



Tuberculosis: Is it the main cause of pleural effusion in patients of Kabul city, Afghanistan?

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ABSTRACT

Background: Pleural effusion is one of the most common pleural diseases, and its causes are various cardiovascular, lung, kidney, cancer, and infectious diseases.

Methods: The present study was carried out in the year 2018 at Sadri Ibn Sina Hospital, involving a total of 4564 patients. Out of these, a specific focus was given to 100 patients diagnosed with pleural effusion. Demographic details, such as age, gender, marital status, causes of effusion, occupation, place of residence, effusion location, type of fluid, and any existing comorbidities, were gathered and analyzed using the SPSS software.

Results: Based on the findings of this study, tuberculosis accounts for 49% of the cases, pneumonia for 13%, congestive heart failure for 12%, corpulmonary disease for 11%, cancer for 10%, and chronic kidney failure for 4%. Additionally, 1% of the cases experienced pleural embolism as a result of pulmonary embolism. In regards to the liquid type, 77% of it was transudative, while 23% was exudative.

Conclusion: Pleural effusion refers to the abnormal buildup of fluid in the pleural cavity, typically caused by either an overproduction of fluid or a compromised lymphatic system's ability to absorb it. This research has firmly established infection, with tuberculosis being the most significant factor, as the leading cause of this condition.

Keywords: Pleural effusion, tuberculosis, Sadri Ibn Sina Hospital, Kabul

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1. Introduction

A pleural effusion refers to the excessive buildup of fluid in the pleural space, indicating an imbalance between the formation and removal of pleural fluid (1). The accumulation of pleural fluid is not a specific disease but rather a manifestation of an underlying pathology. Pleural effusions can occur in conjunction with various lung, pleural, and systemic disorders (2).

Tuberculous pleural effusion (TPE) ranks as the second most prevalent type of extrapulmonary tuberculosis (TB), following lymphatic involvement. Moreover, it stands as the primary cause of pleural effusion in regions where TB is widespread. TPE is present in both the initial infection and the reactivation process. In regions with a low prevalence of TB, the average yearly occurrence of pleural TB is around 3-5%. However, in areas where TB is endemic, this prevalence can rise up to 30%, primarily due to a higher number of individuals infected with the human immunodeficiency virus (HIV) (3). The accumulation of fluid in the pleural space resulting from *Mycobacterium tuberculosis* (Mtb) infection is a complex process influenced by various factors. The initial trigger is the rupture of a subpleural caseous focus, which allows Mtb antigen to enter the pleural space (4). This antigen then elicits an inflammatory response, leading to an increase in capillary permeability. Consequently, proteins are able to enter the pleural space, causing a higher concentration of protein within the accumulated fluid. This increased protein content further stimulates the production of pleural fluid. In addition to the inflammatory response, the pleuritis caused by Mtb infection also obstructs the lymphatic stomata in the parietal pleura. This obstruction reduces the rate at which pleural fluid is cleared from the pleural space. As a result, the

accumulation of fluid becomes more pronounced (5).

TPEs can manifest as uncomplicated exudatives (resulting from pleuritis), empyematous, chylous, or pseudo-chylous. Effusions can arise in cases of primary pulmonary TB or when the disease reactivates. In primary TB, the potential cause of TPE is the introduction of the MTB antigen into the pleural space due to the rupture of a subpleural parenchymal focus. Reactivation TB patients typically exhibit more pronounced parenchymal involvement (6).

To effectively treat a pleural effusion, it is crucial to identify its underlying cause. Pleural effusion can be attributed to a diverse range of causes. Due to the multitude of etiologies associated with this condition, diagnosing the underlying cause often poses a challenge, despite thorough investigations (7). Typically, the determination of the cause of pleural effusion relies on a comprehensive analysis of clinical, radiological, histological, and laboratory findings (8). The clinical manifestation of pleural effusion varies depending on the quantity of fluid present and the underlying cause. It is not uncommon for patients to exhibit no symptoms when a pleural effusion is initially detected. However, potential symptoms may include pleuritic chest pain, difficulty breathing (dyspnea), and a dry, nonproductive cough (9). The chest pain associated with pleural effusion is a result of inflammation in the parietal pleura, which occurs due to friction between the two pleural surfaces during movement. This pleuritic chest pain can be localized or referred to, and it is typically sharp. It tends to worsen with activities that involve movement of the pleural surfaces, such as deep breathing, coughing, and sneezing. However, the pain may subside when the chest is strapped or when fluid

accumulates. Since dyspnea and chest pain are nonspecific symptoms, it is crucial to conduct a thorough medical history and physical examination to narrow down the potential causes (8). According to the results, it appears that there is a lack of specific data or studies regarding the prevalence, common causes, and significance of pleural effusions in Afghanistan. The available information primarily concentrates on the etiology of pleural effusions in various populations, excluding Afghanistan specifically. This study aims to investigate whether TB is the primary cause of pleural effusion in patients residing in Kabul City, Afghanistan.

