Managing Aggressive Small Cell Lung Cancer in a Young Smoker: A Case Report of Rapid Progression and Severe Complications

Abstract:

This case report has detailed out the clinical journey of a 35-year-old male, who was diagnosed with small cell lung carcinoma (SCLC), a rare and aggressive neuroendocrine tumor. The patient presented with a left hilar mass and extensive metastasis to the spine and right hip bone. His medical history included chronic smoking, and he exhibited symptoms of worsening shortness of breath, cough, weight loss, and chest pain. Despite aggressive management, including chemotherapy, the patient succumbed to acute complications. We discussed his clinical presentation, diagnostic process, treatment course, and outcome, highlighting the rarity and aggressive nature of SCLC, which accounts for approximately 15% of all lung cancers. This report has emphasized the importance of early diagnosis and aggressive treatment in managing SCLC. Further research is necessary to understand better the epidemiology, prognosis, and most effective treatment strategies for these patients. Addressing knowledge gaps in this area will be key to improving patient outcomes.

INTRODUCTION:

SCLC is an aggressive neuroendocrine tumor, accounting for almost 15% of all lung cancer cases, and is most often found among older people with a history of heavy smoking [1-3]. These cancerous tumors exhibit rapid growth and early metastasis, as well as a unique neuroendocrine phenotype characterized by the expression of chromogranin, synaptophysin, and neuron-specific enolase molecules - characteristics that impact its aggressive nature and treatment responses [4]. Gene mutations found in tumor suppressor genes such as TP53 and RB1 can often play an integral part in SCLC's pathogenesis, along with environmental carcinogens and occupational exposures [5]. Clinically, SCLC typically presents with symptoms from either its primary tumor or distant metastases, necessitating imaging and biopsy to diagnose it [5,6]. Following diagnosis, the most commonly used treatments for SCLC include platinum-based chemotherapy and radiation therapy to manage disease progression and relieve symptoms [6,7]. Even after the initial response to treatment, the prognosis remains poor due to high relapse rates; therefore, novel therapeutic approaches must be developed to enhance affected patients' survival and quality of life [7-9]. This case report highlights the challenges of managing SCLC while emphasizing the importance of a multidisciplinary treatment approach that provides comprehensive care for the primary tumor and its metastatic spread.

Case Presentation:

The patient, a 35-year-old male with a 20-pack-year smoking history, complained of worsening shortness of breath, persistent cough, significant unintentional weight loss of 15 kg within two months, and increasing chest and back pain. He had a past medical history of chronic obstructive pulmonary disease (COPD) and hypertension, both managed with medications. He reported reduced appetite, extreme weakness, and increasing pain, particularly in his spine and right hip area, which had worsened over the last month.

On examination, the patient appeared cachectic and had severe respiratory distress. His vital signs indicated low blood pressure, a rapid pulse, elevated respiratory rate, and oxygen saturation levels that required high-flow oxygen supplementation with poor GCS, signifying altered mental status; his chest auscultation revealed bilateral crepitations which were most pronounced on the left side; examination of his cardiovascular system revealed tachycardia with normal heart sounds; and there was significant tenderness over both of his thoracic spines and right hip, his neurological examination was found to be unremarkable. High-flow oxygen was immediately administered, and triple inotropic support was initiated for hypotension. Unfortunately, however, his blood pressure remained borderline while his tachycardia continued. For pain management, analgesics and prompt consultation with the oncology team were given for further assessment and care. Table 1 demonstrates the results of different parameters of his laboratory investigations.

Test	Result	Normal Range
Complete Blood Count (CBC)		
Hemoglobin (Hb)	11.5 g/dL	Normal: 12.0 - 16.0 g/dL
Total Leukocyte Count (TLC)	15,000 cells/µL	Normal: 4,000 - 11,000 cells/µL
Platelets	350,000 cells/µL	Normal: 150,000 - 450,000 cells/µL
Liver Enzymes		
AST (Aspartate	55 U/L	Normal: 5 - 40 U/L

Aminotransferase)		
ALT (Alanine Aminotransferase)	60 U/L	Normal: 7 - 56 U/L
ALP (Alkaline Phosphatase)	90 U/L	Normal: 44 - 121 U/L
Renal Function Tests		
Creatinine	0.9 mg/dL	Normal: 0.6 - 1.2 mg/dL
Urea	15 mg/dL	Normal: 7 - 20 mg/dL
Electrolyte Analysis		
Sodium (Na+)	130 mmol/L	Normal: 135 - 145 mmol/L
Potassium (K+)	4.0 mmol/L	Normal: 3.5 - 5.0 mmol/L

Table 1: Results of Laboratory Investigations

A chest X-ray (CXR) and CT scans of his chest, abdomen, and pelvis (CTCAP) revealed a large left hilar mass with mediastinal widening and infiltration into nearby structures, including the mediastinum, spine, and right hip bone, consistent with metastatic spread. He had a bone scan which confirmed multiple areas of increased uptake in the spine and right hip.
Figure 1 shows the CXR of the patient, highlighting the left lobar
mass.

