Small Cell Lung Carcinoma On Contrast enhanced Chest Computer Tomography, Are There Special Characteristics be Found ?

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ABSTRACT

Background: Small Cell Lung Carcinoma is the most common primary pulmonary neuroendocrine malignancy. Usually patients present with metastatic disease at diagnosis and poor prognostic. Early and accurate diagnosis is important for SCLC. A contrast enhanced chest CT scan is needed to show more clearly the abnormalities detected on chest X-ray so that it can help to diagnose and reveal the extent of mediastinal invasion.

Method: This study was a descriptive type with a retrospective approach. In 30 patients who underwent contrast enhanced chest CT with histopathologically proven SCLC at Dr. Soetomo Hospital, Surabaya. Assessing feature of SCLC based on age, gender, location, and mediastinal extension (airways and vascular).

Results: Total sample were 30 patient, with 23 male subjects (76,6%) and 7 female subjects (23,3%), The age range of the study was between 31 years and 80 years, with an average age of 62 years, with incidence rate in males being higher than females. it was found that type I 3,3% (n = 1), type II a 13,3% (n = 4), type II b 30% (n = 9), type III a 3,3% (n = 1), III b 23,3% (n = 7), III c 10% (n = 3), type IV 13,3% (n = 4), and type V 3,3% (n = 1). Involvement airways approximately 60% (n=18), either involving one bronchus or 2 or 3 bronchial segments. About 86,6 % (n=26) prove to involve vascular with involvement pulmonal artery in 73,3% (n=22), superior vena cava in 13,3% (n=4) and combination of pulmonal artery and superior vena cava about 6,6% (n =2).

Conclusion: Feature of contras enhanced chest CT scan found in SCLC is hilar mass with ipsilateral mediastinal extension involves the main bronchi with 2 or more segmental bronchi. Vascular involvement particularly the pulmonal artery was found.

Keywords: SCLC, diagnosis, CT scan

INTRODUCTION

Lung cancer ranks 3rd most cancer in Indonesia. Whereas in men, lung cancer ranks number one for the most cancers suffered. Approximately 10 - 15% of cases are of the SCLC type which is an aggressive type of lung cancer that develops rapidly and spreads to other parts of the body (1).

SCLC is the most common primary pulmonary neuroendocrine malignancy and is characterized by a rapid doubling time and a high growth fraction. Approximately 60 – 70 % of patient present with metastatic disease at diagnosis and poor prognostic, characterized by < 7% 5-years survival and account for 13% - 15% of all cancers. So early and accurate diagnosis is important for SCLC (2,3,4).

Further investigations such as a chest CT scan with contrast are needed to show a clearer feature of the abnormalities detected on a plain chest X-ray so that it can help to diagnose and reveal the extent of mediastinal invasion.

However, only few studies have reported chest CT findings of patients with SCLC abroad. According to Pesrlberg et all, reported the distribution of enlarged lymphnodes and the frequency of the other intrathoracic findings in 37 patient with SCLC Furthermore, Kazawa et al classified 68 SCLC cases into 8 types and report some features of SCLC. However, the number of cases in the study was small and the classification was not well organized (4).

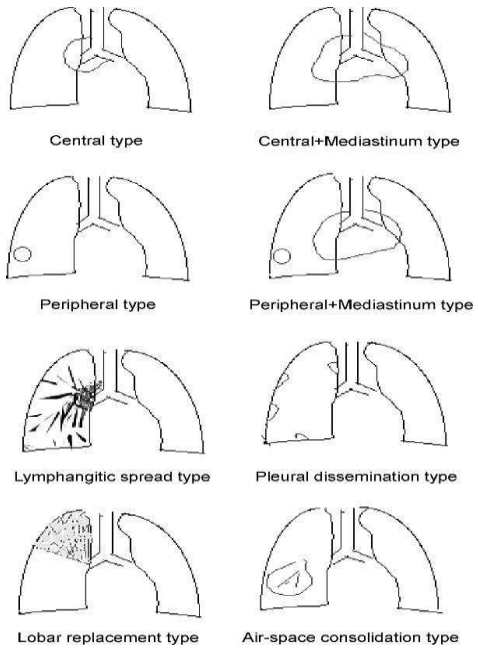

Figure 1. Schematic of 8 types of tumor extension and pattern of spread of SCLC; central perihilar type, central + mediastinal extension type, peripheral type, peripheral + mediastinal extension type, lymphangitic spread type, pleural dissemination type, lobar replacement type, and air space consolidation type (5)

Lee et al., 2016, classified SCLC into SCLC into hilar masses only (type I), hilar masses with ipsilateral mediastinal extension (type II), hilar masses with bilateral mediastinal extension (type III), and peripheral masses (type IV). This classification is simple and easy to identify the characteristics of SCLC. When mediastinal lymphadenopathy (m-LAP) is indistinguishable from a hilar mass, it is defined as a mediastinal conglomerate mass (m-CM). Type II a or III a have ipsilateral or bilateral m-LAP and type II b, III b or III c have ipsilateral or bilateral m-CM.

