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Clinical and computed tomography findings in Chinese lung cancer patients with HIV infection: A multi-center study

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Keywords
Acquired immunodeficiency syndrome, computed tomography, human immunodeficiency virus, lung cancer.

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Abstract

Background: The study was conducted to investigate clinical and computed tomography (CT) features in Chinese lung cancer patients with human immunodeficiency virus (HIV).

Methods: Forty consecutive lung cancer patients with HIV were included. Clinical data were collected, and CT features were reviewed and measured. The factors associated with stages of cancer and the CT features with opportunistic pulmonary infections (OPIs) were also analyzed.

Results: Thirty-four of the patients were men (85%), and the mean age was 57.5 years. The mean CD4 count was 288 cells/μL, and 23 patients received highly active antiretroviral therapy. OPIs were common (50%). The major histological type (85%) was non-small cell lung cancer (NSCLC), and 15 NSCLC patients (44%) were in stages IIIb and IV. NSCLC patients with an OPI were more common in the advanced stages compared with those without an OPI ($P = 0.04$). There were no significant differences in advanced and non-advanced stages in terms of CD4 level, highly active antiretroviral therapy, and smoking ($P = 0.31$, $P = 1.00$; $P = 0.49$, respectively). The average size of tumors was 4.5 cm. Irregularly shaped or larger sized tumors were associated with OPIs ($P = 0.03$, $P = 0.04$, respectively).

Conclusions: The persistence of locally irregular and large lesions in middle-aged men with HIV and a history of OPIs should be an alert for lung cancer, and clinical management is needed.

Introduction

Morbidity and mortality associated with opportunistic infection in patients with human immunodeficiency virus (HIV)/acquired immunodeficiency syndrome (AIDS) has dramatically decreased since the introduction and the extensive application of highly active antiretroviral therapy (HAART) in the last two decades.[1,2] Morbidity and mortality has also decreased in AIDS-defining cancers (ADCs), such as Kaposi's sarcoma (KS), Non-Hodgkin's lymphoma (NHL), and cervical cancer.[3,4] The life expectancy of these patients has been extended, and their quality of life has been ameliorated. However, the incidence of non-AIDS-defining cancers (NADCs), such as lung cancer, melanoma, anal cancer, hepatocellular carcinoma, and Hodgkin's lymphoma,[5] has recently increased in these patients[6–8] and is significantly higher than that of the general population.[9] It was estimated that half of the cancers of this population were NADCs.[10] Lung cancer was the most prevalent type of cancer,[7,10–15] and the incidence in this population was approximately two to four times higher than that of the general population.[9] In addition, lung cancer affects younger patients in this population with more advanced

stages and a poorer overall survival rate compared with the general population.[16]

In China, although relevant data are limited, a retrospective study reported that 7.7% of hospitalized patients had concurrent cancers, and 66.4% of them had NADCs (13% with lung cancer).[17] Our center (a designated hospital for HIV/AIDS care of the Shanghai Municipal Commission of Health and Family Planning) has also recently witnessed an increasing trend in NADCs, particularly lung cancer. Moreover, an early diagnosis of lung cancer was mostly delayed in the setting of an opportunistic pulmonary infection (OPI), and low clinical suspicion might be a factor.[18] There were 437 000 people living with HIV/AIDS in China by 2014, as a result of the availability of HAART and subsequent prolongation of survival.[19] Therefore, our study purpose was to obtain early diagnostic clues by reviewing the clinical and radiological features of lung cancer in the population and, consequently, improve patient prognosis with timely intervention.

Methods

Medical records

We reviewed the medical records of patients with lung cancer and HIV infection confirmed by histology and the local Centers for Disease Control and Prevention from three hospitals during November 2011 and April 2016. A total of 40 consecutive patients were included for further demographic analyses (e.g. age at diagnosis, gender), chief complaints, smoking history, HIV-1 viral loads, CD4+ T cell counts, HAART duration, OPIs, histological types, and stages.

