

**Original Research Article****Diagnostic Utility of Body Fluid Cytology****Arpana Dharwadkar<sup>a</sup>, Shruti Vimal<sup>b</sup>, Vidya Viswanathan<sup>c</sup>, Manoj Sawadkar<sup>d</sup>**

<sup>a</sup>Associate Professor, <sup>d</sup>Senior Resident, Dept. of Pathology, Dr. D.Y. Patil Medical College, Hospital & Research Centre, Pimpri, Pune, Maharashtra 411018, India.

**Abstract**

**Background:** Cytological examination of various body fluids like ascitic, pleural, synovial, CSF, urine etc, plays an important role in diagnosing various non- neoplastic and neoplastic conditions. Hence, this study is conducted to evaluate the utility of this simple procedure and to understand the newer techniques that can be applied in further confirming our diagnosis.

**Materials and Methods:** It is a retrospective study conducted on all the body fluids which came for cytological analysis. The fluids were centrifuged, the supernatant was discarded and the sediment was used to make three smears which were stained with Papanicolaou, Hematoxylin and Eosin stains (H&E) and with leishman stain. All the smears were then thoroughly examined.

**Results:** The most common sample received was pleural fluid (55%) with ascitic fluid being the second most common. Chronic inflammation was the most common pathology noted in both the pleural as well as the ascitic fluid. A total of 8 cases showed metastatic deposits which were from adenocarcinoma. The cells showed typical features of malignancy.

**Conclusion:** Cytological analysis of body fluids helps us in differentiating non-neoplastic and neoplastic lesions. Further typing of the neoplastic lesions can be done using special stains and immunohistochemical stains

**Keywords:** Body Fluids; Cytology; Mesothelial Cells; Neoplastic Cells.

**Corresponding Author:**

**Shruti Vimal,**  
Associate Professor,  
Dept. of Pathology,  
Dr. D.Y. Patil Medical College,  
Hospital & Research Centre,  
Pimpri, Pune, Maharashtra 411018,  
India.

**E-mail:**  
shruti.vimal@gmail.com

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**Introduction**

Cytological analysis of body fluids plays a pivotal role in the diagnosis of various lesions and aids the clinicians in the appropriate management of them [1-2]. A major contribution is in detection of the cancer cells accurately and then typing of the tumor [3]. Apart from this, fluid examination also reveals other pathological conditions, most commonly inflammation, infection with bacteria, fungi or viruses and parasitic infestation [4].

The main serosal body cavity fluids comprise of peritoneal, pleural, cerebrospinal and pericardial fluids.

Cytological analysis has gained increased acceptance to such an extent that a positive diagnosis is often considered as a definitive diagnosis. In our study we try to understand the cytology of various body fluids, categorize effusions and study their implications in the proper diagnosis of various clinical conditions [5].

**Materials and Methods**

This study was conducted in the Department of Pathology, Dr D.Y. Patil Medical College, Pimpri. It was a

retrospective study of one year duration from October 2016 to September 2017. All the body fluids which came for cytological analysis were included in the study. Relevant clinical information regarding age, sex, symptoms and accompanying signs which were previously available were obtained. These fluids were analyzed for physical properties like the volume of fluid received, colour and odour. 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, these fluids were centrifuged at 2000rpm for five minutes, 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.

## Results

Cytological analysis was done on 273 cases of body fluids. The age ranged from 15- 85 yrs. Maximum number of patients was in the age range 46- 60 yrs (Figure 1). The male to female ratio was 1.7:1 with 171 males and 102 females. The most common sample received was pleural fluid (55%) with ascitic fluid being the second most common (36%). The other less frequent fluids that were

