Section: Pathology

Original Research Article

DIAGNOSTIC ACCURACY OF SEROUS EFFUSION USING INTERNATIONAL SYSTEM FOR REPORTING SEROUS FLUID IN A TERTIARY CARE HOSPITAL AT PONDICHERRY – A PROSPECTIVE STUDY

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ABSTRACT

Background: In order to diagnose and stage a variety of cancers and non-malignant diseases, serous effusion cytology is essential. However, because there is no standardised reporting, its interpretation has historically been variable. To increase repeatability and expedite diagnosis, the International System for Reporting Serous Fluid Cytopathology (TIS) was implemented. Goal: Examine the cytological spectrum in different effusion forms and assess the diagnostic precision of serous effusion cytology using the International System for Reporting Serous Fluid Cytopathology (TIS).

Materials and Methods: 91 serous fluid samples (pleural, ascitic, pericardial, and peritoneal) were used in this prospective investigation, which was carried out over the course of a year at a tertiary care hospital in Pondicherry. The TIS technique classified all specimens as unsatisfactory, negative for malignancy, atypia of unknown significance, suspicious for malignancy, and malignant after they were processed using traditional smears. SPSS version 25 was used for statistical analysis.

Results: The patients had a male-to-female ratio of 1.2:1 and a mean age of 56.35 years (range: 29–85 years). The most frequent specimen was pleural effusion (47.25%), which was followed by ascitic fluid (46.15%). 84 (92.31%) of the 91 samples were deemed adequate for assessment. Malignant-secondary (14.29%), unsatisfactory (4.4%), malignant-primary (1.1%), and suspicious for malignancy (1.1%) were the next most common results, after negative for malignancy (78.02%). Compared to pleural fluids, ascetic fluids had a greater percentage of malignant effusions.

Conclusion: Serous effusion cytology is still an affordable, less invasive diagnostic method. Clinical communication, uniformity, and diagnostic clarity are all improved by the International System for Reporting Serous Fluid Cytopathology. In cytopathological practice, its use guarantees consistency and enhances diagnostic precision.

Keywords: Serous effusion, Cytology, International System for Reporting Serous Fluid Cytopathology (TIS), Diagnostic accuracy, Pleural effusion, Ascitic fluid.

INTRODUCTION

Many disease processes that affect the pericardial, peritoneal, and pleural compartments can cause serous effusions, which are a common clinical finding. These effusions may be caused by malignant infiltration, benign inflammatory disorders,

congestive states, or infections. Effusion fluid cytological analysis is a rapid, low-invasive, and cost-effective method of identifying underlying disease processes, including cancer. Shidham VB et al (2021).[1]

Effusion fluid cytological assessment offers important prognostic and therapeutic information in addition to helping distinguish benign from malignant origins. Malignant effusions frequently indicate advanced illness, which affects therapy choices and staging. Bhanvadia VM et al,[2] (2014) Nonetheless, a significant obstacle in effusion cytology has been the absence of standardised reporting and inconsistent diagnostic nomenclature, which can result in interobserver variability and communication gaps between cytopathologists and physicians. Wang M et al (2023).[3]

To address this issue, the International System for Reporting Serous Fluid Cytopathology (TIS) was proposed by Nayar Yang H et al in (2023).[4] The system establishes five diagnostic categories:

1. Nondiagnostic/Unsatisfactory (ND/UNS)
2. Negative for Malignancy (NFM)
3. Atypia of Undetermined Significance (AUS)
4. Suspicious for Malignancy (SFM)
5. Malignant (MAL)

Each category is associated with a risk of malignancy (ROM), allowing clinicians to interpret cytological findings with greater precision. The TIS system promotes uniform terminology, improves communication, and facilitates data comparison across studies and laboratories. Kundu R et al (2021).[5]

The TIS framework has been verified by several investigations, which demonstrate that it improves interobserver agreement and diagnostic accuracy. TIS greatly increased the consistency of effusion cytology reporting and made correlation with histopathology easier, according to Kundu R et al. (2021) and Ahuja S et al (2022).[5,6] In a similar vein, Kannan S et al (2022) emphasised that the TIS technique improves clinical care choices and risk stratification.[7]

Data on the use of TIS in Indian tertiary care facilities is still scarce, despite its increasing popularity. Thus, the purpose of this study is to assess the distribution and diagnostic accuracy of serous effusion cytology using TIS and to compare results with clinical patterns seen in a Pondicherry tertiary care hospital.