Staging was based on either the International Association for the Study of Lung Cancer (IASLC, 7th edition) tumor node metastasis (TNM) classification for NSCLC or Veterans Administration Lung Study Group (VALSG) criteria for limited disease and extensive disease for small cell lung cancer (SCLC).[20,21] Pathological staging was utilized in patients who received surgery, while clinical staging was used for patients who had not undergone surgery. Chinese guidelines for the diagnosis and treatment of primary lung cancer were referred to in the management.[22]

All procedures were conducted in accordance with the ethical standards of the responsible committee on human experimentation in the three hospitals, and with the Helsinki Declaration of 1975 (revised 2008). Informed consent was obtained from all included patients or an immediate family member if they had died.

Chest computed tomography (CT)

Computed tomography scans were performed using various scanners (Siemens Sensation 16, Siemens Medical Systems, Forcheim, Germany; Hitachi Scenaria 64, Hitachi Medical Systems, Tokyo, Japan). The patients were examined in the supine position with their arms extended overhead. Scans were obtained at 5 mm intervals from the thoracic inlet to the inferior of the adrenal gland with a suspension after the end of inspiration. The parameters were as follows: tube voltage 120 or 140 kV; tube currency 160–250 mA; gantry rotation time 0.5 seconds; collimation 16 × 0.75 mm, 64 × 0.625 mm; pitch 1 or 1.0781; field of view (FOV) 350 mm; matrix 512 × 512; and slice thickness/interval 5 mm/5 mm. Contrast-enhanced scans were performed 40 seconds after iohexol (Shuangbei 100 mL: 35 g [I], Beilu Pharmaceutical Co. Ltd., Beijing, China) was injected via the cubital vein at a rate of 2.5–3 mL/second and a total volume of 70–90 mL. Reconstruction images were obtained in 1 mm slice thicknesses at 0.5 mm intervals and a 150 mm FOV on the targeted region using a lung standard algorithm.

The CT scans were blindly reviewed and interpreted by two thoracic radiologists with seven and 15 years of experience in diagnostic chest imaging, via the Picture Archiving and Communication System (PACS, UniRISC, DJ HealthUnion, Shanghai, China). If there was any disagreement, consensus was achieved through discussion. The evaluation included tumor location (lobar distribution); size (the maximal diameter on the transverse section); shape (irregular or regular [round or oval]); intensity (homogeneous or heterogeneous); adjacent obstructive pneumonia/atelectasis (increased attenuation accompanying a reduced volume of the adjacent affected lung);[23] pleural indentation, thickening, or effusion; adenopathy (mediastinal, hilar and axillary nodes with short axes of at least 1 cm);[24] and enhancement after the administration of contrast materials.

Clinical impressions from determinate benign, likely benign, indeterminate, likely malignant, to determinate malignant were made. A misdiagnosis was defined as an impression of indeterminacy, likely, or determinate benignity.

Statistical analysis

Statistical analysis was performed by STATA (version 12.0; Statacorp; Houston, TX, USA) using a Mann–Whitney test for CD4+ cell counts, an unpaired *t*-test for tumor size, and a Fisher's exact test for the categorical data (i.e. proportion of HAART, smoking, and OPI with different stages; proportion of tumor with clear borders, regular shape, pleural changes, hydrothorax, and adenopathy with OPI). A two-tailed *P* value of less than 0.05 indicated a significant difference.

Results

Clinical findings

The clinical data of patients with lung cancer and HIV are displayed in Table 1. Most of the patients were men (85%, 34/40). The mean age at diagnosis was 57.5 years (range 40–77). Seven patients complained of bloody phlegm, seven complained of chest pain, 21 experienced cough (4/21 had accompanied expectoration), five complained of chest tightness, seven had no symptoms, and one patient experienced fatigue only. Eighteen patients (45%, 18/40) had a history of smoking, with a mean consumption of 50 pack-years (range 15–160), and all were men.

Twenty patients (50%, 20/40) had an OPI before the diagnosis of lung cancer: eight patients had tuberculosis (TB), five had a fungal infection (FI), two had *Pneumocystis carinii* pneumonia (PCP), one had both non-tuberculosis mycobacteria (NTM) and TB, two had both TB and an FI, one had both NTM and an FI, and one patient had both TB and PCP.

An HIV-1 viral load was available for 21 patients ranging from under the lower limits of detection (<40 copies/mL) to 90 900 copies/mL. The mean CD4+ T cell count was 288 cells/μL (range 8–641 cells/μL; normal lower limits of 410 cells/μL in our laboratory) within one month of the diagnosis of lung cancer. Twenty-three patients received HAART, with a mean duration of 40 months (range 2–168) at diagnosis.

