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Original Research Article

A Retrospective Analysis of Pleural Effusion Utilizing the Recently Introduced Indian Academy of Cytologist (IAC) for Reporting Significant Serous Fluid Cytopathology

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Abstract:

Introduction: Serous effusion is characterized by an abnormal build-up of fluid within a body cavity, such as the peritoneal, pleural, or pericardial spaces. Recently, the Indian Academy of Cytologists (IAC) has published the guidelines for interpretation and reporting of serous effusions.

Aim and Objective: Present study is conducted to apply recently purposed IAC diagnostic categories for reporting the cytological diagnosis of pleural effusion fluid.

Methodology: A retrospective study for one year duration from December 2022 to December 2023 was conducted in cytology section, Department of Pathology, R.N.T Medical College. Pleural fluid received for cytological analysis from all the departments is included in the study. All the pleural effusions retrieved from database. Recategorization was performed using Indian Academy of Cytologist (IAC) diagnostic category.

Result: A total 175 pleural effusion samples were received. There were 110 males and 65 females and male to female ratio was 1.69:1. The age range from 2.5 year to 90 year with maximum bulk between being in age group of 61-70 year. In present study we analysed the pleural effusion according to IAC diagnostic categories, out of total 14(8%) cases were non diagnostic (category 1), 121(73.27%) cases were in category 2 and 11(6.28%) cases were reported in category 3, out of total 7(4%) cases were in category 4 and in category 5, 22(12.57%) cases were reported in category 5.

Conclusion: The categorization of serous effusion cytology samples as per the reporting format developed by the IAC which is in line with the international system is feasible and recommendations appropriate for the different diagnostic categories.

Keyword: Cytology Serous effusion, Pleural effusion, The International System for Reporting Serous Fluid.

Introduction

The occurrence of Serous effusion in body cavities, such as the pleural and peritoneal cavities often occur due to imbalance between production and reabsorption of serous fluid.[1,2] Pleural effusion can be produced in both malignant and non-malignant circumstances. Their presence is always regarded as a pathologic condition.[3] Due to its minimal invasiveness, cost-effectiveness, and easy accessibility, serous effusion cytology is frequently employed to distinguish between benign and malignant effusions.[4-6].

Clinical diagnosis relies on the patients clinical presentation, radiological observations, and laboratory assessments, which encompass biochemical assays and cytological Evalution, with or without ancillary techniques and molecular testing.[7] Effusion cytology extend beyond morphology alone following microscopic examination, special stains, immunohistochemical stains or flow cytometry may be utilized according to the initial morphologic findings [8,9]. The presence of pulmonary, pleural or a systemic disease can result in the formation of pleural effusion. Except for primary pleural mesothelioma, all pathologies involving the pleural membrane result from an abnormality in its maintenance or dynamic balance [10]. Pleural effusions are categorized into benign and malignant pleural effusions. Malignant pleural effusions are possible across all cancer types.

The primary culprit include lung cancer, breast cancer, lymphoma and gastrointestinal cancer.[11] In the beginning of this year, 2020, the Indian Academy of Cytologists (IAC) published guidelines for collection, preparation, interpretation, and reporting of serous effusion fluid samples with the vision of attaining uniformity across all laboratories, ensuring good

cytopathology practice and implementing a standard reporting format with same recommendations in similar context.[12] After cytological evaluation the case is placed into any of the five recommended categories (Category 1, Unsatisfactory for evaluation; Category 2, No malignant cells detected/benign cellular changes; Category 3, Atypical cells, NOS; Category 4, Atypical cells, suspicious for malignancy; Category 5, Malignant cells seen).

The present study was carried out to assess the feasibility and utility of application of categorization of effusion cytology samples into the various diagnostic categories recommended by the IAC.

Material and Method:

Data collection: The study was approved by the Ethics Committee of the R. N. T. medical college and Hospital. The inclusion criteria were cytopathological samples of Pleural effusions from all department of our Hospital from December 2022 to December 2023. Data were collected from pathology record and databases and electronic medical records, encompassing patient demographics, clinical presentations, cytological profiles medical history, ancillary studies and patient management details. The cases underwent reclassification through microscopic examination of the samples, final diagnosis assessment, and codification of the cytology report. If the reports information was deemed inadequate, the original slides were re-evaluated and categorized into the most appropriate IAC category.