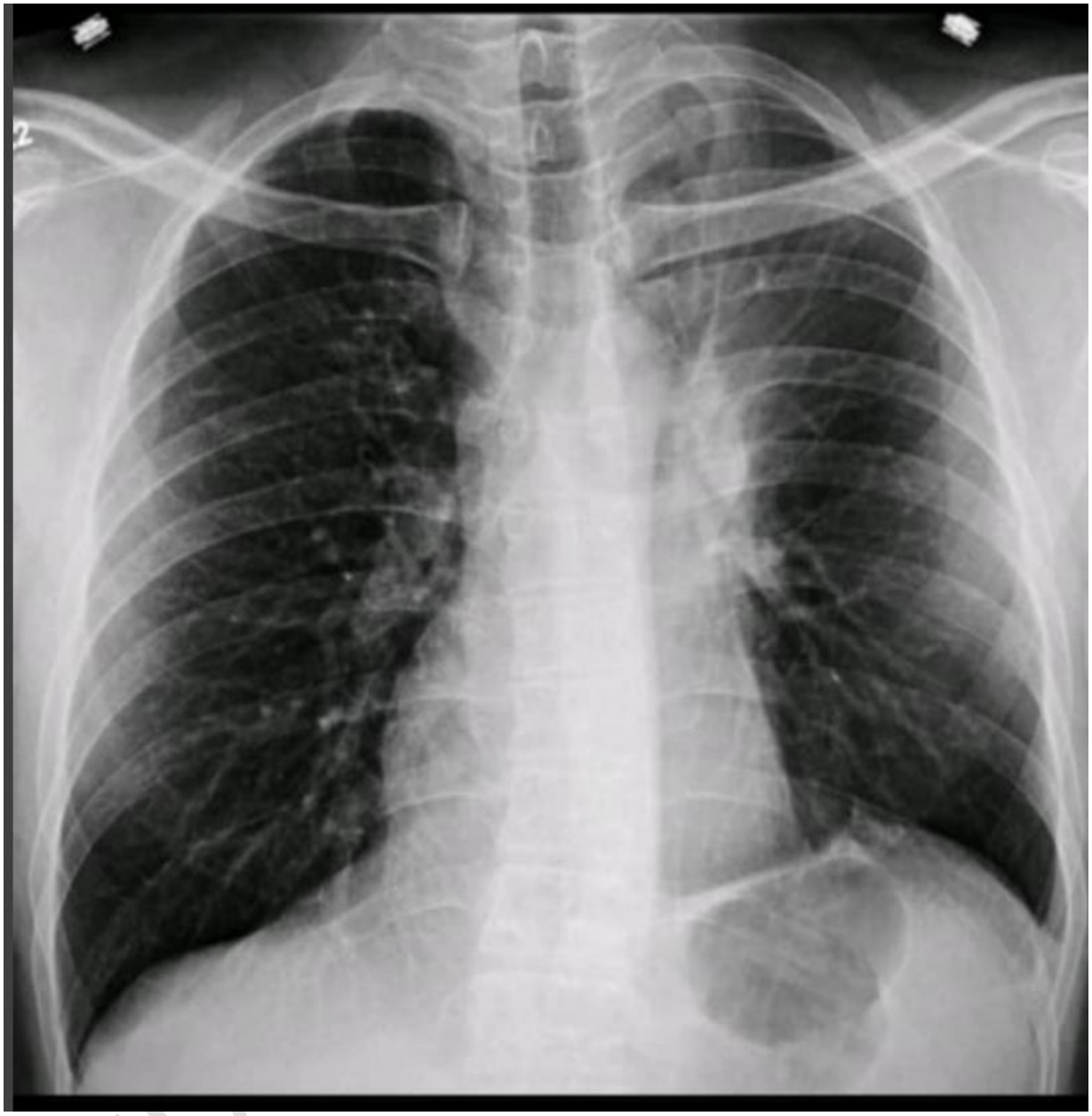
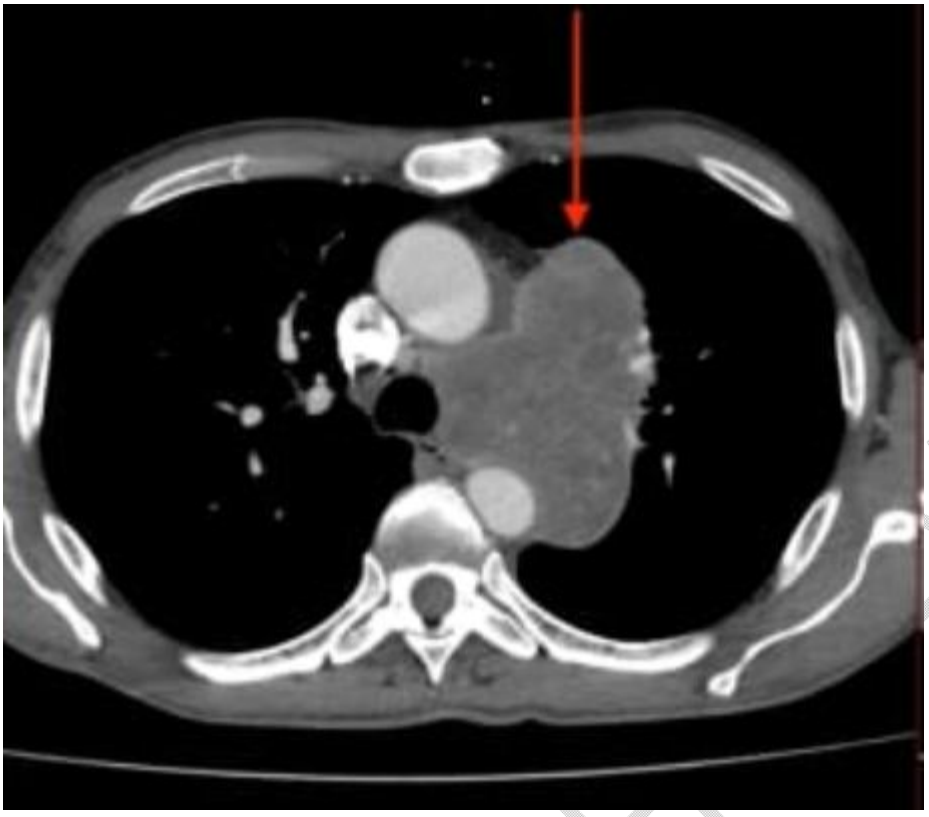
