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| RESEARCH ARTICLE

Unilateral Pleural Effusion as The Initial Manifestation of Occult Lung Carcinoma: A Case Report

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| ABSTRACT

Pleural effusion is a common clinical condition with a wide differential diagnosis, ranging from benign inflammatory processes to advanced malignancy. In some patients, malignant pleural effusion may represent the first manifestation of an underlying lung cancer. Early recognition and systematic evaluation are therefore essential for timely diagnosis and management. We report the case of a fifty eight year old Saudi male who presented with progressive shortness of breath and right sided chest discomfort of three weeks duration. The patient had a long history of cigarette smoking but no previous diagnosis of malignancy. Physical examination revealed reduced chest expansion and markedly diminished breath sounds over the right lower lung zone. Initial chest radiography demonstrated a moderate right sided pleural effusion without a clearly visible lung mass. Further diagnostic evaluation included contrast enhanced computed tomography of the chest, which confirmed a large right sided pleural effusion with partial lung collapse, mild pleural thickening, and a small irregular lesion in the right upper lobe. Diagnostic thoracentesis yielded exudative pleural fluid according to Light criteria. Microbiological studies were negative for bacterial infection and tuberculosis. Cytological examination of the pleural fluid revealed atypical epithelial cells suspicious for malignancy, and repeat analysis supported the diagnosis of malignant pleural effusion. Subsequent CT guided biopsy of the right upper lobe lesion demonstrated histopathological features consistent with pulmonary adenocarcinoma. Management initially focused on symptomatic relief through pleural fluid drainage and supportive care. Following confirmation of the diagnosis, the patient was referred for oncologic evaluation and further staging. This case highlights the importance of considering malignancy in patients presenting with unexplained pleural effusion, particularly in individuals with significant smoking history, and emphasizes the role of pleural fluid analysis and tissue biopsy in establishing the diagnosis.

| KEYWORDS

Lung Cancer, Pleural Effusion, Malignant Pleural Effusion, Thoracocentesis, Cytology, Dyspnea, Chest Pain

| ARTICLE INFORMATION

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Introduction

Lung cancer remains one of the leading causes of cancer related illness and death worldwide despite advances in early detection and treatment. It accounts for a significant proportion of cancer diagnoses each year and continues to have a high mortality rate in many regions. The disease often progresses silently in the early stages, and many patients present with advanced disease at the time of diagnosis. Because symptoms may be mild or nonspecific at first, the diagnosis is frequently delayed until complications develop or imaging reveals abnormal findings [1,2]. Early recognition of unusual presentations is therefore important in improving timely diagnosis and management. Pleural effusion is a common clinical problem encountered in medical practice and can occur due to a wide range of conditions, including infection, heart failure, liver disease, and malignancy. In some patients, pleural effusion may be the first clue that leads to the discovery of an underlying cancer. Malignant pleural effusion refers to the accumulation of fluid in the pleural space as a result of cancer involvement of the pleura or obstruction of lymphatic drainage by tumor cells. Among malignancies, lung cancer is one of the most frequent causes of malignant pleural effusion [1,3]. The presence of malignant pleural effusion often indicates advanced disease and is associated with significant morbidity. Non small cell lung cancer is the most common type of lung cancer and accounts for the majority of cases worldwide. It includes several histological subtypes such as adenocarcinoma, squamous cell carcinoma, and large cell carcinoma. Adenocarcinoma in particular has been increasingly reported as the leading subtype associated with pleural involvement. In many patients with non small cell lung cancer, malignant pleural effusion may develop during the course of the disease as tumor cells spread to the pleural surfaces [3]. However, in some cases the pleural effusion may be the first clinical manifestation that brings the patient to medical attention. The development of malignant pleural effusion occurs through several mechanisms. Tumor infiltration of the pleura can increase vascular permeability and disrupt normal fluid balance within the pleural space. In addition, obstruction of lymphatic drainage by malignant cells may impair the normal clearance of pleural fluid. These changes result in the accumulation of fluid within the pleural cavity, which may gradually increase in volume. As fluid accumulates, patients may develop respiratory symptoms related to lung compression and impaired ventilation [1,2]. Clinically, patients with pleural effusion often present with symptoms such as shortness of breath, chest discomfort, or persistent cough. The severity of symptoms usually depends on the size of the effusion and the rate at which the fluid accumulates. Some patients may have mild symptoms initially, while others may develop significant respiratory distress if the effusion becomes large. Physical examination may reveal reduced breath sounds, dullness to percussion, and decreased chest expansion on the affected side. These findings often prompt further evaluation with imaging studies [2]. Chest imaging plays a key role in the detection and evaluation of pleural effusion. A chest radiograph is often the first investigation performed and may show blunting of the costophrenic angle

