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VARIABILITY OF PLEURAL LIQUID CHARACTERISTICS AND THEIR ROLE IN DIAGNOSIS

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Key words: *pleural fluid, biochemical, bacteriological, cytological investigations*

INTRODUCTION

Pleurisy, a common condition in the field of pneumonia, poses complex problems for the clinician both in terms of positive and differential diagnosis, assessment of severity, evaluation of the effectiveness of applied therapy and in establishing predictions.

Their elucidation can be specified by paraclinical exploration (imaging and laboratory) alone able to confirm or refute the initial clinical diagnosis.

The existence of dysynergies and asynchronies that cannot clarify the aspects of casuistry to the same extent and respectively at the same time, emphasize the laboratory exploration of the pleural fluid through its three levels: biochemical, bacteriological and cytological.

If in the first two of these, false positive or negative results are often the major source of errors through the limits and variations of tests, cytology remains one of the most valuable methods in specifying the diagnosis, especially the differential.

The presence of lymphocytosis, polymorphonucleosis or eosinophilia can accurately differentiate the etiology of pleurisy (tuberculosis, parapneumococcal, allergic, virotic, Rickettsian or neoplastic).

Pleurisy and lung cancer are closely linked because advanced lung cancer can cause a form of this condition known as malignant pleural effusion. The development of pleurisy in a cancer patient is a bad sign and indicates that the patient's chances of survival decrease. Many patients live only three to seven months after the onset of pleural effusion, even with treatment.

The corroboration of the cytological data with the clinical and imaging aspect, thus contributes to the specification of the diagnosis allowing the monitoring of the evolution and the individualization of a therapeutic strategy.

This paper aims to highlight the value of laboratory investigations in various pleurisy by exploring the pleural fluid on the three levels (biochemical, bacteriological and cytological), correlating it with the clinical and imaging aspect to establish the etiology of pleurisy.

MATERIALS AND METHODS

In the virtual space between the parietal and visceral blankets of the pleura, there is normally a tiny amount of fluid that moistens them, making it easier for them to slide on each other.

Under pathological conditions, a large amount of fluid accumulates causing pleurisy.

In transudates, the pleural surface is not affected by a pathological process and the accumulation of fluid results from a decrease in colloidoosmotic pressure or an increase in hydrostatic pressure in the systemic or pulmonary circulation.

In exudates there is always a pathological pleural process, within a local disease or a general disease - with increased capillary permeability to proteins or fluid accumulation through lymphatic obstruction.

The researches were performed in the Clinical Laboratory within the Bacau Pneumoftiziology Hospital during March - May 2020.

To study the characteristics of pleural fluids, a number of 56 subjects diagnosed with pleurisy of different etiologies were analyzed. Laboratory tests were performed on pleural fluid obtained by pleural puncture.

The patients investigated were grouped by sex, according to the environment of origin and the following age groups:

Group I: 18 - 40 years;

Group II: 41 - 65 years;

Group III: 66-90 years

Both **the biochemical investigations** in the pleural fluids and those in the patients' blood serum were performed using the Pentra 400 automated analyzer (Fig. 1). Pentra 400 concentrates three detection methods in a single system: photometry, turbidimetry, potentiometry with ion-selective electrodes (ISE).

Bacteriological investigations were performed only from pleural fluids. These consist of:

Macroscopic examination of pleural fluid

It is very important in guiding the diagnosis. The following are followed (Fig. 2):

- *color* - generally yellowish-citrine; green in the case of pneumococcus; dirty gray for anaerobes or mixed infection;

- *turbidity* - a clear liquid can appear in tuberculous pleurisy, but also in pleurisy caused by other bacteria: pneumococcus, enterobacteria, Legionella;

- *purulent*, very cloudy occurs in the case of pulmonary empyema, suggests possible infection with anaerobic germs, staphylococci, G bacilli (-);

-*viscosity* - increased in the case of pulmonary empyema, creamy in the case of staphylococci, caseous in tuberculosis, fluid for streptococci;

-*smell* - specific in case of infection with some Enterobacteriaceae; rotten, fetid in the case of anaerobes.

