

Lung abscess: analysis of 252 consecutive cases diagnosed between 1968 and 2004*

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ABSTRACT

Objective: To relate the experience of the staff at a health care facility specializing in the management of patients with aspiration lung abscess. **Methods:** Diagnostic aspects and therapeutic results of 252 consecutive cases of lung abscess seen in patients hospitalized between 1968 and 2004. **Results:** Of the 252 patients, 209 were male, and 43 were female. The mean age was 41.4 years, and 70.2% were alcoholic. Cough, expectoration, fever and overall poor health were seen over 97% of patients. Chest pain was reported by 64%, 30.2% presented digital clubbing, 82.5% had dental disease, 78.6% reported having lost consciousness at least once, and 67.5% presented foul smelling sputum. In 85.3% of the patients, the lung lesions were located either in the posterior segments of the upper lobe or in the superior segments of the lower lobe, and 96.8% were unilateral. Concomitant pleural empyema was seen in 24 (9.5%) of the patients. Mixed flora was identified in the bronchopulmonary or pleural secretions of 182 patients (72.2%). All patients were initially treated with antibiotics (mainly penicillin or clindamycin), and postural drainage was performed in 98.4% of cases. Surgical procedures were performed in 52 (20.6%) of the patients (drainage of empyema in 24, pulmonary resection in 22 and drainage of the abscess in 6). Cure was obtained in 242 patients (96.0%), and 10 (4.0%) died. **Conclusion:** Lung abscess occurred predominantly in male adults presenting dental disease and having a history of loss of consciousness (especially as a result of alcohol abuse). Most of the patients were treated clinically with antibiotics and postural drainage, although some surgical procedure was required in one-fifth of the study sample.

Keywords: Lung abscess; Pneumonia, aspiration; Bacteria, anaerobic; Bacterial infections; Drainage, postural

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INTRODUCTION

Lung abscess is a necrotic cavitory lesion of more than 2 cm in diameter and containing pus.⁽¹⁾ The term is generally applied when the lesion is caused by pyogenic bacteria, most commonly anaerobic bacteria, *Staphylococcus aureus* or aerobic gram-negative bacteria.⁽²⁻³⁾ Primary or putrid aspiration lung abscess, in immunocompromised adults and caused by anaerobic bacteria, accounts for a significant percentage of the cases of this type of disease.⁽⁴⁾ In children, aspiration lung abscess is infrequent.⁽⁵⁾ In the differential diagnosis of lung abscess, caseous tuberculosis should be especially included, as should cavitory bronchial carcinoma,⁽⁶⁾ intralobar bronchopulmonary sequestration,⁽⁷⁾ Wegener's granulomatosis⁽⁸⁾ and, in endemic areas, dead hydatid cyst with membrane retention.⁽⁹⁾

In primary lung abscess, the secretions coming from the diseased mouth (generally with dental disease), which are aspirated during an episode of unconsciousness, contain a large quantity of several species of microorganisms (mixed flora, with a predominance of anaerobic bacteria).⁽¹⁰⁾ The aspirates typically migrate to the posterior segments of the upper lobes and in the superior segments of the lower lobes,⁽¹¹⁾ and the abscesses are typically singular, appearing in the chest X-rays as cavities with irregular walls, with air-fluid levels and generally with no foci of bronchial dissemination to other sites within the lung.

Within 24 to 48 hours after the aspiration episode, the abscess will already be well formed, presenting (internally) low pH and low oxidation reduction potential,⁽¹⁰⁾ which favors the multiplication of anaerobic bacteria, either gram-positive (*Peptostreptococcus* sp, microaerophilic streptococcus) or gram-negative (*Prevotella* sp, *Bacteroides fragilis* and fusobacteria). It must be emphasized, however, that *B. fragilis* - a penicillin-resistant bacterium - is rarely present in anaerobic infections located above the diaphragm,⁽¹²⁾ albeit frequently found in diaphragmatic structures. The visualization of mixed flora in (gram) cultures of the secretions strongly indicates the presence of anaerobic microorganisms, and this is extremely useful for making a quick working diagnosis. The definite identification of these bacteria, however, requires the culture of the material collected (with protection) under anaerobic conditions,⁽¹³⁻¹⁵⁾ which,

in practice, is rarely necessary for the correct implementation of the treatment. It must be emphasized, however, that the routine sputum cultures carried out under anaerobic conditions do not show anaerobic bacteria, revealing only the growth of accompanying aerobic microorganisms, such as non-hemolytic streptococcus, pneumococcus or some gram-negative cocci.