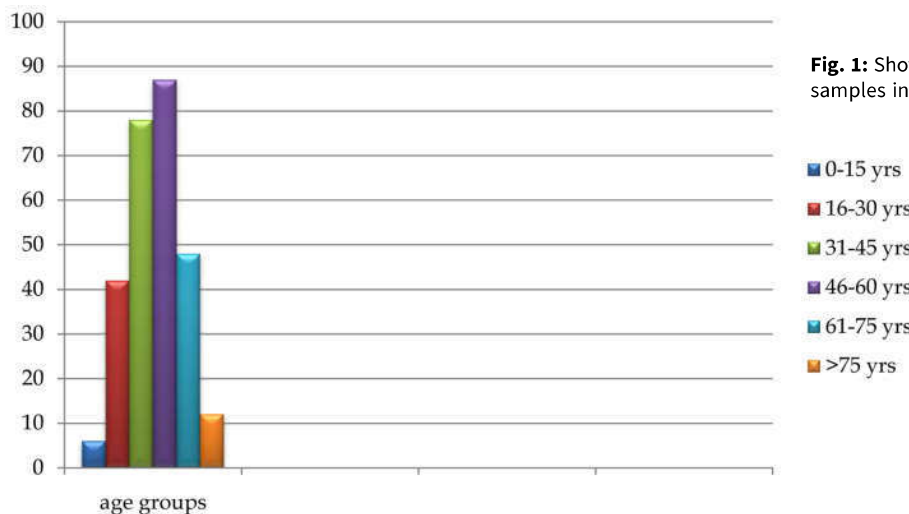
received were urine for cytology, testicular fluid, CSF and synovial fluid (Table 1).

Chronic inflammation was the most common (60%) pathology noted in the pleural fluid. The smears showed chronic inflammatory infiltrate composed of lymphocytes and macrophages on a proteinaceous background (Figure 2). Reactive mesothelial cells with no pathology were seen in 24 cases (16%). Acute suppurative inflammation was seen in 23 cases (15.3%) (Figure 3). Eleven cases of tuberculous inflammation were diagnosed with smears showing epithelioid cells and lymphocytic infiltrate. Only 2 cases (1.3%) of malignancy (Figure 4) were noted, and were diagnosed as positive for adenocarcinoma (Figure 5). The most common pathology noted on ascitic fluid cytological analysis was also chronic inflammation. Forty eight cases (48.4%) showed smears with chronic inflammatory cells like lymphocytes and macrophages. Reactive mesothelial cells were noted in 34.3% of the cases (Figure 6). Eight cases (8%) showed neoplastic cells in the fluid. Many large tumor cells with hyperchromatic nuclei scanty cytoplasm arranged in clumps depicting adenocarcinoma, were seen (Figure 7). Five cases of bacterial peritonitis and 2 cases of tuberculous peritonitis were also noted (Figure 8).

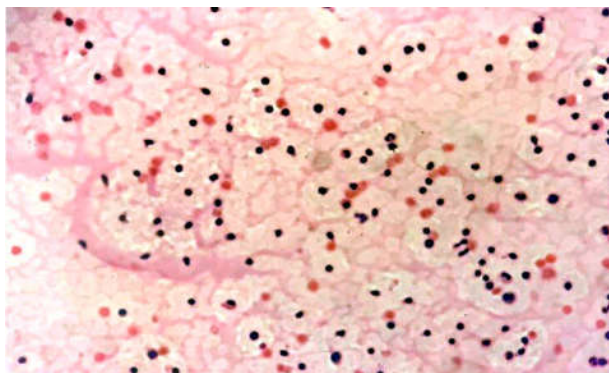
Out of the 9 cases of urine samples received, predominantly to rule out malignancy, only 1 case showed dysplastic cells with large nuclei and scant cytoplasm and was reported as suspicious of malignancy (Figure 9).