or a more extensive opacity in cases of large effusion. Computed tomography of the chest provides additional information and can help identify pleural thickening, nodularity, or lung masses that may suggest malignancy. Imaging findings may guide further diagnostic procedures such as thoracentesis or pleural biopsy [2,5]. Thoracentesis is an essential diagnostic step in patients with unexplained pleural effusion. The procedure allows removal of pleural fluid for laboratory analysis and cytological examination. Evaluation of the pleural fluid typically includes assessment of protein level, lactate dehydrogenase, cell count, and microbiological studies when infection is suspected. Cytological examination is particularly important in identifying malignant cells and confirming the diagnosis of malignant pleural effusion. In some cases, repeated fluid sampling or additional procedures such as pleural biopsy may be required to establish the diagnosis [1,2]. Malignant pleural effusion is frequently associated with lung cancer and may occur in a considerable proportion of patients during the course of the disease. The detection of malignant cells in pleural fluid confirms pleural involvement and usually indicates stage IV disease in non small cell lung cancer. This has important implications for staging, prognosis, and treatment planning. The presence of malignant pleural effusion often limits the possibility of curative surgical treatment and shifts the focus toward systemic therapy and symptom control [3,4]. In addition to its diagnostic importance, malignant pleural effusion has significant clinical impact on patient quality of life. The accumulation of pleural fluid can lead to persistent dyspnea, reduced exercise tolerance, and repeated hospital visits for drainage procedures. For many patients, management of pleural effusion becomes an important component of supportive care during cancer treatment. Various treatment options are available, including repeated thoracentesis, pleurodesis, and placement of indwelling pleural catheters to allow ongoing drainage [2,11]. Several studies have shown that the presence of pleural effusion in lung cancer patients is associated with poorer prognosis. It often reflects advanced tumor spread and more aggressive disease biology. In patients receiving modern systemic therapies, including targeted therapy or immunotherapy, the presence of malignant pleural effusion has been linked with reduced treatment response and shorter survival in some reports [4,14]. For this reason, recognition and proper management of pleural effusion remain important aspects of lung cancer care. Although malignant pleural effusion is well recognized in advanced lung cancer, its role as the first presenting feature of the disease is less commonly discussed. In some patients, respiratory symptoms related to pleural fluid accumulation may be the earliest manifestation before a lung mass is clearly identified. Such presentations may initially be attributed to infection, heart failure, or other benign causes, especially when imaging findings are subtle. This can lead to delays in diagnosis if malignancy is not considered early in the evaluation process [5,6].The differential diagnosis of pleural effusion is broad, and clinicians must consider both malignant and non malignant causes during assessment. Infectious conditions such as pneumonia or tuberculosis are common causes of exudative pleural effusion in many regions. Other conditions such as pulmonary embolism, autoimmune diseases, and pancreatitis may also lead to pleural fluid accumulation. Careful clinical assessment combined with appropriate laboratory and imaging studies is therefore required to determine the underlying cause [2]. Recent advances in molecular and laboratory analysis have improved the understanding of malignant pleural effusion. Research has explored various biomarkers in pleural fluid that may assist in diagnosis or provide prognostic information. For example, certain tumor related markers and proteins have been studied for their potential role in distinguishing malignant from benign pleural effusions. Although these tests are still being evaluated, they may contribute to improved diagnostic accuracy in selected cases [3,10]. Management strategies for malignant pleural effusion continue to evolve with the development of new therapeutic approaches. In addition to conventional drainage procedures and pleurodesis, newer interventions such as targeted therapies and intrapleural treatments are being investigated. Some studies have explored the use of anti angiogenic agents administered through pleural catheters to help control recurrent effusions in patients with lung cancer [11]. These approaches aim to reduce symptoms and improve quality of life for patients with advanced disease. Case reports remain valuable in highlighting uncommon or early presentations of serious diseases such as lung cancer. They provide practical clinical examples that can help clinicians recognize patterns that may otherwise be overlooked. Reports describing pleural effusion as the first manifestation of malignancy emphasize the importance of thorough evaluation when patients present with unexplained pleural fluid accumulation. Increased awareness of such presentations can encourage timely investigation and earlier diagnosis [5,13]. This case report describes a patient who presented with pleural effusion that ultimately led to the diagnosis of lung cancer. The case highlights the diagnostic challenges that may arise when pleural effusion is the initial manifestation of malignancy. By discussing the clinical course and diagnostic approach, this report aims to emphasize the importance of considering lung cancer in the differential diagnosis of unexplained pleural effusion. Improved recognition of such presentations may contribute to earlier diagnosis and more appropriate management for affected patients.