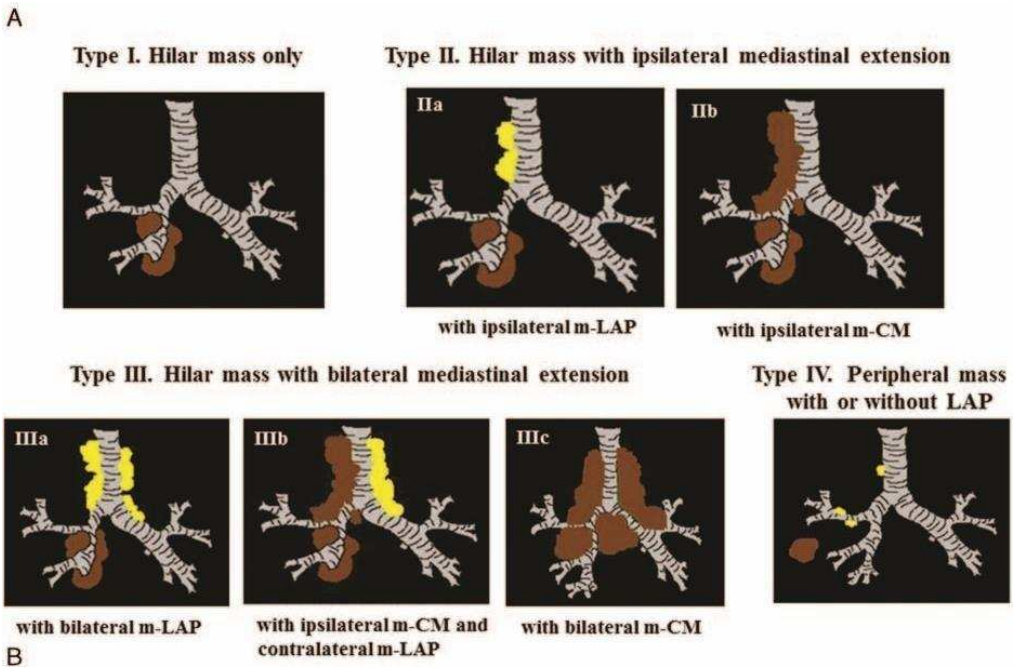

Figure 2 Schematics for the 4 types of SCLC according to tumor location and mediastinal extension

Based on the background above, this research was conducted. Classification of tumors was carried out based on the combined classification carried out by Kazawa dan Lee where tumors were classfified into 5 type based on location and mediastinal extension and also evaluated other features to find the characteristics of SCLC from contrast enhanced chest CT.

MATERIALS AND METHODS

Study Design, Location, and Time frame

This study was a descriptive type with a retrospective approach on confirmed cases at Dr. Soetomo Hospital, Surabaya, Indonesia. Data were taken from confirmed case's medical record at Dr. Soetomo Hospital from Juni 2017 to September 2022. We include 30 patients who underwent contrast enhanced chest CT and histopatollogically proven SCLC. The CT image were reviewed by 1 radiologist who were not blinded to the clinical data. Each image underwent careful evaluation by assessment of CT finding based on location and mediastinal extension. We defined hilar tumor as those where the center of mass was within or proximal to the lobar-segmental bronchial lumen and peripheral tumors as those where the center of the mass was within the peripheral lung parenchyme or distal to a segmental bronchus. Lymph nodes were considered enlarged if their short axis diameter in the axial plane was > 10 mm. When mediastinal lymphadenopathy (m-LAP) was indistinguishable from the hilar mass, we defined it as mediastinal conglomerate mass (m-CM). According to these criteria, we classified SCLC into 5 type. Type I, which was only a hilar mass, type II, which was hilar mass with ipsilateral mediastinal extension, type III, which was a hilar mass with contralateral mediastinal extension, type IV, which was a peripheral mass with or

without m-LAP, and type V, which was a mediastinal mass only. Among them, when ipsilateral or bilateral m-LAP was recognized as an independently enlarged lymph node, it was defined as type II a or III a. When ipsilateral or bilateral m-LAP was indistiguishting from a hilar mass, so called m-CM, it was defined as type II b, III b, or III c. Based on airway and vascular involvement. Single or multiple central bronchial wall thickening with stenosis and/or obstruction was evaluated for airways involvement. The central airway included main stem bronchi, bronchus intermedius, and lobar segmental bronchi of each lobe. Vascular invasion included the superior vena cava (SVC), the main pulmonal artery (PA), and lobar PA but excluded other vascular structures, such as the segmental PA, superior and inferior pulmonary vein or cardia chamber.

