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Evaluation of Pathological Body Fluids: An Important Diagnostic Aid

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Abstract

Background: The analysis of body fluids is an important diagnostic modality. Meticulous evaluation of body fluids for their biochemical and cytomorphological properties helps in providing an insight into the diagnostic, prognostic and therapeutic aspect of various pathological processes in the body.

Material and methods: The present retrospective study comprised of a total of 500 cases of aspirated body fluids referred to cytology section. The smears were stained by Giemsa and Papanicolaou (PAP) stains and cell count was done by improved Neubauer counting chamber. All cases were analysed for biochemical parameters and cytological features.

Results: Out of 500 fluids, 228 were of pleural fluid, 168 were of peritoneal fluid, 63 were of cerebrospinal fluid and 41 were of synovial fluid. The range of age varied between 7 years to 90 years. Male to female ratio was 1.9:1. Total exudates cases in our study were 269 (53.8%) and transudates were 231(46.2%) . Cytological findings showed that 452(90.4%) cases were benign, 27(5.4%) cases were malignant and 21(4.2%) cases were suspicious of malignancy.

Conclusion: Cytological evaluation of fluids is a relatively simple, rapid, inexpensive and less invasive tool having a high accuracy & low incidence of false positive diagnosis. Effusion cytology in resource limited settings still remains an effective technique. It provides an assess to both clinician & pathologist to reach the diagnosis for further management of the patient in a cost effective manner and thereby reducing the need for invasive investigations.

Keywords: Body Fluids, Transudate, Exudate, Malignant Effusions

Introduction

The analysis of body fluids is an important diagnostic modality that dates back a long way in the history of pathology. The cytological interpretation of individual cells that are exfoliated into these fluids is of paramount importance since they provide an insight into the diagnostic, prognostic and therapeutic aspect of various pathological processes in the body.^{1,2} A high sensitivity and specificity of a cytological diagnosis

of body fluids is presumably because the cell population present in the fluid sediment provides a more representative sample of a much larger surface area than that obtained by needle biopsy.^{3,4} Main body fluids like pleural, peritoneal, pericardial, cerebrospinal fluid (CSF) and synovial fluid are normally present in minimal quantities with their constituents in specific proportions, within respective body cavities. These fluids during a disease process undergo abnormal and

disproportionate qualitative and quantitative changes.^{4,5}

Cytological examination of these fluids helps in diagnosing of both non neoplastic and neoplastic conditions. Most important is the recognition of a malignant pathology. But many other conditions such as inflammatory diseases, parasitic infestations, bacteria, fungi and viruses can also be identified.⁶

Cytological evaluation of fluids is a relatively simple, rapid, inexpensive and less invasive tool having a high accuracy with low incidence of false positive diagnosis.⁷ The purpose of present study is to evaluate the significance of fluid cytology for various pathological conditions.

Material and Methods

The present retrospective study was conducted in the cytology section of Post Graduate Department of Pathology, ASCOMS & Hospital, after obtaining due clearance from Institutional Ethics Committee. The study was performed to analyze body fluids for various pathological conditions. A total of 500 cases of aspirated body fluids were studied. Records of all patients were retrieved and reviewed for pertinent clinical history, details of other investigations performed. Relevant clinical details and history was noted and correlated accordingly.

The fluid samples received were centrifuged at 2000 revolutions per minute for 10 minutes. The supernatant was discarded. To prepare wet film one drop of sediment was transferred to a clean glass slide and mixed with a drop of 1% toluidine blue. After mounting with cover slip, wet film was observed under microscope for immediate identification of cell morphology. Both air dried and wet fixed smears were made from the remaining sediment and stained by Giemsa and Papanicolaou (PAP) stains respectively, using standard methods.^{8,9} For hemorrhagic fluids, glacial

acetic acid was used as a hemolysing agent and then these were processed. Improved Neubauer counting chamber was used for cell counts. All cases were analyzed for biochemical parameters and cytology.

Results

Five hundred cases of fluid specimens were examined. Out of 500 fluids, 228 were pleural fluid, 168 were of peritoneal fluid, 63 were of cerebrospinal fluid and 41 were of synovial fluid.

The range of age varied between 7 years to 90 years of age as shown in Table 1. The maximum number of cases was in the age group of 21-30 years (18%), closely followed by 31-40 years (16.8%). Minimum number of cases was in the age group of 0-10 years (1.8%).

Male preponderance was noted. Out of 500 cases, 326 were males and 174 were females with male to female ratio being 1.9:1. Out of 228 cases of pleural fluid, 162 were males and 66 were females and 87 males and 81 females were seen in 168 cases of peritoneal fluids. Maximum number of cases of CSF and synovial fluids were also males, 42 of 63 and 21 of 41 cases, respectively. Above observations are shown in Table 2.