Ziehl-Nielsen microscopic examination on stained smears. Dry smears in the inclined position were examined under an immersion objective microscope. Acid-alcohol-resistant bacilli will appear colored in siclam on a blue background.

The examination through culture. The inoculum is sown on tubes with Löwenstein Jensen medium (Fig. 3). Incubate the cultures up to two months after sowing in a thermostat at 36.5-37° C.

All the maneuvers described above are carried out in the bacteriological hood (Fig. 4).

RESULTS AND DISCUSSIONS

Romania is located in a hyperendemic area, the risk of acquiring lung infections, especially pulmonary tuberculosis, being very high both in the general population and in risk groups - medical staff.

Koch bacillus infection responsible for pulmonary tuberculosis is widespread in the population, which, untreated or treated incorrectly, has a significant fatality. Predominantly affecting the adult population in the most productive years of life, directly and indirectly causes serious social consequences.

Tuberculosis is considered today the most important communicable disease in the world, because annually there are over 10 million new cases, of which 40-50% are highly contagious and their number is constantly growing. [Gherasim, 2002]

Along with tuberculosis, pneumonia, asthma and obstructive conical bronchopneumonia occupy an important place in the prevalence of respiratory diseases.

In order to evaluate the prevalence of pleurisy, we compared the clinical-epidemiological situation of a number of 56 patients with pleurisy hospitalized in the Bacau Pneumoftiziology Hospital during March - May 2020.

Fig.1. Pentra 400 automatic analyzer

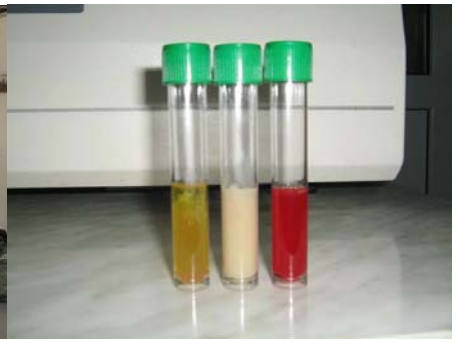

Fig. 2. Types of pleural fluid

Fig. 3. Medium Löwenstein Jensen

Fig. 4. Bacteriological hood

The incidence of pleurisy distributed by sex, age group and place of origin of patients

Lung diseases have a significant morbidity worldwide. Morbidity and mortality from respiratory diseases is one of the highest in Romania in Europe and is well above the European Union average. Bronchopulmonary cancer, pneumonia, tuberculosis and chronic obstructive diseases are the main diseases responsible for this high morbidity.

Although medicine is making significant progress, the number of people with lung disease, especially tuberculosis, obstructive bronchopathy, infectious pneumonia, asthma, remains constant or even increasing from year to year.

Out of the total of 56 subjects subjected to the study, a number of 42 persons belonged to the male sex, representing a percentage of 75%, and the remaining 14 persons belonged to the female sex, representing a percentage of 25%, as shown in Fig. 5.

The distribution by age groups of females diagnosed with pleurisy was as follows: 5 cases in age group I: 18-40 years, 3 cases in age group II: 41-65 years and 6 cases in age group III: 66-90 years (Fig. 6).

Analyzing Figure 6, it is found that the highest number of cases were registered in age group III, 66-90 years (43%). It is noted that the number of cases registered in group I, 18-40 years is very close to the number of previous cases (36%).

The age distribution of males diagnosed with pleurisy was as follows: 6 cases in group I, 18 cases in group II and 18 cases in group III. This distribution is represented in Fig. 7.

Analyzing Figure 7, it is found that there was an equal number of cases in male patients belonging to groups II and III (43%). The number of cases belonging to group I is much smaller (14%).

Comparing the distribution by age groups between female and male patients, it is found that the highest number of cases were registered for both sexes in age group III. Regarding the age group I of females, the percentage of diseases is higher (36%) than that of males from the similar group (14%). In the case of patients in age groups II, the percentage of diseases of men (43%) is higher than that of women (21%).

