

# EMPHYEMA THORACIS AND LUNG ABSCESS

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## ABSTRACT

The case histories of 22 patients with lung abscess and empyema presenting to Hospital Universiti Sains Malaysia (HUSM) between 1984 and 1989 are reviewed. The presenting features of both lung abscess and empyema were similar. The commonest predisposing factor was pneumonia, and the commonest organism isolated was *Staphylococcus aureus* but in the majority of cases, no causal organisms were identified. All the patients were treated with antibiotics and in addition, closed chest tube drainage was performed initially in all patients with empyema. Three patients with empyema required additional surgical drainage procedures. Death occurred in one patient with empyema and in one patient with lung abscess. The features, aetiology, treatment and outcome of thoracic empyema and lung abscess are discussed.

**Keywords:** Lung abscess, empyema thoracis

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## INTRODUCTION

Since the introduction of antibiotics, the incidence and mortality of lung abscess and empyema has declined, but they still constitute serious illnesses and are associated with significant mortality. Over the last 40 years, there have been changes in the natural history and aetiology of lung abscess and empyema particularly regarding the emergence of different pathogens consequent upon the widespread use of broad-spectrum antibiotics for the treatment of respiratory and other infections<sup>(1-3)</sup>. The importance of empyema drainage was appreciated long before the advent of antimicrobial treatment and this remains the treatment of choice for empyema. However, for the management of lung abscess, medical treatment has now largely replaced surgical intervention.

We present the clinical features, microbiological results, treatment and outcome of 22 patients with lung abscess and empyema seen at the Hospital Universiti Sains Malaysia (HUSM) between 1984 and 1989.

## PATIENTS AND METHODS

The clinical records of 22 patients with a discharge diagnosis of empyema and lung abscess seen at the HUSM during the five-year period (September 1984 to August 1989) were reviewed. Lung abscess or empyema that were due to tuberculosis were excluded. HUSM has departments of general medicine, general surgery, paediatrics, orthopaedics and gynaecology. Cardiothoracic surgery was available only during the period from April 1987 to April 1988.

Clinical information, including the presenting symptoms, predisposing factors, sites of lesions, bacteriology, treatment

and eventual outcome were extracted from the case records. The empyema fluids obtained by needle aspiration or during chest tube drainage were cultured aerobically in the microbiology laboratory. Needle aspiration of lung abscess was performed in one case only. Fluids were also cultured for *Mycobacterium* and fungi but anaerobic culture was not routinely performed. Blood and sputum specimens were taken for culture in most patients.

## RESULTS

During the five-year period of study, 22 patients with lung abscess and empyema were admitted to HUSM (13 abscess and 9 empyema). The clinical features are summarised in Table I and the similarity of their presentations is noted. Although the conditions can occur at any age, they are more common in middle age (mean age 36 years). There is equal sex distribution with male:female ratio of 7:6 and 5:4 for lung abscess and empyema respectively. Both diseases occur more often on the right side and there is no correlation between the site of lesion and the underlying cause.

**Table I**  
Summary of Clinical Features

Clinical Features	Lung Abscess (n = 13)	Empyema (n = 9)
Age (years)		
Mean + 1SD	32 + 18	40 + 16
Range	16 - 68	25 - 67
Sex (Male : Female)	7 : 6	5 : 4
Site : Right	8	7
: Left	5	2
Symptoms:		
Fever	12 (91%)	6 (66%)
Cough	10 (76%)	6 (66%)
Chest pain	10 (76%)	8 (89%)
Dyspnoea	2 (15%)	5 (56%)
Duration of symptoms before presentation:		
Mean (weeks)	2	4
Range (weeks)	1 - 12	1 - 40

The most common presenting symptoms for lung abscess is fever (91%) followed by cough (76%) and chest pain (76%). For

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empyema, chest pain was the most common presenting symptom (89%) and in one-third of patients fever or cough was not present. The mean duration of symptoms before presentation was 2 weeks for abscess (range 1 to 12 weeks) and 4 weeks for empyema (range 1 to 40 weeks).

Identifiable underlying or predisposing factors are recognised in 8 patients (36%) with abscess and 3 patients (33%) with empyema (see Table II). These included pneumonia: 4, bronchiectasis: 1, and chronic obstructive airway disease: 2. No case of oropharyngeal aspiration as a predisposing factor to abscess or empyema was found although microaspiration could not be excluded. In all cases, the conditions were present on admission and none were hospital acquired.