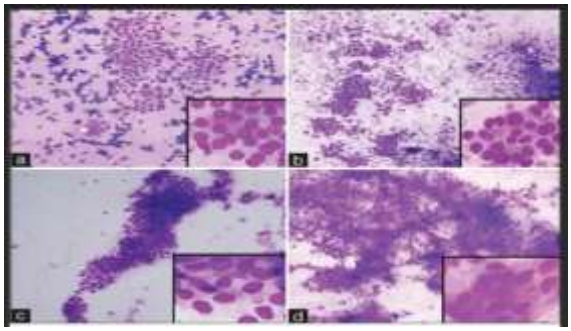

Image 1: Atypia of Undetermined Significance (AUS)

Aims and Objectives

1. To classify serous effusion samples according to the International System for Reporting Serous Fluid Cytopathology (TIS).
2. To determine the distribution of diagnostic categories among pleural, ascitic, pericardial, and peritoneal fluids.
3. To assess the diagnostic yield and cytological adequacy of serous fluid samples.
4. To evaluate the role of TIS in improving diagnostic accuracy and communication between pathologists and clinicians.

MATERIALS AND METHODS

Study Design and Setting: This was a prospective observational study conducted in the Department of Pathology, [Hospital Name], Pondicherry, over a one-year period from January 2024 to December 2024.

Sample Size and Source: A total of 91 serous effusion samples were included, comprising pleural, ascitic, pericardial, and peritoneal fluids.

Inclusion Criteria

- All patients presenting with clinically significant serous effusions referred for cytological evaluation.
- Both malignant and non-malignant effusions were included.

Exclusion Criteria

- Hemorrhagic or inadequate samples unsuitable for cytological interpretation.
- Repeated samples from the same patient.

Sample Processing: All samples were processed immediately after collection. The fluids were centrifuged at 2500 rpm for 10 minutes, and smears were prepared from the sediment. Both air-dried (for May-Grünwald–Giemsa) and wet-fixed (for Papanicolaou stain) preparations were made.

Each case was evaluated by experienced cytopathologists and classified according to The International System for Reporting Serous Fluid Cytopathology (TIS) into five diagnostic categories as described by Nayar Yang H et al in (2023).[4]

Statistical Analysis: All data were compiled and analyzed using SPSS version 25.0. Descriptive statistics were applied, and results were expressed as frequencies and percentages.

RESULTS

Over the course of the investigation, 91 serous effusion samples were examined. Patients' ages varied from 29 to 85, with a mean age of 56.35. The male-to-female ratio was 1.2:1, with 50 (54.9%) of them being men and 41 (45.1%) being women. Since effusions are more common in middle-aged and older people, the majority of patients were in their fifth or seventh decade of life [Table 1].

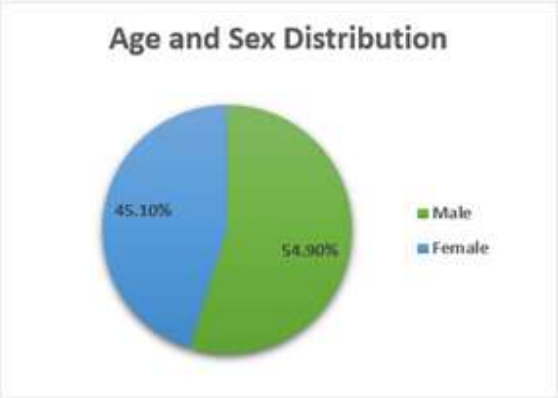

Figure 1: Age and Sex Distribution

Pleural fluid accounted for 43 (47.25%) of the effusions examined, followed by ascitic fluid in 42 (46.15%), peritoneal fluid in 5 (5.49%), and pericardial fluid in 1 (1.10%). Over 93% of the specimens were made up of both pleural and ascitic fluids [Table 2].