According to the resulting data, as a result of the study conducted in the three months of research, it is observed that the predominance of pleurisy is present in people in age groups II and III.

Following the place of origin of the patients, we found that: 9 women come from rural areas and 5 from urban areas, and in the case of men, 23 from rural areas and 19 from urban areas. Analyzing these data, we conclude that the number of diseases in rural areas is higher than in urban areas in all age groups (Fig. 8).

The distribution by age groups of women from rural areas, diagnosed with pleurisy was as follows: 3 cases in age group I, 1 case in group II and 5 cases in group III (Fig. 9).

The distribution by age groups of women from urban areas, diagnosed with pleurisy, as shown in Figure 10, was as follows: 2 cases in age groups I and II and 1 case in group III.

Comparing the two situations, it was concluded that the highest number of pleurisy was recorded in women from rural areas (64%), compared to the number of pleurisy recorded in women from urban areas (36%).

The distribution by age groups of males from rural areas highlighted the following distribution of cases: 4 cases in age group I, 18-40 years, 8 cases in age group II, 41-65 years and 11 cases in age group III, 66-90 years (Fig. 11).

In the case of males, from urban areas, diagnosed with pleurisy, the distribution by age groups was as follows: 2 cases in age group I, 10 cases in age group II and 7 cases in age group III (Fig. 12).

Analyzing Figures 23 and 24, it was concluded that the number of pleurisy in male patients from rural areas (55%) is higher than that of pleurisy in patients of the same sex from urban areas (45%).

Values of biochemical indicators obtained by analysis of pleural fluids

Pleural fluid from the vessels of both pleural sheets drains along the pleural membranes into the pleural space from where it is absorbed by the parietal lymphatics. In this way, the pleural space is analogous to any interstitial space of the body. This "turnover" of pleural fluid depends not only on the balance between hydrostatic and colloidosmotic pressures, but also on the permeability of the capillaries and the mesothelial membrane. Lymphatic drainage occurs entirely in the parietal pleura and is initiated in the submezothelial lymphatic spaces.

The absorption of the contents of the pleural cavity in the lymphatic system of the parietal pleura is always higher than the filtration. Thus, under physiological conditions, the pleural cavity is a potential space occupied by a minimal amount of fluid. For pleural fluid to accumulate between the two pleural sheets, either increase the rate of entry exceeding the absorption capacity of the lymphatic vessels or the rate of absorption decreases.

The first information on the etiology of pleurisy was obtained by establishing the macroscopic appearance of pleural fluid.Next, the classical method of differentiating between transudate and exudate was used. Light criteria based on the measurement of serum and pleural levels of LDH and proteins were used. According to Light, pleural fluid is an exudate if one or more of the following criteria are met:

- the ratio between pleural proteins and serum proteins> 0.5;

- the ratio between pleural LDH and serum LDH> 0.6;

ADA and glucose were also assayed with LDH and PT. LDH and PT were assayed from both LP and serum, while ADA and glucose from LP alone. Analyzing the data obtained and taking into account Light's criteria, it was found that in 39 cases the analyzed pleural fluids were exuded, representing a percentage of 70% and in the remaining 17 cases the pleural fluids were transuded, representing a percentage of 30% (Fig. 13).

Regarding the macroscopic appearance of pleural fluids, it was found that 91% of the fluids were serocitrin, 7% were purulent and 2% were hemorrhagic.

Regarding glycopleuria, values between 0 and 442 mg / dl were obtained. In the case of exudates, the minimum value of glucose obtained was 0 and the maximum value was 215 mg / dl. In the case of transudates the minimum glucose concentration obtained was 26 mg / dl and the maximum glucose concentration was 442 mg / dl.

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The concentration of metered ADA varies between 9.7 - 371 U / L. In the case of exudates the minimum limit was 30 U / L and the maximum 371 U / L, and in the case of transudates the lowest value obtained was 9.7 and the highest 71.9 U / L.