Case Presentation

Patient's history and Physical Examination

This case involves a fifty eight year old Saudi male who presented to the emergency department with progressive shortness of breath and right sided chest discomfort. He was previously independent and living with his family. The patient worked as a truck driver for many years and had a long history of cigarette smoking. According to him, he had been smoking approximately one pack of cigarettes daily since his early twenties. He denied alcohol consumption or illicit drug use. He had no previous diagnosis of malignancy. The patient reported that his symptoms started about three weeks before presentation. He initially noticed mild

shortness of breath when climbing stairs or walking long distances. At first he thought the symptoms were related to fatigue from work and did not seek medical advice. Over the following days the shortness of breath gradually worsened and began to occur even with minimal exertion. He also developed a dull discomfort on the right side of his chest that was more noticeable when taking deep breaths. Approximately one week before admission, the patient noticed that his breathing had become more difficult, especially when lying flat at night. He described a feeling of heaviness in the right side of his chest but denied severe sharp pain. He did not report any recent trauma. There was no history of productive cough, although he mentioned occasional dry cough during the same period. He denied hemoptysis. He also denied fever, chills, or recent respiratory infections. During the same period, the patient noticed a gradual decrease in his appetite. He reported eating less than usual and feeling full quickly after small meals. He estimated that he had lost around four kilograms of weight over the previous two months but had not paid much attention to it until the breathing difficulty became more significant. He also described feeling more fatigued than usual, especially during the last two weeks. The patient had a medical history of hypertension that was well controlled with oral medications. He denied a history of chronic lung disease such as asthma or chronic obstructive pulmonary disease. There was no previous history of tuberculosis or known exposure to tuberculosis. He had never undergone chest surgery and had no prior history of pleural disease. There was no known family history of lung cancer or other malignancies. The patient lived with his wife and children and reported no recent travel or exposure to sick contacts. He had not been hospitalized in the past few years and had not undergone any recent medical procedures. When his shortness of breath began to interfere with daily activities, his family encouraged him to visit the emergency department for evaluation. On arrival to the hospital, the patient was awake and oriented but appeared mildly uncomfortable due to breathing difficulty. He was able to speak in full sentences but preferred to remain seated upright. His vital signs at presentation showed a temperature of 36.9 degrees Celsius, blood pressure of 138 over 82 millimeters of mercury, heart rate of 102 beats per minute, respiratory rate of 22 breaths per minute, and oxygen saturation of 94 percent on room air. He was not using accessory muscles for breathing but appeared slightly tachypneic. General examination showed a middle aged man who appeared mildly fatigued but not in acute distress. There was no obvious cyanosis or jaundice. Mild pallor was noted on inspection of the conjunctiva. There was no clubbing of the fingers. Examination of the neck did not reveal any obvious cervical lymph node enlargement. Respiratory examination showed reduced movement of the right side of the chest during inspiration. On palpation, chest expansion appeared decreased on the right side compared with the left. Percussion over the right lower chest produced a dull sound. On auscultation, breath sounds were markedly reduced over the right lower lung zone with preserved breath sounds over the upper zones and the entire left lung field. No obvious wheezes were heard. These findings raised suspicion for a moderate to large pleural effusion. Cardiovascular examination revealed normal heart sounds with no murmurs. Peripheral pulses were present and symmetrical. There was no peripheral edema. Abdominal examination revealed a soft abdomen with no tenderness. The liver and spleen were not clearly enlarged on palpation. Bowel sounds were normal. There were no palpable abdominal masses. Neurological examination was unremarkable. The patient was alert and oriented with normal speech and normal movement of all limbs. There were no focal neurological deficits. Initial laboratory investigations were obtained in the emergency department. Basic blood tests showed mild anemia while white blood cell count and platelet count were within normal limits. Renal functions and liver functions were within normal range. Inflammatory markers were mildly elevated but not significantly high. A chest radiograph was performed as part of the initial evaluation. The imaging showed a moderate right sided pleural effusion with blunting of the right costophrenic angle and partial compression of the underlying lung (Image 1).

