Fluorodeoxyglucose Uptake in Advanced Non-small Cell Lung Cancer With and Without Pulmonary Lymphangitic Carcinomatosis

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Abstract. *Aim: To assess the correlation between advanced non-small cell lung cancer (NSCLC) with or without pulmonary lymphangitic carcinomatosis (PLC) and fluorodeoxyglucose (FDG) uptake and its effect on survival outcomes. Patients and Methods: We retrospectively reviewed 157 patients with NSCLC. The mean and maximum standardized uptake values (SUV_{mean} and SUV_{max}, respectively), metabolic tumor volume (MTV) and total lesion glycolysis (TLG) were evaluated for their effect on overall survival (OS) and progression-free survival (PFS). Results: The PLC group included 55 patients and the non-PLC group included 102 patients. The SUV_{mean}, SUV_{max}, MTV and TLG values were lower in the non-PLC group. In the PLC group, primary lung tumor TLG was a significant predictor of PFS, while whole-body TLG was found to be a significant predictor in non-PLC patients. Conclusion: Primary lung tumor TLG was a good predictor in PLC patients. Whole-body TLG could be a useful predictor only in patients without PLC.*

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Key Words: Lung cancer, pulmonary lymphangitic carcinomatosis, fluorodeoxyglucose, prognosis.

Pulmonary lymphangitic carcinomatosis (PLC) is defined as the dissemination of cancer into the lymphatic system in the lung. It is caused by cancer spreading from the pulmonary circulation into the interstitium of lung (1, 2). The invasion may be antegrade, spreading directly from the axial lymph node into the lung parenchyma, or retrograde, spreading from the lung periphery into the hilar lymph node (3). PLC may be localized to small areas of the lung or may be diffuse over larger areas and is often associated with advanced non-small cell lung cancer (NSCLC) (4).

The characteristic clinical diagnostic computed tomography (CT) features of PLC, which correlate with histopathologic findings, are an uneven thickening of the interstitial septa and bronchovascular bundles (5-7). The majority of studies using fluorodeoxyglucose-positron emission tomography (FDG-PET) in lung cancer patients have evaluated tumors and metastases based on the extent of FDG uptake, which correlates with tumor cell metabolism, measured by glucose uptake. High uptake reflects a high metabolic rate and increased tumor cell aggression. The degree of FDG uptake in tumors as seen on PET, which is determined by the mean standardized uptake value (SUV_{mean}), maximum standardized uptake value (SUV_{max}), metabolic tumor volume (MTV) and total lesion glycolysis (TLG), is useful for predicting overall survival (OS) and progression-free survival (PFS) in lung cancer patients (8-11). However, the interpretation of these FDG uptake parameters in PLC has not been fully established. To our knowledge, 3 small case series have investigated the use of PET/CT for the detection of PLC (12-14), whereas no previous reports describing the differences in TLG uptake between PLC-positive and PLC-negative cases exist.

The purpose of this study was to assess the correlation between advanced NSCLC with or without PLC and FDG-PET/CT uptake and to evaluate its effect on survival outcomes.

Patients and Methods

Patient population. We retrospectively reviewed the medical charts of all patients with histopathologically confirmed NSCLC who underwent FDG-PET/CT at our institution, prior to lung cancer treatment, between January 2007 and December 2012. The histopathological confirmation of diagnosis was made using body fluid cytology, CT-guided biopsy or operative specimens. The median follow-up period was 13.5 months; all patients were followed up until the end of study on 31 December 2013. The inclusion criteria were as follows: (i) no known history of cancer, (ii) lung cancer that was staged using the American Joint Cancer Committee (AJCC) 2002/2010 criteria (5-7), (iii) the patient was evaluated according to institutional guidelines and (iv) the patient received subsequent clinical follow-up at our institution. The pretreatment work-up consisted of Eastern Cooperative Oncology Group (ECOG) performance status evaluation, clinical and physical examination, complete blood counts and biochemistry tests. The imaging studies included chest CT, chest radiography, brain magnetic resonance imaging (MRI)/CT and bone scintigraphy. Exclusion criteria were as follows: (i) no histopathologically confirmed NSCLC, (ii) a diagnosis of small cell carcinoma or bronchial adenoma, (iii) no FDG-PET/CT imaging prior to therapy, (iv) a history of cancer, (v) lung cancer not staged according to AJCC 2002/2010 criteria, (vi) lung cancer that was not diagnosed according to institutional guidelines, (vii) no subsequent clinical follow-up at our institution, (viii) administration of a steroid before the FDG-PET/CT examination and (ix) active tuberculosis, interstitial lung disease, pulmonary edema, opportunistic infection, radiation fibrosis and autoimmune disease/drug-induced lung disease.

