

LUNG PUNCTURE ASPIRATION IN THE DIAGNOSIS OF ACUTE PNEUMONIAS

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ABSTRACT

The present study was carried out in 100 children of acute pneumonia to establish the diagnosis of etiologic agents. Clinico-radiological assessment and routine investigations including sputum, throat swab and blood culture did not help in identifying the offending micro-organisms. The bacteriological examination of lung puncture aspirate was the most satisfactory tool for the etiologic diagnosis. Direct smear examination/culture were positive in 50% aspirates. On cytology, definite epithelioid granulomas indicated tuberculous infection. However, in direct smear/culture negative patients, predominant mononuclear cell infiltration in the aspirated material may indicate non-pyogenic infection. *Staphylococcus aureus* (22%) was the commonest organism causing pneumonia in the present study.

Key words: Lung puncture aspiration, Pneumonia, Culture.

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Early diagnosis of etiologic agents in pneumonia, a waxing problem in pediatric patients, is essential for proper and effective antimicrobial therapy(1,2). The relevance of culture of material obtained from upper respiratory tract, viz., throat swab and of sputum in isolating the etiologic agent in pneumonia is questionable(3). On the other hand, bacteriological examination of material obtained by simple needle aspiration from the area of consolidation in lung provides useful information to detect the causative agent, as normally lower respiratory tract is free of viable bacteria(4-7). The technique has been described superior to sputum examination and culture of blood of nasopharyngeal swab(1,7-10). The present study was undertaken to assess the efficacy of lung puncture aspiration (LPA) in establishing the diagnosis of etiologic agents in pneumonia and to correlate the result with the organism grown from the upper respiratory tract.

Material and Methods

The study was carried out in 100 children suffering from acute pneumonia between the ages of six months to 14 years admitted to Pediatric ward of Medical College Hospital, Rohtak. These patients were divided into two groups, i.e., Group 'A' 50 children who had not received any antibiotics and Group 'B' 50 children who had received antibiotics (chloramphenicol, cotrimoxazole, penicillin) and were not responding to therapy.

In all patients, in addition to routine clinical examination, blood and urine investigations, Mantoux test, gastric lavage for AFB, blood culture for pyogenic organisms, sputum and throat swabs culture and sensitivity were done. Skiagram of chest was taken in all cases.

The indication for LPA in Group 'A' was to establish the exact identity of offending micro-organisms and to guide the antimicrobial therapy according to sensitivity. In Group 'B', it was performed when the child was either not responding to routine antibiotics or had deteriorated.

Lung puncture aspiration was done in the area of maximum consolidation/infiltration on the basis of clinico-radiological assessment before the start of treatment, using 10 ml syringe and 18 gauge short bevelled needle with 0.5 ml sterile saline drawn into syringe. The material was immediately inoculated on blood agar and McConkey's agar media. Direct smears were also made and examined after staining with Gram's and Ziehl Neelsen's stains. One air dried smear was stained with May Grunwald Giemsa stain to see the type of cells. The standard bacteriological procedures were carried out for identification of various organism and their sensitivity(11). Non-fatal complications observed were pneumothorax and hemoptysis in 2 cases each. The pneumothorax responded to tube drainage for 24 hours.

The procedure was not carried out in presence of pulmonary emphysema, pneumothorax and bleeding tendency(1).

Results

1. Clinico-Radiological Examination

These patients mainly presented with fever and cough. Lobar pneumonia was observed in 80 cases (44 of Group 'A' and 36 of Group 'B') while 20 (Group 'A'-6, Group 'B'-14) had bronchopneumonia. One patient in Group 'A' had multiple pneumatoceles in addition to lobar pneumonia.

2. Bacteriological Examination

(a) *Throat swab culture*: Three types of organisms, viz., *Staphylococcus aureus*, *Streptococcus pneumoniae* and *E. coli* were isolated from 18 patients (Table I). Rest of them were either sterile or showed normal flora.

