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Pulmonary Cryptococcosis in Immunocompetent Patients: CT Findings

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—Abstract—

Purpose: To evaluate the computed tomography (CT) findings of pulmonary cryptococcosis in immunocompetent patients.

Materials and Methods: CT scans of 25 patients with biopsy-proven cryptococcosis [surgery (n=3), percutaneous needle biopsy (n=21), and bronchoscopic biopsy (n=1)] were analyzed. Thirteen patients were men and 12 patients were women, with a mean age of 53.7 years. Presenting symptoms were cough, sputum, and dyspnea and 12 patients presented with incidentally found chest radiographic abnormalities.

Results: Nodule or multiple conglomerate nodules (n=10, 40%) and segmental or lobular consolidation (n=9, 36%) were most common, followed by mixed patterns (n=5, 20%). Predilection sites were lower lobe (n=21/37, 57%) and subpleural areas (n=23, 92%). Air bronchograms within consolidations (n=11/14, 79%) with mild volume loss (n=10/14, 71%) were common. While interlobular septal thickening (n=11, 44%) and cavitation or central low-attenuations (n=11, 44%) were relatively common, lymphadenopathy (n=2, 8%) or free pleural effusions (n=1, 4%) were uncommon.

Conclusion: Nodules or airspace consolidation with a predilection of lower lobe and subpleural area are the most common appearances of pulmonary cryptococcosis in immunocompetent patients.

Key Words: Computed tomography (CT), Cryptococcosis, Immunocompetent patient

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INTRODUCTION

Cryptococcus neoformans is a nonmycelial budding yeast of worldwide distribution which is isolated from soil contaminated by pigeon and chicken excreta.[1] Inhalation of the organism is considered to be the usual route of infection. Cryptococcal infections are usually confined to the lungs in immunocompetent patients but may result in severe disseminated diseases in immuno compromised hosts.[2-5]

Little has been written about the computed tomography (CT) form of cryptococcal pulmonary infections in immunocompetent patients compared with that of immunocomprised hosts. The purpose of our study was to evaluate the CT findings of cryptococcal pulmonary infections in 25 patients.

MATERIALS AND METHODS

We retrospectively reviewed 25 patients with pulmonary cryptococcosis diagnosed and treated at six institutions (Table 1). The diagnosis of intrathoracic cryptococcosis was proven by identification of the organism from the lung [surgery (n=3), percutaneous lung biopsy (n=21), and bronchoscopic biopsy (n=1)]. Patients with other pathogens isolated from the lung were excluded.

The patients consisted of 13 men and 12 women, with an age range of 20 to 82 (mean =53.7) years. All patients were completely immunocompetent. Two patients had neurological signs and had high cryptococcal antigen titer in the cerebrospinal fluid (CSF). Clinically, thirteen of the 25 patients (52%) had pulmonary symptoms such as coughing, sputum, dyspnea, and chest pain. Two patients (8%) had constitutional symptoms of fever or chills. Twelve patients (44%) had no clinical symptoms or signs.

Chest radiographs and CT scans taken at the time of presentation were analyzed with regard to the patterns of pulmonary lesions, presence of interstitial thickening, cavitation or central low-attenuation, lymphadenopathy, and pleural effusion. The most common initial radiological diagnosis was pulmonary tuberculosis (n=10, 44%), followed by lung cancer (n=8, 32%), pneumonia (n=6, 24%), and actinomycosis (n=1, 4%).

Fig. 1. Pulmonary cryptococcosis in an asymptomatic 58-year-old woman showing nodular pattern (case 1). CT scan obtained at the level of the right upper lobe bronchus shows a well-defined subpleural nodule in right upper lung.