Results of cytological investigations

Analyzing the obtained data, it was found that in the case of exudates, 21 of them predominate lymphocytes, 10 predominate PMN and 4 mesothelial (Fig. 14). In the case of transudates, lymphocytes predominate in 9 of them, PMN in 1 and mesothelial in 2 (Fig. 15).Regarding tumor cells, they were present in the case of 3 exudates and 2 transudates (Fig. 16).

Results of bacteriological investigation

The data obtained show that out of the 33 examinations performed for bK, two were positive in both microscopy and culture, two were positive only in culture with negative microscopy, and the remaining 29 were negative in both microscopic examination and culture (Figures 17, 18).

By corroborating the biochemical results obtained with bacteriological and cytological results, with clinical manifestations and radiological results, patients with the following types of pleurisy were diagnosed: parapneumonic, tuberculous, neoplastic, with eosinophils and due to other causes (Fig. 19).

From Figure 19 it can be seen that the first place is occupied by pleurisy of tuberculous etiology (45%; 25 cases), this being followed by pleurisy caused by other causes (30%; 17 cases), by parapneumonic pleurisy (14%; 8 cases) , neoplastic pleurisy (9%, 5 cases) and those with eosinophils (2%; 1 case).

CONCLUSIONS

Following the study, the following conclusions were drawn:

1. The frequency of pleurisy can be correlated with certain age groups. In both female and male patients, the highest percentages were recorded in age groups II and III.
2. Regarding the sex of patients, there is a preponderance in this direction, the disease affecting in 75% of cases men.
3. Regarding the environment of origin of patients, the statistics show a higher frequency of patients from rural areas.
4. The investigation of pleural fluids on the three levels (biochemical, cytological and bacteriological), correlated with clinical manifestations and radiological aspects led to the diagnosis of patients with the following types of pleurisy: tuberculous pleurisy, parapneumonic, neoplastic, eosinophils and pleurisy due to other causes. In all types of pleurisy, male patients have the highest number of cases.
5. All neoplastic pleurisy was recorded in age group III.
6. In the context of pleural fluid exploration, the biochemical level has a predominantly indicative contribution. Instead, the contribution of cytological and bacteriological explorations is substantial.
7. The cytological picture of pleural fluid differs depending on its etiology. Thus, in tuberculous pleurisy, lymphocytes predominate, in serofibrinous polymorphonuclear cells, in that with eosinophils, eosinophils. Neoplastic pleurisy is characterized by the presence of mesothelial cells (in high percentage), which have different degrees of dyskaryosis (neoplastic cells).

ABSTRACT

The paper aims to highlight the value of laboratory investigations in various pleurisy by exploring the pleural fluid on the three levels (biochemical, bacteriological and cytological), correlating it with the clinical and imaging aspect to establish the etiology of pleurisy. The researches were performed in the Clinical Laboratory within the Bacău Pneumoftiziology Hospital between March and May 2020. To study the characteristics of pleural fluids, a number of 56 subjects diagnosed with pleurisy of different etiologies were analyzed.

Laboratory tests were performed on pleural fluid obtained by pleural puncture. The patients investigated were grouped by sex, according to background and age groups. The investigation of pleural fluids on the three levels (biochemical, cytological and bacteriological), correlated with clinical manifestations and radiological aspects led to the diagnosis of patients with the following types of pleurisy: tuberculous pleurisy, parapneumonic, neoplastic, eosinophils and pleurisy due to other causes. In all types of pleurisy, male patients have the highest number of cases. All neoplastic pleurisy was recorded in age group III.