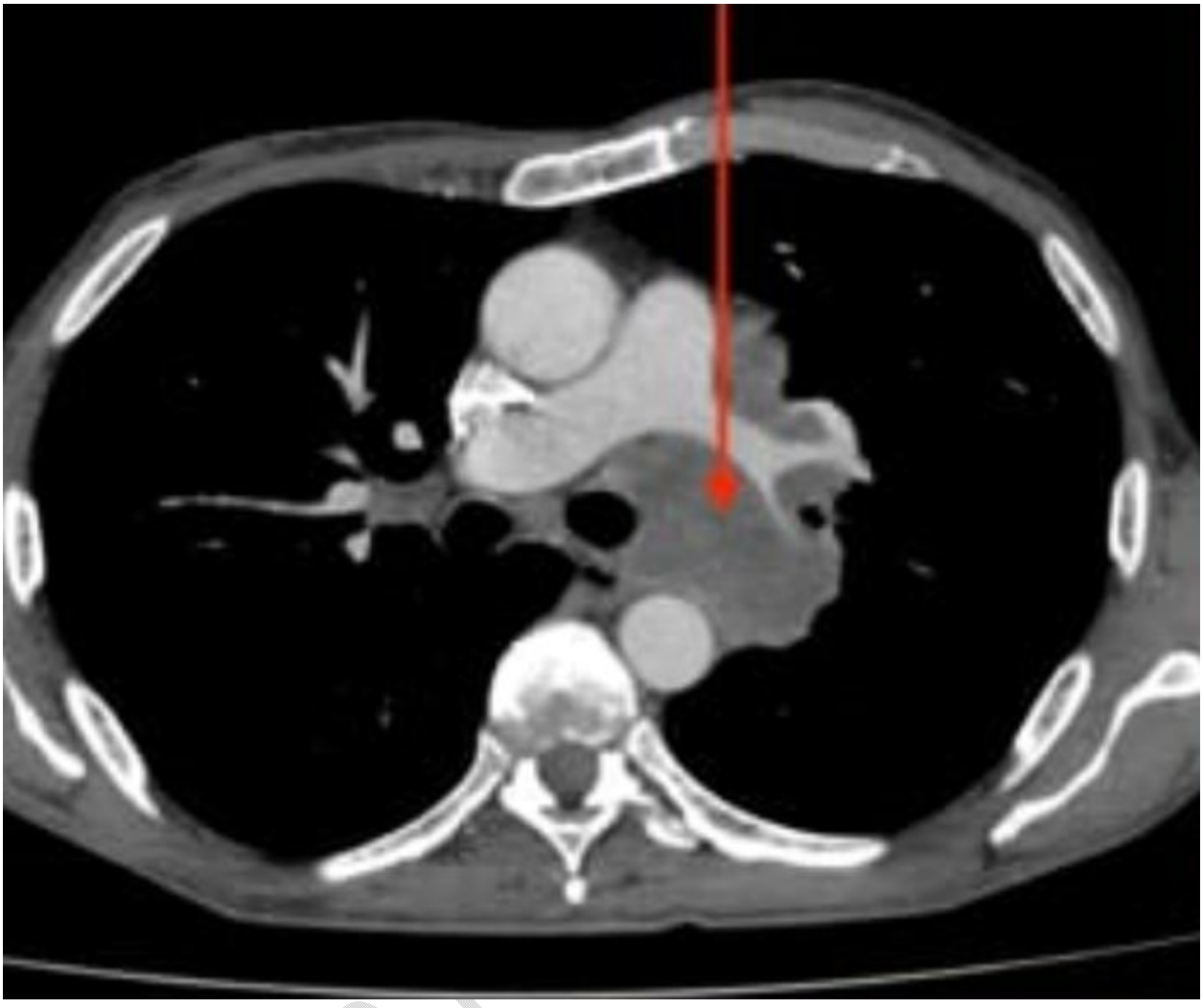