Preparation of the specimens: The fluid was divided into two parts; one part was used for cell count. One drop of fluid was mixed with a drop of toluidine blue and the cells were counted in an improved Neubauer counting chamber. The other part was poured into the centrifuge tubes and centrifuged for 10 minutes at 2000 rpm. The supernatant was poured off. Part of the sediment was transferred to a clean glass slide and mixed with a part of 1% toluidine blue. After placing the cover slip, the slide was observed under the microscope for immediate identification of cell morphology. With the remaining sediment three smears are made and stained with Giemsa, Hematoxylin & eosin and Papanicolaou stains respectively. ZN stain was done in the suspected of tuberculosis. Smears were examined for the differential cell count, cell morphology and reported descriptively, final impression given as malignant or non-malignant pleural effusion. Malignant pleural effusions were further classified according to its morphology.

Result

In our present study cytological analysis was done for 175 pleural fluids. The male to female ratio was 1.69:1 with 110 cases of male patients and 65 cases of female cases. Chart -1. The pulmonary department had sent pleural fluid examination mostly among the all other departments.

In our study, out of 175 cases, majority of effusion, 139 cases (79.42%) were non neoplastic and 22 cases (12.57%) were of neoplastic effusion and 14 cases were of unsatisfactory effusion. Chart 2.