2. 2. Materails and methods

2-1. Study Design and population

This study employed a retrospective observational design to assess the prevalence and etiology of pleural effusion in patients from Kabul City, Afghanistan. The study included patients who presented at Ibn Sina Sadri Hospital in Kabul City in 2018. Relevant medical records and diagnostic reports were reviewed for each patient.

2-2. Data Collection

Data regarding patients' demographic information, clinical presentation, medical history, laboratory investigations, and radiological findings were collected from medical records. All data was anonymized and handled confidentially. The diagnosis of pleural effusion was based on a clinical examination and chest radiography findings.

2-3. Data Analysis

The information was gathered using predetermined variables, including age, gender, marital status, occupation, underlying diseases, place of residence, nature and location of infusion, and any concurrent illnesses. This data was obtained either directly

from the patients themselves or through questionnaires inserted into their medical records, which were subsequently analyzed using the SPSS program.

3. Resultls

This study, conducted at Ibn Sina Sadri Hospital in 2018, is a case-series investigation. Of all, 1342 patients presented with respiratory problems, and 2422 others had heart diseases. Within the group of respiratory patients, 100 individuals were diagnosed with pleural effusion, which was thoroughly examined.

We enrolled a total of 100 patients diagnosed with pleural effusion, of which 69 were male and 31 were female. There are 27 housewives, 21 unemployed individuals, 21 farmers, 14 workers, 6 shopkeepers, and 3 students. According to the results, 92 participants got married, and the remaining 8 were single. Of all, 59 were from Kabul province, 8 were from Parwan province, and the remaining patients were from Logar, Bamyan, and Ghazni provinces. Notably, there were 4 cases each from Baghlan, Khost, and Paktia provinces, while two other provinces, namely Wardak and Faryab, had 3 cases each. Out of the 100 patients diagnosed with pleural effusion, 21 fell within the age range of 18–30 years; 30 were aged between 31 and 50 years; 42 were aged between 51 and 70 years; and 7 were aged between 76 and 92 years.

Ultimately, it can be inferred that the majority of patients were diagnosed with pleural effusion during their fifth and sixth decades of life. Based on the findings of this study, it was observed that out of a total of 100 individuals diagnosed with pleural effusion, 77 of them exhibited transudative pleural effusion, while the remaining 23 displayed exudative pleural effusion. Moreover, there were 48 individuals who experienced pleural effusion in their right pleural cavity, while 38 individuals had pleural

effusion solely in the pleural cavity of their lung. Additionally, 14 individuals had pleural effusions on both sides. Consequently, it can be inferred that the number of patients with pleural effusion on the right side exceeded those with pleural effusion on the left side (Table 1). Out of the 100 patients, 49 were diagnosed with tuberculosis, 13 with pneumonia, 11 with COPD, 8 with dilated cardiomyopathy, 4 with ischemic heart disease, and 4 with chronic heart failure. Additionally, 4 patients had pleural embolism due to lung cancer, 4 due to breast cancer, and 1 due to pulmonary embolism. Pleural effusion was observed in 49 individuals due to tuberculosis, in 13 individuals due to pneumonia, in 12 individuals due to congestive heart failure, in 11 individuals due to cor pulmonale disease, in 10 individuals due to cancer diseases, in 4 individuals due to chronic renal failure, and pulmonary embolism caused embolism in 1 individual (Table 1).

4. Discussion

This study conducted at Ibn Sina Sadri Hospital in 2018 involved a case series investigation of 1342 patients with respiratory diseases. A total of 100 patients were diagnosed with pleural effusion, of whom 69 were male and 31 were female. The majority of patients were diagnosed during their fifth and sixth decades of life. The study found that 77 of the 100 patients exhibited transudative pleural effusion, while 23 displayed exudative pleural effusion. The majority of patients experienced pleural effusion in their right pleural cavity, with 48 experiencing it in their right pleural cavity and 38 in their lung cavity. Additionally, 14 patients had pleural effusions on both sides. Out of the 100 patients, 49 were diagnosed with tuberculosis, 13 with pneumonia, 11 with COPD, 8 with dilated cardiomyopathy, 4 with ischemic heart disease, and 4 with chronic heart failure (10).