RESULT

Based on this study, a total sample of 30 patients was obtained, with 23 male subjects (76.7%) and 7 female subjects (23.3%).

The age range of the study subjects was between 31 years and 80 years, with an average age of 62 years, with the incidence rate in males being higher than females. 6 : 1 with 18 men and 3 women.

In this study, the most SCLC characteristics based on location and mediastinal extension were type II b, a hilar mass with conglomerated mediastinal mass ipsilateral as much as 30% (n = 9), followed by type III b, a hilar mass with ipsilateral conglomerated mass and contralateral mediastinal conglomerated lymphadenopathy as much as 23.3% (n = 7), type II a, hilar mass with ipsilateral mediastinal lymphadenopathy as much as 13.3% (n = 4), type III c, hilar mass with bilateral conglomerated mediastinal masses10% (n = 3), type IV peripheral mass with or without lymphadenopathy 10% (n = 3), type I hilar mass only and type V mediastinal mass only 3.3% (n = 1), as in table 4.3. a combination of hilar and mediastinal conglomerated mass, as in type II b, III b and type III c in 63% (n = 19). As shown in table 2 and figure 3

Table 2 Type Classification of SCLC by Location and Mediastinal Extension

SCLC Type Classification		
Type I hilar mass only	1 (3.3%)	
Type II Hilar mass with ipsilateral mediastinal extension	13 (43.3%)	
Type II a with ipsilateral mediastinal lymphadenopathy		4 (13.3%)
Type II b with an ipsilateral mediastinal conglomerated mass		9 (30%)

Type III hilar mass with bilateral mediastinal extension	11 (36.7%)	
Type III a bilateral medical lymphadenopathy		1 (3.3%)
Type III b with ipsilateral conglomerated mass and contralateral mediastinal conglomerated lymphadenopathy		7 (23.3%)
Type III c with bilateral conglomerated mediastinal masses		3 (10%)
Type IV Peripheral mass with or without lymphadenopathy	4 (13,3)	
Type V Mediastinal mass only	1 (3.3%)	
Total, N	30	

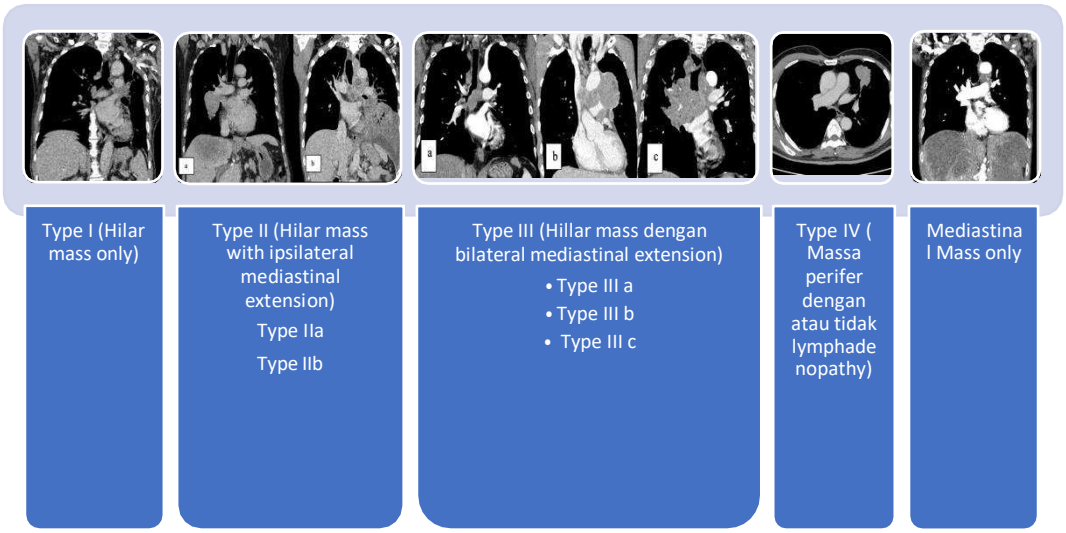

Figure 3. Classification of SCLC types based on location and mediastinal extension