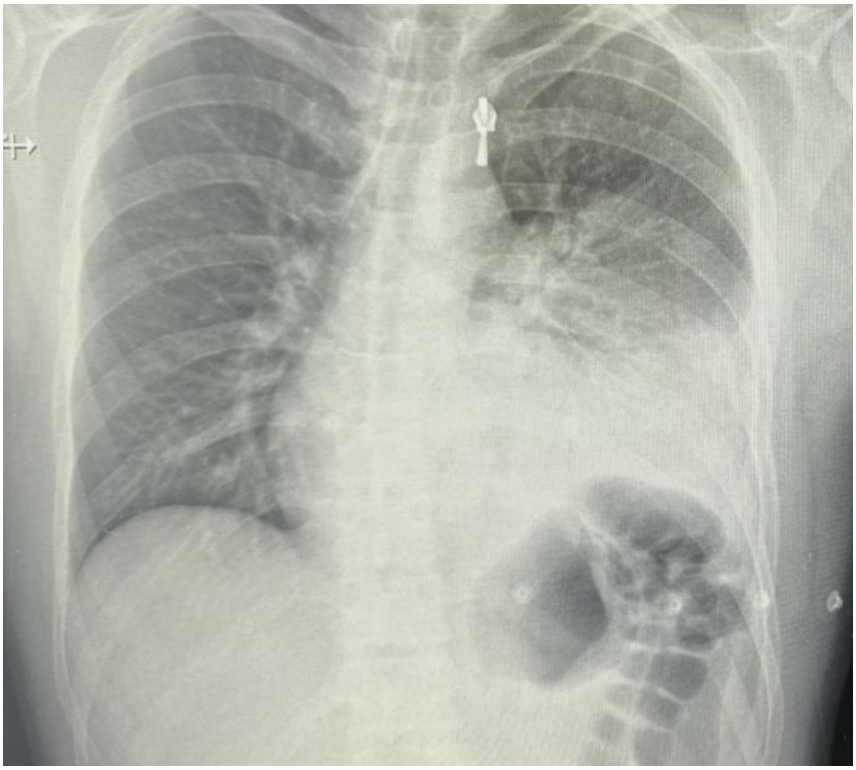

Image 1: left sided opacification associated with obliteration of the costo-phrenic angle, strongly suggesting moderate pleural effusion.

No obvious lung mass could be clearly identified on the initial radiograph. Given the clinical findings and imaging results, the patient was admitted to the medical ward for further evaluation and management. Diagnostic thoracentesis was planned to analyze the pleural fluid and determine the underlying cause of the effusion. Further imaging studies were also arranged to evaluate the lungs and pleura in more detail.