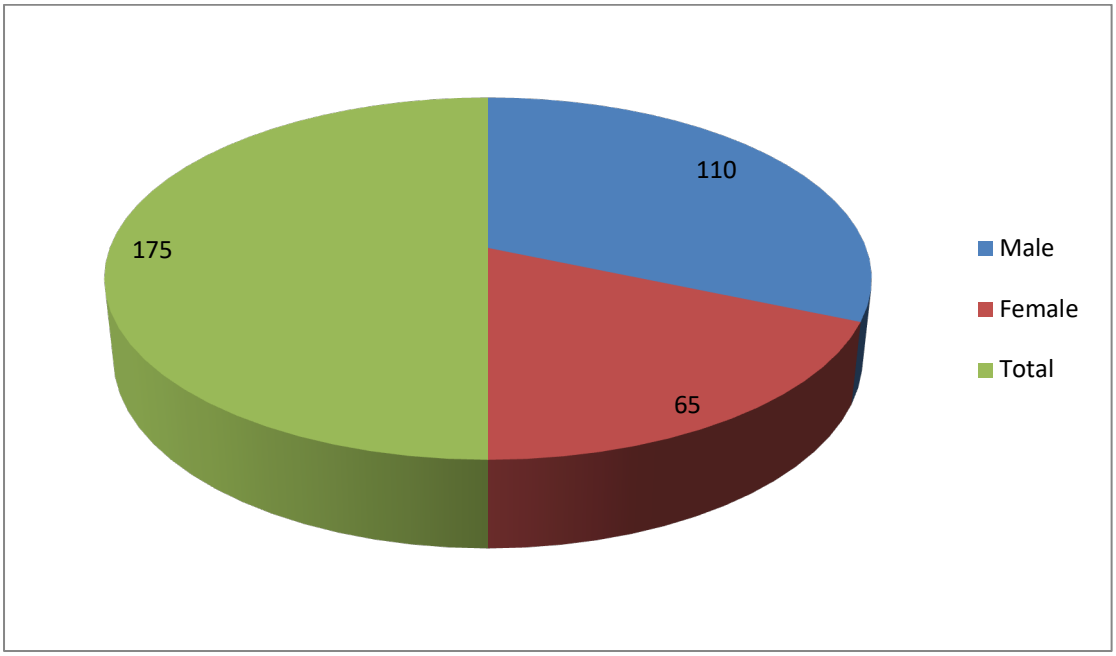

Chart 1: Distribution of pleural effusions based on sex

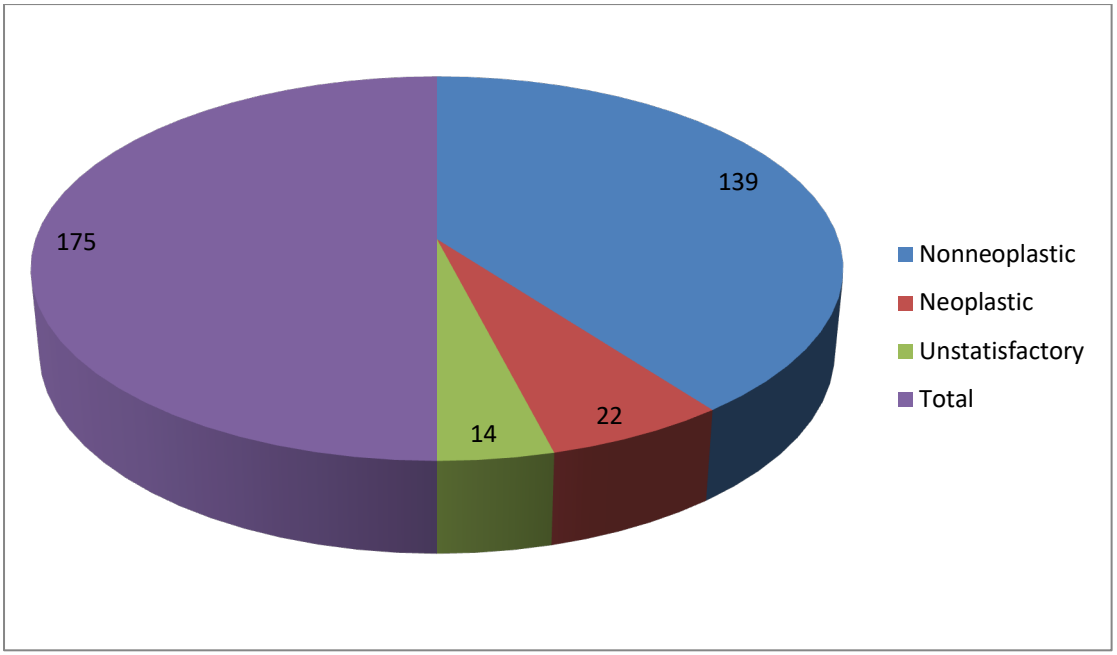

Chart 2: Distribution of Neoplastic Vs Non neoplastic causes of pleural effusion

In Table 1 we analysed the cytology sample of pleural effusion according to The Indian Academy of Cytologist (IAC) diagnostic categories. Out of 175 cases, 14(8%) cases were unsatisfactory for evaluation or scant cellularity (category 1). Among (category 2A) out of 175 cases, 23 cases (19%) were of no malignant cells. In category 2B (Benign cell changes), 19 cases (15.70%) were of reactive mesothelial cells, inflammatory cells were seen in 31(25.61%) cases and lymphocytic rich effusion were of 48(39.66%) cases. In Category 3 (Atypical cells, not otherwise specific) 11(6.28%) cases were reported. Out of 175 cases, 7 (4%) cases were of category 4 (Atypical cell, suspicious for malignancy). In our study category 5 (malignant cells seen), 22(12.57%) were reported, out of which 8(36.36%) cases were of metastatic adenocarcinoma, 2(9.09%) cases were of metastatic lymphoma and remaining 12(54.54%) pleural effusion have nonspecific malignant cells effusions.

Table 1: IAC Diagnostic categories for reporting serous effusion cytology samples

S.No	IAC Category	Cases	Cytology result
1	1-	14(8%)	Unsatisfactory
2	2A	23(13.14%)	No Malignant cells seen
	2B	19(10.85%)	Reactive Mesothelial cells
		31(17.71%)	Inflammatory effusion
		48(27.42%)	Lymphocytic rich effusion
3	3	11(6.28%)	Atypical cells, not otherwise specified(NOS)
4	4	7(4%)	Atypical cells, suspicious for malignancy
5	5	22(12.57%)	Malignant cells seen
Total cases		175(100%)	

The age ranged from 2.5 year to 90 years with maximum bulk between being in the age group of 61-70 years. Figure 1 shows centrifuged smear of pleural effusion showing only RBC (Unsatisfactory). Figure 2 shows centrifuged smear of pleural fluid showing reactive mesothelial cells and figure 3 showing atypical cell having high N: C ratio, irregular nuclear membrane indicating IAC category 3. In figure 4 centrifuged smears of pleural fluid indicating IAC category 4 showing atypical cells, highly suspicious for malignancy. Figure 5 showing IAC category 6, centrifuged smear of pleura fluid shows three dimensional ball formation by malignant cells suggestive of Adenocarcinoma.