**Table 1:** Showing the type and percentage of various body fluids

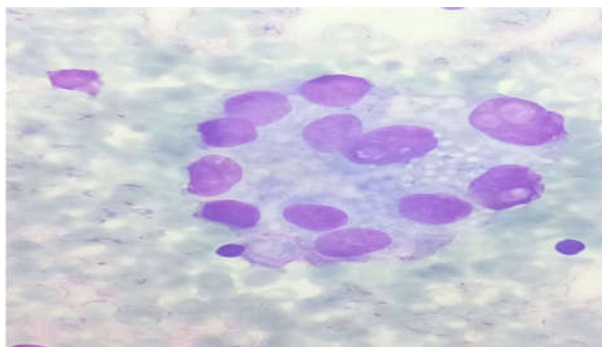
	Type of body fluid	No of samples	%
1	Pleural fluid	150	54.9
2	Ascitic fluid	99	36.3
3	Urine	9	3.3
4	Testicular fluid	6	2.2
5	CSF	6	2.2
6	Synovial fluid	3	1.1
	Total	273	



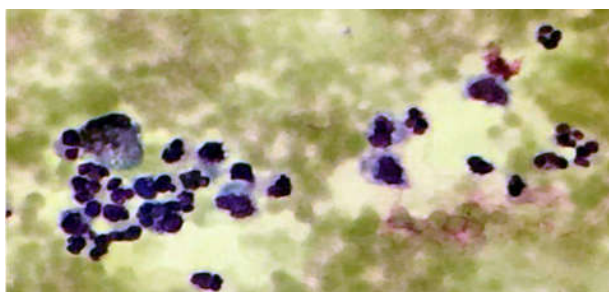
**Fig. 1:** Showing the distribution of cytological samples in various age groups



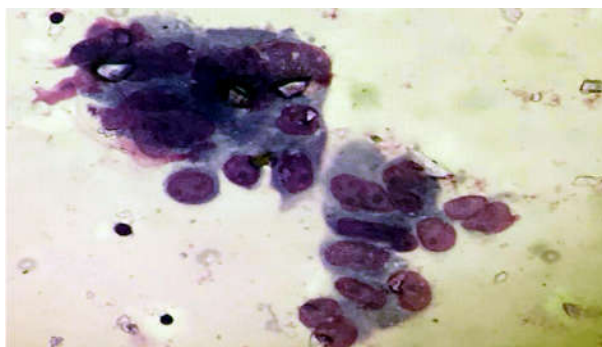
**Fig. 2:** Chronic inflammatory infiltrate showing predominantly lymphocytes



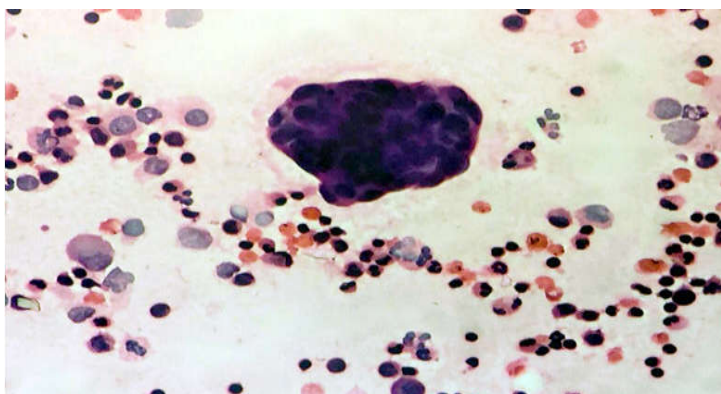
**Fig. 5:** Showing spectrum of lesions on pleural fluid cytology