It was observed that 269 (53.8%) cases were exudative in nature and 231(46.2%) cases were transudates as shown in Table 3. One hundred forty four exudative cases were pleural fluids, 66 were peritoneal fluids, 35 were synovial fluids and 24 were CSF. One hundred two cases of peritoneal fluids were transudative followed by 84 cases of pleural fluids. Thirty nine cases of CSF and 6 cases of synovial fluids were transudative in nature.

Cytological findings showed that 452(90.4%) cases were benign, 27(5.4%) cases were malignant and 21(4.2%) cases were suspicious of malignancy (Table 4). Among malignant cases, 21 were peritoneal fluids, 6 were pleural fluids. Maximum malignant cases were seen after 5th decade except

one case which was metastasis from an ovarian malignancy seen in a 25 year old female. The malignancy observed in peritoneal fluids was adenocarcinoma in 19 cases and Non Hodgkin's Lymphoma in 2 cases. Out of 19 cases of adenocarcinoma 6 were ovarian, 5 from gastrointestinal tract and 8 unknown primaries. 5 cases of malignant pleural fluid were of adenocarcinoma and 1 case was squamous cell carcinoma. Lung was found to be primary in 3 cases and 3 cases had unknown primary. In our study 12 cases of peritoneal fluids and 9 cases of pleural fluids were categorized as suspicious of malignancy as they showed few clusters of atypical cells.

Discussion

Cytological evaluation of body fluids is diagnostically challenging. The history of fluid cytology dates back to 19th century when Lucke and Klebs in 1867, first described atypical cells in ascitic fluid. However, Quincke, in 1882, was the first investigator to diagnostically confirm the presence of malignant cells in pleural effusion. In 1891, in Germany, with the advent of lumbar puncture technique, CSF cytological examination was introduced in the field of cytopathology.^{5,10} For decades, body fluid analysis has played an important role as a diagnostic aid in establishing a definitive diagnosis, predicting prognosis and planning or monitoring therapy. It has gained increased acceptance in clinical practice today, since it is relatively simple, safe and an inexpensive procedure.^{1,11}

In the present study, a total of 500 cases of aspirated fluid specimens were studied. Most common fluid observed was pleural (228/500), followed by peritoneal (168/500). This was in accord with the studies done by Bhanvadia et al, Kumavat et al and Hathila et al who also noted pleural effusion to be the commonest fluid.^{10,12,13}

Males were more as compared to females with male to female ratio being 1.9:1. This was in concordance with most of the studies by other authors.^{1,4,5,11,13} In our study age of the patients ranged between 7 years to 90 years. In contrast to other studies, maximum number of cases was observed in a slightly lower age group of 21-30 years (18%). This was closely followed by age group of 31-40 years (16.8%). Studies done by Chakrabarti et al, Sulbha et al and Kumavat et al observed most number of cases in the age group of 31-40 years.^{4,5,12} However studies by other authors observed an even higher age range of 41-60 years.^{1,2} Minimum number of cases (1.8%), in our study was observed in the age group of 0-10 years. This was close to the observation made in the study by Poorana Priya.²

Pathological body fluids are classified into transudates and exudates. On routine evaluation, this differentiation is mainly on the basis of protein estimation of the fluid. Transudative fluid has protein levels <3 gm% and exudative fluid has protein >3gm%.^{4,7,13} Transudative effusions are seen when there is an imbalance of hydrostatic and oncotic pressures and clinically, common causes are congestive heart failure (CHF), cirrhosis and nephrotic syndrome. Exudative effusions are because of injury to the cavity lining and causes for this are malignancy, inflammation or infection, lupus, pulmonary infarction, trauma.^{3,14} In present study, 53.8% cases were exudative fluids and 46.2% were transudates. Kol et al and Kumavat et al showed similar findings.^{11,12} However few studies demonstrated higher number of transudative fluids.^{4,5} In the present study, pleural and synovial fluids were more commonly exudative in nature where as peritoneal fluids and CSF showed more number of transudates. These findings were in accordance with many other studies.^{2,5,12,15}