Figure 1: Lobar mass of left lung on CXR
CXR: Chest X- ray

Figure 2 and 3 depicts the slices of CTCAP, Indicating a mass in the left lung.





Figures 2 and 3: CT scan of the thorax showing a mediastinal mass

Pathology examination of a biopsy of the left hilar mass confirmed small cell lung carcinoma of neuroendocrine origin. Histopathology examination of the left hilar mass biopsy specimen revealed small, round blue cells with a high nuclear-to-cytoplasmic ratio, significant necrosis, and nuclear molding. Immunohistochemistry staining studies of biopsy specimens of his left hilar mass showed positive staining of the tumor cells for Cytokeratin AE1/AE3, CD56, Synaptophysin, and TTF-1, verifying the neuroendocrine source. The patient was diagnosed with extensive-stage small cell lung cancer, which was confirmed through biopsy and evidence of widespread metastases. Once diagnosed with SCLC, this patient began systemic chemotherapy therapy - specifically, cisplatin and etoposide as first-line treatments. Cisplatin was administered intravenously and typically dosed at 75 mg/m2 on day one of each 21-day cycle; 100 mg/m2 of etoposide was taken on days one to three. Over 12 weeks, four cycles were completed. Even though an initial decrease in tumor size was noted on follow-up imaging studies after two cycles, his treatment was marked by severe side effects. The patient experienced debilitating nausea, vomiting, and fatigue that required ongoing supportive care, including antiemetic therapy (Ondansetron) and hydration to address. On his second

chemotherapy cycle, the patient experienced neutropenic fever - an unwelcome yet potentially severe side effect of chemotherapy that affects immune system health - prompting him to seek hospitalization immediately and treated with broad-spectrum antibiotics (piperacillin-tazobactam) and G-CSF to stimulate white blood cell production and combat neutropenia. After his condition temporarily stabilized, he underwent the remaining two cycles of chemotherapy, although it progressively deteriorated his overall physical health. During chemotherapy, thoracic radiotherapy was also considered, as it is commonly combined with chemotherapy in limited-stage SCLC to enhance local control and improve survival. However, the patient's declining performance status led to a delay in starting radiotherapy. Eventually, Radiotherapy of 45 Gy was given in 30 fractions over six weeks, targeting both primary lung mass and mediastinal lymph nodes.

At last, the patient's condition declined further, and he developed acute complications such as persistent neutropenia and infection; neutropenic fever even returned post-radiotherapy despite aggressive management; he succumbed to these complications. Unfortunately, this case has illustrated the difficulty associated with managing SCLC, given its aggressive nature and severe side effects of chemotherapy treatment, as it has highlighted the need to balance effective care with patient quality of life and tolerance of therapy. Further research is essential to develop appropriate treatment and supportive care strategies for SCLC to minimize treatment-related toxicities while optimizing outcomes. As this form of lung cancer accounts for 15% of cases overall, the ongoing study should take place into its epidemiology, prognosis, and therapeutic options.