(b). *Blood culture*: Pathogenic organisms were shown in 4 cases (*Strep. pneumoniae*-2, *Staph. aureus*-2) with a distribution of 2 cases in each group.

(c) *Sputum culture*: Positivity was observed in 12 cases (8 in group 'A' and 4 in Group 'B'). The pathogenic organisms isolated were *Staph. aureus*-3 cases, *Strep. viridens*-3 cases, *Strep. pneumoniae*-3 cases, both *Staph. aureus* and *Strep. pneumoniae* in 1 case and *E. coli* in 1 case.

TABLE I—Organismwise Distribution of Positive Pulmonary Aspirate Culture in Patients with Positive Throat Swab Culture

Type of organism	Positive throat swab culture	Positive pulmonary aspirate (Total)	Positive pulmonary aspirate Group 'A'	Positive pulmonary aspirate Group 'B'
<i>Staph. aureus</i>	4	2	—	2
<i>K. pneumoniae</i>	10	2	—	2
<i>E. coli</i>	4	2	—	2

(d) *Lung Puncture Aspiration*: Direct smear and/or culture were positive in 50% cases, i.e., 29 (58%) of Group 'A' and 21 (42%) of Group 'B' (Table II). Direct smear examination revealed acid fast bacillus (AFB) in two cases who had bronchopneumonia.

Antibiotic sensitivity pattern of microorganisms is shown in Table III. The patients were put on antibiotics to which the organisms showed maximum sensitivity. Penicillin, cloxacillin and cephalosporins were used in combination in patients with negative culture and positive direct smear. In Group 'B' the treatment was changed in all the patients. All responded to revised antimicrobial therapy.

A very poor correlation was obtained between the results of throat swab and lung aspirate cultures. The growth of similar organisms was seen in only 6 cases (Table I) of Group 'A'. Similarly, same organism on sputum and lung aspirate culture was grown in 6 cases.

3. Cytological and Hematological Examinations

The total and differential leucocyte counts revealed leucocytosis (TLC 12,000-24,000/cumm) with neutrophilia (polymorphs 64-95%) in all cases showing infection with *Staph. aureus*. In infection with other agents, counts were variable

TABLE II—Results of Lung Puncture Aspirate

S. No.	Direct smear positivity		Type of organism	Culture positivity in relation to direct smear positivity	
	Group 'A'	Group 'B'		Group 'A'	Group 'B'
1. Gram positive cocci in clumps	22 (44)	8 (16)	<i>Staph. aureus</i>	18 (36)	4 (8)
2. Gram positive cocci	1 (2)	—	<i>Strep. viridans</i>	1 (2)	—
3. Gram positive diplococci	2 (4)	3 (6)	Sterile	2 (4)	3 (6)
4. Gram positive cocci in clumps and chain	2	1	<i>Staph. aureus</i> & <i>Strep. hemolyticus</i>	2 (4)	1 (2)
5. Gram negative bacilli	2	7	<i>Klebsiella</i>	2 (4)	5 (10)
6. Acid fast bacillus	—	2 (4)	Sterile	—	2 (4)
Total	29 (58)	21 (42)	Positive culture	23 (46)	10 (20)
			Negative culture with positive direct smear	6 (12)	11 (22)

1. In none of the cases, positive culture was obtained with negative direct smear.

2. *Staph. citreus* and *Staph. albus* were reported as contaminants.

Figures in parantheses, represent percentages.

TABLE III—Antibiotic Sensitivity Pattern

Drugs	<i>Staph. aureus</i>		<i>Staph. viridans</i>		<i>Strep. hemolyticus</i>		<i>Klebsiella</i>	
	Gp 'A' (n=20)	Gp 'B' (n=5)	Gp 'A' (n=1)	Gp 'B' (n=0)	Gp 'A' (n=2)	Gp 'B' (n=1)	Gp 'A' (n=2)	Gp 'B' (n=5)
Penicillin	10	Nil	1	—	1	—	—	—
Cloxacillin	14	3	—	—	2	1	—	—
Ampicillin	8	4	—	—	1	1	—	—
Cephalosporins	16	1	—	—	2	1	2	5
Gentamicin	3	—	1	—	—	—	2	2
Cotrimoxazole	18	—	—	—	—	—	—	—
Chloromycetin	4	—	—	—	—	—	—	—