**Fig. 3:** Acute suppurative inflammation showing numerous polymorphs

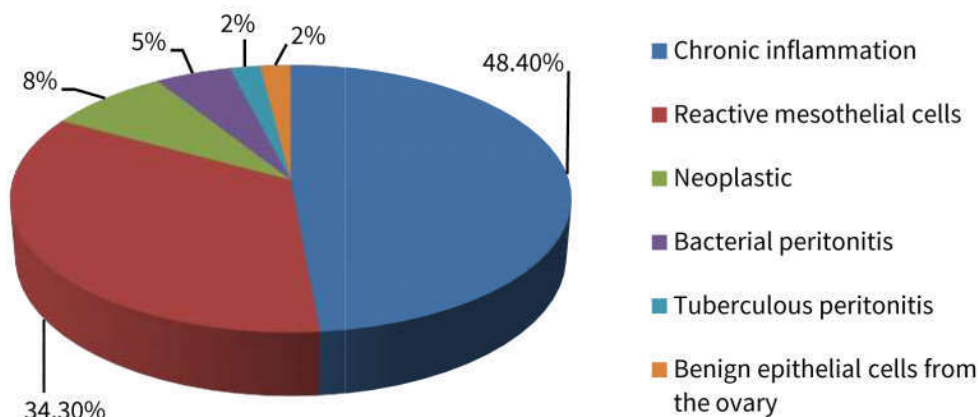


**Fig. 6:** Showing reactive mesothelial cells



**Fig. 4:** Showing a cluster of large pleomorphic cells with hyperchromatic nuclei on a background of mixed inflammatory infiltrate

**Various peritoneal fluid lesions**



**Fig. 7:** Showing metastatic deposits of adenocarcinoma

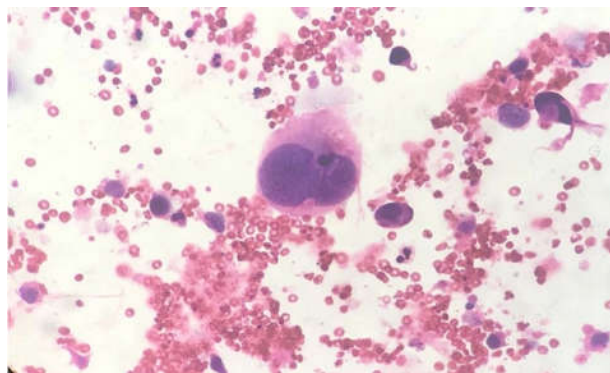


Fig. 8: Showing the various pathological lesions seen on ascitic fluid

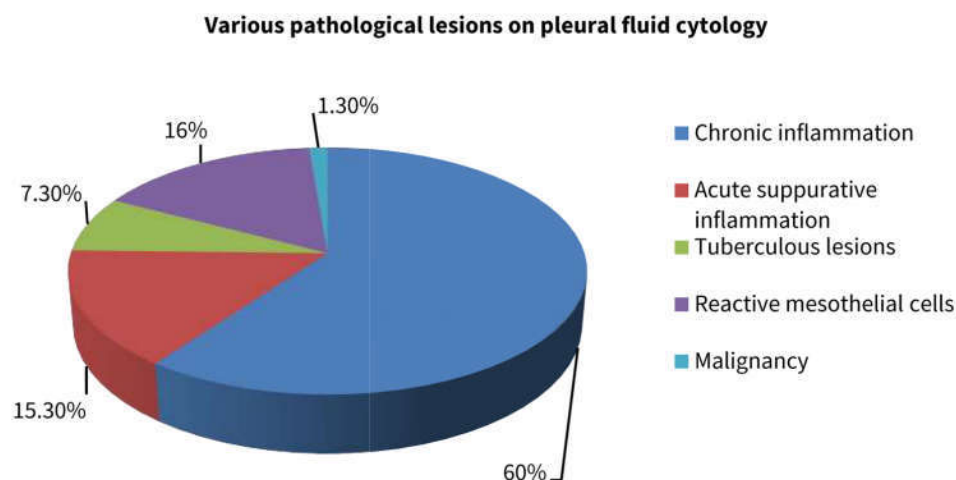


Fig. 9: Dysplastic cells in urine

**Discussion**

In 1867, Lucke and Kiebs first observed lymphocytes and other larger round cells with large clear nuclei in a milky ascitic fluid but an authenticated description of cancer cells in pleural and peritoneal fluids appeared only in 1882. In that year Quincke published a detailed description of cancer cells originating in ovarian and pulmonary cancer. And even now analysis of the body fluids is considered as a simple and an important method of diagnosing many non- neoplastic and neoplastic conditions [1].