Histological type was based on either tissues or cells from percutaneous fine needle aspiration under CT guidance (21 patients), bronchoscopic biopsy (8 patients) and resected specimen (7 patients), or on hydrothorax (4 patients). Thirty-four patients (85%, 34/40) were confirmed with NSCLC: 21 with adenocarcinoma, 10 with squamous cell carcinoma, and three with large cell carcinoma (1 patient with neuroendocrine). Five patients had SCLC, and one patient had an atypical carcinoid.

Fifteen patients (44.1%, 15/34) with NSCLC were in advanced stages (14 at stage IV, 1 at stage IIIb), while the remaining 19 patients were in stages I–IIIa (8 at stage Ia, 3 at stage Ib, 3 at stage IIa, 1 at stage IIb, and 4 at stage IIIa). Two patients with SCLC had limited disease, and three had extensive disease.

Six patients received positron emission tomography–CT (PET-CT) scans before surgery and chemotherapy. The remaining 34 patients were evaluated by other imaging modalities (e.g. ultrasound, contrast-enhanced magnetic resonance imaging, and CT scan) for possible remote metastases.

Seventeen patients underwent surgery (10 radical resection, 4 lobectomy, 3 wedge resection); 15 patients received chemotherapy (14 in stage IV, 1 with poor pulmonary function in stage IIIa ineligible for surgery). Eight patients were not treated with either surgery or chemotherapy: three had a poor overall general condition, one died from a severe pulmonary infection before treatment, and four patients refused treatment.

Factors associated with stages

Eight NSCLC patients in advanced stages had a history of smoking (53.3%, 8/15), while seven in non-advanced stages had a history of smoking (36.8%, 7/19). Smoking history did not differ between the advanced and non-advanced stage groups ($P = 0.49$). Out of the 15 NSCLC patients at advanced stage, 10 (66.7%, 10/15) had a previous OPI, while six (31.6%, 6/19) with non-advanced stages had a previous OPI. An OPI was more common in NSCLC patients at advanced stage ($P = 0.04$). The mean CD4+ T cell count of the advanced NSCLC patients did not differ from that of the non-advanced NSCLC patients (313 vs. 255 cells/μL; $P = 0.31$). Of the 20 patients receiving HAART before a lung cancer diagnosis, nine were at advanced stages (45%, 9/20), and no difference was observed between the stages for patients treated with or without HAART ($P = 1.00$) (Table 2).

CT findings

Most of the lung cancers (80%, 32/40 patients) were in lobar distribution: 10 in the right upper lobes, 10 in the right lower lobes, seven in the left upper lobes, four in the left lower lobes, and one in the right middle lobe. One squamous cell carcinoma was located within the middle segmental bronchus, and one was located in the right hilum. One Pancoast tumor was located in the right apex with adjacent rib destruction. One multiple metastatic adenocarcinoma was scattered in different lobes. The remaining four tumors were indeterminate: one was possibly from the right upper lobe, one might have been from the right hila, and two might have been from the left hila.

The majority of lung cancers with clear borders were round or oval (71%, 22/31 tumors; 16 with lobulation, 13 with spiculation), and the remaining nine tumors manifested as irregular masses (8 tumors) or an irregular thickening cavity (1 tumor). The average size of the lung cancers with clear borders was 4.5 cm (range 0.4–12 cm), and the density of these tumors was mostly heterogeneous (80.6%, 25/31 tumors). Fifteen patients received contrast CT scans with obvious heterogeneous enhancement of the tumor after contrast administration (increased enhancement >15 HU).

