
Original Research Article

Pleural Fluid Cytology: A Simple Tool in the Differential Diagnosis of Various Lesions

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Abstract

Background: In this modern era where many sensitive techniques have emerged for achieving a specific diagnosis, cytological study of pleural fluid cytology still remains an easy and a basic step in diagnosing a variety of pulmonary and non-pulmonary lesions. Both non-malignant and malignant causes of effusion can be identified by the relatively non-invasive technique of pleural fluid cytology.

Materials and methods: It was a retrospective study including cases over a period of one year. Pleural fluids were analyzed for physical properties like the volume of fluid received, colour and odour. The cells were counted on Neubauers chamber and stained smears were examined to study the type of cells present.

Results: Pleural cytology of 150 cases was studied. The ages of the patients ranged from 8 years to 69 years. Twenty four cases (16%) showed transudative effusion and 126 cases (84%) showed exudative effusion. The most common cause of transudative effusion was congestive cardiac failure (50%), followed by liver cirrhosis. Tuberculosis was the most common (62.2%) cause of exudative effusion. Four cases of malignancy were noted which caused exudative effusion.

Conclusion: Pleural fluid cytology is a simple, easy and effective method for diagnosing various conditions. Numerous pulmonary and systemic conditions can be suspected and diagnosed with this relatively non-invasive method. The cytological examination of body effusion is a complete diagnostic modality which aims at pointing out the etiology of effusions.

Keywords: Pleural Fluid; Transudate; Exudate; Neoplastic Cells.

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Introduction

The presence of fluids (>10ml) within the three body cavities namely pleural, peritoneal and pericardial cavity constitutes an effusion which can be transudate or an exudate [1].

Pulmonary, pleural or a systemic disease can lead to the development of pleural effusion. All pleural membrane pathologies except primary pleural mesothelioma are caused by an abnormality

of pleural membrane maintenance or its dynamic balance [2]. Pleural effusions are divided into two groups as benign and malignant pleural effusions. Malignant pleural effusions can occur in all types of cancer. The most common causes are lung cancer, breast cancer, lymphoma and gastrointestinal cancer [3].

Cytological study of pleural fluid is a complete diagnostic modality which aims at pointing out the etiology of effusion as well as, in certain cases, a means of prognostication of disease process.

The diagnostic performance may be attributable to the fact that the cell population present in the sediment is representative of a much larger surface area than that obtained by needle biopsy. Detailed study of the cytomorphologic features of various metastatic malignant cells in pleural effusions provides definite clues regarding the primary site [4].

Materials and methods

This study was undertaken in the Department of Pathology, at a tertiary care hospital, Maharashtra. It was a retrospective study including cases over a period of one year. Relevant and available clinical information regarding age, sex, symptoms and accompanying signs was obtained from the records.

These fluids were analyzed for physical properties like the volume of fluid received, colour and odour. The fluid was divided into two parts, one part was used for cell count and the other part was poured into the centrifuge tubes and centrifuged for 10 minutes at 2000 rpm. For cell count, a drop of fluid was mixed with a drop of toluidine blue and cell counts were done on the improved Neubauer counting chamber. All the cases were analyzed for protein, sugar, cytology and microbiological study. Later, from the centrifuged fluids the supernatant was discarded and the sediment was used to make three smears. Two were fixed in 95% methyl alcohol, and then stained with Papanicolaou and Hematoxylin and Eosin stains (H & E). Other was air dried and stained with leishman stain. For hemorrhagic fluids, glacial acetic acid or 0.1 N HCl was used as hemolysing agent and then they were processed

Results

Pleural cytology of 150 cases was studied. The ages of the patients ranged from 8 years to 69 years, with maximum cases between 56-65 years of age. Male preponderance was noted with the ratio of male to female being 1.3:1.

Twenty four cases (16%) showed transudative effusion and 126 cases (84%) showed exudative effusion. The most common cause of transudative

Table 1: Causes of transudative effusion:

Causes	No of Cases (n=24)
CCF	12
Liver cirrhosis	4
Renal failure	4
Idiopathic	3
Hypoproteinemia	1

effusion was congestive cardiac failure (50%), followed by liver cirrhosis (16.7%) and renal failure (16.7%). Only a single case of effusion due to hypoproteinemia (4%) was noted. (Table 1). All the transudates were secondary to non-neoplastic conditions and no neoplastic lesions were noted as the cause of this. Cytological smears of them showed few lymphocytes and reactive mesothelial cells on a proteinaceous background.