Image analyses. CT scans were obtained according to the manufacturers' protocol using a General Electric HighSpeed or LightSpeed scanner (General Electric Medical Systems, Milwaukee, WI, USA). Intravenous contrast agent (100 ml) containing 300 mg/ml ioxilan was administered at a rate of 2 ml/s. Mediastinal (window width=350 Hounsfield units (HU), window level=40 HU) and lung (window width=1,500 HU, window level=2,600 HU) CT scans were obtained using a picture archiving and communication system (PACS). We retrospectively determined the presence of septal lines, bronchovascular thickening, ground-glass opacities, pulmonary nodules, lymphadenopathy and pleural effusions.

On chest CT images, if a primary lung cancer was noted, PLC was identified as uneven thickening of bronchovascular bundles, broad interstitial septal lines and a polygonal pattern in the interstitium. PLC was defined as diffuse if areas of the whole lung were involved and focal if localized to an interstitial line of one lung lobe. Other associated findings, such as lymphadenopathy, pleural effusion and nodules were also recorded (15). Two radiologists with 10 and 8 years of experience, respectively, independently assessed the images to diagnose PLC. Disagreements were resolved by discussion to reach a consensus interpretation.

Analysis of tumor volume in FDG-PET/CT. We used Volume Viewer software on a GE Advantage Workstation 4.4 (GE Healthcare, Milwaukee, WI, USA) to measure the tumor volume, which delineated the volume of interest using an automated SUV to provide an isocontour threshold. PET/CT parameters SUV_{max}, SUV_{mean} and MTV were recorded. MTV was defined as the total computed tumor volume greater than the threshold SUV baseline as compared with the mediastinal background. SUV_{mean} values plus 2 standard deviations are shown. The TLG was calculated from the product of MTV and SUVmean. These PET parameters were examined for normality and skewness, while log-squared transformation was applied to the skewed variables SUV_{max}, MTV and TLG (16-18).

The study was approved by the Human Research Ethics Committee of our institution (Buddhist Tzu Chi General Hospital, Dalin; B10201023), with the need for informed consent being waived because of the retrospective nature of the study.

Statistical analyses. PFS was defined as the period extending from the date of FDG-PET imaging until disease recurrence or final follow-up and OS was defined as the period extending from the date of FDG-PET imaging until death or final follow-up.

For SUV_{mean}, SUV_{max}, MTV and TLG, we selected cut-off values that maximized the profile partial likelihood in the Cox regression model. These were treated as binary explanatory variables, with their cut-off values determining positive or negative results. Patients were classified into low/high PET volume parameter groups for the whole-body and primary lung tumor, as described in previous volume parameter studies (19, 20). Accordingly, the cut-off values for the primary lung tumor were determined as 21.60 for SUVmean, 31.25 for SUV_{max}, 47.00 for MTV, and 330.00 for TLG. Those for the whole-body were determined as 22.00 for SUV_{mean}, 41.25 for SUV_{max}, 30.82 for MTV and 383.29 for TLG.

Table I. *Patients' clinicopathological characteristics*.

Characteristic	n
Gender, n	
Male	94
Female	63
Age, years (mean±SD)	63.12±11.23
Smoking, n	
Non-smoker or ex-smoker	96
Current smoker	61
ECOG performance status, n	
0	103
1 or 2	54
Histology, n	
Adenocarcinoma	110
Non-adenocarcinoma	47
Lymphangitic carcinomatosis, n	55
Focal	30
Diffuse	25
Non-lymphangitic carcinomatosis 102	
Treatment, n	
Chemotherapy	112
Radiation/chemoradiation	45
PFS, months (mean±SD)	7.52±3.34
OS, months (mean±SD)	16.23±12.54

Mean±SD, mean value±standard deviation; ECOG, Eastern Cooperative Oncology Group; OS, overall survival; PFS, progression-free survival.