In our study a total of 273 fluids were received. Males were more than females. Most of the patients were in the age group of 46-60 yrs. Pleural fluid was the most common fluid received in our study. This correlates well with studies conducted by others [4,6].

Among the non- neoplastic causes, chronic inflammation was the most commonly seen pathology in both pleural and peritoneal fluids. These smears showed predominantly lymphocytes and few of them also showed macrophages along with lymphocytes on a proteinaceous background. The cause for such chronic inflammatory

exudates is usually infection of the organs enclosed by the serous membranes and sometimes because of the presence of tumors in these organs. Hence, it is advisable that those cases that are reported as chronic inflammation need a repeat sample analysis atleast for three consecutive times to exclude a suspicion of malignancy [7]. Suppurative lesions were lesser in number which showed abundant neutrophils along with very few lymphocytes [8]. Most of the synovial fluids were transudate in nature with majority of them showing neutrophilic predominance. Majority of CSF fluid showed lymphocytic predominance. No metastatic deposits were noted in CSF.

Reactive mesothelial cells were seen in 34 cases of ascitic fluid and in 24 cases of pleural fluid. These cells can often be confused with malignant cells. The mesothelial cells are arranged in mono layered sheets in clusters or singly in contrast to the malignant cells that are usually arranged in papillary or glandular pattern. They are large pleomorphic cells with hyperchromatic nuclei and scanty cytoplasm [9]. Few mesothelial cells

exhibit a typical window between two cells because of the brush border villi seen in them. Also, abnormal mitosis noted in the cells on cytology warrants a careful study to rule out an underlying malignancy. Special stains play an important role in distinguishing reactive mesothelial cells from adenocarcinoma deposits. Periodic acid Schiff stain can be used to demonstrate the PAS positive granules in the cytoplasm of the mesothelial cells and only a diffuse red blush occasionally in the malignant cells where as mucicarmine , a mucin stain shows positivity only in adenocarcinoma and never in mesothelial cells [10].

Immunohistochemistry can also be used to distinguish reactive mesothelial cells from adenocarcinoma. CK, EMA,CEA, Leu M1, B72.3, BerEP4, CA 19-9, HMB45 are the panel of markers that are used. Desmin and calretinin are positive in mesothelial cells while cytokeratin is positive in adenocarcinoma [11].

Neoplastic cells were noted in 8 cases of ascitic fluid and in 2 cases of pleural fluid. All the cases showed deposits of adenocarcinoma cells. The tumor cells showed features of adenocarcinoma, i.e., the tendency to form smoothly contoured cohesive groups composed of large cells with eccentric, malignant-appearing nuclei, prominent nucleoli and vacuolated cytoplasm. However, at times, adenocarcinoma cells in effusions were seen to exhibit

great morphologic variation. Adenocarcinoma is the most common type of tumor to produce metastasis in the serous cavities, with primary most often from breast, lung, ovary and GIT [12,13,14].

Studies conducted by Wong JW et al and Shulbha et al showed that metastatic deposits were noted more in pleural fluids than ascitic fluid [8,15].

The cytological examination of fluids by means of smears, even though carefully prepared, leaves behind a large amount of residual fluid, that is not further investigated but that might contain valuable diagnostic material. This residual material can be evaluated by treating it as cell block in a simple and expedient fashion, and examined in addition to the routine smears.

The cell block technique will increase the positive results, and will help to demonstrate morphological details by preserving the architectural patterns, which could be of great help in making correct diagnosis of the primary site. The cell block technique has an added advantage that multiple sections of the same material can be obtained for special stains [16,17]. Study conducted by Hathila et al mentioned that conventional smear method was useful for all types of specimen with different cellularity. Cytopspin method allowed concentrating the scanty cellular sample but was not quite useful for highly cellular specimen in which it may lead to confusion in interpretation [18].

