

# Pulmonary Abscess in Infancy and Childhood: \*

## Report of 18 Cases

THOMAS C. MOORE, M.D., J. STANLEY BATTERSBY, M.D.\*\*

*From the Department of Surgery, Indiana University Medical Center,  
Indianapolis, Indiana*

PULMONARY ABSCESSSES seldom occur during infancy or childhood. For this reason, perhaps, the problem of lung abscess in this age group has received scant attention in the surgical literature. Although the incidence of pulmonary suppurative disorders has decreased since the availability of numerous chemotherapeutic and antibiotic agents, an increasing number of pulmonary infections due to relative resistant staphylococcal organisms has been encountered in recent years. Sabiston and his associates<sup>2</sup> in 1959, reported their experience at the Johns Hopkins Hospital with the surgical management of complications in 64 cases of staphylococcal pneumonia in infancy and childhood. A recent experience with post-pneumonic lung abscess in childhood due to hemolytic staphylococcus aureus was reported by one of the authors in 1958.<sup>1</sup> Because of current interest in the complications of pulmonary infection in the early years of life, especially those due to staphylococcal organisms, it has seemed desirable to review and report the experience with 18 cases of pulmonary abscess in infancy and childhood seen at the Indiana University Medical Center during a 25-year period, 1934 to 1959.

### Clinical Features

The majority of the patients were seen prior to the availability and frequent use of antibiotics. Ten of the patients were seen initially in the period 1934 to 1945 and anti-

biotics were not employed in their management, whereas antibiotics were given in all of the 8 patients in the period from 1946 to 1959 (Table 1). Fourteen of the 18 patients were seen prior to 1948.

Ten of the patients were boys and eight were girls. Seven of the patients were two years of age or younger. Three patients were between seven and eight weeks of age and four were in the 16 to 24 months age range. The remaining 11 patients were between four and 11 years of age and were evenly distributed by years within this period.

Fever, cough, the expectoration of purulent sputum and weight loss were the most frequently encountered symptoms (Table 2). Fever, the commonest symptom, was observed in 15 of the 18 cases. Hemoptysis occurred in only four of the cases and osteoarthropathy in but one. Chest pain did not appear to be a significant complaint.

The pathogenesis of the pulmonary abscess was reasonably clear in the majority of cases (Table 3). The abscess occurred following an episode of pneumonia or pneumonitis in 12 of the 18 cases. In two cases, the abscesses developed following operations—appendectomy and eye surgery. Tonsillectomy and adenoidectomy had been carried out in three additional cases (Cases 4, 5, 10) prior to admission to the hospital. However, in all three cases the clinical course of the pulmonary abscess had been well established prior to tonsillectomy and the operation had been performed in the hope of controlling the septic process. Foreign-body aspiration was the cause of ab-

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TABLE 1. Summary of Clinical Experience with 18 Cases of Pulmonary Abscess in Infancy and Childhood

Case No.	Year	Age	Sex	Etiology of Abscess	Location of Abscess	Bacteriology of Abscess	Treatment	Operation	Results	Remarks
1	1934	5 yrs.	F	Pneumonia	RUL	Hemolytic <i>Staphylococcus aureus</i>	Bronchoscopy, transfusions	None	Died	Died of massive pulmonary hemorrhage in 1941
2	1935	5 yrs.	F	Pneumonia	LLL	<i>Staph. aureus</i>	Operation	Rib resection and drainage of abscess, 1935	Recovered	
3	1938	9 yrs.	M	Pneumonia	RLL	Hemolytic Strep.	Postural drainage.	Middle and rt. lower lobectomy, 1946	Recovered	
4	1939	6 yrs.	F	Pneumonia	LUL RML	Hemolytic <i>Staph. aureus</i>	Operation tracheotomy, transfusions	None	Died	Died of brain abscess and purulent meningitis, in 1940
5	1940	21 mo.	M	Pneumonia	LUL	Nonhemolytic Strep.	Bronchoscopy, tracheotomy, transfusions	None	Died	Died of brain abscesses in 1940
6	1940	4 yrs.	F	Pneumonia	RLL	<i>Staph. albus</i> <i>Strep. viridans</i>	Bronchoscopy, empyema drainage, postural drainage	None	Died	Died of brain abscess and purulent meningitis, in 1941
7	1942	6 yrs.	F	Pneumonia	LLL		Attempted operation	None	Died	Died in 1942 when abscess ruptured into tracheobronchial tree during induction of anesthesia
8	1943	8 yrs.	M	Pneumonia	RUL RML RLL	Hemolytic Strep.	Bronchoscopy	None	Died	Died in 1944 when solitary abscesses of RUL, RML, and RLL were complicated by left pyopneumothorax
9	1945	2 mo.	M	? Aspiration Feeding problem	RUL		Supportive	None	Died	Died of overwhelming sepsis shortly after admission to the hospital in 1945
10	1945	10 yrs.	M	Aspiration of foreign body. (Twig from fir tree)	LUL	<i>Strep. viridans</i> <i>Staph. epidermidis</i>	Operation	Left upper lobectomy in 1945	Recovered	
11	1946	11 yrs.	M	Pneumonia	RLL	Hemolytic strep. <i>Strep. viridans</i> Anaerobic fusiform bacillus	Sulfa drugs, penicillin, thoracentesis, operation	Right lower lobectomy in 1947	Recovered	
12	1946	2 mo.	M	Pneumonia	RML RLL	<i>Staph. aureus</i> Nonhemolytic strep.	Sulfadiazine, penicillin, thoracentesis	None	Died	Died of overwhelming infection complicated by right tension pneumothorax in 1946
13	1947	8 yrs.	M	Postoperative (Appendectomy)	LUL	Nonhemolytic strep.	Penicillin bronchoscopy	None	Recovered	
14	1947	4 yrs.	F	Postoperative (Eye operation)	RML		Penicillin	None	Recovered	
15	1951	7 wks.	M	Pneumonia	RML RUL	Hemolytic <i>Staph. aureus</i>	Penicillin, operations (2)	Right middle lobectomy, Jan. 1951 Right upper lobectomy, March, 1951	Recovered	
16	1955	18 mo.	F	Mental deficiency. Cerebral spastic	RUL	<i>E. coli</i> Alpha Strep.	Penicillin, supportive therapy	None	Died	Died in 1955 of purulent meningitis
17	1956	2 yrs.	M	Aspiration of Foreign body (Popcorn)	RUL		Bronchoscopy, Achromycin, penicillin, streptomycin, operation	Right upper lobectomy, in 1956	Recovered	
18	1958	16 mo.	F	Pneumonia	LLL	Hemolytic <i>Staph. aureus</i>	Penicillin, Achromycin, operation	Left lower lobectomy, in 1958	Recovered	