Table II. *Clinical factors and positron emission tomography data associated with and without pulmonary lymphangitic carcinomatosis in advanced non-small cell lung cancer patients.*

Factor	PLC	non-PLC	*p*-Value
Age (mean±SD), years	62.06±11.21	61.25±12.18	0.61
Gender, n			0.57
Male	33	71	
Female	22	31	
Tumor size			0.63
≤3 cm	37	30	
>3 cm	63	27	
Histology, n	82	75	0.59
(Adeno vs. Non-adeno.)			
Adenocarcinoma	52	58	
(Moderate/Poor vs. Well)			
Well Differentiation	10	10	
Moderate Differentiation	16	12	0.32
Poor Differentiation	26	36	0.55
Non-adenocarcinoma	30	17	
(Moderate/Poor vs. Well)			
Well Differentiation	6	5	
Moderate Differentiation	7	50	0.63
Poor Differentiation	17	7	0.45
ECOG, n			0.69
0	39	71	
1 or 2	16	31	
Treatment, n			0.19
Chemotherapy	41	71	
Radiation/chemoradiation	14	31	
PET measurement (mean±SD)			
Primary lung			
SUVm	45.00±10.60	29.88±3.64	0.15
SUV_{max}	68.84±16.87	45.25±5.75	0.10
MTV	35.20±1.80	16.03±2.84	0.06
TLG	1638.40±413.20	510.88±119.70	0.04
Whole-body			
SUVm	40.20±9.32	26.52±3.71	0.13
SUV_{max}	68.84±16.87	49.72±6.25	0.16
MTV	269.79±24.09	54.51±5.89	0.05
TLG	2277.12±722.77	843.94±62.28	0.01
OS median, range	9.25(8.53-12.31)	11.10(4.12-21.68)	0.05
PFS median, range	3.1(2.62-4.48)	6.23(1.29-13.87)	0.03

PLC, Pulmonary lymphangitic carcinomatosis; PET, positron emission tomography; ECOG, Eastern Cooperative Oncology Group performance status; SUVm, mean standardized uptake value; SUV_{max}, maximum standardized uptake value; MTV, metabolic tumor volume; TLG, total lesion glycolysis; OS, overall survival; PFS, progression-free survival. Statistical significance at $p<0.05$.

Table III. *Tumor size and histology associated with fluorodeoxyglucose (FDG) uptake in advanced non-small cell lung cancer patients.*

Factor	SUV_{mean}	SUV_{max}	MTV	TLG
Tumor size				
<3 cm	34.66±15.33	52.47±22.95	23.00±18.12	704.20±742.7
>3 cm	27.16±12.86	53.07±21.60	44.85±21.13	1180.09±961.29
Histology (n)				
Adenocarcinoma				
Well-differentiated	20.16±15.06	30.12±21.74	19.50±25.60	477±256.1
Moderately-differentiated	33.64±23.22	49.12±32.76	21.31±20.45	917.27±395.17
Poorly-differentiated	35.27±21.13	52.65±31.07	30.06±24.81	1525.41±646.46
Non-adenocarcinoma				
Well-differentiated	29.89±21.35	45.62±33.71	23.71±17.96	1129.18±608.42
Moderately-differentiated	26.32±21.90	33.90±20.31	50.58±36.96	1465.85±574.30
Poorly-differentiated	29.12±21.81	63.49±43.06	91.86±31.61	1889±674.08

*p-value >0.05. SUV_{mean}, mean standardized uptake value; SUV_{max}, maximum standardized uptake value; MTV, metabolic tumor volume; TLG, total lesion glycolysis.