Cytomorphological examination of pathological body fluids is a well accepted method to categorize them as benign or malignant. By far, the recognition of malignant cells is the most important goal of fluid cytology and this is often used as a first line of investigation to detect and type metastatic disease based on subtle morphological features.^{12,16,17} The presence of malignant cells in body fluids indicates spread of disease beyond the organ of origin and this is important both therapeutically as well as prognostically.¹⁸ However, the interpretation of malignancy is difficult in body fluids . This may be due to less number of malignant cells present in the fluid which may go unrecognized on cytological examination leading to false-negative diagnosis. Also, reactive mesothelial cells may mimic malignant cells in conventional cytological smears, largely because reactive mesothelial cells show nuclear enlargement and hyperchromasia, with or without presence of prominent nucleoli and they may be arranged in rosettes, pseudoacini or acini, resulting in a false- positive diagnosis.^{1,13,18} In the present study, a total of 27(5.4%) cases were malignant and 452(90.4%) were benign. 21(4.2%)

cases were suspicious of malignancy. These findings were in accordance with studies done by Hathila R et al and Khatib WM et al.^{13,19} Out of 27 malignant effusions, 21 were peritoneal and 6 were pleural. Out of 21 cases categorized as suspicious of malignancy, 12 were peritoneal and 9 were pleural effusions. Adenocarcinoma was the most frequent cause of malignant peritoneal and pleural effusions. These findings are in agreement with the study of Kol PC et al.¹¹ In cases of suspicious samples a repeat examination should be advised. The rate of detection of malignancy is increased further if multiple effusion samples are evaluated. Fluid analysis although not a substitute for conventional histopathology but can be complementary to it in diagnosing malignant conditions.

Conclusion:

The study of fluid cytology can be used as a routine diagnostic investigation to help arrive at a definitive diagnosis. Preliminary body fluid analysis in resource limited setups still remains the most simple, convenient and cost effective technique in reaching to a particular diagnosis.

Table 1: Age wise distribution of effusions

Age in Years	Pleural	Peritoneal	Synovial	CSF	Total
0-10	00	00	03	06	09
11-20	25	02	11	06	44
21-30	30	42	12	06	90
31-40	30	27	09	18	84
41-50	29	30	03	15	77
51-60	45	38	00	09	92
61-70	20	17	00	03	40
71-80	33	09	03	00	45
>80	16	03	00	00	19
Total	228	168	41	63	500

Table 2: Gender wise distribution of cases

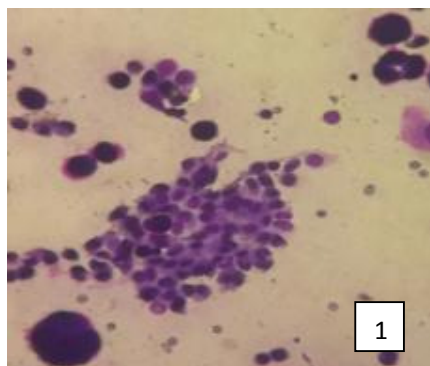
Type of Specimen	Number of Cases	Male	Female
Pleural	228	162	66
Peritoneal	168	87	81
Synovial	41	35	06
CSF	63	42	21
Total	500	326	174

Table 3: Distribution of body fluids according to biochemical properties

Type of Fluid	Transudate	Exudate
Pleural	84	144
Peritoneal	102	66
Synovial	06	35
CSF	39	24
Total	231	269

Table 4: Cytological Diagnosis of Body Fluids

Site	Benign	Suspicious of Malignancy	Malignant
Pleural	213	09	06
Peritoneal	135	12	21
Synovial	41	00	00
CSF	63	00	00
Total(500)	452	21	27



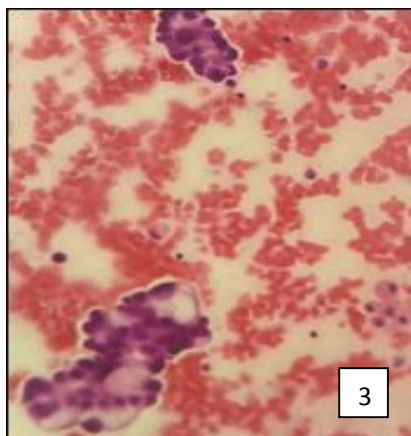
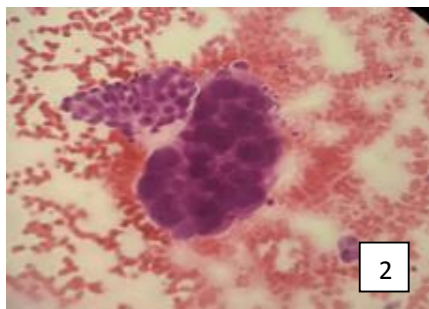


Figure 1: Smears showing sheets of reactive mesothelial cells with windows in case of pleural effusion (Giemsa stain X 400).

Figure 2: Malignant pleural effusion showing Adenocarcinoma cells arranged in three dimensional clusters (Pap stain X400).

Figure 3: Smears showing metastatic deposits of a signet ring adenocarcinoma in peritoneal effusion (PAP stain X 400).

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