytological analysis was done, in the other half the analysis was done with the cell block technique. Half of the specimens were centrifuged for 5 minutes with 2000 rpms. The sediment acquired was applied on the slide and stained with routine Giemsa and Hematoxylin Eosin stains. The other halves of the specimens were centrifuged for 5 minutes with 2000 rpms. The residual fluid over the tube was emptied. The sediment in the bottom was gathered on the blotting paper by turning the tube upside down. The material obtained was fixed with 10% formalin solution and then routine histological follow up was done. After follow up paraffin blocks were formed and paraffin blocks were cut in 4 µ sections. These sections were stained with routine Hematoxylin Eosin.

After light microscope examination, in required cases special histochemical and immunohistochemical studies were done. In cytological diagnosis the conventional diagnosis criteria were divided in to 3 categories as benign, malignant and undetermined. Every preparator's cellularity, the cytoplasm and nuclear details of the cells, the arrangements (acini, papillary structure, two- or three-dimensional cell clusters) were analyzed. In the cell block examination, in cases with sufficient cell counts histopathological diagnosis was done. In this study, the cell block technique compared to the conational method is compared and the procedure of the cell block technique is discussed.

3. Results

Out of the total 50 cases included in this study, males were 50 and female were 20 contributing 71.4% and 28.6% respectively. Males are more than females. Age range of the study participants was from 20-70 years, with the dominant age group being 31-40 years.Table 2

Table 1. Type of Sample after aspiration/tapping of pleural cavity among study population

Color of pleural fluid	Total number of cases
Non-hemorrhagic fluid	47
Hemorrhagic	23

On physical examination 23/50 (32.9%) were hemorrhagic on appearance.Table 1

Table 2. Laterality of pleural effusions in study population

Side	Males	Females	Total
Right	24	14	38
Left	14	10	24
Bilateral	5	3	8
Total	43	27	70

Table 3. Type of diagnosis arrived from cytosmear

Diagnosis	No of cases	Percentage
Benign/inflammatory	39	55.7
Suspicious of malignancy	20	28.6
Malignancy	11	15.7
Total	70	100

On conventional smear method, benign/inflammatory condition cells are 55.7% which outnumbered malignancy that is only 15.7%, followed by suspicious for malignancy 28.6%.Table 3

Table 4. Type of diagnosis arrived from cell block

Diagnosis	No of Cases	Percentage
Benign/inflammatory	47	67.1
Suspicious for malignancy	0	0
Malignancy	23	32.9
Total	70	100

On cell block method, majority of the cases diagnosed were of benign/inflammation (67.1%) and then malignancy (32.9%). Table 4

4. Discussion

Present study included all pleural effusion samples irrespective of the clinical or radiological findings of the patient. More benign and inflammatory pleural effusions were identified in cytology and cell block. Studies done by Joshi A et al and Vellios F et al also reveal similar findings. [10,11]

Among 70 cases in present study, few cases were reported as negative for malignancy in cytology. Similar findings were observed by Thapar M et al as among 190 cases, 26(37.2%) were showing features of negative for malignancy in cytology. [12] Only two cases of cancer in pleural effusion in our study were due to sample obtained from general hospital treating mainly non-cancerous patients. Similar low cases (3 out of 37 cases) were observed by Bista Non malignant cases were broadly categorized into reactive and malignant effusions as done by Bista. [13]

Cytological smears stained with the giemsa and Papanicolaou technique yield adequate result of malignant cellular changes. In addition to cytological smears, cell blocks are helpful when cytological findings are misleading, especially in reactive mesothelial cells smears obscure with blood and inflammatory cells as well as in malignant cases. [14]

To augment and uplift the diagnosis from cytohistology of pleural fluid, the sediment from centrifuged pleural fluid can be processed as cell block for histology. Although cell block technique has been well established technique among pathologists, it is still under prescribed by clinicians. Therefore, this study was conducted this study to identify the benefits of cell block when assessed as a part of pleural fluid examination in routine clinical practice. Cell block was prepared with alcohol formal fixative which was followed by simple paraffin processing and similar procedure was used by Nathan NA. Cell blocks obtained from residual fluids in addition to smears aids on more definitive cytopathologic diagnosis. [15]

Age of the patients with pleural effusions ranged from the age of 7 to 89 years. This was similar to the age range in the study done by Davidson B. The majority of the patients were in the sixth decades of life. The male: female ratio of the studied patients was 1.18:1. Similar male predominance was found in study by Shivakumarswamy U. [16] Both cytological and cell block showed good cellular architecture in malignant cases but the overall findings in cell block in terms of cellular architectures like acini, cell ball, and papillary pattern also helped in giving idea and hint about the origin of the primary tumor. Similar findings were found in studies done by Mulkalwar M. [17]

One of the problems with the reactive effusion is the way some cell may appear or mimic malignancy which can lead to difficulty in diagnosis. We have encountered 2 such cases in cytology which were diagnosed as suspicious for malignancy. However on doing cell block and reviewing the slides the morphology were clearly malignant. Similar results were found in studies done by Santwani PM et al. [18]

5. Conclusion

The diagnostic performance of cytological study of fluid may be attributable to the fact that cell population present in sediment is representative of larger surface area than that obtained by needle biopsy. Morphological features were better identified by Cell block technique, when compared to cytological smear and additional yield of malignancy was more in cellblock method. There is adequate cellularity and delineation of nucleus and cytoplasmic details. Among the inflammatory effusions lymphocytic predominance is noted in majority of cases. Malignant pleural effusion was more common in males; the primary tumor was in the lung. In the present study, 16% were diagnosed as malignancy on cell block and only 10% were diagnosed as positive for malignancy on cytosmears. We conclude that the cell block technique method when used as an adjuvant to routine smear.

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