Obstructive pneumonia/atelectasis distal to the tumor was frequent (65%, 26/40 patients). Adenopathy was quite

Table 1 Clinical data of 40 patients with lung cancer and HIV infection

Case No./ Gender/Age	CC	Smoking (pack-years)	OPI	HIV-RNA (copies/mL)	CD4 (cells/μL)	HAART (months)	Histology	TNM/stage
1/M/40	Bloody phlegm	0	No	NA	522	3	ADC	pT2bN0M0/IIa
2/M/52	Cough, chest pain	60	No	83 500	223	0	SCLC	ED
3/M/50	Cough, expectoration	15	TB	<40	464	24	ADC	cT3N2M1a/IV
4/F/51	Fatigue	0	No	142	319	NA	ADC	pT2aN0M0/Ib
5/M/62	Cough, expectoration	30	TB	50.4	38	9	ADC	cTxN3M1b/IV
6/M/57	Cough, polypnea	0	TB, NTM	183	127	0	SCLC	LD
7/M/55	Cough	0	No	<40	594	96	LCNEC	pT1bN0M0/Ia
8/M/44	Cough	60	TB, F	NA	98	36	SCC	cT2aN3M0/IIIb
9/M/51	Chest pain	60	TB	NA	213	0	SCC	cT3N3M1a/IV
10/M/50	None	20	No	NA	266	24	ADC	pT2aN0M0/Ib
11/M/44	Bloody phlegm	0	NTM, F	<40	111	36	ADC	pT2bN2M0/IIIa
12/M/59	Cough, bloody phlegm	30	TB	NA	263	0	LCC	pT3N0M0/IIb
13/M/77	Cough, expectoration	0	No	40	274	0	SCC	pT1bN0M0/Ia
14/F/59	Bloody phlegm	0	TB	<40	373	24	AC	pT3N0M0/IIb
15/M/53	Chest tightness, polypnea	0	No	NA	281	24	ADC	cT4N2M1a/IV
16/M/67	Cough	48	No	NA	341	0	SCLC	ED
17/F/62	Cough	0	No	NA	204	0	ADC	pT1aN0M0/Ia
18/M/60	Cough, bloody phlegm, chest pain	60	No	<40	235	72	SCC	cT4N1M0/IIIa
19/M/65	Cough	0	F	NA	145	0	ADC	cT1bN0M0/Ia
20/M/59	None	37.5	No	9010	160	12	SCC	pT2bN2M0/IIIa
21/M/65	None	30	No	<40	253	3	SCC	pT2aN0M0/Ib
22/M/57	Chest tightness	36	No	NA	174	0	ADC	cT2aN3M1b/IV
23/F/57	Chest tightness	0	TB	NA	483	36	ADC	cTxN2M1a/IV
24/M/60	Chest tightness	0	No	4170	641	0	ADC	cTxN1M1a/IV
25/M/57	Cough, bloody phlegm	160	No	90 900	422	0	SCC	pT1aN0M0/Ia
26/M/46	Chest pain	0	PCP	<40	412	32	ADC	pT1aN0M0/Ia
27/M/51	None	0	No	7630	435	0	ADC	pT2aN1M0/IIa
28/M/66	Cough, fever	0	F	21 300	113	0	SCC	cT4N3M1a/IV
29/M/76	Cough, chest tightness	0	PCP, TB	NA	325	24	ADC	cTxN0M1b/IV
30/M/58	Cough, bloody phlegm	52.5	No	10 400	210	0	LCC	cT4N2M1a/IV
31/M/63	Cough, expectoration	50	TB	NA	NA	24	SCC	cT4NxM1b/IV
32/M/62	None	80	F	<40	401	168	ADC	pT1aN0M0/Ia
33/M/69	None	0	No	NA	574	36	ADC	pT1aN0M0/Ia
34/M/51	None	0	No	NA	147	60	ADC	pT2aN1M0/IIa
35/F/67	Cough, fever	0	F	NA	245	0	ADC	cT2aNxM1a/IV
36/M/55	Chest pain, fever	0	F	3860	207	0	ADC	cT3N1M0/IIIa
37/M/52	Chest pain	30	TB	NA	109	2	ADC	cT3N3M1b/IV
38/M/37	Chest pain, cough, phlegm	40	No	<40	679	60	SCLC	LD
39/M/66	Cough, phlegm	0	F, TB	NA	8	20	SCLC	ED
40/F/68	Cough, phlegm	0	No	NA	173	96	SCC	cT4N3M1a/IV

AC, atypical carcinoid; ADC, adenocarcinoma; CC, chief complaint; c, clinical; ED, extensive disease; F, fungus; HAART, highly active antiretroviral therapy; HIV, human immunodeficiency virus; LCC, large cell carcinoma; LCNEC, large cell neuroendocrine carcinoma; LD, limited disease; NA, not available; NTM, non-tuberculosis mycobacteria; OPI, opportunistic pulmonary infection; p, pathological; PCP, *Pneumocystis carinii* pneumonia; SCC, squamous cell carcinoma; SCLC, small cell lung cancer; TB, tuberculosis; TNM, tumor node metastasis.

common, especially in the mediastinal lymph nodes (75%, 30/40). Thirteen patients with adenopathy showed confluence, and four patients had axillary adenopathy. In the patients with adenopathy, 16 had OPIs (53.3%, 16/30).