From 4 cases of peripheral type SCLC, approximately 75% (n = 3) showed a bronchial cutoff sign (+), as shown in Figure 4

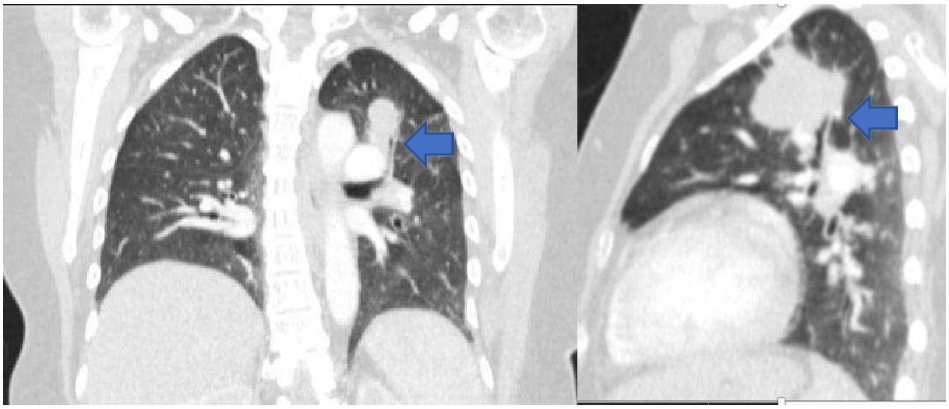

Figure 4. Female, 57 years with peripheral SCLC. Contrast enhanced chest CT coronal and sagittal section of lung window shows bronchial cutoff sign (+) (blue arrow)

From 30 samples, there was 1 type that showed type V with a CT scan feature in the form of a solid mass with punctate calcification in the mediastinum medius, without mediastinal lymphadenopathy, which seemed to be attached to the aortic arch and left pulmonary artery with indistinct boundaries, like figure 5.

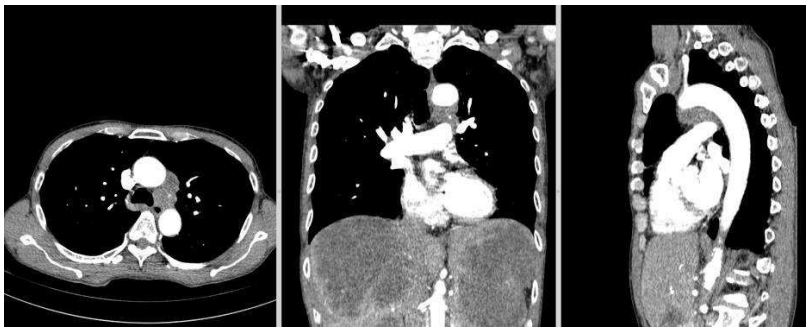

Figure 5. Male, 63 years old with Neuroendocrine Mediastinal Small Cell Carcinoma. Contrast enhanced chest CT axial, coronal and sagittal sections with the mediastinal window showed heterogeneous enhancement lesions in the arterial phase, irregular shape with punctate calcifications inside in the mediastinum medius, appearing to be attached to the aortic arch and left pulmonary artery. Metastases were seen in the right lobe of the liver

In this study, from 30 samples, approximately 60% (n = 18) of the samples proved to involve the airways, either involving one bronchus (main bronchus) or 2 or 3 bronchial segments with the most common type being type II b approximately 100% (n = 9). From this study, approximately 73.3% (n = 22) were shown to involve vessels with involvement of only pulmonal artery in 73.3% (n = 22), only the superior vena cava in 13.3% (n = 4) and combination of pulmonary artery and superior vena cava as much as 6.6% (n = 2).

DISCUSSION

In this study it was found that the incidence of SCLC was more dominant in men over 60 years old, but this study also found cases in women. In 1973 the incidence of SCLC was dominated by men, but in the last 20 years it has continued to decline, in 2002 the ratio of male and female patients with SCLC was 1: 1 (6).