TABLE 2. *Symptoms Encountered in the 18 Cases*

Fever	15
Cough	10
Purulent sputum	6
Weight loss	6
Hemoptysis	4
Cyanosis	3
Nausea and vomiting	2
Dyspnea	2
Lethargy	2
Clubbing of fingers and toes	1
Weakness	1
Headache	1
Convulsions	1

scuss formation in two cases. It was due to a segment of popcorn in one case and in the other, a twig from a fir tree was found obstructing the bronchus of the surgical specimen. One two-month-old infant had been a feeding problem and the possibility of aspiration had been considered. It is possible also that this infant might have suffered from an unrecognized pneumonia prior to the development of a right upper lobe abscess. Another patient was mentally deficient and a cerebral spatic. It appeared likely that aspiration had occurred in this case.

Twenty-three lobes were involved in the 18 cases. The abscess was confined to one lobe in 14 cases and more than one lobe was affected in four cases. Two lobes were involved in three cases and three lobes in one. The lobe distribution of the abscesses

TABLE 3. *Pathogenesis of Pulmonary Abscess*

Pathogenesis	No. Cases
Post-pneumonic	12
Postoperative	2
Appendectomy	1
Eye operation	1
Foreign body aspiration	2
Twig from fir tree	1
Popcorn	1
Feeding problem (? Aspiration)	1
Mental deficiency and cerebral spasticity	1
Total	18

showed a greater tendency for right-sided involvement (Table 4). It was of interest that the right middle lobe was affected in all four of the cases in which multiple lobe involvement occurred. In two cases, an abscess was found in both the right middle and right upper lobes and, in one case, all three right lobes contained abscesses. Abscesses in the right middle lobe and the left upper lobe was found in the other patient with multiple lobe involvement. It also was of interest that all four of the cases in which multiple lobe involvement occurred were post-pneumonic in etiology.

Cultures were obtained from the abscesses of 14 of the 18 cases. Streptococcus was grown in 10 cases and a staphylococcus in eight. A fusiform bacillus and *E. coli*

TABLE 4. *Lobes Involved in Abscess Formation*

Right upper lobe	6
Right middle lobe	5
Right lower lobe	5
Left upper lobe	4
Left lower lobe	3

were encountered in one case each. Staphylococcus was discovered in the cultures of seven of the 11 cases in the post-pneumonic group in which a culture was obtained. In the post-pneumonic group, hemolytic *Staphylococcus aureus* was the only organism cultured in four cases and hemolytic streptococcus was the only organism in two. Only nonhemolytic streptococcus was grown in one post-pneumonic case.

The diagnosis was made from the clinical picture and the roentgen studies of the chest and was confirmed in 16 of the cases by operation or by postmortem examination. Eleven of the patients were managed by nonoperative measures in which no direct surgical attack on the abscess was made and seven patients were treated by drainage of the abscess or by pulmonary resection (Table 5). The "nonoperative" measures included general supportive therapy, transfusions, thoracenteses, broncho-

copy, tracheostomy, postural drainage and antibiotics. These "nonoperative" measures were employed in seven cases prior to the availability of antibiotics and all seven died. Antibiotic therapy was utilized in addition to the other "nonoperative" means of treatment in four cases. Two of these patients recovered and two died. All seven of the patients who were managed by drainage or resection of the abscess recovered. Drainage of the abscess was carried out in only one case. In six cases, a total of eight involved lobes were removed in seven operations without fatality or serious complications. In the first three operations a tourniquet type of lobectomy was performed, whereas dissection lobectomy was employed in the last four operations.