Table IV. *Predictions of OS and PFS based on clinical factors and PET measurements in NSCLC patients with and without pulmonary lymphangitic carcinomatosis.*

Items	PLC (n=55)				Non-PLC (n=102)			
	OS, months	*p*-Value	PFS, months	*p*-Value	OS, months	*p*-Value	PFS, months	*p*-Value
Clinical factors								
Age		0.003		0.22		0.06		0.004
≤65 years	11.94		9.88		14.93		9.95	
>65 years	9.56		8.87		10.92		5.86	
Gender		0.53		0.20		0.08		0.14
Female	14.90		11.75		13.15		8.59	
Male	9.47		7.47		13.52		6.55	
Histology		0.19		0.13		0.48		0.18
Adenocarcinoma differentiation	11.85	0.21	9.63	0.12	13.57	0.35	8.04	0.56
Well-differentiated	13.62		8.61		12.58		7.63	
Mod/poor differentiated	9.52		7.96		11.95		6.99	
Non-adenocarcinoma differentiation	17.95	0.36	4.73	0.74	13.38	0.63	7.98	0.25
Well-differentiated	15.32		6.21		11.38		8.50	
Mod/poor differentiated	13.52		4.89		12.66		6.96	
ECOG PS		0.47		0.71		0.89		0.15
0	12.24		10.15		14.13		7.34	
1-2	12.09		5.96		13.27		5.98	
Treatment		0.0015		0.002		0.0031		0.0016
Chemotherapy	15.51		10.82		6.80		4.31	
Chemoradiotherapy	10.11		8.32		13.02		3.38	
PET measurements								
Primary lung tumor								
SUV_{mean}[a]		0.12		0.59		0.43		0.21
Low	14.03		7.50		12.81	8.43		
High	13.18		7.11		9.38	5.12		
SUV_{max}[b]		0.61		0.06		0.23		0.06
Low	13.33		9.29		13.33		7.75	
High	12.75		8.00		9.25		5.18	
MTV[c]		0.52		0.81		0.60		0.26
Low	13.87		6.81		12.63		10.21	
High	12.51		4.26		11.66		8.35	
TLG[d]		0.07		0.04		0.32		0.06
Low	14.85		11.78		12.93		6.13	
High	13.01		7.35		11.48		4.90	
Whole-body								
SUV_{mean}[e]		0.65		0.56		0.22		0.07
Low	13.46		9.16		14.12		10.51	
High	13.78		6.47		9.35		6.37	
SUV_{max}[f]		0.58		0.07		0.09		0.05
Low	14.70		8.18		12.93		9.83	
High	13.36		7.19		10.50		5.19	
MTV[g]		0.12		0.64		0.21		0.14
Low	14.07		9.32		12.96		9.96	
High	9.90		7.06		11.51		8.39	
TLG[h]		0.08		0.05		0.01		0.00
Low	12.24		10.26		14.06		8.15	
High	16.92		6.38		8.33		4.21	

Data were analyzed using the Mann-Whitney test. PLC, Pulmonary lymphangitic carcinomatosis; PET, positron emission tomography; ECOG, Eastern Cooperative Oncology Group performance status; SUV_{mean}, mean standardized uptake value; SUV_{max}, maximum standardized uptake value; MTV, metabolic tumor volume; TLG, total lesion glycolysis; OS, overall survival; PFS, progression-free survival. Statistical significance at $p<0.05$. [a]SUV_{mean} greater than the cut-off of 21.60 *vs.* less than or equal to the cut-off of 21.60. [b]SUV_{max} greater than the cut-off of 31.25 *vs.* less than or equal to the cut-off of 31.25. [c]MTV greater than the cut-off of 47.00 *vs.* less than or equal to the cut-off of 47.00. [d]TLG greater than the cut-off of 330.00 *vs.* less than or equal to the cut-off of 330.00. [e]SUV_{mean} greater than the cut-off of 22.00 *vs.* less than or equal to the cut-off of 22.00. [f]SUV_{max} greater than the cut-off of 41.25 *vs.* less than or equal to the cut-off of 41.25. [g]MTV greater than the cut-off of 30.82 *vs.* less than or equal to the cut-off of 30.82. [h]TLG greater than the cut-off of 383.29 *vs.* less than or equal to the cut-off of 383.29.

OS and PFS were calculated using the Kaplan-Meier method and groups were compared using the log-rank test. A multivariate analysis was performed using the Cox proportional hazards model to assess joint effects of the following variables on OS and PFS: age, sex, ECOG performance status, histology, treatment modality, SUVmean, SUV_{max}, MTV and TLG (relating to the primary tumor).

Results

Patients' characteristics. A total of 346 patients with histopathologically confirmed NSCLC were identified. A total of 157 patients met the inclusion criteria. The clinicopathological characteristics of patients are listed in Table I.