Diagnostic Workup:

Following admission to the medical ward, further investigations were arranged to determine the underlying cause of the patient's right sided pleural effusion. At this stage, the differential diagnosis included parapneumonic effusion, tuberculosis related pleural effusion, and malignancy. Given the patient's long smoking history and recent weight loss, malignancy was considered an important possibility, although infection still needed to be excluded. Baseline laboratory tests were repeated after admission. Complete blood count showed hemoglobin of 11.2 grams per deciliter, which indicated mild anemia. The white blood cell count was within normal limits at 8,600 cells per microliter with no significant shift in differential count. Platelet count was 310,000 per microliter. These findings did not suggest an acute infection or hematologic disorder. Renal functions were within normal range, with normal blood urea and creatinine levels. Liver function tests were also within normal limits apart from mildly reduced albumin level. C reactive protein was slightly elevated but not significantly high. Overall, the laboratory results did not clearly point toward an infectious cause. A contrast enhanced computed tomography scan of the chest was requested to better evaluate the pleural space and underlying lung tissue. The scan confirmed the presence of a large right sided pleural effusion occupying a significant portion of the right hemithorax. The effusion was causing partial collapse of the right lower lobe. In addition, the scan showed mild irregular thickening of the right pleura. A small irregular opacity measuring approximately two centimeters was noted in the right upper lobe close to the pleural surface. There were also a few mildly enlarged mediastinal lymph nodes. These findings raised suspicion for an underlying malignant process. Given the significant amount of pleural fluid seen on imaging, diagnostic thoracentesis was performed under ultrasound guidance. The procedure was carried out at the bedside and approximately one liter of straw colored pleural fluid was drained, which resulted in partial improvement in the patient's breathing. The fluid was sent for laboratory analysis including biochemical testing, microbiological studies, and cytological examination. Pleural fluid analysis showed protein level of 4.6 grams per deciliter and lactate dehydrogenase level higher than the corresponding serum value. According to Light criteria, these findings were consistent with an exudative pleural effusion. The fluid glucose level was within normal range and the pH was mildly reduced. Cell count demonstrated a predominance of lymphocytes rather than neutrophils. Microbiological testing was performed to evaluate for infection. Gram stain of the pleural fluid did not reveal bacteria. Bacterial cultures were sent and later showed no growth. Acid fast bacilli smear

was negative, and samples were also sent for tuberculosis polymerase chain reaction testing, which returned negative. These findings made infectious causes such as bacterial empyema or tuberculosis less likely. Cytological examination of the pleural fluid was then performed to evaluate for malignant cells. The initial cytology report described the presence of atypical epithelial cells arranged in clusters. These cells had enlarged nuclei, prominent nucleoli, and irregular nuclear borders. The cytological features were suspicious for malignancy, although the sample was considered limited for definitive diagnosis. Because pleural fluid cytology may occasionally yield inconclusive results, further evaluation was recommended. Given the suspicious imaging findings and the cytology report, the case was discussed with the pulmonology team. A repeat thoracentesis was performed two days later to obtain additional pleural fluid for cytological analysis. The second sample again demonstrated atypical malignant appearing epithelial cells. Based on these repeated findings, malignant pleural effusion became the leading diagnosis. To identify the primary source of malignancy, further imaging was arranged. A computed tomography scan of the abdomen and pelvis was performed to evaluate for possible primary tumors in other organs. The study did not reveal masses in the liver, kidneys, pancreas, or gastrointestinal tract. There were no suspicious lesions in the adrenal glands or other abdominal organs. These findings made an extrathoracic primary tumor less likely. Because the chest CT had already demonstrated a small irregular lesion in the right upper lobe, further assessment of this lesion was planned. A bronchoscopy was performed to examine the airway and obtain tissue samples if possible. During bronchoscopy, the trachea and major bronchi appeared patent with no obvious endobronchial mass. However, brushings and washings were obtained from the right upper lobe bronchus and sent for cytological analysis. In parallel, a CT guided percutaneous biopsy of the right upper lobe lesion was arranged. Under radiological guidance, a core needle biopsy sample was obtained from the suspicious pulmonary nodule. The procedure was performed without complications and the specimen was sent for histopathological examination. Histopathology results from the lung biopsy revealed malignant epithelial cells forming glandular structures. The tumor cells showed enlarged nuclei and prominent nucleoli with moderate cytoplasm. Immunohistochemical staining was positive for markers consistent with pulmonary adenocarcinoma. These findings confirmed the diagnosis of primary lung adenocarcinoma. When correlated with the earlier pleural fluid cytology results, the overall findings established that the pleural effusion was malignant and related to pleural involvement by lung cancer. The presence of malignant pleural effusion indicated advanced disease according to lung cancer staging systems. At this stage, the diagnostic workup had confirmed non small cell lung cancer presenting with malignant pleural effusion. The patient's initial symptom of progressive shortness of breath was therefore explained by the large pleural fluid accumulation caused by pleural spread of the tumor. Following confirmation of the diagnosis, the patient was referred to the oncology and pulmonology teams for further staging and discussion of treatment options. The diagnostic process, which began with evaluation of unexplained pleural effusion, ultimately led to the identification of lung cancer as the underlying cause.