**Table II**  
**Predisposing Factors**

Predisposing factors	Lung Abscess (n = 13)	Empyema (n = 9)
Pneumonia	2	2
Bronchogenic carcinoma	1	–
Chronic obstructive airway disease (COAD)	2	–
Bronchiectasis	1	–
Diabetes	1	–
Nephrotic syndrome on steroid	1	–
Trauma (Motor vehicle accident)	–	1
<b>Total</b>	<b>8</b>	<b>3</b>

The rate of positive cultures in our series was low. Overall, only in 27% (6/22) of cases the specimens grew any organisms. Sputum was bacteriologically positive in 31% (4/13) of patients with lung abscess, and the organisms isolated were *Staphylococcus aureus*: 2, *Haemophilus influenzae*: 1, and *Klebsiella pneumoniae*: 1. Blood culture was performed in 7/13 cases and all were cultured negative. In spite of vigorous cultures of blood, sputum and pleural fluid, of the 9 empyema cases only one grew *Streptococcus viridans* from sputum, blood and pleural fluid and one case grew anaerobic *Streptococcus* from pleural fluid.

The mode of therapy instituted in the patients is summarised in Table III. All but one patient with lung abscess required medical treatment alone. This patient underwent therapeutic needle aspiration for a large abscess. Only one case of lung abscess required surgery and this was for a large persisting cavity complicated by bronchopleural fistula presenting four months after initial treatment of the abscess. Closed chest tube drainage was performed in all patients with empyema. Additional surgery was performed in four patients; two patients requiring thoracotomy and decortication and one patient requiring rib resection. One patient was referred to another hospital for surgical treatment (details of procedure unknown).

The medical management of lung abscess and empyema was similar. All the patients received intravenous antibiotics before the results of cultures became available and the antibiotics were continued until the patients were discharged. The majority of patients (82%) received a combination of ampicillin, gentamicin, and metronidazole. Other antibiotics commonly used were cloxacillin and cephalosporins (second and third generation). Single antibiotics were used in three patients. Some patients (those with residual radiological abnormalities) were continued

on oral antibiotics between one to two weeks after discharge. Two patients (1 abscess and 1 empyema) were referred to the tuberculosis centre for non-resolving infection where tuberculosis was suspected although *Mycobacterium* were not isolated.

**Table III**  
**Mode of Treatment**

Conditions	Mode of treatment	No. of cases
Lung abscess (n = 13)	Medical treatment alone	12
	Medical treatment plus therapeutic aspiration	1
Empyema (n = 9)	Closed tube drainage alone*	5
	Closed drainage plus surgery*	
	Thoracotomy & decortication	2
	Rib resection	1
	Unknown	1

\* Medical treatment was given concurrently in all patients

The mean duration of hospital stay for lung abscess was 22 days (range 3 to 90 days) and for empyema was 24 days (range 1 to 81 days). Patient outcome is shown in Table IV. Fifty-four percent (7/13) of patients with lung abscess and 44 percent (4/9) of patients with empyema were discharged well without complications. Complications occurred in two patients with lung abscess and in three patients with empyema. These were bronchopleural fistula: 2, persistent cavity: 1, localised bronchiectasis: 1 and persistent pneumothorax: 1. One patient with empyema died due to septicaemia associated with disseminated intravascular coagulation both of which were present on admission. Death also occurred in one patient with abscess but the cause of death in this patient was not known. He died suddenly when he was clinically improving. No postmortem was carried out. Two patients with lung abscess were discharged against medical advice and did not return for review. The outcome of these two cases is not known.

**Table IV**  
**Patient Outcome**

Outcome	Abscess	Empyema
Cured (improved without sequelae)	7	4
Referred for tuberculosis therapy	1	1
Improved with late sequelae		
Persistent cavity	1	–
Bronchiectasis (localised)	1	–
Bronchopleural fistula	–	2
Persistent pneumothorax	–	1
Died	1	1
Outcome unknown	2	–
<b>Total</b>	<b>13</b>	<b>9</b>

## DISCUSSION

Although treatment of pleuropulmonary infection of the respiratory system with antibiotics has improved over the last

decades, this condition still constitutes a serious illness with significant mortality.