Hydrothorax was observed in 13 patients with ipsilateral predominance (84.6%, 11/13), and was mostly in minimum stage (69.2%, 9/13). Irregular pleural thickening was observed in 22 patients (55%, 22/40); seven of these patients were complicated with multiple nodules. Pleural indentation was observed in 14 patients; 11 of these patients had histological adenocarcinoma (78.6%, 11/14).

Table 2 Comparisons of associated factors between non-advanced stages

	Stages		
Factors	I–IIIa†	IIIb–IV†	*P*
Smoking (+)	7	8	0.49
Smoking (–)	12	7	
OPI (+)	6	10	**0.04**
OPI (–)	13	5	
CD4+ T cell count	313	255	0.31
HAART (+)	11	9	1.00
HAART (–)‡	7	6	

†I–IIIa and advanced stages (IIIb–IV) of non-small cell lung cancer with HIV infection. ‡HAART data unavailable in case 4 with stage Ib, thus patient data was excluded. Bold indicates statistically significant difference. (+), with; (–), without; CD4+, CD4 positive; HAART, highly active antiretroviral therapy; OPI, opportunistic pulmonary infection; CD4+ T cell count-using Mann–Whitney test; smoking, OPI, HAART using Fisher's exact text.

CT features with opportunistic pulmonary infection

The relationship between certain CT features and OPIs was analyzed (Table 3). An OPI was more frequent in tumors with an irregular shape (75.0%, 9/12 patients) than in those with a round or an oval shape (31.8%, 7/22; $P = 0.03$) and in tumors larger in size (5.34 ± 0.72 vs. 3.66 ± 0.41; $P = 0.04$). Other CT features, including a tumor with or without a definite pulmonary lesion, with or without adenopathy, pleural indentation, pleural thickening, and hydrothorax, did not differ with respect to OPIs ($P = 0.66$, 0.72, 0.21, 0.34, and 0.20, respectively).

Table 3 Comparison of CT features of lung tumors between HIV patients with and without OPI

	OPI		
CT features	+	–	*P*
TD	16	18	0.66
TI	4	2	
Round/oval	7	15	**0.03**
Irregular†	9	3	
Size (cm)	5.34 ± 0.72	3.66 ± 0.41	**0.04**
Adenopathy (+)	16	14	0.72
Adenopathy (–)	4	6	
PI (+)	8	6	0.21
PI (–)	10	16	
PT (+)	14	8	0.34
PT (–)	8	10	
Hydrothorax (+)	9	4	0.20
Hydrothorax (–)	11	16	

†Four patients with opportunistic pulmonary infection (OPI) had indeterminate lung cancers (e.g. tumors mixed with infection or atelectasis, tumors without concise origin), and two patients without OPI. (+), with; (–), without; PI, pleural indentation; PT, pleural thickening; TD, tumor with determinate boarder; TI, tumor with indeterminate boarder. Bold indicates statistically significant difference.

Radiological impression

Twenty-seven patients were diagnosed with great confidence (13 with determinate malignancy, 14 with likely malignancy). In addition, six patients were diagnosed with dilemma, while seven were misdiagnosed with an infection (2 with interpretation of a TB infection, 4 with interpretation of an FI [Fig 1], and 1 with interpretation of pleural malignancy for its broad base adjacent to the pleura).

