Diagnostic Utility Of Fluid Cytology By Conventional Smear And Cell Block Method In Pleural Effusion

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ABSTRACT

The cytological examinations of serous effusions have been well-accepted, and a positive diagnosis is often considered a definitive diagnosis. The study was planned to determine the diagnostic utility of fluid cytology by conventional smear and cell block method in pleural effusion. This was a hospital-based open cohort observational study conducted on patients diagnosed with pleural effusion. The study period was one year, and patients were recruited using a nonprobability sampling method. The fluid samples were subjected to the conventional smear examination, followed by cell block preparation. The overall morphologic details, cellularity, architecture, and nuclear and cytoplasmic details were studied and compared in conventional smear and cell block techniques. The samples were categorized as unsatisfactory, benign, suspicious for malignancy, or malignancy. The study was conducted on 113 pleural fluid samples. The study demonstrated that the cell block technique improved the cellular yield and established diagnosis in malignant effusions.

KEYWORDS: Serous Effusion, Cytology, Mair's Criteria.

1. INTRODUCTION

Diagnostic cytology is the scientific art of interpretation of cells that exfoliate or are removed from various tissues. The cytological examinations of serous effusions have been well-accepted, and a positive diagnosis is often considered a definitive diagnosis [1]. Determining the precise cause of the pleural effusion is essential for definite management. Thoracocentesis, followed by fluid analysis, is the first step to establishing the diagnosis. Cytological study of body fluid is a complete diagnostic modality. Cytology by conventional smear (CS) and cell block (CB) methods are helpful to complement the biochemical evaluation of pleural effusion. CB preparation has a better diagnostic yield in comparison to conventional smear [1]. Thoracoscopy and pleural biopsy are invasive techniques and can have procedure-related complications like pneumothorax, hemothorax, and injury to adjacent organs. In addition, closed-blind biopsy has its limitations. A pleural biopsy may not provide representative tissue, or the tissue may be inadequate as pleural metastasis are focal [2,3]. This study was planned with the objective of determining the diagnostic utility of fluid cytology by CS and CB methods in pleural effusion.

2. AIMS AND OBJECTIVES

To determine the diagnostic utility of fluid cytology by conventional smear and cell block method in pleural effusion.

3. METHOD(S)

This was a hospital-based cross-sectional observational descriptive study conducted in a tertiary care referral hospital in Himachal Pradesh, India. The recruitment period was one year between January 2020 to December 2020, using a nonprobability sampling method. The inclusion criteria were all the pleural fluid received from patients in the department of Pathology. The patient's demographic data, including age and gender, were recorded. Detailed clinical history was taken, and an examination was performed in all cases. Relevant investigations, including biochemical analysis of pleural fluid, were recorded. The clotted and suboptimal quantity of fluid specimens were excluded from the study. A minimum of six milliliters of the fluid sample was collected and processed after the physical examination. The fluid was divided into two equal parts of three milliliters each. One part was subjected to the CS cytology technique, and the other to the CB technique [4]. The cytological smears and block sections were examined by two pathologists separately for cellularity, architectural patterns, and morphology (cytoplasmic and nuclear details) to render a cytological diagnosis for each case, and the findings were compared. The samples were categorized as unsatisfactory, benign, suspicious for malignancy, or malignancy. Mair's criteria were applied, including assessing the volume of blood /clot obscuring, amount of diagnostic cellular material present,

degree of cellular degeneration and trauma, and retained architecture/cellular arrangement present. A point scoring system of 0, 1, or 2 was applied [5]. According to Mair's criteria, the comments were rendered on the quality of the slides by qualitatively grouping them into three categories.

1) Diagnostically unsuitable (score=0)
2) Diagnostically adequate (score=1-4)
3) Diagnostically superior (score=5-8)

Data was entered in the Microsoft Office Excel Sheet and analyzed using SPSS version 21 (IBM corporation, Armonk, New York, USA). Quantitative variables were expressed as mean with standard deviation and categorical variables as frequencies and percentages. For analysis of continuous variables student's *t*-test was applied, and the chi-square test for proportions. A value of $p < 0.05$ was considered significant. The institutional ethics committee approved the study.

