

STAPHYLOCOCCUS AUREUS PNEUMONIA AMONG PEDIATRIC AGE GROUP: THE PHILIPPINE GENERAL HOSPITAL EXPERIENCE

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Abstract

Pneumonia caused by *Staphylococcus aureus* (*S. aureus*) is a serious and rapidly progressive infection which is associated with high incidence of complications and mortality unless recognized early and treated appropriately. This study aims to describe the clinical profile and outcome of patients with *Staphylococcal aureus* pneumonia (SAP).

A total of 31 patients admitted at the Philippine General Hospital from January 1, 1996 to December 31, 1998 with SAP with or without bacteriologic evidence were included. Age range was one month to seventeen years with a mean age of 4.46 years. Forty one percent were below one year of age. Cough (90.32%), fever (83.87%), and difficulty of breathing (77.42%) were the most common presenting symptoms while clinical signs on admission were tachycardia seen in 35.48% of patients, increased in sleeping time and alar flaring, 29% and 25.81% respectively. Decreased breath sounds and rales on the affected lung are the common physical examination findings. Nine patients (29%) had other skin and soft tissue infection other than the lung involvement.

Pallor is commonly noted. Empyema thoracis was seen in 28 patients (90.32%), bronchopneumonia with pneumatocele in 2 patients (6.45%) and one patient had pyopneumothorax (3.2%). Out of the 28 patients with empyema thoracis, 23 (85.20%) underwent diagnostic/therapeutic thoracentesis, 19 (82.61%) of whom subsequently had chest tube insertion, 2 refused the procedure. In 15 (60%) out of the pleural fluid specimen submitted, *S. aureus* was isolated. 86.67% were sensitive to oxacillin. 2 were oxacillin resistant but were sensitive to vancomycin. Only 9 out of the 23 pleural fluid sent yielded gram positive cocci on gram stain. All patients had blood culture on admission, but only one (3.4%) grew *S. aureus*.

Extrapulmonary complications were noted in two patients. One had pericardial effusion and the other one had subdural empyema with hepatic abscess.

All patients were treated with high dose oxacillin except 2 patients in whom oxacillin resistant *S. aureus* were isolated. One was treated with vancomycin, the other refused admission and further intervention.

In conclusion SAP is common during the first year of life with cough and fever as the most common clinical manifestation. Empyema thoracis is the most common presentation. Thoracentesis is superior over blood culture in isolating the organism. Oxacillin resistance of *S. aureus*

needs to be monitored for guidelines on empiric therapy.

INTRODUCTION

In the Philippines pneumonia ranks number 4 as a cause of morbidity in all ages and is the second most common cause of death among our infants¹. *Staphylococcus aureus pneumonia* (SAP) accounts for approximately 9% of community acquired pneumonias² and is relatively an uncommon nosocomial pathogen in our setting. But it remains to be a serious bacterial infection with associated complications and prolonged hospital stay and high mortality rate.

A study done in 1985 by Kabigting et al concluded that the usual pathogens isolated from cultures of lung aspirates done immediately after death in severe pneumonia either complicating rubeola or not were *S. aureus* and *P. aeruginosa*. Same conclusion was disclosed by Gonzaga et al in 1990.

However determination of the etiology of pneumonia in young children is difficult. Clinically, SAP varies in presentation with the age and method of origin of the infection. It is diagnosed when a patient develops fever, increase in bronchial secretions, leukocytosis, *S. aureus* isolation from the blood tracheal or lung aspirates, and new or increasing infiltrates on chest x-ray. Clinically and laboratory features of SAP are not accurately correlated and radiographic features are not specific to guide us in early diagnosis. This paper aims to describe the clinical characteristic and outcome of SAP. More specifically, it will:

1. describe the demographic data as to age and sex.
2. determine the clinical profile of pediatric patients with SAP as to:
 - a. Presenting signs and symptoms
 - b. Radiological findings
 - c. Hospital stay
 - d. Clinical outcome
 - e. Complications, and,
3. And describe the outcome of therapy based on clinical and bacteriologic criteria

Keywords: *staphylococcus aureus, pneumonia*

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MATERIALS AND METHODS

A. Study design

This is a retrospective-descriptive study of pediatric patients aged 0-18 years admitted from January 1, 1996 to December 31, 1998 at UP-PGH.

B. Data collection

The medical records of pediatric patients from January 1, 1996 to December 31, 1998, admitted to the wards were reviewed. All those with a discharge diagnosis of SAP, pneumonia with pneumatocele, pleural effusion, empyema thoracis, with *S. aureus* isolated on blood, sputum, bronchialveolar lavage pleural fluid and all those who do not have isolates but treated as such were included in the study. Excluded are those with identified organism other than *S. aureus*. After identification of patients and their case numbers, a review of their medical records was conducted. Data on age, sex, admitting diagnosis, clinical course, outcome of therapy were collected.