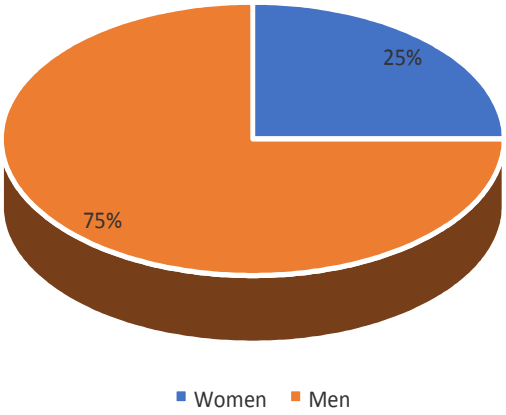

Fig 5. Gender distribution of people with pleurisy

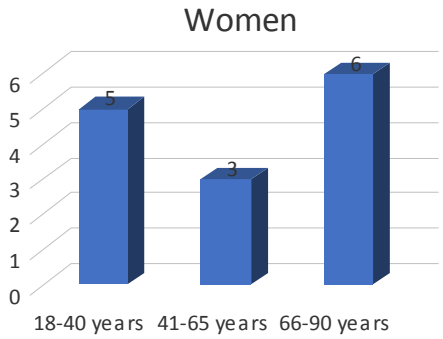

Fig. 6. Distribution by age groups of female persons with pleurisy

Fig. 7. Distribution by age groups of males with pleurisy

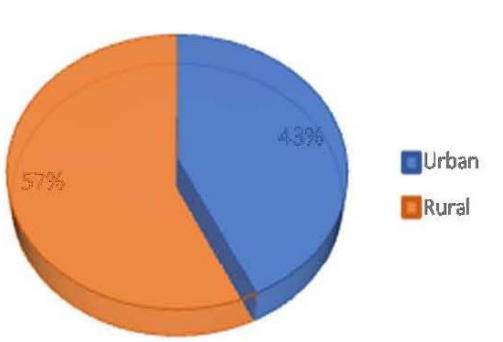

Fig. 8. Incidence of pleurisy according to the place of origin of patients

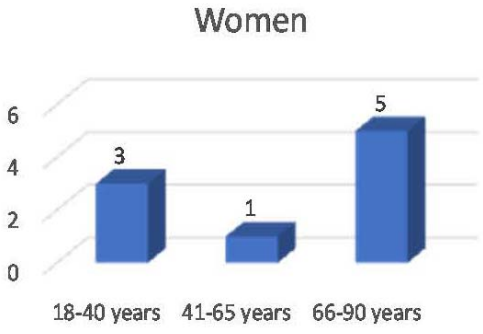

Fig. 9. Distribution by age groups of rural women with pleurisy

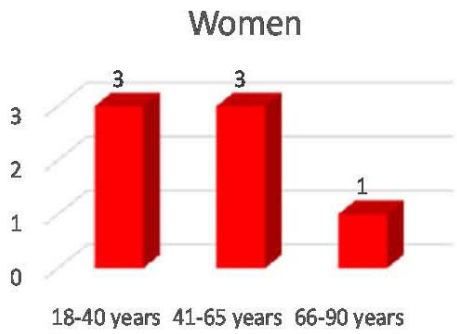

Fig. 10. Distribution by age groups of women in urban areas with pleurisy

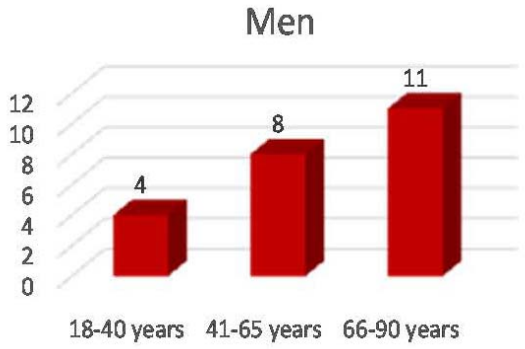

Fig.11. Distribution by age groups of rural men with pleurisy

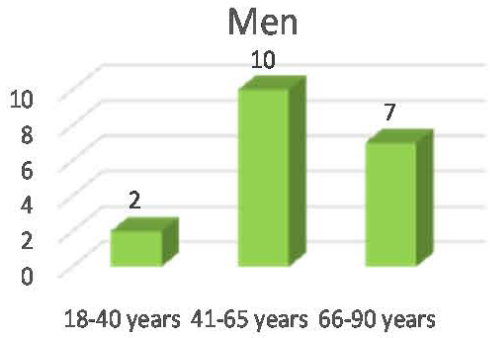