Table 1. Summary of 25 patients with pulmonary cryptococcosis

No	Sex	Age	Sx	Dx	Location	Patt	S/M	S/C	C/L	Air	Sep	GGA
1	F	58	-	OP	RU	N	S	S	-	-	-	-
2	F	51	-	OP	RL	N	S	S	-	-	-	-
3	M	42	-	PCNA	RL	N	S	S	C	-	-	-
4	F	57	-	PCNA	RU	N	S	S	-	-	+	-
5	M	33	P	PCNA	LL	N	S	S	C	-	-	-
6	M	50	-	PCNA	LL	N	S	S	L	-	-	-
7	M	54	-	PCNA	RL	N	S	S	C	-	-	-
8	M	42	-	PCNA	LU	N	S	S	-	-	-	-
9	F	52	-	PCNA	RU	N	M	S/C	-	-	-	-
10	F	55	C	PCNA	LU, LL	N	M	S/C	L	-	+	-
11	M	58	C	OP	RL	C	S	S	-	+	+	-
12	M	59	C/S	PCNA	M	C	S	S/C	-	+	-	-
13	F	60	-	PCNA	RU	C	S	S	-	+	-	+
14	F	80	P	PCNA	RU	C	S	S	C	-	-	-
15	M	53	-	PCNA	LL	C	S	S	-	+	+	-
16	M	55	-	PCNA	RL	C	M	S	L	+	+	-
17	M	59	-	PCNA	LL	C	M	S	-	-	+	-
18	F	37	C,f/c	PCNA	RL, LL	C	M	S	C	+	+	-
19	F	82	P	PCNA	M, RL	C	M	S	L	-	+	-
20	F	56	C/S	PCNA	M, RL	M	M	S	C	+	+	-
21	M	53	C/S	PCNA	M, RL	M	M	S	-	+	-	+
22*	M	20	C/S,D	PCNA	RU, RL, M, LL	M	M	C	-	+	-	+
23	M	48	C/S,D	PCNA	RL	M	M	S/C	-	+	-	+
24	F	62	C	PCNA	RU, RL, LU, LL	M	M	S	C	+	+	+
25*	F	44	P,C,f	Bron.	M, RL		M	C	-	-	+	-

Sx, Symptom; Dx, Means of diagnosis; Patt, Pattern of lesions; S/M, Single or multiple lesions; S/C, Subpleural or central location; C/L, Cavitation or central low attenuation; Air, Air-bronchogram within consolidations; Sep, Interlobular septal thickening; GGA, Ground- glass attenuation; C/S, Cough/sputum; P, Chest pain; f/c, fever/chilling; D, Dyspnea; OP, Operation; PCNA, Percutaneous needle aspiration biopsy; Bron., Bronchoscopic biopsy; RU, Right upper lobe; M, Middle lobe; RL, Right lower lobe; LU, Left upper lobe; LL, Left lower lobe; *lymphadenopathy

RESULTS

Nodules (n=10, 40%) and segmental or lobular consolidations (n=9, 40%) were the most common CT findings. Of the 10 patients with nodular pattern, eight patients had a single lesion with a well-defined margin (Fig. 1) measuring 0.5 to 4 cm (mean=1.58 ± 1.24cm) in diameter, and the remaining two patients showed ill-defined nodules. Of the 9 patients with a consolidated pattern, five showed single segmental (Fig. 2) or lobular consolidations, and the remaining four showed multiple consolidations. Six

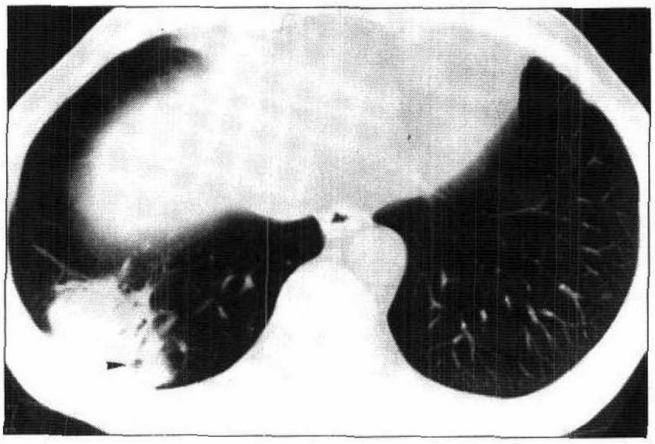


Fig. 2. Pulmonary cryptococcosis in a 58-year-old man presenting with dry cough showing an airspace consolidation pattern (case 9). CT scan obtained at the level of the lower lung shows ill-defined airspace consolidation in right lower lobe containing air-bronchograms (arrowhead) and a small cavity.

patients showed air bronchograms within the consolidations associated with adjacent septal line thickening(n=6) and ground-glass opacity (n=1). Mixed nodule and consolidation was seen in five patients (20%). All five patients with a mixed pattern (Fig. 3) showed multiple lesions containing air bronchogram (n=5), adjacent GGO (n=4), or septal line thickening (n=2). One patient showed diffuse bronchovascular thickening in the right middle and lower lobes associated with hilar and mediastinal lymphnode enlargements (Fig. 4).

Twenty-one out of 37 lesions (57%) were located in the lower lobe followed by the upper lobe (n=10, 27%), and right middle lobe (n=6, 16%). Twelve patients (48%) had multiple lesions. Nineteen patients (76%) had lesions at subpleural areas, and the remaining patients showed either central (n=2) or mixed central and peripheral lesions (n=4).