RESULTS

A total of 34 cases were identified over a period of three years. However, medical records of 31 patients only were available for review. There were 16 males and 15 females. The youngest was 1 month old and the oldest was 16 years old with a mean age of 4.46 years.

It can be noted from Table 1 that majority of patients belong to less than one year old at 41%. Table 2 shows that majority of SAP patients present with cough (83.87%) followed by fever and difficulty of breathing (77.42% and 70.97% respectively). Frequently noted among the clinical signs, are increase in sleeping time and tachycardia (both with 29.03%) and nasal flaring (20.69%) (see Table 3)

Table 1. Number and percentage distribution of patients treated as SAP as to age and sex, UP-PGH, Jan. 1996 - Dec. 1998.

Age Group	Male	Female	Total	%
<1 month				
1-3 months	2	1	3	9.68
4-6 months	2	2	4	12.90
7-11 months	0	4	4	12.90
1-3 years	3	6	9	29.03
4-7 years	5	0	5	16.13
8-13 years	2	0	2	6.45
14-17 years	2	2	4	12.90
Total (%)	16 (51.6)	15 (48.39)	31	100%

Table 2. Presenting symptoms in 31 patients with SAP.

Symptoms	Number = 31	Percentage (%)
Cough	26	83.87
Fever	24	77.42
Difficulty of breathing	22	70.97
Tachypnea	1	41.94
Unable to feed	6	19.35
Seizure	3	9.68
Vomiting	2	6.45
Diarrhea	2	6.45

Table 3. Presenting Signs in 31 patients with SAP.

Signs	Number = 31	Percentage (%)
Increase in sleeping time	9	29.03
Tachycardia	9	29.03
Nasal flaring	6	19.35
Chest indrawing	5	16.13
Cyanosis	2	6.45
Irritability	1	3.22
Some dehydration	1	3.22

In terms of physical examination, Table 4 lists the most common findings on admission. Most common were decreased breath sounds on the affected lung. Nine patients (29%) had skin and soft tissue infection other than the lung involvement. Rales and pallor are

Table 4. Physical Examination findings on admission.

P.E. Findings	Number = 31	Percentage (%)
Dec breath sounds on affected lung field	21	67.74
Other site of infection	9	29.03
Rales	8	25.81
Pallor	3	9.68
Wheezing	1	3.22
Hepatomegaly	1	3.22

also commonly noted.

In all cases chest radiography was used as a diagnostic tool. Empyema thoracis was seen in 28 patients (90.32%), bronchopneumonia with pneumatocele in 2 patients (6.45%) and one patient

Figure 1. Distribution of radiologic findings in 31 patients with SAP.

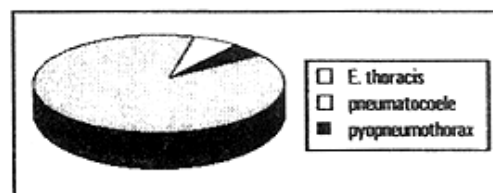
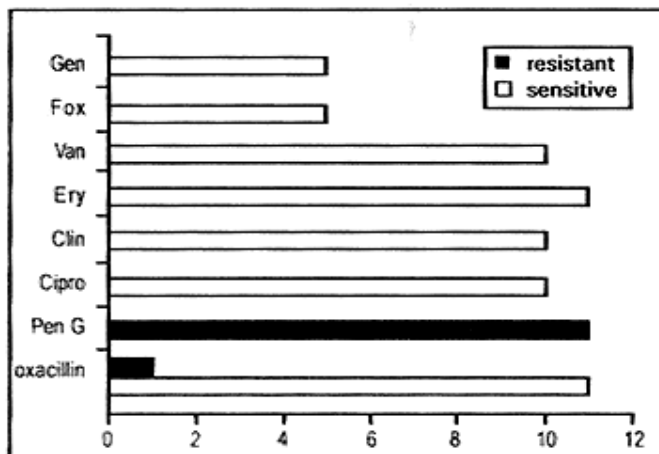


Figure 2. Sensitivity pattern of *S. aureus* isolated in pleural fluid.



(3.2%) had pyopneumothorax (Fig. 1).

Out of the 28 patients with empyema thoracis 23 (82.14%) underwent diagnostic and therapeutic thoracentesis, 19 (82.61%) of whom subsequently had chest tube insertions within the first five days of confinement. Two patients refused the procedure. *S. aureus* were isolated in 12 of the 23 pleural fluid specimen submitted. 11 isolates were sensitive to oxacillin, 1 is oxacillin-resistant but was sensitive to vancomycin. (Fig. 2) Only 50% yielded gram positive cocci in pairs or in clusters on gram stain.