Table 1. General information of patients with pleural effusion

Gender	Number	Frequency
Male	31	31%
Female	69	69%
Total	100	100%
Marital Status		
Married	92	92%
Single	8	8%
Age		
18-30	21	21%
31-50	30	30%
51-75	42	42%
76-92	7	7%
Occupation		
Housewives	27	27%
Unemployed	21	21%
Farmers	21	21%
Social worker	14	14%
Shopkeepers	6	6%
Students	6	3%
Driver	5	5%
Transudative	77	77%
Exudative	23	23%
Side of pleural effusion		
Right pleura	48	48%
Left pleura	38	38%
Both side	14	100%
Comorbidities Cases		
Tuberculosis	49	49%
Pneumonia	13	13%
COPD,CPC	11	11%
DCM	8	8%
ICM	4	4%
CRF	4	4%
Lung CA	4	4%
Brest CA	4	4%
Pulmonary Embolism	1	1%
Leukemia	1	1%
Mesothelioma	1	1%
Cases of pleural effusion		
Tuberculosis	49	49%
Parapneumonic	13	13%
Congestive Heart Failure	12	12%
Cor Pulmonale	11	11%
Metastatic Malignancies	10	10%
CRF	4	4%
Pulmonary Embolism	1	1%

Additionally, 4 patients had pleural embolism due to lung cancer, 4 due to breast cancer, and 1 due to pulmonary embolism. Kabul city, like many other regions in Afghanistan, has been grappling with the burden of TB for years. Factors such as overcrowding, poor living conditions, limited access to healthcare, and a high prevalence of drug-resistant TB strains contribute to the persistence and spread of the disease. These conditions make TB a likely culprit for pleural effusion cases in Kabul (10).

TBE is far from being a harmless condition (11) and is a frequently observed occurrence of extra-pulmonary TB, with varying incidence rates across different regions. In TB-non-endemic areas, the involvement of the pleura is estimated to be around 3-5% (12). In regions with a high prevalence of TB, the occurrence can reach up to 30%, primarily because of the significant number of people living with HIV. Among HIV-positive individuals, TB is the leading cause of lymphocytic effusions (13). At present, the prevalence of drug-resistant TB is alarming, with one out of every five TB isolates globally showing resistance to at least one anti-TB drug. Furthermore, the rate of drug-resistant TB affecting extra-pulmonary cases is on par with that of pulmonary TB (14). Globally, the prevalence of TBE is more common among younger patients. However, in areas where TB is not endemic, patients tend to be older when they first present with the disease. This is because reactivation of the infection is more common than primary infection as the underlying cause of the disease's development (5). TBE was previously believed to primarily affect young individuals, with an average age of 28 years, in contrast to parenchymal tuberculosis, which typically occurs in individuals around 54 years old. However, Epstein and colleagues have shown an increase in the median age (15).

The cellular component of the inflammatory response progresses through different phases, which can vary among individuals (16). Typically, the early response to pleural injury caused by Mtb infection involves a rapid influx of polymorphonuclear leukocytes, particularly neutrophils. Subsequently, macrophages migrate to the site of infection, followed by a prolonged immune reaction driven by lymphocytes. This immune reaction is characterized by the release of adenosine deaminase (ADA) and the formation of pleural granulomas. Overall, the accumulation of fluid in the pleural space due to Mtb infection is a multifactorial process involving the rupture of caseous foci, inflammatory responses, altered capillary permeability, impaired lymphatic drainage, and immune reactions (17).

Conclusion

In conclusion TPE is a type of pleural effusion that occurs as a result of *Mycobacterium tuberculosis*, the bacterium responsible for TB. It poses challenges in terms of diagnosis due to its diverse clinical presentation and similarities to other pleural diseases. However, by combining clinical evaluation, radiological imaging, and laboratory tests, including analysis of pleural fluid, an accurate diagnosis can be achieved. TBE continues to be a significant health concern, especially in areas with a high prevalence of tuberculosis. It is crucial to continue efforts in early detection, appropriate treatment, and prevention strategies in order to minimize the impact of this condition on affected individuals and public health.

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