Interlobular septal thickenings adjacent to consolidations or nodules were present in 11 (44%) patients. Cavitation (n=7) (Fig. 5) or central low-attenuation (n=4) was seen in 11 patients (46%).

Eleven (79%) of the 14 patients with consolidation or mixed patterns showed air-

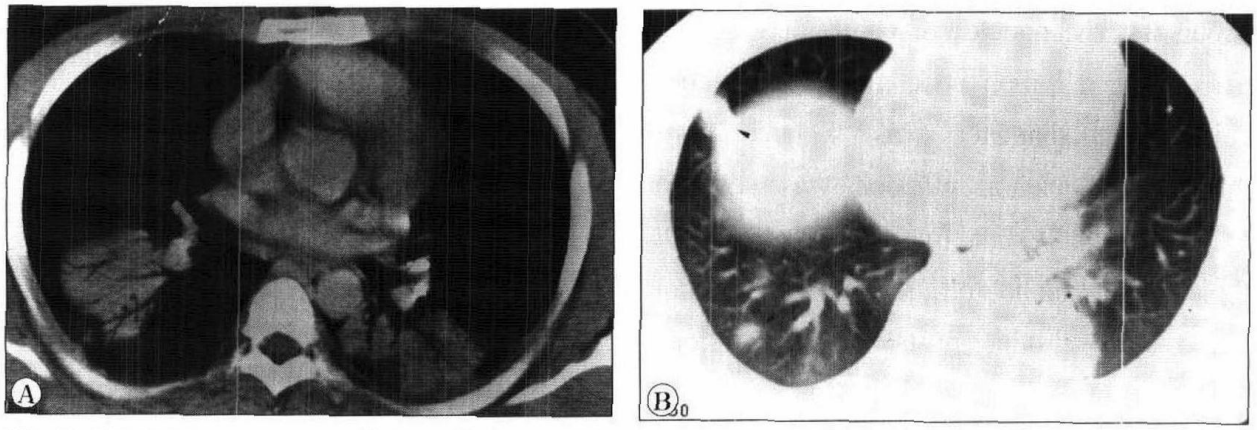
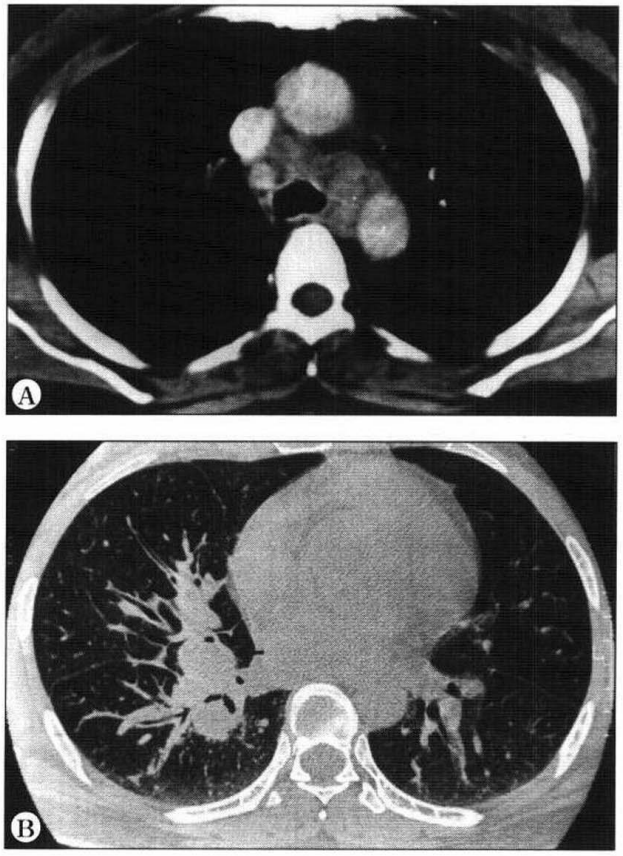


Fig. 3. Pulmonary cryptococcosis in a 20-year-old man presenting with cough, sputum, and mild dyspnea, showing mixed nodular and airspace consolidation pattern (case 20). A: CT scan obtained at the level of the right middle lobe bronchus shows segmental and lobular air space consolidation in superior segment of both lower lobes. Note air bronchograms within the consolidated lung. B: Scan obtained 4cm below A shows multiple nodules (arrowheads) with focal ground- glass opacities in right lower lobe.