Table 2: Age wise distribution

S.No.	Age Group	No. of Patient
1	0-10	2(1.14%)
2	11-20	19(10.85%)
3	21-30	18(10.28%)
4	31-40	21(12%)
5	41-50	15(8.57%)
6	51-60	29(16.57%)
7	61-70	36(20.57%)
8	71-80	23(13.14%)
9	81-90	12(6.85%)
Total		175(100%)

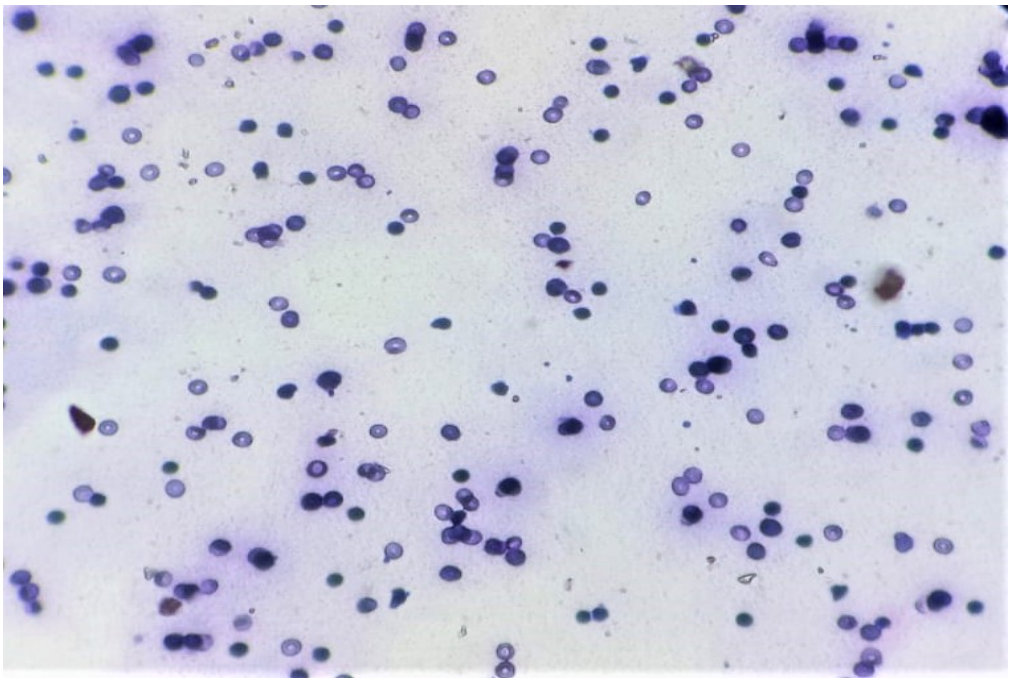

Figure 1: IAC category 1: Centrifuged smear shows only RBC (Unsatisfactory for evaluation); MGG stain 40X