Discussion

SCLC is an aggressive cancer with a dismal prognosis [1,2]. For our patient, his long history of smoking, COPD, and late presentation with significant weight loss and bone pain were hallmarks of advanced disease. His struggle with the disease was evident, and it was further confirmed through neuroendocrine differentiation and immunohistochemical markers such as CD56, synaptophysin, and TTF-1 immunostaining, had confirmed this diagnosis. SCLC remains one of the most challenging aspects of oncology due to its aggressive nature, rapid progression, and high recurrence rates [3,4]. It is strongly associated with smoking history; approximately two-thirds of SCLC patients report past smoking histories, while males tend to be affected more due to past habits than women due to historically higher smoking prevalence rates [4]. However, some authors had iterated that recent advancements may improve outcomes for SCLC cases with widespread metastases, such as in their patients [4,5]. Chemotherapy is the cornerstone of SCLC treatment, particularly for extensive-stage disease [1-5]. Platinum-based regimens like cisplatin or carboplatin combined with etoposide are considered to be the standard of care and have shown substantial success at reducing tumor burden and improving survival rates; however, rapid disease progression and high relapse rates often limit long-term benefits from chemotherapy treatments [6]. Our patient was prescribed platinum-based chemotherapy, but his disease had progressed quickly regardless of this treatment. It has been stated that radiation therapy is usually combined with chemotherapy in limited-stage SCLC patients [6,7]. It has also been iterated that prophylactic Cranial Irradiation (PCI) may help lower the risk of brain metastases [6,7]. PCI was recommended in our patient's case due to her extensive-stage

disease; he underwent concurrent chemoradiotherapy – which is typically reserved for limited-stage disease but in or case, it was used as part of treatment to palliate his symptoms and control local growth of the tumor and to manage his symptoms while slowing local tumor growth; however, due to disease progression.

Immunotherapy represents a recent breakthrough in treating SCLC [8]. Immune checkpoint inhibitors like atezolizumab and durvalumab have recently been approved as immune response enhancers to improve survival outcomes in advanced-stage SCLC [8]. Our patient did not take advantage of immunotherapy due to the rapid progression and extensive nature of his disease. Yet, immunotherapy remains increasingly significant when managing SCLC and could have provided additional benefits in our case. Targeted therapies for SCLC remain under development; however, genetic mutations such as TP53, RB1, and MYC mutations are frequently seen and may contribute to its aggressive nature [8,9]. No definitive targeted treatments have yet been developed, but ongoing clinical trials examine various targeted agents, such as PARP inhibitors and DLL3 therapies, as potential remedies [8,9]. Our patient's case exemplifies this need for further investigation to find more effective treatments against SCLC, particularly cases with extensive metastases. A case described by Qian et al. involving a 71-year-old male diagnosed with SCLC and adenocarcinoma treated by surgery and adjuvant chemotherapy has illustrated the value of histopathological evaluation when making treatment decisions [10]. Unlike our patient, who presented with extensive metastatic disease, this case involved a localized tumor amenable to surgical resection, highlighting different prognoses based on disease stage and histopathology. Lee et al. described a case report of a-51-year-old male patient, who diagnosed with limited-stage SCLC, who underwent simultaneous chemoradiotherapy and photodynamic therapy (PDT) and that demonstrated the possibility for long-term remission in limited stages through aggressive multimodal treatments [11]. Our patient's extensive disease still had a poor prognosis despite aggressive treatments; these cases have highlighted the value of early detection and multimodal approaches to provide patients with improved outcomes for SCLC.

Conclusion

SCLC treatment is complicated due to its aggressive nature and high relapse rates, particularly in cases with widespread metastatic disease like the one presented here. Despite employing chemotherapy, radiation therapy, and emerging treatments like immunotherapy, the prognosis for SCLC patients remains poor. Our case has underscored this through the rapid progression and metastasis of advanced forms, highlighting the need for early detection and novel therapeutic approaches. Clinical trials are essential to uncover more effective treatments that would improve prognosis outcomes for SCLC patients. This case has illustrated the aggressive nature of SCLC, particularly among smokers with an extended history. The patient's late presentation with extensive metastasis contributed to a poor prognosis; even after receiving chemotherapy, his condition quickly worsened until his death. Early detection and intervention are essential in managing lung cancer among high-risk populations. Emerging therapies, including immunotherapy, may improve outcomes in the future. Additionally, early palliative care measures provide crucial support in managing disease and improving the quality of life for advanced SCLC patients.

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