The constituted abscess, closed, leads to the onset of symptoms such as high fever, cough, chest pain, overall poor health and rapid weight loss, as has been shown in other studies.⁽¹⁶⁻¹⁷⁾ In the second or third week of the disease, a large amount of extremely foul smelling sanguinopurulent or purulent secretion gains access to the bronchial tree and is eliminated through (projectile) coughing. However, when there is necrosis of the abscess wall, the infected purulent material can invade the pleural space, forming an empyema and, consequently, aggravating the symptoms.⁽¹²⁾ Septic emboli can also lodge themselves in other organs, brain abscess being particularly serious. After the occurrence of the vomiting, patients may present milder fever and have the severity of their toxic status attenuated. Occasionally, the content of the abscess remains trapped in the interior of the cavity due to stenosis of the drainage bronchus. In such cases, computed tomography and fiberoptic bronchoscopy help to diagnose the nature of the obstruction, especially excluding (or confirming) the presence of a carcinoma occluding the bronchial tree.⁽¹⁸⁾ Through the use of fiberoptic bronchoscopy, it is also possible to clear (non-neoplastic) obstructions by aspirating the thicker secretions,⁽¹⁹⁾ and this facilitates the treatment. Blood counts revealing leukocytosis with a shift to the left are common findings, especially in the initial phases of the evolution of the abscess, and prior to any treatment with antibiotics.

In general, most patients with lung abscess seek medical assistance within the first two weeks after the onset of symptoms, spurred by the aggressiveness of the disease. However, a significant number (25% to 30%) only seek treatment later, after four to eight weeks, presenting chronic abscess, having lost weight, coughing, and expectorating the foul smelling purulent material. In these patients with chronic abscess, digital clubbing is frequently observed.

The treatment of patients with aspiration chronic abscess is primarily clinical, with the use of antibiotics, postural drainage and general care.

However, approximately 10% are eventually submitted to some surgical procedure (drainage of the abscess, pulmonary resection, empyema drainage).⁽²²⁾ Penicillin and clindamycin are the antibiotics that have been most often used in the fight against pulmonary infections caused by anaerobic bacteria, with the preference progressively shifting to clindamycin,⁽²³⁻²⁴⁾ although other antibiotics have also proven effective.⁽²⁵⁾ Currently, mortality from primary lung abscess, which was high before the advent of the antibiotics, is approximately 5%.⁽²⁶⁾

In the present study, we describe cases of aspiration lung abscess in 252 patients treated at a university health care facility specializing in lung diseases. The diagnostic characteristics of the disease, therapeutic indications, and treatment outcomes are also analyzed.

METHODS

We studied 252 patients who were treated in the Pulmonology Department of the Pavilhão Pereira Filho (Pereira Filho Hospital), which is part of the Santa Casa Hospital Complex of Porto Alegre. All patients were admitted between 1969 and 2004 and were diagnosed with aspiration lung abscess. The cases were being accumulated, being periodically surveyed and presented,⁽²⁷⁻²⁸⁾ culminating in the aforementioned number at the end of 2004. In this 36-year period, there have been between six and eight cases a year at the facility.

We collected clinical histories from and performed physical examinations of all patients, special attention being given to the occurrence of episodes of loss of consciousness preceding the onset of symptoms, as well as to the presence of oral disease (teeth in a state of decay and with periodontal involvement) and foul smelling bronchopulmonary secretions.