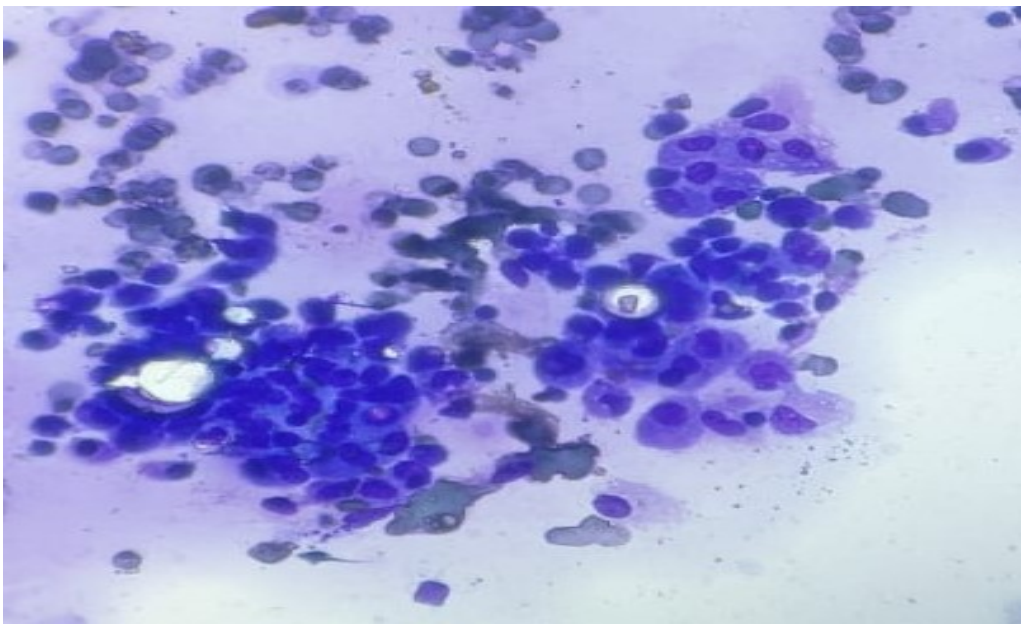

Figure 2: IAC Category 2: Centrifuged smear shows reactive mesothelial cells (MGG stain 40X)

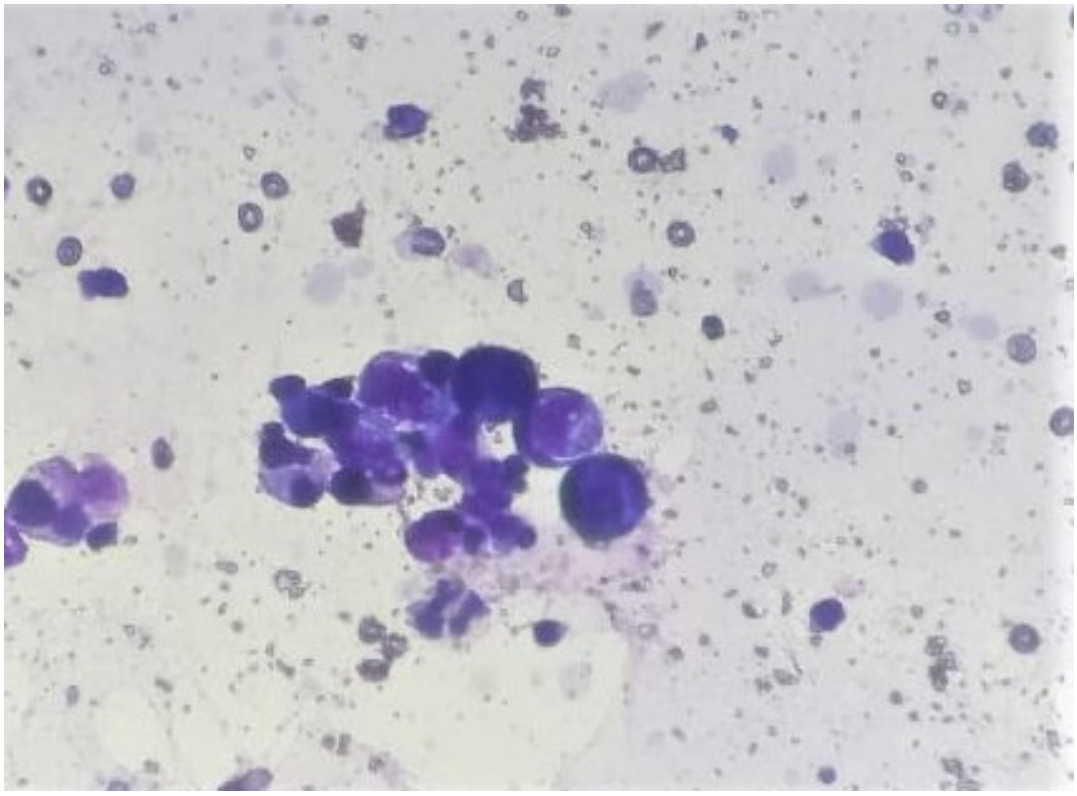

Figure 3: IAC Category 3: Centrifuged pleural fluid smear shows atypical cells, not otherwise specified. (MGG; 40X)