Management course

Management initially focused on relieving the patient's respiratory symptoms, stabilizing his clinical condition, and planning further oncologic evaluation following confirmation of malignant pleural effusion secondary to lung cancer. Because the patient's main complaint was shortness of breath related to the large pleural effusion, early symptomatic management of the pleural fluid was prioritized. After the initial diagnostic thoracentesis provided partial relief of symptoms, the patient was monitored closely for recurrence of fluid accumulation. His oxygen saturation and respiratory status were assessed regularly. Supplemental oxygen was provided intermittently when he experienced increased shortness of breath, although he remained stable on room air most of the time. Basic supportive care was maintained throughout his hospital stay. Intravenous access was secured, and routine blood tests were monitored to observe hemoglobin level, electrolytes, renal functions, and liver functions. Analgesics were given when needed to control chest discomfort. The patient was encouraged to maintain adequate oral intake, and his nutritional status was assessed given the recent history of weight loss. Because malignant pleural effusion often recurs, the pulmonology team discussed options for ongoing management of the pleural fluid. Repeated thoracentesis was considered if symptoms worsened. Placement of an indwelling pleural catheter was also discussed as a possible option if the effusion became recurrent and symptomatic, as this allows intermittent drainage and can improve quality of life in patients with advanced disease. Following confirmation of lung adenocarcinoma on lung biopsy and malignant cells in pleural fluid cytology, the oncology team was involved early in the management plan. Further staging investigations were arranged to determine the extent of disease and guide treatment decisions. Molecular testing on the tumor sample was requested to evaluate for potential targetable mutations that may influence systemic therapy. The patient and his family were counseled regarding the diagnosis and the nature of malignant pleural effusion as a complication of lung cancer. The discussion included explanation of the disease stage, available treatment options, and the goals of therapy. Emotional support was provided, and time was given for the patient and family members to ask questions and understand the planned approach. A multidisciplinary plan was developed involving pulmonology, oncology, and radiology teams. Because the presence of malignant pleural effusion indicated advanced disease, treatment was expected to focus primarily on systemic therapy and symptom control rather than surgical intervention. Before discharge, the patient's breathing had improved following pleural fluid drainage, and he was clinically stable. Arrangements were made for close outpatient follow up with the oncology clinic to begin further cancer management and continue monitoring of the pleural effusion.