4. RESULTS

The study comprised a total of 113 pleural fluid samples. The mean age of the study participants in this study was 58.8±16.6 years. Among 113 pleural fluid samples, 65(57.5%) were males, and 48(42.5%) were females. The clinical impression was benign pathology in 90 patients and malignant pathology in 23 patients. The interpretation of cytological examination by CS and CB is shown in Table 1.

Table 1: Showing interpretation of conventional smear and cell block in pleural effusion.

Interpretation	Conventional smear(%)	Cell Block (%)	p-value
Benign	101	100	0.83
Suspicious for malignancy	05	02	0.25
Malignant	07	11	0.32
Total	113	113	

Four pleural effusions were diagnosed with metastatic deposits on CB, one of which was diagnosed as benign and three as suspicious on CS (Figures 1, 2, and 3). The cases diagnosed as benign on CS were clinically suspected cases of malignancy of the ovary. Two of the three cases diagnosed as suspicious on CS were clinically suspected cases of lung malignancy and the other of COPD. The results of qualitative grouping are shown in Table 2.

Table 2: Showing results of qualitative grouping.

Grouping(score)	Conventional smear(%)	Cell block (%)	p-value
Diagnostically unsuitable **(0)**	5(4.42)	0(0)	0.023
Diagnostically adequate **(1-4)**	62(54.87)	30(26.55)	<0.001
Diagnostically superior **(5-8)**	46 (40.71)	83 (73.45)	<0.001
Total	113 (100)	113 (100)	

5. DISCUSSION

The serous membrane lines the pleural cavity, hence the serous cavity. The basic integral component of the serosal membrane is a mesothelial cell that loosely rests on sub-mesothelial stromal matrix tissue [6]. The development of spontaneous effusions due to a variety of etiologies provides a clinically useful specimen for cytologic evaluation to diagnose the underlying pathologic process. Light's criteria are the gold standard for differentiating exudate from transudate pleural effusion [7]. Cytologic examination of fluid is fast, efficient, and minimally invasive to establish a diagnosis. The sensitivity of cytology for malignant pleural effusions varies from 40-87% [8-10]. The factors influencing the diagnostic yield of cytology include the methodology applied, i.e., conventional smear versus cell block method, the extension of malignancy, and the type of malignancy. A negative cytologic result is usually a sine qua non for nondiagnostic pleural biopsy [11].

In this study, the clinical impression of malignant pleural effusion associated with malignancies of ovaries, gastrointestinal tract, lungs, gall bladder, and liver was kept in 23(20.3%) patients. The CS and CB cytology was compared, and the results were interpreted as benign, suspicious for malignancy, and malignant. It was observed that 4.4% of patients were suspicious of malignancy on CS compared to 1.7% on CB. However, the difference was not statistically significant. Similarly, 6.1% of patients were found malignant on CS compared to 9.7% on CB. This difference was not statistically significant. The interpretation of benign, suspicious, and malignant results on conventional smear and cell block in our

study are consistent with the results of other studies [12-14]. Four Pleural effusions were diagnosed as metastasis malignancies on CB, one of which was benign and three as suspicious on CS. The cases diagnosed as benign on CS were clinically suspected cases of malignancy of the ovary. Two of the three cases diagnosed as suspicious on CS were clinically suspected cases of lung malignancy and the other of COPD. In this study, while analyzing the distribution of quality grouping, it was observed that 62(54.8%) on the conventional smears and 30 (26.5%) on the cell block preparations were grouped under the diagnostically adequate category with a score range of 0-4; whereas 46 (40.7%) of the conventional smears and 83 (73.4%) of the cell block preparations were grouped under diagnostically superior category with a score range of 5-8. Diagnostically unsuitable were observed in 5(4.4%) patients on CS. None of the patients on CB has diagnostically unsuitable quality. These differences were statistically significant. Our results of significant differences of having diagnostically superior category among CB compared to CS are consistent with the results in other studies [15-17].