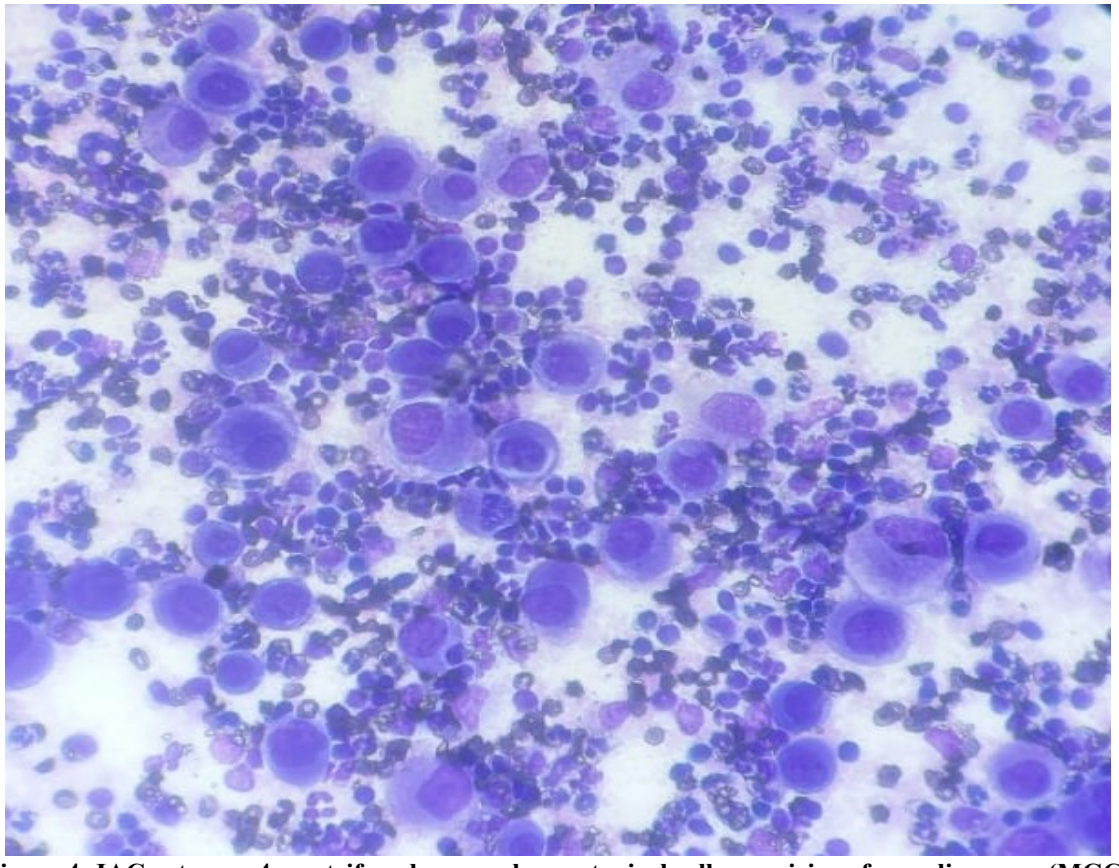

Figure 4: IAC category 4: centrifuged smear shows atypical cells, suspicious for malignancy. (MGG; 40X)