Simple anteroposterior and lateral chest X-rays and penetrating X-rays of the mediastinum were taken of all 252 patients prior to and after the initiation of treatment. Either linear tomography (prior to 1986) or computed tomography (after that date), together with bronchoscopy (rigid or fiberoptic), was performed whenever judged necessary, especially when there was a delay in clinical improvement, suspicion of bronchial neoplasia or bilateral lesions, as well as in patients

submitted to pulmonary resection. Patients presenting concomitant fluid in the pleural cavity were submitted to thoracentesis, and material was collected for microbiological, cytological and biochemical tests.

Bacteriological examinations of sputum were routinely performed, sputum smear microscopy being especially favored, in the search for evidence of mixed flora, which is indicative of anaerobic bacteria. Material collected through bronchoscopy (109 patients), pleural puncture (24 cases) or lung puncture (8 cases, including drainage of the abscess) were also examined by the microbiologist, who carried out direct tests and cultures in common media, but not under anaerobic conditions. In surgical cases with resection, the samples were submitted to anatomopathological examination. Other routine blood and urine tests were performed in all patients.

All treatment, clinical and surgical modalities were performed within the facility itself. After discharge, patients were referred for dental treatment, either in the facility itself or outside it.

Proportion (chi-square) tests were used to compare the variables of interest, and the level of significance was set at 5%.

RESULTS

Of the 252 cases of lung abscess, 209 occurred in males (82.9%) and 43 in females (17.1%), a significant difference ($p < 0.001$). The mean age was 41.4 years, ranging from 8 to 76 years. An eight-year-old child had diabetes mellitus that was being treated with insulin. Smoking was reported in 65% of the cases, alcohol abuse in 70.2% and at least one episode of lost consciousness in 78.6%. Alcohol abuse was associated with 89.4% of the confirmed cases of loss of consciousness, and this number was significantly higher ($p < 0.001$) than that of the other conditions together (epilepsy, skull-brain trauma, etc). Dental disease was seen in 82.2% of the cases. Cough, expectoration and fever were the symptoms most often presented by the patients. A total of 88 patients (35%) the symptoms persisted for more than four weeks (Table 1).

In most cases (96.5%), the abscesses were unilateral and singular. They were found in the same frequency in both lungs, were generally between 4 and 8 cm in diameter, and with a marked

preference for the posterior segments of the upper lobes and the superior segments of the lower lobes. Table 2 shows the radiological presentations seen in the 252 patients, all of them having been submitted to simple anteroposterior and lateral chest X-rays, with complementary tomography scans in 136 cases (54%).

Figure 1 shows the radiographic findings in one case that is representative of most the cases that were analyzed in the present study, that is, cavitory lesion, singular, moderate-sized, with air-fluid level in its interior, located in the superior segment of the lower lobe, with no evidence of foci of dissemination to other sites of the lung. Figure 2 shows, on a simple X-ray and a computed tomography scan of the chest, an uncommon case of multiple abscesses, in both lungs, in an alcoholic female patient. In the two cases used as examples, as well as in the others, the absence of foci of dissemination (bronchopneumonic, pericavitary or distant) is notable.

Rigid bronchoscopy (in the first years of the study) or fiberoptic bronchoscopy were performed in 109 patients (43.6%): in all of the 52 surgical cases, and in 57 cases that were treated clinically, but with delayed response (more than two weeks) or in which there was suspicion of neoplasia, which was excluded later. In 3 patients, there was significant stenosis of the bronchus draining the abscess cavity. In 2 others, there was active bleeding. In the remaining patients, there was abundant

TABLE 1
Aspiration lung absces
Clinical data from 252 patients

	N	%
Cough	252	100.0
Expectoration	252	100.0
Fever	252	100.0
Overall poor health	246	97.6
Dental decay	208	82.5
Loss of consciousness*	198	78.6
Rales	193	76.6
Foul smell	170	67.5
Chest pain	161	64.0
Digital clubbing	76	30.2

Symptoms had been present for more than four weeks in 35% of the patients. *In 89.4% of the cases, the episode of loss of consciousness was related to alcoholism, other causes being epilepsy, skull-brain trauma, cerebrovascular accident, hypoglycemia and anesthesia.