FDG-PET uptake in patients with and without PLC. Associations of PLC with clinical factors or PET measurements are shown in Table II and Table III. No clinical factors were significantly different between PLC and non-PLC groups. PET measurements were lower in the non-PLC group than in the PLC group, although only primary lung tumor TLG and whole-body TLG were significantly different between the groups with or without PLC (p=0.04 and p=0.01, respectively). In addition, tumor differentiation status and size were not significantly associated in between the groups with or without PLC. Survival analysis showed that the non-PLC group had longer median PFS and OS compared to the PLC group (p=0.03 and p=0.05, respectively).

Prognostic value of clinical factors and FDG uptake on survival. Clinical factors, such as age (>65 *vs*. <65 years) and treatment modality (chemotherapy *vs*. radiation/chemoradiation), were significantly associated with OS or PFS in the PLC and non-PLC groups (Table IV).

In patients with PLC, whole-body scan values of SUV_{mean}, SUV_{max} and MTV were not significant prognostic factors. In contrast, in these patients, whole-body TLG and primary lung tumor TLG were significant prognostic factors for PFS. In patients without PLC, only whole lung TLG was a significant prognostic factor for PFS and OS, whereas whole-body SUV_{max} was a significant prognostic factor for PFS (Table V).

According to Kaplan-Meier estimates, in the PLC group, primary lung tumor TLG was significantly associated with PFS but not OS. In contrast, in the PLC group, whole-body TLG was not associated with survival (Figure 1). In the non-PLC group, primary lung tumor TLG was not associated with PFS or OS; however, whole-body TLG was significantly associated with both PFS and OS (Figure 2).

Table V. *Association between OS and PFS in the PLC and non-PLC groups analyzed by Cox regression analysis*.

Groups/factors	Overall survival		Progression-free survival	
	HR (95% CI)	*p*-Value	HR (95% CI)	*p*-Value
PLC GROUP				
Age	1.36 (0.68-5.32)	0.54	2.46 (1.25-6.76)	0.12
Gender	1.31 (0.75-2.99)	0.46	2.41 (1.80-5.48)	0.24
Tumor size	0.57 (0.45-2.39)	0.52	0.89 (0.65-1.58)	0.36
Histology	2.05 (0.52-4.67)	0.31	0.98 (0.48-2.65)	0.97
Grade	1.58 (0.54-2.36)	0.21	2.11 (0.64-3.02)	0.56
ECOG PS	0.96 (0.42-2.72)	0.79	1.78 (1.94-4.13)	0.08
Treatment	3.22 (2.07-6.78)	0.05	2.25 (1.64-8.49)	0.03
PET measurements				
Primary lung tumor				
SUV_{mean}	1.12 (0.16-4.45)	0.21	1.24 (0.23-4.08)	0.10
SUV_{max}	2.61 (0.82-7.00)	0.06	4.63 (0.79-7.37)	0.05
MTV	1.06 (0.57-1.42)	0.46	1.12 (0.75-2.94)	0.68
TLG	3.24 (0.63-6.69)	0.32	4.18 (2.05-6.74)	0.00
Whole-body				
SUV_{mean}	1.71 (0.67-5.22)	0.42	1.21 (0.31-5.11)	0.21
SUV_{max}	0.83 (0.15-6.48)	0.29	0.18 (0.05-2.11)	0.34
MTV	2.13 (0.45-1.48)	0.43	8.92 (0.96-5.78)	0.26
TLG	4.31 (1.22-1.25)	0.56	3.32 (1.72-8.19)	0.06
Non-PLC GROUP				
Age	2.41 (0.78-8.52)	0.05	3.31 (0.74-12.34)	0.71
Gender	3.71 (2.39-11.29)	0.10	2.46 (0.75-7.46)	0.32
Tumor Size	1.07 (0.23-1.54)	0.41	1.62 (0.42-1.72)	0.12
Histology	0.52 (0.06-2.20)	0.35	3.45 (1.04-6.59)	0.51
Grade	0.98 (0.32-1.45)	0.11	1.22 (0.41-1.32)	0.38
ECOG PS	3.19 (0.97-6.87)	0.35	1.56 (0.33-3.21)	0.24
Treatment	1.95 (0.81-4.72)	0.13	1.31 (0.93-3.24)	0.07
PET measurements				
Primary lung tumor				
SUV_{mean}	1.95 (0.24-13.51)	0.51	2.75 (0.78-4.71)	0.08
SUV_{max}	2.61 (0.64-12.30)	0.42	1.44 (0.81-5.39)	0.31
MTV	0.95 (0.53-2.37)	0.81	0.76 (0.07-1.75)	0.25
TLG	1.75 (0.32-5.74)	0.60	2.54 (0.68-4.51)	0.17
Whole-body				
SUV_{mean}	2.78(1.89-11.50)	0.19	1.40 (0.92-13.59)	0.32
SUV_{max}	1.15(0.25-4.56)	0.86	0.59 (0.05-2.35)	0.92
MTV	3.62(0.89-2.36)	0.12	2.79 (1.52-11.85)	0.17
TLG	2.21(1.35-2.75)	0.04	4.13 (2.12-14.23)	0.01