Although lung abscess and empyema occur at any age, like others<sup>(4,6)</sup>, we found that they are more common in middle age. Hagan<sup>(7)</sup> found that lung abscess is a disease of middle age males and Varkey<sup>(8)</sup>, found that with one exception, all of his 72 patients with empyema were men. Neild et al<sup>(9)</sup> however, found no difference in the sex distribution. In our series, lung abscess and empyema occurred slightly more commonly in males.

The clinical picture of patients with aerobic bacterial pneumonia and pleural effusion is quite similar to that of patients with bacterial pneumonia without effusion. In patients with acute bacterial pneumonia, the incidence of chest pain and the degree of leukocytosis are comparable whether or not there is accompanying pleural effusion<sup>(10)</sup>. Patients with anaerobic bacterial infections involving the pleural space usually present with a subacute illness<sup>(11)</sup>.

Most of our patients with lung abscess and empyema (82%) presented with fever, cough and chest pain. Similar features were reported by Bartlett et al and Cameron et al<sup>(6,12)</sup>. The relatively long duration of illness before presentation of our cases suggests that anaerobes may be the causal organisms, even though they were not cultured in the majority of cases (vide infra).

Our finding that both lungs abscess and empyema more commonly occur on the right side agrees with previously reported studies<sup>(4,9,13)</sup>.

Direct extension from a pulmonary focus, usually an area of pneumonia, is a common route of infection to the pleural space. Before the Second World War, pneumonia accounted for approximately 80% of reported cases of thoracic empyema<sup>(14)</sup>. With the increase in intrathoracic and abdominal surgery in recent decades several studies have recorded an increase in post-operative empyema<sup>(15)</sup>. In our series, 20% empyema developed after pneumonia, and one case developed after chest trauma following a motor vehicle accident. In the others, no cause of the empyema was identified. Because cardiothoracic surgery was not routinely performed at HUSM, there was no post-operative empyema in our series.

It has been well established that most primary lung abscesses result from oropharyngeal aspiration, with decreased level of consciousness being the major predisposing factor<sup>(16)</sup>. Experimentally, recognisable abscess formation generally occurs 8 to 14 days following the episode of aspiration<sup>(17)</sup>. In our series, no case of aspiration as a cause of abscess formation was identified, although microaspiration could not be excluded.

Microbiological results indicate that a wide variety of bacteria, both aerobic and anaerobic, are found in pleuropulmonary infection. The bacteriology of empyema and lung abscess has changed remarkably over the years since the introduction of antibiotics<sup>(1-3)</sup>. Before the availability of antimicrobial agents, the leading cause of empyema was *Streptococcus pneumoniae* followed by haemolytic *Streptococcus*<sup>(3)</sup>. With the availability of penicillin, these organisms dramatically decreased, but empyema caused by *Staphylococcus aureus* and gram-negative rods rose steadily<sup>(3)</sup>. Neild et al<sup>(9)</sup> found that the commonest aerobic organism isolated to be *Streptococcus*.

Currently, the commonest organisms isolated are the anaerobes<sup>(1)</sup>. The reported incidence of anaerobic empyema (alone or in combination with aerobes) varied greatly in different series. Sullivan et al<sup>(18)</sup> reviewed 22 previous series; each included at least 100 cases of empyema. He found that the percentage of anaerobic organisms reported in these studies ranged from 0 to 11%; one of the reasons for this being the differences in the methods of transportation and processing of pleural specimens. If care is taken when the pleural fluid is cultured, nearly 90% will yield positive anaerobic culture results<sup>(1)</sup>. In a study of 93 lung

abscesses investigated by transtracheal aspiration, Bartlett (19) recovered anaerobes from 83 (89%), and in 40 of these aerobes were also present.

The importance of anaerobic bacteria in lung abscess has also been emphasised, particularly in recent years<sup>(19,20)</sup>. Bartlett<sup>(21)</sup> found with careful anaerobic cultures of transtracheally-obtained specimens that the majority of the lung abscesses (24 of 26 in his series) contained anaerobes. In another series, Gonzales<sup>(22)</sup> found that 100% of his patients had at least one anaerobic organism grown from the lung abscesses.