TABLE 2
Aspiration lung abscess: Radiographic
presentation of the lesions in 252 patients

	N	%	p
Unilateral lesions*	244	96,8	0,001
Bilateral lesions	8	3,2	
In the posterior segment of the superior lobe or superior segment of the inferior lobe**	215	85,3	0,001
In the basal pyramid	29	11,5	
In the middle lobe or lingula	8	3,2	
Lesions of up to 4 cm in diameter	40	15,9	
Lesions between 4 and 8 cm in diameter	168	66,0	0,001
Lesions of more than 8 cm in diameter	44	18,3	
Concomitant pleural effusion (empyema)	24	9,5	

*Equally distributed in both lungs

**Including 38 contiguous lesions in both segments and 29 in axillary subsegments

purulent or sanguinopurulent secretion in the bronchial tree.

Direct bacteriological examination of sputum or bacteriological testing of the material obtained through bronchoscopy, lung puncture, pleural puncture or empyema drainage revealed the presence of mixed flora, which is indicative of anaerobic microorganisms, in 182 patients (72.2%). This was seen especially in cases of more recent onset of the disease, in which antibiotics still had not been used. In one-third of the cases, other bacteria, especially nonhemolytic *Streptococcus* spp, *S. viridans*, *S. pneumoniae* or, occasionally, gram-negative aerobic bacteria were also seen. These were identified primarily through sputum culture under aerobic conditions (using the same material in which the direct examination had shown the presence of mixed flora). Two-thirds (72) of the 109 patients who were submitted to bronchoscopy and sample collection underwent the exam after having been hospitalized for more than one week and already being treated with antibiotics.

Blood counts revealed leukocytosis in 211 patients (83.7%), 192 of which also presented a shift to the left. The cases presenting no leukocytosis were found especially among those who had been experiencing symptoms for more than four weeks, some of whom had already used antibiotics.

Mixed flora in the secretions and leukocytosis with a shift to the left in the blood count were findings highly suggestive of aspiration lung abscess ($p < 0.001$).

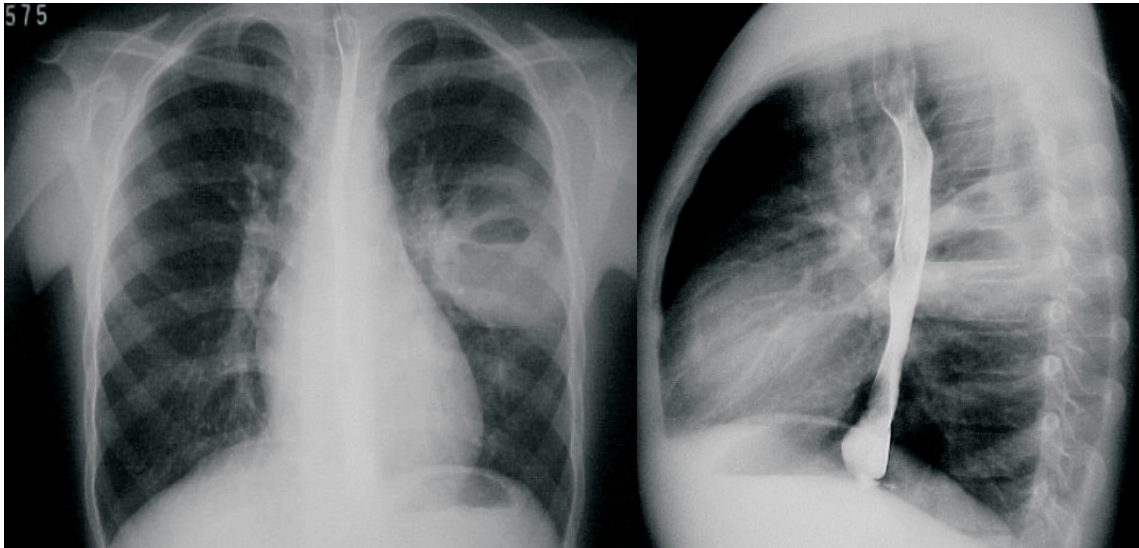


Figure 1 - Radiographic aspects of an aspiration abscess located in the superior segment of the lower lobe of the left lung. Cavitary lesion, singular, with thick walls and an air-fluid level. Absence of foci of bronchial dissemination.