PLC, Pulmonary lymphangitic carcinomatosis; PET, positron emission tomography; ECOG PS, Eastern Cooperative Oncology Group performance status; SUV_{mean}, mean standardized uptake value; SUV_{max}, maximum standardized uptake value; MTV, metabolic tumor volume; TLG, total lesion glycolysis; HR, hazard ratio; CI, confidence interval. Statistical significance was considered at p<0.05.

Discussion

Various neoplasms can cause PLC, although the most common cause is lung cancer (20, 21). PLC is associated with the movement of tumor emboli into the adjacent vessels or lymphatics. The engorgement of the lymphatics may compress the adjacent pulmonary vessels and blockage of the lymphatic system can cause the lymphatic bed surrounding the alveoli to become stiff, increasing the workload of the lungs and the breathing rate, which can lead to profound dyspnea in NSCLC patients with PLC. It is believed that tumor emboli account for the poor prognosis in advanced NSCLC patients with PLC (22, 23).

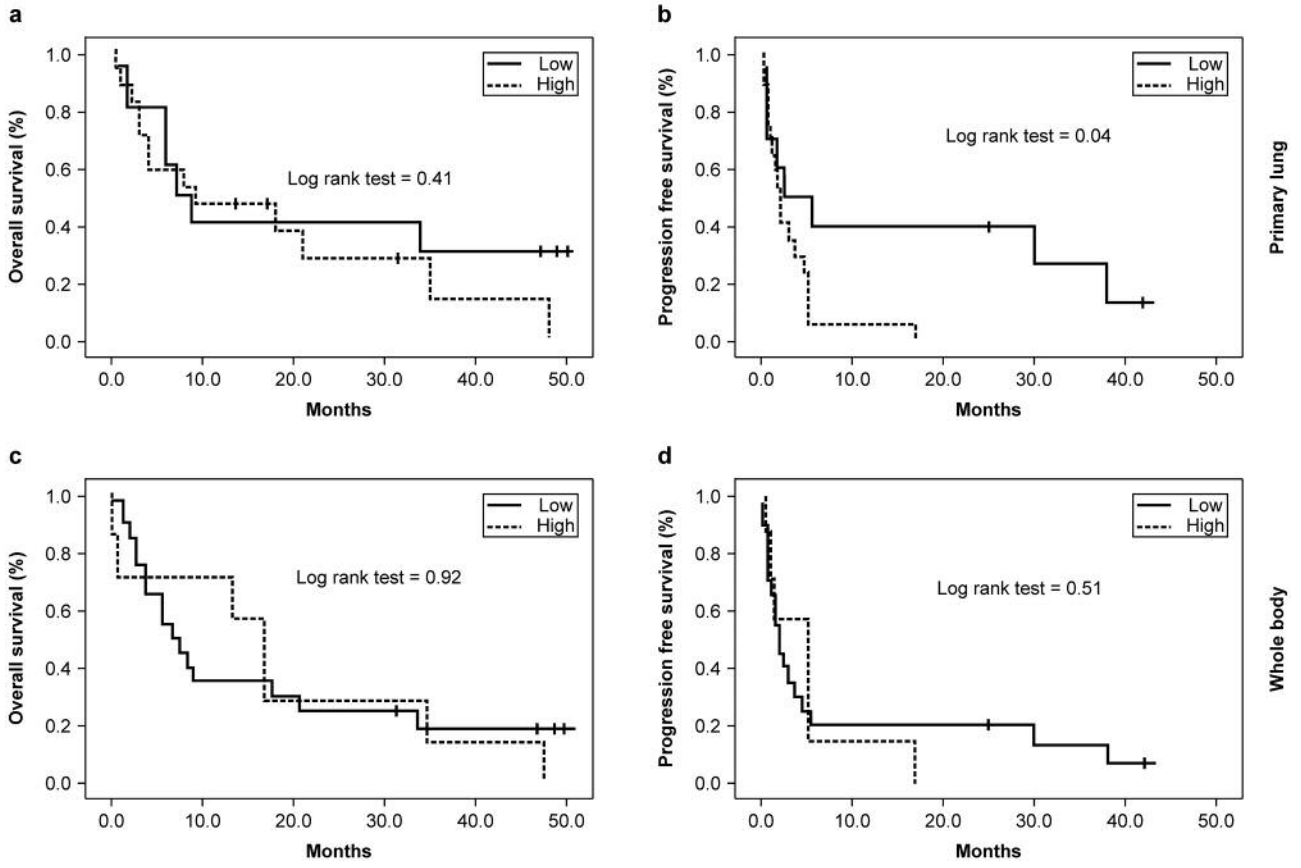

Figure 1. *Kaplan–Meier estimates of OS and PFS for the PLC group. (a) OS in the PLC group did not correlate with primary lung TLG (log rank test, p=0.41) (b) PFS in the PLC group correlated with primary lung TLG (log-rank test, p=0.04). (c) OS in the PLC group did not correlate with whole-body TLG (log-rank test, p=0.92). (d) PFS in the PLC group did not correlate with whole body TLG (log-rank test, p=0.51). OS, Overall survival; PFS, progression free survival; PLC, pulmonary lymphangitic carcinomatosis; TLG, total lesion glycolysis.*

The current study showed that increased diffuse FDG uptake in the lungs correlated with the CT pattern of PLC, that was concordant with previous studies (12-14). For example, Digumarthy *et al*. showed that the FDG uptake pattern in 7 patients with PLC was the same as that on chest CT (14).