The causes of death in the nine "medically" managed cases which failed to respond to treatment are of some interest (Table 6). Brain abscess and purulent meningitis were the most frequently encountered causes of death. Other fatal complications of the pulmonary abscess in this group included exsanguinating pulmonary hemorrhage, rupture of abscess into the tracheo-bronchial tree, pneumothorax and overwhelming infection.

**Discussion**

Pulmonary abscess, as reported in the literature, has been largely an adult disease. This is illustrated by the representative experience reported by Taber and Ehrenhaft,<sup>3</sup> in 1953, from the Hospital of the State University of Iowa. They found that only five of 128 consecutive patients in their series (4%) were under 10 years of age. It is of interest to compare their largely adult experience with the pediatric experience recorded here.

The pathogenesis of the abscess was roughly comparable in the two age groups. Post-pneumonic abscesses were the most frequently encountered in both groups. The symptoms also were similar with the exception of chest pain which did not appear

TABLE 5. Summary of Treatment and Results

Treatment	No. Cases	Deaths
Nonoperative	11	9
Without antibiotics	7	7
With antibiotics	4	2
Operative	7	0
Rib resection and abscess drainage	1	0
Lobectomy*	6	0
Totals	18	9

\* Eight lobes were resected during 7 operations.

to be a significant complaint in childhood. The anatomic lobar distribution of the abscesses was nearly identical in the two groups. In both, the involvement of the right lung was approximately twice that of the left. However, in the pediatric group there appeared to be a greater tendency for right middle lobe involvement.

There was a relatively greater incidence of staphylococcal infections in the pediatric group. The ratio of streptococcus to staphylococcus cultures in the adult series was 65 to 16, while in the pediatric group it was only 10 to eight. A pure culture was obtained in seven of the cases in the post-pneumonic pediatric group. Hemolytic staphylococcus aureus was grown in four of the seven.

The results of the "nonoperative" management of pulmonary abscesses in the pediatric age group prior to the availability of antibiotics were poor indeed. All of

TABLE 6. Causes of Death

	No. Cases
Brain abscess, purulent meningitis or both	4
Massive pulmonary hemorrhage	1
Rupture of abscess into tracheo-bronchial tree	1
Pyopneumothorax	1
Tension pneumothorax with overwhelming infection	1
Overwhelming infection	1
Total	9

the patients in this series died. Suppurative intracranial disease was the most lethal complication and was responsible for nearly one-half of the deaths. Even the addition of antibiotic therapy to the "nonoperative" program of management was not entirely effective or successful. On the other hand, the results experienced when pulmonary resection was employed were most encouraging.

The incidence of pulmonary abscess has decreased markedly in recent years in both adult and pediatric age groups due largely to the availability and skillful use of a variety of antibiotics in acute pulmonary infections. Few pneumonic processes are permitted to reach the stage of acute abscess formation and it is likely that many of the acute pulmonary abscesses which do form may be managed successfully in their early stages by vigorous antimicrobial therapy. The major difficulty at the present time arises in those cases in which the infection is due to an organism which is resistant to the available antibacterial agents. It is in this group of cases that we may expect pulmonary resection to remain of value.

### Summary

1. A 25-year experience with 18 cases of pulmonary abscess in infancy and childhood is reported.

2. There was no significant sex distributions and the ages of the patients ranged from seven weeks to 11 years.

3. The pathogenesis of the abscess was regarded as post-pneumonic in the majority of cases. The abscess occurred following an episode of pneumonia or pneumonitis in two-thirds of the patients.

4. Fever was the commonest symptom. It was encountered in 15 of the 18 cases. It was followed in order of frequency by cough, purulent sputum, weight loss and hemoptysis.

5. The clinical features of pulmonary abscess in the pediatric age group are discussed and compared with those encountered with this disorder in adulthood.

6. The right lung was involved in abscess formation approximately twice as often as the left. There appeared to be a greater tendency toward right middle lobe involvement in the pediatric age group. Multiple lobe involvement was encountered in four of the 18 cases. All four cases were post-pneumonic and, in all four, the right middle lobe was involved.

7. The relative incidence of hemolytic staphylococcus aureus infection was greater in the pediatric age group.

8. Eleven of the patients were managed by "nonoperative" measures and only two recovered. All seven patients managed by "nonoperative" measures without antibiotics died and two of the four whose "nonoperative" management included the use of antibiotics died.

9. Nearly one-half of the deaths resulted from brain abscesses or purulent meningitis. Other fatal complications included massive pulmonary hemorrhage, rupture of the abscess into the tracheo-bronchial tree, pneumothorax and overwhelming infection.

10. All seven of the patients on whom a direct surgical attack on the abscess was carried out recovered. Rib resection with drainage of the abscess was the only procedure utilized in one case. The remaining six cases were managed successfully by lobectomy. Eight lobes were removed in these six cases during seven operations.

11. The decreasing incidence of pulmonary abscess in infancy and childhood and the role of pulmonary resection in the management of abscesses caused by resistant organisms are discussed.

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