### Conclusion

Cytological analysis of body fluids helps us in diagnosing various pathological conditions and differentiating non-neoplastic from the neoplastic lesions. Further typing of the neoplastic lesions can be done using special stains and immunohistochemical stains.

### Funding

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### Conflict of Interest

NIL

### References

1. James W Reagan. Exfoliative cytology of pleural, peritoneal and pericardial fluids. Cytology series. 153-160.
2. Archana Josh, Nidhi Mahajan, Karmarkar J, S.D. Mahore. Diagnostic utility of various techniques used in body fluid cytology. IOSR Journal of Dental and Medical Sciences. 2014;13:2279.
3. Gupta S, Sodhani P, Jain S. Cytomorphological profile of neoplastic effusions: An audit of 10 years with emphasis on uncommonly encountered malignancies. J Can Res Ther 2012;8:602-9.
4. Kumavat PV, Kulkarni MP, Sulhyan KR et al. Cytological study of effusions: Indian Medical Gazette. 2013.p.306.
5. Gupta R et al. Exfoliative cytology of body fluids: a study from provincial hospital of Jammu region, India. Int J Res Med Sci. 2016 Apr;4(4):1016-1019.
6. Prasaad P R, Rao B, Suresh N, Analytical and Cytological Study of Effusions. Journal of Dental and Med Sci. July 2016;15(7):83-87.
7. Jha R, Shrestha HG, Sayami G, Pradhan SB. Study of effusion cytology in patients with simultaneous malignancy and ascites. Kathmandu University Medical Journal 2006;4(16):483.
8. Shulbha VS, Dayananda B. Cytology of body fluids- an aid to primary diagnosis. Indian Journal of Pathol Oncol. 2015;2(2):81-3.
9. Karoo RS, Llyod TDR, Garcea G, Redway HD, Robertson GSR. How valuable is ascitic fluid cytology in detection and management of malignancy. Post graduate medical journal. 2003;79:292-299.
10. Koss L.G.—Diagnostic Cytology and its Histological Basis.5th ed. Philadelphia:JB Lippincot; 2006.
11. Sen R, Hasija S, Kalra R, Garg S, Singh A, et al. Morphometric analysis and immunocytochemical staining on cytopspin preparation in effusion cytology. A study. J Cytol Histol 2015;6:314.
12. Pradhan SB, Pradhan B, Dali S. Cytology of body fluids from different sites : An approach for early diagnosis of malignancy. J Nepal Med Assoc 2006;45:353-56.
13. Ong KC, Indumathi V, Poh WT, Ong YY. The diagnostic yield of pleural fluid cytology in malignant pleural effusions. Singapore Med J 2000;41:19-23.
14. Awasthi A, Gupta N, Srinivasan R, Nijhawan R, Rajwanshi A. Cytopathological spectrum of unusual malignant pleural effusions at a tertiary care centre in north India. Cytopathology2007;18:28-32.
15. . Wong JW, Pitlik D, Abdul Karim FW. Cytology of pleural, peritoneal and pericardial fluids in children. A 40 year summary. Acta Cytol. 1997;41(2):467-73.
16. Agrawal T, Shetty K P, Shetty K J. Cytomorphological Study of Body Cavity Fluids in Disease: Conventional Cytology Versus Cell Block Journal of Dental and Med Sci. Nov 2016; 15(1):73-77.
17. Thapar M, Mishra RK, Sharma A, Goyal V, Goyal V. Critical analysis of cell block versus smear examination in effusions. J Cytol, 2009;26:60-64.
18. Hathila RN, Dudhat RB, Saini PK, Italiya SL, Kaptan KR, Shah MB. Diagnostic importance of serous fluid examination for detection of various pathological conditions -A study of 355 cases. Int J Med Sci Public Health, 2013;2:975-979.