To our knowledge, there have been no prior publications reporting MTV, TLG or SUV_{max} in advanced NSCLC patients with PLC. Although Prakash *et al*. reported that the SUV_{mean} in patients with PLC was significantly greater than that in patients without PLC (12), the authors analyzed SUV_{mean} alone. Recent studies have demonstrated that MTV, TLG and SUV_{max} are significantly better predictors than SUV_{mean} (24-26). In the current study, FDG uptake values (SUV_{mean}, SUV_{max}, MTV and TLG) were lower in patients without PLC. In addition, there was a significant difference in primary lung tumor and whole-body TLG between patients with or without PLC. Primary lung tumor TLG was a predictor of PFS in patients with PLC, whereas whole-body TLG was a predictor of PFS and OS in patients without PLC.

Prognostic factors of lung cancer have been studied extensively, including clinical factors, such as tumor stage, age, treatment and ECOG performance status (27-29). In the current study, clinical factors, such as age and treatment modality, were significantly associated with OS or PFS in both the PLC and non-PLC groups. However, treatment modality was the only significant predictor of OS among patients with PLC.

This study has several limitations. First, we used a percentage threshold (*i.e*. 50% of SUV_{max}) to compute the tumor volume; we compared the value with the background of fused CT images, irrespective of whether any adjustment of the threshold was needed (30, 31). The choice of this threshold influences the tumor volume measurements; however, there is no consensus on how to delineate tumor volume and, thus, validation of this method is needed for future studies. Second, inflammation, especially in granulomatous changes, could also affect FDG uptake in the lung. However, to minimize this, we excluded any patients