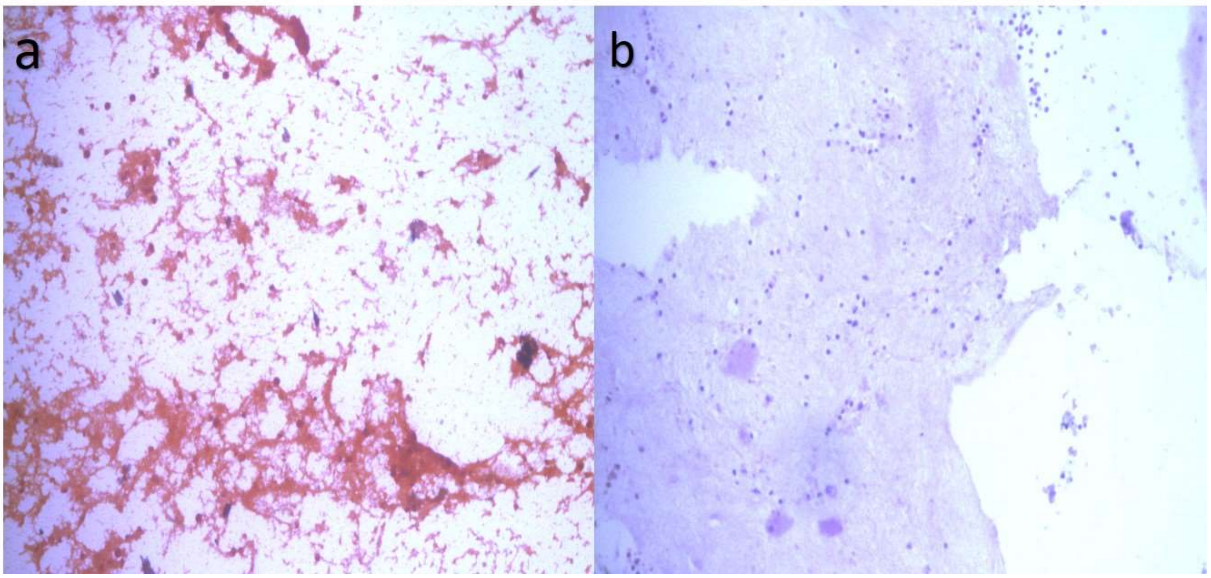

Figure 1: Pleural fluid sample a) photomicrograph of conventional smear showing scant lymphocytes and marked debris in the background (Giemsa×10). b) photomicrograph of cell block showing increased cellularity of lymphocytes with retention of architecture and minimal obscuring background (H&E×10).