SCLC is one of the cancers with the strongest association with tobacco and its prevalence tends to reflect that of smoking, with a time lag of about 30 years. Only 2% of SCLC cases occur in never-smokers (defined as lifetime smokers of less than 100 cigarettes), genetic factors are thought to play a minor role in the susceptibility to developing SCLC (1)

Although the understanding of the CT manifestations of NSCLC (non small cell lung carcinoma) has advanced, the CT findings of SCLC have not been sufficiently reported. In this study, SCLC was classified into 5 types based on location and mediastinal extension on contrast-enhanced chest CT scan using mediastinal window and lung in arterial phase. This classification of SCLC characteristics is easy and simple. In this study, the most common type found was type II b, the hillar mass with an ipsilateral mediastinal conglomerated mass as much as 30% (n = 9) (table 5.2). Type II cases were the most frequently found in this study about 43.3% (n=13), this number is almost the same as the frequency of type III events as much as 36.7% (n=11), especially the combination of hilar mass with conglomerated mediastinal mass as in type II b + III b + III c found as much as 63.3 % (n = 19). SCLC spreads mainly in the submucosa and peribronchovascular connective tissue and invades small vessels and lymphatics during its early stages.(4). These characteristics are in accordance with the results of this study, so that a hilar mass with a conglomerated mediastinal mass is a pattern of CT findings from SCLC that can be easily recognized. In addition, type IV, peripheral masses with or without lymphadenopathy were found in 13.3% (n=4), SCLC manifesting as peripheral nodules was rare, the incidence was less than 5%.(7).

From 4 cases of peripheral type SCLC, 75% (n = 3) showed a bronchial cutoff sign (+), the reasons that may be attributed to the fact that peripheral SCLC usually originates in the mucosa and grows along the submucosa layer (7).

Thus peripheral SCLC is easily invaded along with alveolar structures and peripheral bronchioles. Currently, no other publication has reported this sign in detail in peripheral SCLC. From 4 cases of peripheral SCLC in this study, approximately 25% (n = 1) showed a different feature in the form of a mass attached to the pleura with solid and necrotic components inside, lobulated edges, did not appear to show a bronchial cuttoff sign. This mass appears to be stuck to the pleura, and younger age, although there are studies that say there is a high incidence of SCLC occurs in younger patients (27-66 years) compared to other cancer patients (1).

In addition, men also accounted for the majority (75%) of peripheral SCLC cases in this study. This finding may be related to the fact that the majority of men smoke (6).

From 30 samples in this study, 1 patient (3.3%) was located in the mediastinum, without any features of lymphadenopathy, which was categorized as type V, which was only a mass in the mediastinum with or without lymphadenopathy. Primary Neuroendocrine Small Cell Carcinoma Mediastinum is a very rare form of malignancy. With only a few cases currently documented in the literature, the etiology itself is unknown, these tumors are aggressive, have high recurrence rates and often metastasize, making patient management difficult.in this study we found metastases in various locations, in the form of contralateral lung nodules, liver metastases and also the head. Primary Neuroendocrine Small Cell Carcinoma Mediastinum is reported to occur frequently in a male with an age of onset of 54 years. This case occurred in a 63 year old male. On CT, these lesions show invasion of adjacent tissue and appear irregular with ill-defined borders, homogeneous density and large areas of necrosis. In this study, 1 case of tumor showed a heterogeneous lesion with punctate calcification in it with a size of less than 3 cm, in the mediastinum medius, appearing to be attached to the aortic arch and pulmonary artery. Where a scattered image of punctate calcification was found which may be an important CT sign of this rare disease (9)

In this study we evaluated the involvement of the central airways, including the main, intermediate, and segmental lobar bronchi of each lobe. In general, SCLC tends to spread to the submucosa and peribronchovascular connective tissue, leading to loss of airways and underlying blood vessels. Endobronchial extension, which is common in squamous cell carcinoma, is seen less frequently, so airway obstruction is usually caused by compression of an expanding tumor rather than by intraluminal obstruction (4).

The most common types involving the bronchi are types II b and III b, hilar mass with a conglomerated mediastinal mass. This supports the spread of submucosal tumors from SCLC and suggests that involvement of the main airway and 2 or more bronchi is a characteristic feature of SCLC. From all the types in this study, only type IV and type V proved not to involve the bronchi.

Vascular invasion was evaluated in this study, as many as 86,6% (n = 26) cases involved vascular with involvement only pulmonal artery about 73,3% (n=26), only vena cava superior 13,3% (n=4) and combination of pulmonal artery and superior vena cava as much as 6,6% (n=2), the most involvement was pulmonal artery, which may be due to the pulmonary artery's proximal location from the central airway where the SCLC arises (4).

Conclusion

We classified 5 general types of SCLC according to location and mediastinal extension detail in chest CT. A recognazible special CT characteristic of SCLC was a central hilar tumor with a bulky mediastinal conglomerated mass. Most cases with hilar mass involving 2 or more bronchi with stenosis or obstruction and also vascular involvement especially pulmonal artery.

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Conflict of Interest

Nil

Abbreviations :

SCLC : Small Cell Lung Carcinoma; CT : Computer tomography; NSCLC :Non Small Cell Lung Carcinoma

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