In our series, the causative organisms are not known in the majority of cases. Even in cases in which organisms were identified, it is still doubtful whether these were the causative organisms because in most cases only a single specimen was positive. The low rate of positive cultures may be due to prior antibiotics treatment, poor specimen collections and culture methods. The range of organisms isolated from lung abscess and empyema were similar. *Staphylococcus aureus* was the commonest pathogen isolated. Other organisms isolated included hemolytic *Streptococcus*, *Haemophilus influenzae* and *Klebsiella pneumoniae*. Anaerobic *Streptococcus* was isolated from pleural fluid aspirated from one patient with empyema. The low yield of anaerobic organisms is most likely due to our methods of specimen collection, transport and culture. Also anaerobic culture was not done routinely in all cases.

For many years, penicillin has been recommended for the treatment of lung abscess<sup>(11,21,23)</sup>. But the sole use of penicillin is unsuitable before sensitivity results are available since 45% of aerobes and 17.8% of anaerobes are resistant to penicillins<sup>(4,8,9)</sup>. In a study by Levison et al in 1983, comparing intravenous penicillin G with clindamycin for the treatment of anaerobic lung abscess, it was shown that clindamycin is significantly superior to penicillin<sup>(24)</sup>. Nevertheless, penicillins are preferred by many based on its crucial historical position, the reduced side-effects and the low cost.

Another drug that has been used for anaerobic infections is metronidazole. It is active in vitro against nearly all anaerobic bacteria. However, in the treatment of anaerobic pulmonary infections, a high failure rate was reported<sup>(25,27)</sup>. The probable explanation for this poor outcome is that metronidazole is not active against aerobic and microaerophilic streptococci that are contributing pathogens in many of these cases. Metronidazole is now advocated only in combination with penicillin<sup>(28)</sup>. Therefore, for the initial treatment of lung abscess and empyema, most physicians would still use the penicillins with or without combination with metronidazole. Neild et al in a study in 1985, suggested that if treatment is to be started before culture and sensitivity results are available, oral ampicillin or amoxycillin and metronidazole is usually appropriate<sup>(9)</sup>. The frequent use of aminoglycosides in the cases studied would not be appropriate.

The principles of management of thoracic empyema include the institution of appropriate antimicrobial treatment with provision for adequate dependent drainage and obliteration of pleural space. Studies suggest that antibiotics alone are often insufficient. Drainage of empyema is a well established principle of treatment<sup>(15)</sup>. Closed chest tube drainage, rather than multiple thoracocentesis, is the preferred method of initial treatment of an acute empyema<sup>(29,32)</sup>. However, a review of previous reports indicates that closed chest tube drainage alone may not be sufficient, and other methods of surgical drainage are required in up to a third of cases<sup>(17,29,32,33)</sup>. Such surgical procedures include rib resection and open drainage, open window thoracotomy or thoracotomy with decortication aimed at obliterating the pleural space.

Successful closed drainage of complicated parapneumonic effusion (defined as those effusions that do not resolve without

tube thoracostomy) is associated with clinical and radiological improvement within 24 to 48 hours<sup>(12)</sup>. Weiss<sup>(34)</sup> studied cavity behaviour in 71 patients with acute, primary non-specific lung abscess and found that 13% of cavities were gone in 2 weeks, 44% in 4 weeks, 59% in 6 weeks and 70% in 3 months after appropriate treatment had been initiated.

The overall mortality (case-fatality ratio) is high in empyema and lung abscess. Previous series that include primarily adult patients found the mortality ranges from 11.2% to 48.5%<sup>(31, 35-37)</sup>. The factors that affect the prognosis include large cavity (> 6cm), prolonged symptoms (> 8 weeks), multiple small abscess (necrotising pneumonia), old age, immunologically compromised host, bronchial obstruction (secondary abscess) and abscess due to aerobic bacteria<sup>(7)</sup>.

In summary, our series of 22 patients with lung abscess and empyema is similar to previously reported series in terms of presenting symptoms, treatment and outcome. However, some important differences did emerge. Firstly, there was generally a low yield of organisms isolated and in particular, only one positive anaerobic culture was obtained. This most probably reflects specimen handling, transport and processing.

Secondly, the period of time prior to presentation to hospital was longer than in other reported series. This may be due to anaerobes being the dominant causal organism (although this could not be proved) but also due to differences in illness perception in this group of patients (ie. visiting alternative health care). Lastly, there was a relatively high number of cases without identifiable predisposing factors. Tests of immune function were not performed, but it is possible that a degree of immunological incompetence may have been present in some patients.

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