Discussion

Similar to a previous review, our study also determined that lung cancer was common in male patients with HIV.[13] This may be because of the high frequency of HIV in men as a result of high-risk sexual behavior, particularly men who have sex with men, and heavy tobacco consumption in this population. The mean age was 57.5 years old, which was somewhat younger than the general population and slightly older than that reported by Winstone *et al.*[13] Our study sample included lung cancer patients likely HIV infected at a relatively older age and younger HIV patients who died from serious OPIs before lung cancer genesis, compared with the sample in Winstone *et al.*'s review. OPIs were common in our patients. Inflammation caused by an OPI, notably the *Pneumocystis carinii* infection (a common subtype of an OPI), might promote lung tumor genesis though the activation of inflammation and coagulation of the inflammatory cytokines,[25–27] as some studies found high rates of such pathogen colonization were detected in lung cancer.[28,29] Two of the patients in our sample developed lung adenocarcinoma two years after PCP (Fig 2).

Similar to the results of other reports, our study also found that NSCLC was the most common histological type of lung cancer, and adenocarcinoma was the most predominant subtype.[30–32] Forty-four percent of the NSCLC patients were in advanced stages. We analyzed the possible risk factors (including smoking, OPIs, CD4+ T cell counts, and HAART) associated with lung cancer staging) and found that the patients with OPIs were more frequently in advanced stage compared with other risk factors. This may be a result of the delayed diagnosis of lung cancer in patients with OPIs. Preventive medication for OPIs and clinical suspicion of lung cancer of a persistent pulmonary lesion after regular and adequate antibiotic treatment might help to make an earlier diagnosis, and ultimately, improve survival.

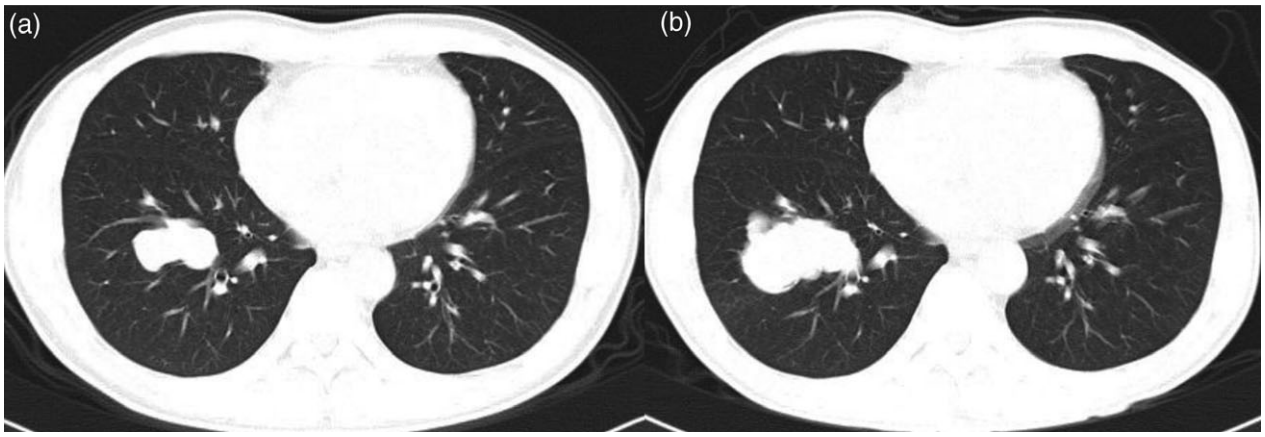

Figure 1 A 44-year-old male treated with highly active antiretroviral therapy for 36 months complained of occasional bloody phlegm. (**a**) An irregular mass with a maximal diameter of 4.4 cm in the transverse section was located in the right lower lobe. He received antibiotic treatment, as the mass was interpreted as an infection and non-tuberculosis mycobacteria was proven by sputum culture. (**b**) Eighteen months later, the mass had grown to 5.9 cm. Mucinous adenocarcinoma was histologically confirmed after radical resection (stage IIIa).

Computed tomography scan manifestations of lung cancer in patients with HIV infection have previously been reported in North America and Europe;[33–35] however, few studies have been reported in the Chinese literature thus far. Our study found that all of the lung cancers with prominent nodules or masses on CT scan were in a lobar distribution. Of these 32 lung cancers, 65.6% were in the right lung, similar to previous reports.[33,35] Lobulation and spiculation were common, mirroring similar manifestations in the general population. The mean size of the tumors with clear borders on CT scan was 4.5 cm; therefore, the intensity was usually heterogeneous, and they were generally classified as T2 stage. Secondary manifestations, including OPIs, hydrothorax, pleural thickening or indentation, and adenopathy, were also quite frequent in our group. It is worth mentioning that adenopathy is common in the era of HAART, which is mainly caused by OPIs and malignancy. A recent investigation found that the prevalence of adenopathy caused by NADCs, such as lung cancer, had increased.[36] In view of this, an early biopsy of enlarged lymph nodes should be conducted in such patients without overt pulmonary lesions when necessary.