Discussion

Pleural effusion is a common clinical finding encountered in respiratory and general medical practice, but its underlying cause can vary widely from benign conditions to advanced malignancy. The present case highlights an important clinical scenario in which pleural effusion represents the first manifestation of lung cancer. Although pleural effusion is frequently associated with advanced malignancy, it may occasionally be the initial presentation that leads to the diagnosis of an underlying lung tumor. Recognizing this possibility is important because the diagnostic pathway, prognosis, and management strategy differ significantly from those of benign pleural diseases. Malignant pleural effusion is defined as the accumulation of pleural fluid due to direct or indirect involvement of the pleura by malignant cells. Among all malignancies, lung cancer is one of the most common causes of malignant pleural effusion worldwide. It is estimated that malignant pleural effusion develops in approximately fifteen percent of patients with cancer, and lung cancer accounts for a large proportion of these cases [1,2]. In patients with lung cancer specifically, pleural effusion may develop during disease progression or may be present at the time of initial diagnosis. The pathophysiology of malignant pleural effusion is multifactorial. Tumor infiltration of the pleura leads to increased vascular permeability, disruption of normal pleural membrane integrity, and obstruction of lymphatic drainage. These mechanisms result in the progressive accumulation of fluid within the pleural space. In addition, tumor related inflammatory mediators can further promote fluid formation by increasing capillary permeability and altering pleural fluid dynamics [1]. These changes explain why malignant effusions often recur after drainage unless the underlying tumor process is addressed. Clinically, patients with pleural effusion most commonly present with dyspnea, chest discomfort, and cough. The severity of symptoms depends on both the volume of fluid and the rate of accumulation. Rapid accumulation may produce significant respiratory symptoms even with moderate fluid volume, while slowly developing effusions may remain asymptomatic for some time [2]. In the present case, the patient developed gradually progressive shortness of breath over several weeks, which is a typical pattern seen in malignant pleural effusion.

From a diagnostic standpoint, imaging plays a central role in the evaluation of pleural effusion. Chest radiography is usually the first investigation performed and can detect moderate or large effusions. However, computed tomography provides greater detail and allows assessment of pleural surfaces, lung parenchyma, and mediastinal structures. Features such as pleural nodularity, pleural thickening, and associated pulmonary lesions may raise suspicion for malignancy [2,5]. In this case, CT imaging identified a small pulmonary lesion and pleural abnormalities that guided further diagnostic evaluation. Thoracentesis remains a key step in the evaluation of unexplained pleural effusion. Analysis of pleural fluid allows differentiation between transudative and exudative effusions using biochemical criteria. Malignant pleural effusions are typically exudative, reflecting increased vascular permeability and inflammatory changes within the pleura. Cytological examination of pleural fluid is particularly important because the identification of malignant cells can establish the diagnosis without the need for more invasive procedures in many cases [1,2]. The diagnostic yield of pleural fluid cytology varies depending on the type of malignancy. Studies suggest that a single pleural fluid cytology sample detects malignant cells in approximately sixty percent of cases, while repeat sampling can increase the diagnostic yield to around seventy five percent [2]. This explains why repeat thoracentesis is often recommended when initial cytology is inconclusive but clinical suspicion remains high. In the present case, repeated cytological examination confirmed the presence of malignant cells and supported the diagnosis of malignant pleural effusion. When malignant pleural effusion is detected, identifying the primary tumor is essential. Lung adenocarcinoma is the most common histological subtype associated with pleural involvement. Adenocarcinoma has a tendency to arise in peripheral lung tissue and may spread early to the pleural surfaces. As a result, pleural effusion may develop even when the primary tumor is relatively small or difficult to detect on initial imaging [3]. This pattern was observed in the present case, where a small pulmonary lesion was later confirmed as lung adenocarcinoma on tissue biopsy. The presence of malignant pleural effusion has important implications for staging and prognosis. In non small cell lung cancer, detection of malignant pleural fluid generally indicates advanced disease and is classified as stage IV according to current staging systems. This classification reflects the fact that pleural involvement represents metastatic spread of the tumor beyond the primary site [3]. Consequently, curative surgical resection is usually not considered appropriate in these patients, and treatment strategies focus primarily on systemic therapy and symptom control. Several studies have demonstrated that malignant pleural effusion is associated with poorer clinical outcomes in lung cancer patients. The presence of pleural fluid has been identified as an independent negative prognostic factor in various patient populations. For example, research has shown that lung cancer patients with malignant pleural effusion often have shorter survival compared with those without pleural involvement [4,14]. These findings highlight the importance of early detection and appropriate management of pleural disease. In addition to its prognostic significance, malignant pleural effusion can have a substantial impact on quality of life. Accumulation of pleural fluid may cause persistent dyspnea, fatigue, and reduced physical activity. Many patients require repeated procedures to drain the fluid and relieve symptoms. For this reason, management strategies often aim not only to treat the underlying cancer but also to provide effective control of pleural fluid accumulation [2]. Several therapeutic approaches are available for the management of malignant pleural effusion. Initial thoracentesis is usually performed for both diagnostic and symptomatic relief. However, recurrence of pleural fluid is common because the underlying tumor process continues to produce fluid. In patients with recurrent symptomatic effusion, more

definitive interventions such as pleurodesis or placement of an indwelling pleural catheter may be considered [2]. These procedures aim to prevent reaccumulation of fluid and improve respiratory symptoms.