Fig. 12. Distribution by age groups of men in urban areas with pleurisy

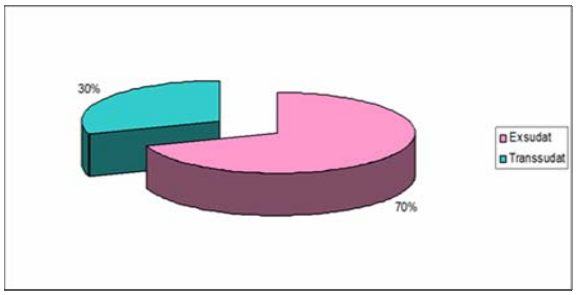

Fig. 13. Percentage expression of exudates and transudates

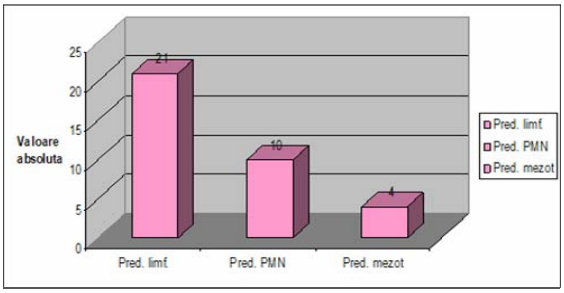

Fig. 14. Frequency of lymphocytes, PMNs and mesothelials in exudates

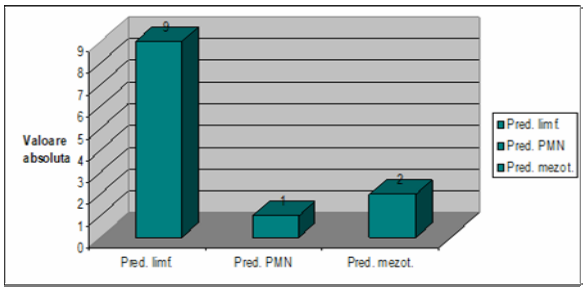

Fig. 15. Frequency of lymphocytes, PMNs and mesothelials in transudates

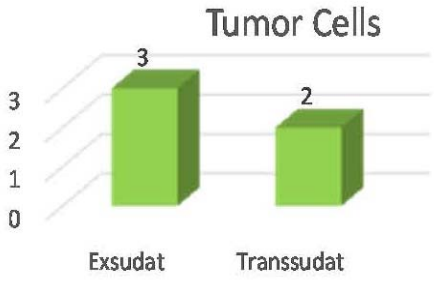

Fig. 16. Frequency of neoplastic cells in exudates and transudates

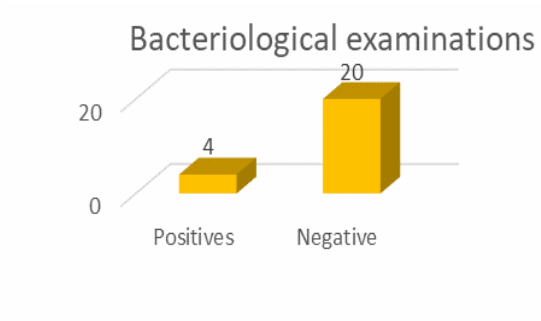

Fig. 17. The result of bacteriological tests in patients with pleurisy

Fig. 18. Positive bK culture

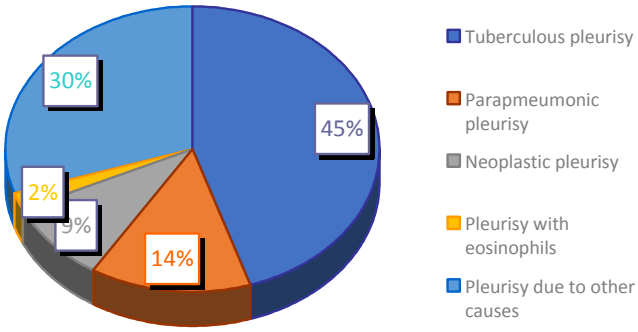

Fig. 19. Types of diagnosed pleurisy

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