Opportunistic pulmonary infections are common in China, which might result from a lack of awareness of HIV infection status and poor compliance with HAART. In view of this, we compared CT scan manifestations of lung cancer with and without OPIs and found that lung cancers with OPIs tended to be irregular and larger. However, there was no significant statistically difference in the latter, indicating that aggressive follow-up of persistently suspected OPIs, especially mass-like and irregular pulmonary lesions, is warranted for the early detection of lung cancers.

In our clinical practice, the misdiagnosis rate was 32.5% (13/40 patients), and the major misdiagnosis was infectious disease (53.8%, 7/13). This may primarily be because of low suspicion, as pulmonary infection is common, and the laboratory confirmed the specific pathogens. Furthermore, there was an overlap of CT manifestations between

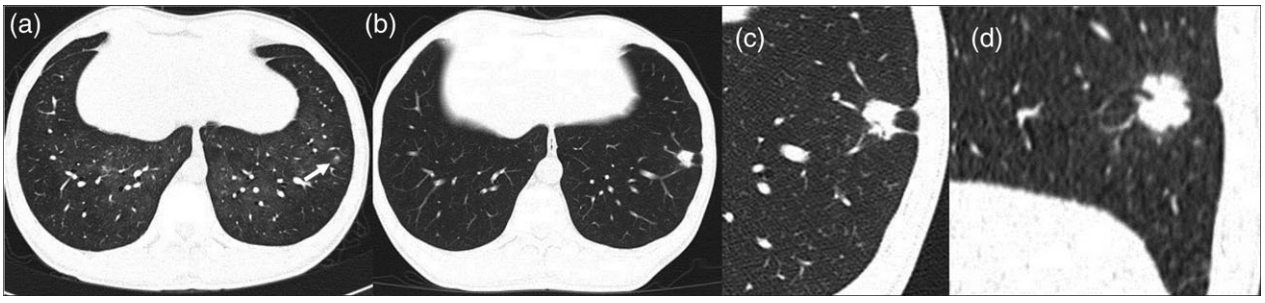

Figure 2 A 46-year-old male treated with highly active antiretroviral therapy for 32 months complained of chest pain for two months. (**b–d**) A solid nodule with lobulation and pleural indentation in the left lower lobe was noticed in the lung window on chest computed tomography scan, which was more prominent and larger than it was two years before (**a**), when it was inconspicuous (white arrow) in the set of *Pneumocystis carinii* pneumonia. Adenocarcinoma was confirmed by wedge resection (stage Ia).

infections and tumors. Secondly, some of the imaging interpreters had limited experience in the diagnosis of lung cancer. Thirdly, there was lack of other referential examinations, such as a PET-CT scan, for economic reasons.

Admittedly, there are several limitations to our study. Firstly, some selection bias is introduced in a retrospective study, and further prospective study is needed. Secondly, measurement bias may have occurred, as data were collected retrospectively; however, the pulmonary lesions were measured and reviewed blindly. Thirdly, PET-CT scans were not generally used for TNM staging, because of economic considerations, but also because of the lack of such a modality in our center. Generally, an infectious disease hospital is not equipped to perform PET-CT scans in China. Discrimination usually occurs if a patient attends a general hospital. Nevertheless, we used other compensative imaging modalities to evaluate and determine TNM stages according to Chinese guidelines for the diagnosis and treatment of primary lung cancer. Finally, a single-center study with a relatively small sample size makes generalization of the findings difficult; therefore, a multicenter study with a larger sample size is warranted.

Lung cancer at advanced stage is more common in middle-aged men with HIV and OPIs. HIV patients with CT manifestation of irregular and large pulmonary lesions and a history of OPIs should be suspected of lung cancer, and receive a biopsy or regular follow up, if necessary.

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Disclosure

No authors report any conflict of interest.

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