All of the 252 patients were treated with antibiotics, in most cases with penicillin G, and were submitted to physical therapy maneuvers (postural drainage). Of those, 52 (20.6%) were also submitted to some thoracic surgical procedure. Table 3 summarizes the therapy adopted and the results obtained. One patient had intracranial dissemination, with formation of a brain abscess, which was treated surgically. The patient presented neurological sequelae.

The lung lesions present in the resected pieces were confirmed as being lung abscesses in the anatomopathological examination.

DISCUSSION

The frequency of hospitalizations due to aspiration lung abscess decreased considerably after the advent of the antibiotics. In the present study, which was initiated in 1968, the frequency remained practically unchanged (six to eight cases per year), which translates, in a way, the persistence of the risk conditions for the development of the disease in the community: alcohol abuse as the main cause of the episode of unconsciousness, and oral disease, especially dental decay.^(1,21) The incidence of the disease in the present study was

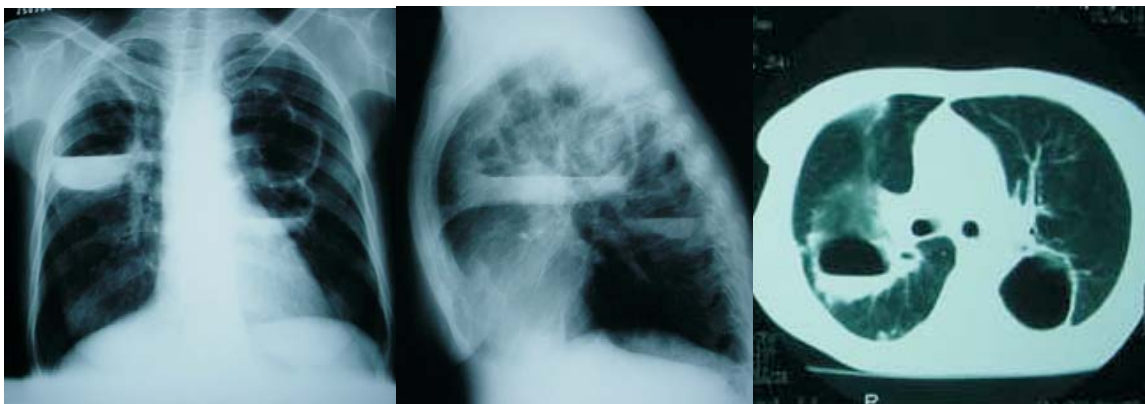


Figure 2 - Multiple abscesses with air-fluid levels, with preferential location in dorsal segments. Female patient, alcoholic, presenting mixed flora in the sputum and in the material collected through fiberoptic bronchoscopy.

TABLE 3
Aspiration lung abscess:
Treatments administered and their outcomes

	Nº	%
Antibiotic therapy	252	100.0
Penicillin G	188	74.6
Clindamycin	46	18.3
Other	18	7.1
Postural drainage	248	98.4
Surgical treatment	52	20.6
Drainage of empyema	24	9.5
Pulmonary resection*	22	8.7
Drainage of the abscess	6	2.4
Cure**	242	96.0
Death***	10	4.0

* Twenty cases of chronic abscesses, three with significant inflammatory bronchial stenosis, and two cases of massive hemoptysis **The majority presented some radiographic evidence of sequelae, one patient presenting a secondary brain abscess ***Patients with large abscesses, three of whom had also presented empyema

also found to be higher among adult males (mean age of 41.4 years), as has previously been reported.⁽¹⁷⁾ One case occurred in an eight-year-old child, who had diabetes mellitus, was taking insulin and was at risk of suffering episodes of unconsciousness with subsequent aspiration.