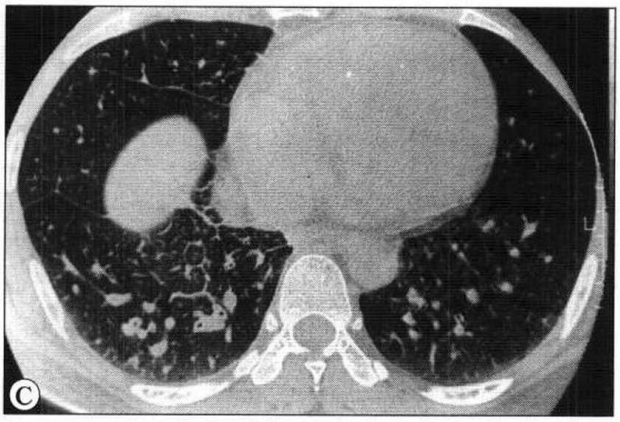


Fig. 4. Pulmonary cryptococcosis in a 44-year-old woman who presented with chest pain, cough, and fever, showing lymphadenitis and interstitial infiltration (case 24). A: CT scan obtained at the level of the tracheal carina shows enlarged lymph nodes in right tracheobronchial and left peribronchial area. There were multiple lymphadenopathies in right paratracheal and both hilar regions (not shown here) B: CT scan with lung window setting image (width 1500 H, level -700 H) shows enlarged intrapulmonary lymph nodes and peribronchovascular infiltration. C: Scan obtained 3cm below B shows thickening of the interlobular septa in right lower lobe.

bronchogram within consolidations (Fig. 3a) and the distribution of consolidation were lobular (n=5, 36%), segmental (n=5, 36%), and mixed (n=4, 28%). 5 patients (33%) showed ground-glass attenuation (Fig. 6) surrounding the nodules or consolidations.

An enlarged lymph node greater than 1cm in its short diameter was seen in two patients. Free pleural effusion was seen in one patient (4%), but five (36%) of the 14 subpleural consolidated lesions had focal fluid collections adjacent to the lung lesions (Fig. 3a).

DISCUSSION

The lung is thought to be the portal of

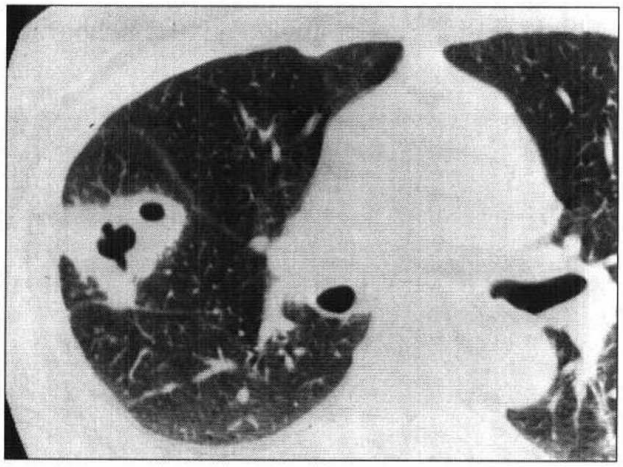


Fig. 5. Pulmonary cryptococcosis showing airspace consolidation or nodules with cavities and necrotic low-attenuation (case 22) CT scan obtained at the level of the right bronchus intermedius shows a conglomerate nodule containing multiple small cavities.

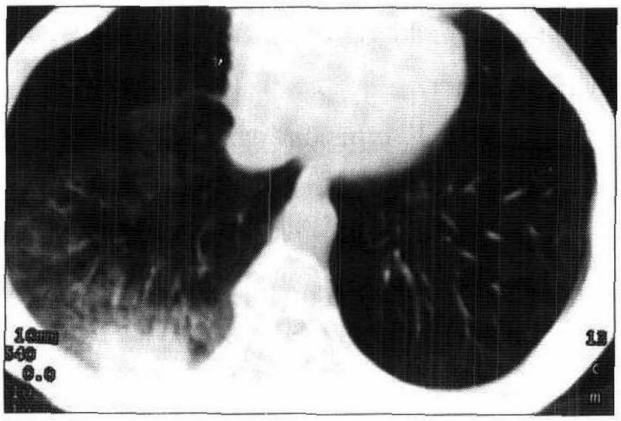


Fig. 6. Pulmonary cryptococcosis in a 48-year-old man (case 23). CT scan at the lower lung shows patchy segmental airspace consolidation and surrounding diffuse ground-glass opacity.

entry for the cryptococcal organism, but pulmonary infections are rare in hosts with normal immunity, and more than half of all reported cases are immunocompromised individuals.[2-6]

The clinical manifestations may vary from localized lesion with a complete lack of symptoms to an overwhelming dissemination and symptoms.[7] Twelve out of 25 patients (48%) in our series, and 32% of the patients in another study[8] were asymptomatic. In our study, presenting clinical symptoms were coughing, dyspnea, and chest pain in 13 cases (52%). Only three patients had fever and chilling sensations. Three patients with chest pain showed pulmonary lesions in subpleural areas.