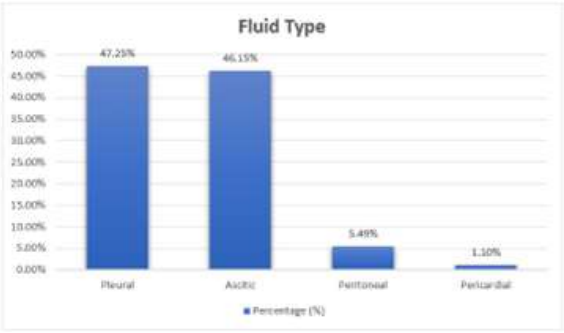

Figure 2: Fluid Type.

Table 1: Age and Sex Distribution

Sex	Number of Cases	Mean Age (yrs)	Min Age (yrs)	Max Age (yrs)	Percentage (%)
Male	50	57.86	35	85	54.9%
Female	41	54.63	29	79	45.1%

Total cases: 91 Mean overall age: 56.35 years. Male: Female ratio: 1.2:1

Table 2: Distribution by Fluid Type

Fluid Type	Number of Cases	Percentage (%)
Pleural	43	47.25%
Ascitic	42	46.15%
Peritoneal	5	5.49%
Pericardial	1	1.10%

Table 3: Sample Adequacy

Sample Adequacy	Number of Cases	Percentage (%)
Satisfactory	84	92.31%
Unsatisfactory	7	7.69%

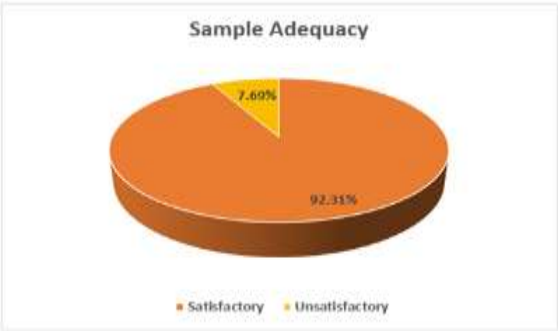

Figure 3: Sample Adequacy

In terms of cytological adequacy, 84 samples (92.31%) were considered good, whereas 7 samples (7.69%) were ruled unsuitable for examination, mostly because of degenerative background or insufficient cellularity [Table 3].

The bulk of the cases—71 (78.02%)—were found to have benign or reactive mesothelial cells during cytological investigation, which was reported as negative for malignancy. One case (1.1%) had a primary malignant effusion diagnosis, whereas thirteen cases (14.29%) had a secondary malignant effusion diagnosis. One case (1.1%) was classified as suspected for malignancy, and four cases (4.4%) were deemed unsatisfactory [Table 4].

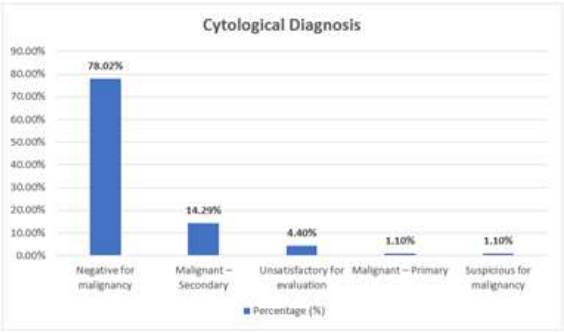

Figure 4: Cytological Diagnosis

Table 5: Distribution of Cytological Diagnosis Across Fluid Types

Fluid Type	Negative	Malignant–Secondary	Malignant–Primary	Suspicious	Atypia	Unsatisfactory
Ascitic	27	11	0	1	1	2
Pleural	40	2	1	0	0	0
Pericardial	1	0	0	0	0	0
Peritoneal	3	0	0	0	0	2

When the distribution of cytological diagnoses was examined in relation to the kind of effusion [Table 5], pleural fluid produced benign cytology in 93% of cases, with just three instances exhibiting malignancy. Ascitic fluid, on the other hand, showed a greater percentage of malignant effusions (11 secondary and 1 suspected case), as well as one case classified as atypia of unknown significance. Peritoneal effusions revealed two inadequate samples, and pericardial and peritoneal fluids were infrequently implicated.