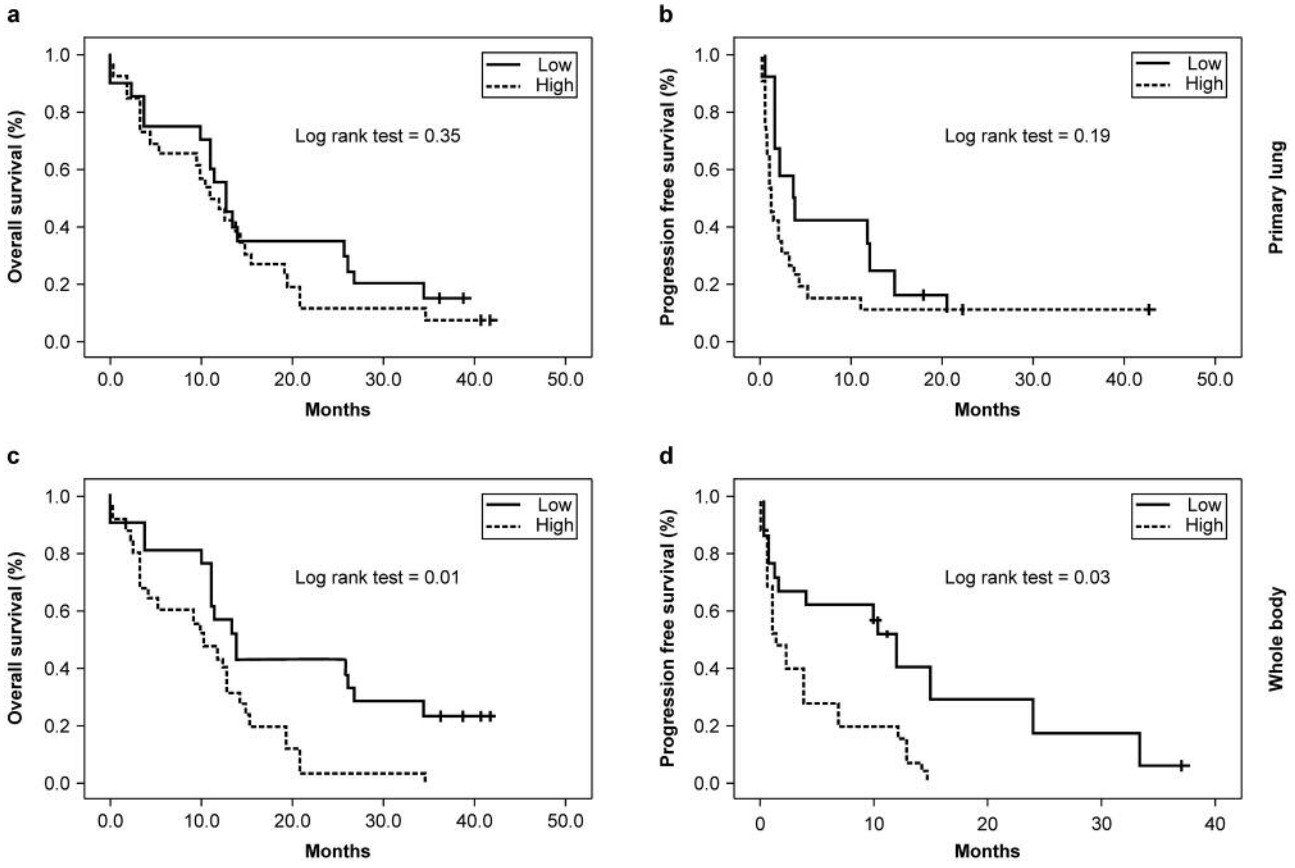

Figure 2. *Kaplan–Meier estimates of OS and PFS for the non-PLC group. (a) OS in the non-PLC group did not correlate with primary lung TLG (log rank test, p=0.35). (b) PFS in the non-PLC group did not correlate with primary lung TLG (log rank test, p=0.19). (c) OS in the non-PLC group correlated with whole lung TLG (log-rank test, p=0.01). (d) PFS in the non-PLC group correlated with whole lung TLG (log-rank test, p=0.03). OS, Overall survival; PFS, progression free survival; PLC, pulmonary lymphangitic carcinomatosis; TLG, total lesion glycolysis.*

with active tuberculosis, interstitial lung disease, pulmonary edema, opportunistic infection, radiation fibrosis or drug-induced lung disease. Third, this was a retrospective study with a limited number of patients. A further large, prospective, randomized, multicenter study is needed to validate the findings of this report.

Conclusion

In conclusion, the data suggest that an assessment of primary lung tumor TLG would be useful for predicting among patients with PLC. However, whole-body TLG could be useful for predicting only in patients without PLC. The different risk group (PLC or non-PLC) should be having a different predicting tool.

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