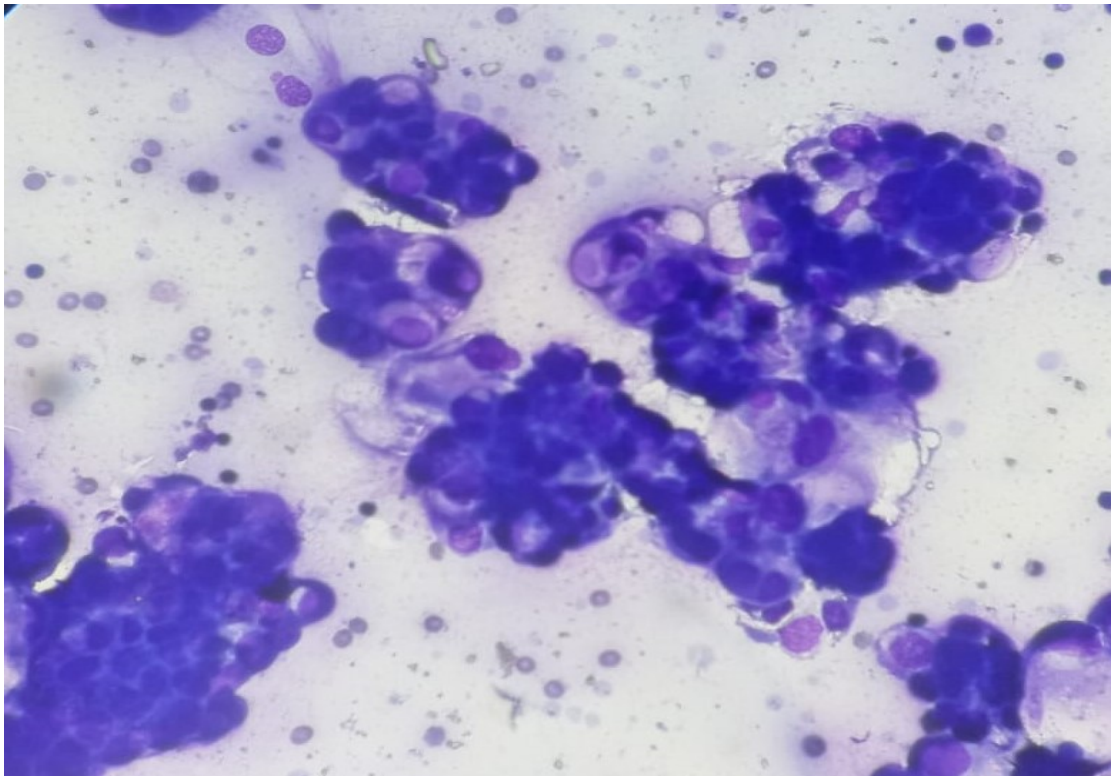

Figure 5: IAC Category 5: Centrifuged pleural fluid smear shows three dimensional ball formation of malignant cells. (MGG; 40X)

Discussion

In this study, the application of the Indian Academy of Cytologist (IAC)) effusion diagnostic categories were evaluated based on serous effusion cytology over a period of one year. Serous effusions constitute a notable portion of the annual workload in the cytopathology laboratory. Serous effusion cytology serves as a minimally invasive and cost effective diagnostic approach for exploring the causes of body cavity effusion, aiding clinical decision making.[13] Pleural effusions result from either pulmonary or non-pulmonary conditions. While the range of causes is extensive, the majority of effusion stem from malignancy, heart failure tuberculosis or bacterial infection [14]. We had total of 175 cases in our study. Male to female ratio of 1.69:1, which is similar with study done by Lekha M.B et al [15], Rasik Hathila et al,[16] Priyanka Kiyawat et al[17], and Ishan Arora et al[18], gojiya et al[19]. In pleural effusion samples, non-neoplastic cases formed the majority (79.42%), whereas neoplastic cases made up 12.57% of the total which is concordance with Lekha M.B et al[15], Ishan Arora et al[18]], and Gojiya et al[19]. In our study the most common malignancy in pleural effusion is metastatic adenocarcinoma which was in concordance with studies done by Di Bonito et al[20] and Hallman et al[21]. In our study the distribution of IAC category showed that pleural effusion were 8% Category 1(ND), 73.27% category 2, and 6.28% category 3(AUS), 4% category 4(SFM),and 12.57% category 5(MAL). The study done by Kundu R et al(22) concluded the 1340 serous effusion cytology sample and categorized the sample according to IAC diagnostic category and observed that out of 35 total cases in category 1, majority were pleural effusion. A total of 954 (71.2%) cases were placed in category 2, a total of 17 (1.3%) cases were placed in category 3. A total of 59(4.4%) cases were in category 4.

A definite diagnosis of malignancy in effusion was made in 275(20.5%) serous effusions with 225 pleural, 17 pericardial, and 33 peritoneal effusions.

Conclusion

In conclusion, the classification of serous effusion cytology samples according to the reporting format established by the IAC which is in line with the international system, demonstrating suitability for various diagnostic categories. Standardizing the interpretation and reporting terminologies minimizes inter observer variability, thereby ensuring precise cytologic diagnosis and facilitating appropriate clinical care and management for patients.

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