Among the 126 exudates, 122 cases were non-neoplastic and the other 4 cases were neoplastic. Tuberculosis was the most common (62.2%) cause of exudative effusion followed by pneumonia (14.75%) and immunosuppression (9%). Tuberculous exudates showed numerous lymphocytes, plasma cells (Fig. 1) with few cases showing epithelioid cells. Reactive mesothelial cells were also seen in many cases. (Fig. 2) Nine cases were idiopathic and 8 cases were because of empyema (6.55%).

Table 2: Non-neoplastic causes of exudative effusion:

Causes	No of Cases (n=122)
Tuberculosis	76
Pneumonia	18
Immunosuppression	11
Idiopathic	09
Empyema	08

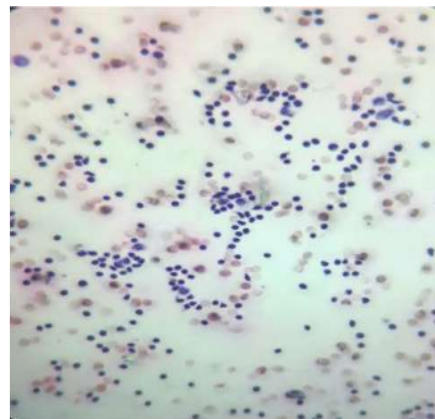


Fig. 1: Smears showing a clump of lymphoplasmacytic cells on a hemorrhagic background.

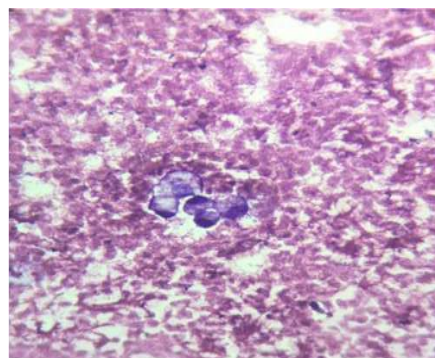


Fig. 2: Reactive mesothelial cells showing spongiotic separation of individual cells.

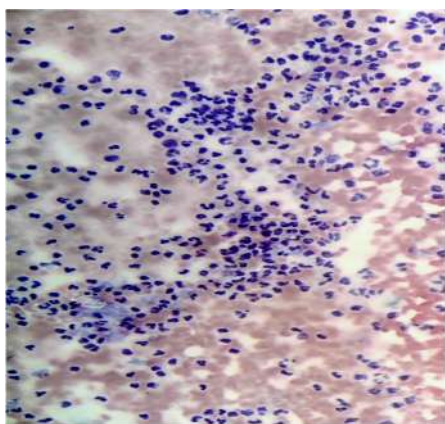


Fig. 3: Abundant polymorphs scattered on a hemorrhagic background.

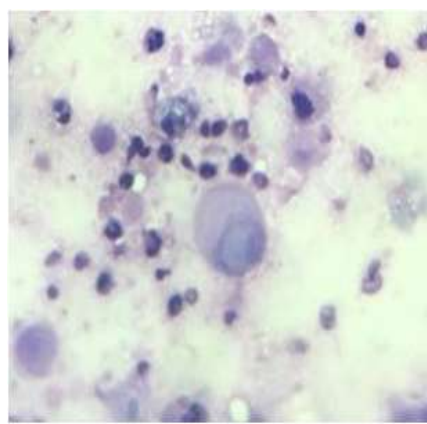


Fig. 5: Malignant cells show prominent nucleoli and blue cytoplasm on Leishman's stain.

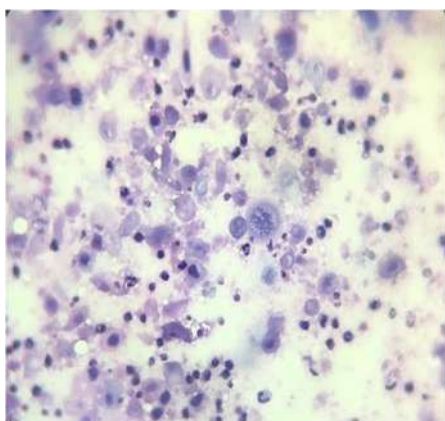


Fig. 4: Dispersed pleomorphic malignant cells with hyperchromatic nuclei on a necrotic background.