The types and the frequency of the symptoms found, as well as the time it takes the disease to evolve, in its more acute and chronic forms, are in accordance with what has been observed in other studies.⁽¹⁶⁾ The abscesses are located predominantly in the dependent zones of the lung when the patient is in dorsal decubitus (85.3% in posterior segments of the upper lobes or in superior segments of the lower lobes). They are typically singular and are seen with equal frequency on the right and left sides. This underscores the importance of the mechanism of aspiration of infected secretions by a supine individual in a coma,⁽¹¹⁾ This has also been observed in children with neurological disease and oral disease.⁽²⁹⁾ Multiple or bilateral abscesses are rarely caused by aspiration. When present, such abscesses must lead to the suspicion that another pathogenic mechanism is involved, especially hematogenous dissemination of microorganisms from an extrapulmonary focus, as is the case, for example, in staphylococcosis. The presence of pericavitary

lesions and pulmonary consolidation foci located far from a cavitory lesion is mainly suggestive of tuberculosis.

Together with clinical observation, simple anteroposterior, lateral chest X-ray, obtained with the patient in the orthostatic position, was the exam most frequently used (in all cases), clearly identifying the characteristics and location of the lesions, and making it possible to visualize the air-fluid levels within the cavities. Tomographic exams and endoscopic procedures were important in the analysis of the condition of the drainage bronchus and the abscess cavity wall, especially for making the differential diagnosis of carcinoma. Another noteworthy radiographic finding was the absence of foci of bronchial dissemination, indicating that, unlike *S. aureus* and *Mycobacterium tuberculosis*, the bacteria involved in this type of abscess (anaerobic bacteria) have less pathogenic power.

Mixed flora, which is indicative of the presence of anaerobic bacteria in the secretions and was observed in 72.2% of the patients in the study sample, as well as the finding of aerobic bacteria in routine sputum culture, are also in accordance with what has been reported in the literature.^(15,17) Aerobic and anaerobic bacteria are aspirated from the mouth into the lung during the period of unconsciousness, but, also, they are still present in the patient mouth after the establishment of the lung abscess. Therefore, bacteria grown in routine cultures (under aerobic conditions) certainly do not indicate the true or full sequence of events occurring within the lung, especially when the material examined is sputum. It is impossible to identify the anaerobic microorganisms, and the aerobic microorganisms found could originate from the lung abscess or from the mouth.⁽¹²⁾

The predominance of the use of penicillin as the antibiotic of choice in the present study is mainly due to two factors: the good clinical response obtained with its use; and the fact that the preference for the use of clindamycin in the treatment of anaerobic lung infections is relatively more recent.⁽²³⁻²⁴⁾ It is also important to emphasize the importance of postural drainage, which has always accompanied the clinical treatment of the patients.

The percentage of surgical cases (20.6%), which is higher than that found in other studies,⁽¹⁶⁻¹⁷⁾ was

probably due to the fact that ours is a facility specializing in pulmonology and thoracic surgery, receiving patients on the basis of referrals specifically for this type of treatment from other health care centers, especially patients whose cases are complicated by pleural empyema. The patients submitted to drainage of the abscess presented large abscesses and overall poor health, with no satisfactory response to the clinical treatment. Hematogenous dissemination of the infection to other organs by anaerobic microorganisms is less frequent. In a study of 123 cases of brain abscess, 17 cases were found to be caused by anaerobic bacteria. Nevertheless, the most prevalent bacteria in the present study were *Klebsiella pneumoniae* and *S. viridans*.⁽³⁰⁾

Mortality attributed to the disease was approximately 40%, and this is also in accordance with what has recently been reported.^(21,26)

The most important conclusion that can be drawn from the results of the present study is that, in accordance with the literature, aspiration lung abscess occurs predominantly in adult males presenting dental disease and having a history of loss of consciousness (especially as a result of alcohol abuse). In addition, we can conclude that aspiration lung abscess is typically accompanied by unilateral cavitation, is found in zones of the lung that are preferential for aspiration and contains mixed flora. Most patients with aspiration lung abscess respond adequately to clinical treatment (antibiotics - preferably penicillin or clindamycin - and postural drainage), although surgery is occasionally required, especially in cases presenting concomitant pleural empyema.

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