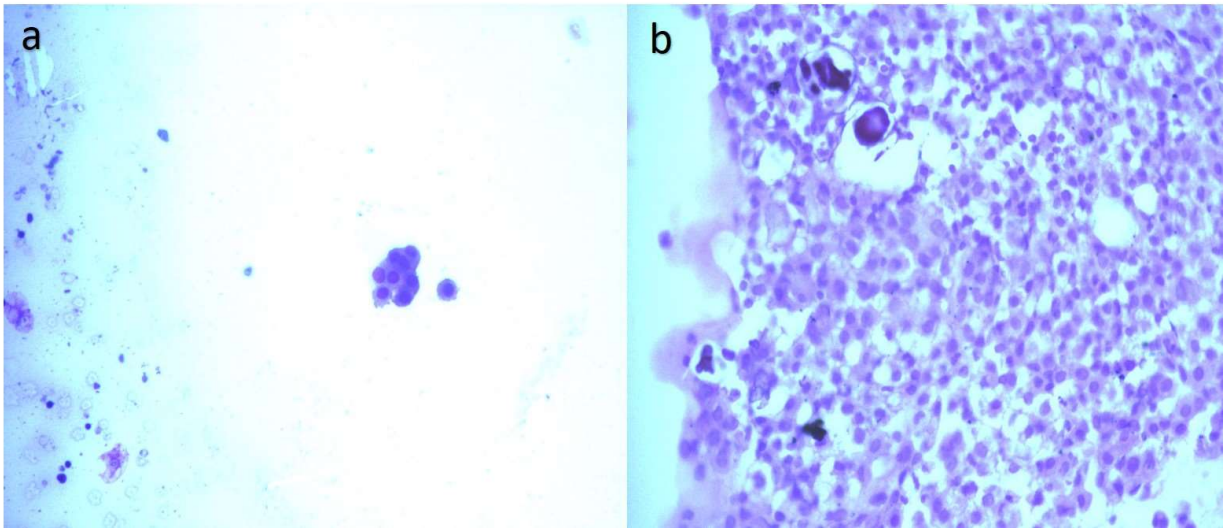

Figure 2: Pleural fluid sample a) Photomicrograph of conventional smears showing a benign cluster of reactive mesothelial cells and lymphocytes in a proteinaceous background (Giemsa×20). b) Photomicrograph of cell block showing improved cellularity of lymphocytes and mesothelial cells along with tiny foci of calcification (H&E×40).

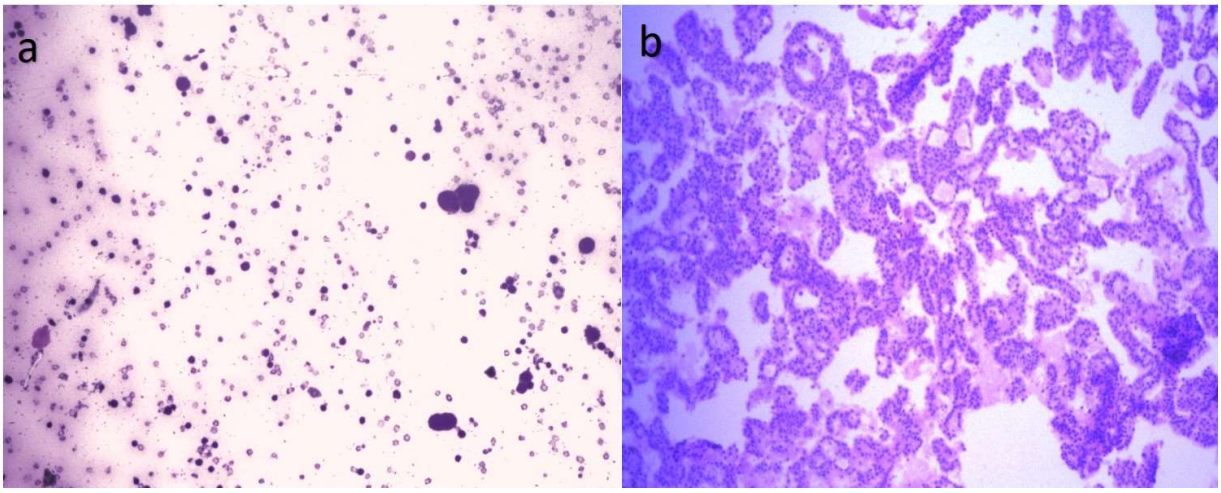

Figure 3: Pleural fluid sample a) Photomicrograph of conventional smears showing singly scattered and small groups of poorly preserved malignant cells along with few lymphocytes in a hemorrhagic background (Giemsa×10). b) Photomicrograph of cell block showing pleomorphic tumor epithelial cells forming acini and papillary architectural pattern (H&E×10).

6. CONCLUSION

A significant difference was observed in the diagnostically superior cell block score compared to conventional smear. The results of the study indicate that the cell block technique is a reliable and quicker approach in diagnostic protocols.

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AUTHOR CONTRIBUTIONS

N, RK, SR, and MS jointly conceived and designed the study, collected and analyzed the data, and prepared the manuscript.

CONFLICT OF INTEREST

None.

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