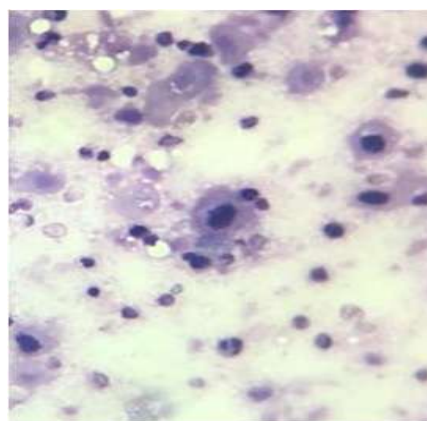


Fig. 6: Abnormal mitosis noted in squamous cell carcinoma

(Table 2). Cases of immunosuppression and empyema showed numerous polymorphs on a hemorrhagic background (Fig. 3).

Among the 4 cases of malignancy, 3 were squamous cell carcinomas and 1 case was of adenocarcinoma. The cytological smears in squamous cell carcinoma exhibited large pleomorphic cells with hyperchromatic nuclei and basophilic cytoplasm (Fig. 4). Some of the cells had conspicuous nucleoli (Fig. 5) and abnormal mitosis (Fig. 6). Background showed hemorrhage with mixed inflammation. While the malignant cells in adenocarcinoma were arranged in a papillary or glandular pattern with large pleomorphic cells, hyperchromatic nuclei and scanty cytoplasm.

Discussion

Pleural effusion is a frequently encountered problem in patients suffering from pulmonary or cardiac problems. Pleural effusion can be a transudate if the cause is increased hydrostatic or decreased oncotic pressure in the pleural cavity, or an exudate, if there is abnormal pleural capillary permeability, reduced lymphatic clearance of

accumulating fluid, infection, or bleeding, into the pleural space [5]. Hence discrimination of the pleural fluid as transudate or exudate remains the basic diagnostic algorithm.

The present study showed slight male preponderance which correlates with the study done by Romero et al. [6]. Transudative effusions were usually characterised by a majority of lymphocytes or other mononuclear cells. Similar findings were noted by authors in other studies [4,7]. The most frequent cause of exudative effusion was tuberculosis, pneumonia and immunosuppression. This is in accordance with the study done by Alusi et al. [8]. Epstein et al. showed that majority of tuberculous effusions had more than 50% lymphocytes, which was noted in our study also [9].

All the malignant pleural effusions were exudative. Three cases of squamous cell carcinomas were seen in males and one case of adenocarcinoma was noted in a female. All of them had primary in the lung. Some authors have said that the most common malignancy to invade or metastasize to the pleural cavity is adenocarcinoma followed by small cell carcinoma and less likely squamous cell carcinoma. This predominance of adenocarcinoma

is probably due to its more peripheral origin in lung parenchyma in comparison to squamous cell carcinoma which arises most often from the main tracheo-bronchial region [10-12]. This disparity in our study could be because of the lesser sample size and fewer cases of malignancy.

Accurately diagnosing cells as being either malignant or benign reactive mesothelial cells in serous effusions is a common diagnostic problem in conventional cytological smears. The lower sensitivity of cytodiagnosis of effusions is mainly attributable to bland morphological details of cells, overcrowding or overlapping of cells, cell loss, and changes due to different laboratory processing methods. Cell block (CB) method provides better architecture, morphological features between reactive mesothelial cells and malignant cells and thereby increases the efficacy of cytodiagnosis [13]. Cell block technique is simple, inexpensive and does not require any special training or instrument. Morphological features are better identified by cell block method when compared to conventional smear method. Multiple sections can be obtained if required for special stain or IHC study. It bridges the gap between cytology and histology [14].

Conclusion

Study of the pleural fluid aims at pointing out the etiology of effusion in various conditions. As cytological smears yield a varied population of cells, a thorough examination helps in establishing a suitable diagnosis and plays an important role in further management. Various benign and malignant conditions can be diagnosed with this simple tool.

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