DISCUSSION

The cytological evaluation of serous effusions remains a cornerstone in diagnostic pathology due to its simplicity, safety, and cost-effectiveness. In this study, the implementation of the International System for Reporting Serous Fluid Cytopathology (TIS) provided a structured framework that enhanced the interpretability and diagnostic consistency of effusion samples.

The current study's mean age of 56.35 years is consistent with research by Kundu R et al. (2021)5 and Ahuja S et al (2022),[6] that shows effusions primarily afflict middle-aged and older people. The small male preponderance (M:F= 1.2:1) is consistent with earlier findings by Michael CW et al,[8] (2021) and Kannan S et al (2022).[7]

In line with worldwide trends, pleural effusions were the most common specimen type, closely followed by ascitic fluids. The increased frequency of gastrointestinal and lung cancers that cause secondary effusions is reflected in this distribution.

Bhanvadia VM et al,[2] (2014) found a 90–95% adequacy range using rapid processing and centrifugation procedures, which is similar to the total adequacy rate of 92.3%. Low cellularity, incorrect fixation, or degraded backgrounds were the primary causes of unsatisfactory samples.

In the present investigation, 14.29% of patients had malignant-secondary effusions, whereas 78.02% of cases tested negative for cancer. These results are consistent with research by Shen Y et al,[9] (2024) and Gonnelli F et al. (2024),[10] which found that benign effusions were responsible for 75–80% of all cases. Because peritoneal metastases from ovarian, gastric, or pancreatic primaries predominated, secondary malignant effusions were most frequently seen in ascitic fluids.

The classification of unclear results was made possible by the application of TIS categories. About 2% of all cases fell into the Atypia of unknown significance and Suspicious for malignancy categories; these numbers are in line with findings by Yang H et al,[4] in (2023) and Layfield LJ et al (2014).[11] These classifications are essential for directing more research or repeat sampling.

The diagnostic accuracy of effusion cytology has been shown by several research. According to Zhu YL et al,[12] (2022) and Sundling KE et al (2018),[13] the sensitivity of effusion cytology for identifying cancer varies from 65 to 95%, contingent on auxiliary procedures and sample quality. Better clinical treatment is supported by the TIS system's improved repeatability and useful risk-of-malignancy estimations for each diagnostic category. Sachan R et al (2023).[14]

Therefore, our study highlights the TIS framework's capacity to standardise reporting, reduce diagnostic ambiguity, and enhance clinician-pathologist communication while reinforcing the diagnostic value of cytology in serous effusions. Further research combining genetic and histological correlation might improve diagnostic precision even more.

CONCLUSION

One essential diagnostic method for determining malignant and non-malignant aetiologies of serous effusions is still cytological testing. Clinical communication and diagnostic standardisation have significantly improved since the International System for Reporting Serous Fluid Cytopathology (TIS) was put into place.

Malignant effusions were mostly seen in ascitic samples in this prospective analysis, although benign effusions made up the majority. Better repeatability, risk classification, and appropriate clinical follow-up are all made possible by the TIS framework. It is advised that pathology labs use this approach more widely in order to attain worldwide consistency in the reporting of serous effusions.

Limitations of the Study

- Not all instances had histopathological connection, which made it difficult to determine sensitivity and specificity with certainty.
- The sample came from a single tertiary centre and was rather small.
- Due to budget limitations, ancillary studies including immunocytochemistry and molecular profiling were not carried out.
- For validation, bigger cohorts and histopathological correlations are needed in future multicentric research.

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