The plain radiographic findings of cryptococcosis in the lung have been well recognized.[9, 10] Reported cases on CT findings of pulmonary cryptococcosis were mostly in immunocompromised hosts[3-5, 11, 12] with a smaller number of immunocompetent patients.[6, 11, 13, 14] Three radiological patterns, irrespective of immune status, have been described[11]: a discrete pulmonary mass varying in size from several millimeters to several centimeters in diameter with either well-defined or ill-defined margins; a lobar or segmental heterogeneous opacity; a diffuse, bilateral small nodular or reticulonodular pattern. Our series represented two of these three types. Single or multiple isolated or conglomerate nodules were present in ten of the 25 patients (40%). Segmental or lobular consolidation was also present in nine (36%). Mixed patterns of consolidations and nodules, which has seldom been described in the previous literature, were seen in 5 patients (20%).

The radiological findings vary from series to series. In Khoury's study[6] of nine immunocompetent hosts, five (56%) showed a single pulmonary nodule with varying degrees of border definition, three patients had multiple nodules (33%), and one patient (11%) showed a bilateral central reticulonodular pattern. However, according to Feigin's study of 18 patients,[14] segmental consolidation was the principal radiographic finding seen in nine patients (50%), followed by poorly-delineated mass with irregular hazy borders in five (28%), and infiltrative masses in four (22%). In a more recent series of cryptococcal pneumonia in AIDS or organ transplatation patients,[2-5, 15] diffuse nodular interstitial

infiltration with alveolar consolidation was predominant. Although our patients were immunocompetent, a relatively large proportion of the patients (56%) had consolidation patterns with multiple lesions (48%). Most lesions inour series (92%) were located in the subpleural area, as was described by Sider et al.[5]

Interlobular septal thickenings adjacent to consolidations or nodules were present in 11 (44%) of our 25 patients. Septal line thickening was seen surrounding the lung lesions, which may suggest a local increase or stagnation of lymphatic flow.

Reported prevalence of cavitation within the cryptococcal pulmonary lesions range from 12 to 22%.[6, 10, 13, 16] In our series, seven of the 25 patients (28%) had cavitation, and 4 cases (16%) had central necrotic low-attenuation within the nodules or consolidations.

Bronchovascular crowding at those proximal parts was present in 10 patients (67%). Those represent volume loss of the involved lung, but massive ateletasis or architectural distortion was not present. Feigin[14] also described that typical granulomatous inflammatory reactions of cryptococcal pneumonia are not causing significant pulmonary scarring or calcification.

Most reports[5, 6, 11] maintain that lymphadenopathy is rare in pulmonary cryptococcosis of both immunocompetent and immunocompromised patients. In our series, two patients (8%) presented with hilar and mediastinal lymph node enlargements, more than 1cm in short diameter.

Free pleural effusion was seen in one patient (4%) in our series. Salyer and Salyer[17] reported that pleural involvement with effusion was more common than generally appreciated. Six out of 37 autopsy patients had an extension of the subpleural nodule to involved pleura. In our series, five out of 14 subpleural-consolidated lesions (36%) had focal fluid collections outside the involved pleura.

SUMMARY

Nodules or airspace consolidations with a predilection of lower lobe and subpleural area are the most common forms of pulmonary cryptococcosis in immunocompetent patients.

한글초록

서론: 면역기능 정상인 환자에서 폐효모균증의 전산화단층촬영상(CT)의 소견을 알아보고자 하였다.

대상 및 방법: 조직학적으로 확진 된 25명의 폐효모균증 환자를 대상으로 하였다. 13명은 남자였고 12명은 여자였으며, 평균연령은 53.7세 였다. 주 증상은 기침, 가래, 및 호흡곤란이었고, 12명의 환자에서는 증상이 없었다.

결과: 결절 혹은 다수결절(10명 40%)을 보이거나 분절 혹은 아분절성 폐경결(9명 36%)이 가장 흔한 소견이었다. 주 침범부위는 하엽(57%) 늑막하부(92%)였다. 폐경결 내부에 공

기기관지 음영(79%)을 보이며 용적감소를 보인 경우(71%)가 흔하였다. 간질비후 음영(44%) 및 공동형성(44%)도 자주 보였으나, 임파절 종대(8%) 및 늑막삼출(4%)은 드문 소견이었다. **결론:** 폐 하엽 늑막하 부위에 다수의 결절 혹은 폐경결성 병변이 면역기능 정상인 환자에서 폐효모균증의 가장 흔한 소견이었다.

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