Recent studies have also explored newer treatment strategies targeting the biological mechanisms involved in malignant effusion formation. For example, anti angiogenic therapies have been investigated as potential treatments for recurrent malignant pleural effusion in patients with lung cancer. Administration of agents such as bevacizumab through pleural catheters has shown promising results in some studies by reducing vascular permeability and fluid production [11]. Although further research is needed, such approaches may offer additional options for selected patients. Another important aspect of malignant pleural effusion is its potential role in guiding molecular and diagnostic testing. Pleural fluid contains tumor cells and circulating biomarkers that can sometimes be used for molecular analysis. Studies have evaluated various pleural fluid markers that may assist in distinguishing malignant from benign effusions or provide additional information about tumor biology [10]. Such advances may improve diagnostic accuracy and help guide targeted therapies in the future. Case reports describing pleural effusion as the initial manifestation of malignancy remain valuable in clinical literature. Although lung cancer commonly causes pleural effusion in advanced disease, its presentation as the first symptom may lead to diagnostic uncertainty. Several reported cases have described patients who initially presented with large pleural effusions before the underlying lung tumor was identified [5,6]. These reports emphasize the importance of maintaining clinical suspicion when evaluating unexplained exudative effusions, particularly in patients with risk factors such as smoking history. The differential diagnosis of pleural effusion remains broad and includes infectious, inflammatory, and systemic conditions. Tuberculosis, pneumonia, heart failure, and pulmonary embolism are among the common causes encountered in clinical practice. However, persistent exudative effusion without clear infectious cause should prompt investigation for malignancy. In regions where tuberculosis is prevalent, clinicians must carefully differentiate between tuberculous pleuritis and malignant pleural disease, as both may present with lymphocyte predominant exudative fluid.

Another learning point from this case is the importance of a systematic diagnostic approach. Evaluation of pleural effusion should follow a structured pathway that includes imaging, pleural fluid analysis, microbiological testing, and cytology. When these investigations suggest malignancy but do not identify the primary source, additional imaging and tissue biopsy are required to establish a definitive diagnosis. This stepwise approach helps avoid unnecessary delays and ensures that patients receive appropriate treatment in a timely manner. In conclusion, this case illustrates how pleural effusion may serve as the first clinical sign of underlying lung cancer. Malignant pleural effusion remains a significant complication of lung malignancy and is associated with advanced disease and poorer prognosis. Careful clinical assessment, appropriate imaging, and thorough pleural fluid analysis are essential for establishing the diagnosis. Clinicians should maintain a high index of suspicion for malignancy in patients with unexplained exudative pleural effusion, particularly those with risk factors such as long term smoking. Early recognition and coordinated multidisciplinary management can improve symptom control and guide appropriate oncologic treatment.

Conclusion

This case highlights the importance of considering lung cancer in patients presenting with unexplained pleural effusion, particularly in older adults or individuals with risk factors such as smoking history and unexplained weight loss. Although pleural effusion is a common clinical finding with many benign causes, persistent or large unilateral effusions should prompt thorough evaluation for malignancy. Early diagnostic thoracentesis with pleural fluid cytology plays a critical role in identifying malignant pleural effusion and guiding further investigations. Clinicians should also recognize that pleural effusion may be the first manifestation of lung cancer even before a primary lung mass becomes clinically evident. Timely imaging, tissue diagnosis, and multidisciplinary collaboration are essential to establish the diagnosis early and initiate appropriate oncologic management while addressing symptom relief.

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