(TLC 9,300-18,000/cumm, polymorphs 28-92%) bearing no correlation with etiological agents. Mean total leucocyte count was slightly higher (13,500/cumm) in patients with positive lung aspirate culture than in the patients with sterile culture (average 10,300/cumm) Lymphocytosis (lymphocyte count 62-86%) was observed in 8 cases with sterile pulmonary aspirate cultures, and in one patient showing AFB on direct smear examination of lung puncture aspirate.

The cytological examination of lung aspirate showed acute inflammatory infiltrate comprising of polymorphs, macrophages, RBCs and few lymphocytes in 78 patients. Smear from aspirates of tubercular patients revealed both acute and chronic inflammatory infiltrates. In addition, epitheloid cells and Langhan's giant cells were observed in one patient showing AFB in pulmonary aspirate. In 10 out of 50 cases with negative lung aspirate culture or direct smear, macrophages and lymphocytes were the predominant inflammatory cells.

Discussion

The etiologic diagnosis of pneumonia poses considerable problem. The clinico-radiological examination is not specific and may change during the course of diseases(12). The results of throat and nasopharyngeal swabs and sputum culture may be misleading because of high incidence of commensals/pathogens in upper respiratory tract(1,3,7-10,13). This reflected in present study also. The growth of organisms similar on culture of lung puncture aspirate and throat swab was observed in only 6 cases out of 18 throat swab positive cases. Difficulty was encountered in collecting the sputum specimen and positivity was observed only in 12 cases in comparison to 50% positivity of LPA. The yield of blood culture was very poor and reflected inadequacy of this method in establishing the etiologic agent of pneumonia.

The indications for performing diagnostic lung puncture as outlined by Klein were (a) A critically ill child in whom a specific etiologic diagnosis is required to guide antimicrobial therapy, (b) A child

who has deteriorated despite therapy, and (c) A child with pneumonia complicated by underlying disease or drugs limiting normal host mechanism(10).

In addition, Gracia recommended the procedure for epidemiological study of causative agents and in patients with suspected pulmonary tuberculosis when diagnosis could not be confirmed by other methods(1).

In the present study, LPA was performed in order to establish the diagnosis of etiologic agents in children serious enough to need hospitalization and in those who were not responding to routinely employed antibiotics (penicillin, cotrimoxazole, chloromycetin) in our hospital. The procedure was generally safe with complications being observed in 4 cases. However, the utility outweighed the complications as all the children in Group 'B' responded to modified antimicrobial treatment. Bacteriological positivity of the material obtained was 50%. The results were better in Group 'A' as compared to Group 'B'. In the latter, direct smear examination provided better results compared to culture. This may suggest no viability of micro-organisms observed on direct smear examination due to antibiotic therapy which may, however, not be effective enough to cure the disease.

As reported in other studies, *Staph. aureus* was to be the commonest cause of pneumonia in the present study also(2,9, 14). The growth of *Staph. citreus* and *Staph. albus* was considered as contamination. The negative bacteriological examination in 50% of sample could be due to inadequate culture method (for virus, mycoplasma and anaerobic infection), prior chemotherapy or defective techniques (appropriate area not adequately aspirated)(10). Predominance of lymphocytes and macro-

phages on cytology of aspirates in 10 out of 50 children who had negative direct smear/culture might suggest atypical pneumonia. A negative yield of bacteriological examination of lung puncture aspirates has been observed by others(10,15). Klein reported culture positivity in 10/28 samples only(10). In the present study, diagnosis of tuberculosis was established in 2 cases on lung puncture aspirates in whom radiological appearance was not suggestive of disease and there was no response to antibiotic therapy. Schuster *et al.* found this method to be most satisfactory to diagnose tuberculosis in such a situation(15).

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