DISCUSSION

Correct recognition of the organism has important implication with regards to initial therapy. Successful treatment of SAP requires high index of suspicion to which antibiotic prescription is based.

Staphylococcal pneumonia is a generally progressive process in all age groups⁴. Two main forms are recognized: primary pneumonia due to direct inoculation through the respiratory tract and secondary or metastatic hematogenous lung infection due to bacteremic seeding to the lung during the course of septicemia associated with the other sites of infection. In this study 20 patients were identified to have primary SAP noted mostly among infancy and early childhood (<3 years of age). Eleven had metastatic SAP, which in this study are mostly due to skin and soft tissue infection.

S. aureus produce coagulase and various other toxins that contribute to its invasiveness. There is a strong tendency for the extrapulmonary staphylococcus infection to spread rapidly through the lungs and other organ system. Extrapulmonary complications noted in this study include convulsions in an 18 month old patient

with brain abscess and an 8 year old boy who developed pericardial effusion while at the wards. In the lungs, this results in various complications such as pleural effusion, empyema, pneumothorax and pneumatocele as shown in this study. *S. aureus* was grown in pleural fluid of six patients with primary disease and six patients with disseminated disease.

Clinically SAP varies in its presentation. The study population mostly presents with marked dyspnea. Fever is a prominent feature and cough is a usual finding. Physical examination on admission showed decreased breath sounds on the affected lung field, which suggest pleural effusion, empyema or pneumothorax.

In all cases chest radiograph was used as a diagnostic tool. A high proportion of patients in the study population have pleural effusion (90.32%); pneumatoceles in two cases and pyopneumothorax in one patient. McFarlane and Donald performed a study in 1996 to determine whether the radiographic features can sufficiently aid us in diagnosis of SAP. They concluded that the spectrum of radiographic features of SAP includes multi-lobar shadowing, cavitation, pneumatocele, pleural effusion and spontaneous pneumothorax were both seen among adults and children. Jooston KF, did a 12 year retrospective review from 1970 to 1992 and among the results of chest x-ray findings of which included are pleural effusion 75%, pneumothorax at 47%, and abscess and/or pneumatocele 39%. Pneumatocele is virtually diagnostic of SAP in a child⁵. And the combination of pneumothorax and empyema-pyopneumothorax- is highly suggestive of staphylococcal pneumonia⁶. But their absence does not exclude the diagnosis.

Diagnosis is established best by the isolation of an organism from blood, sputum, and pleural fluid or lung tap. Since isolation of etiologic agents is difficult in pediatric age group, who cannot expectorate well, blood culture in these circumstances is the practical diagnosis approach. This technique has a low sensitivity and does not always reflect the true etiology of pneumonia⁷. Another consideration in the diminished yield of isolate from blood culture in pulmonary bacterial infection, which in this series showed to be one in 1 in 31 cases (3.2%) is the widespread use of antimicrobial agents in the study population prior to admission.

The initial management pending laboratory cultures is largely empiric. And this mandates the clinicians to have a correct diagnosis and have a high index of suspicion of the pathologic organism on which to base the antibiotic prescription. In many cases in this

series initial antibacterial treatment was adequate in relation to the sensitivity pattern of staphylococci. Strains of *S. aureus* were sensitive mainly to oxacillin and resistant mostly to penicillins. High dose oxacillin at 200 mg per kilogram were given intravenously for the first two weeks then shifted to oral cloxacillin to complete four weeks. 13.3% or 2 out of 15 were reported to be ORSA. This patient was treated with vancomycin; the other patient refused further intervention and management.

Management of SAP requires a joint management plan with the surgeon. Empyema generally is managed best with the implantation of a chest tube for constant drainage⁸. Early recognition of purulent pleurisy is very important in children to ensure effective drainage before the effusion becomes fibrinous⁹. One study cited that in patients whom the first tube was inserted after more than ten days had a difficult drainage and oftentimes require surgery⁸. Due to the frequency of pleural effusion, pneumothorax in this study, about 82.61% of the study population needed surgical drainage or thoracotomy and all were done before the fifth hospital stay. The response to combined drainage and antibiotic therapy is generally slow. The mean duration of hospitalization is 24.5 days.

Pleural thickening, parenchymal fibrous standing, and pneumatocele may persist on chest radiographs for many months. In view of the natural history of slow resolution of these changes and the excellent long-term prognosis, the general consensus now is now that decorticating operation should be avoided⁹.

The zero mortality rate in this study maybe in the result of the relatively high index of suspicion, high rate of thoracotomy and improvements in supportive treatment.

SUMMARY AND CONCLUSION:

The profile of 31 patients with SAP were reviewed. The mean age is 4.46 years old. Features present in all cases were fever and cough. Majority had previous intake of antibiotics prior to admission. Chest x-ray of most patients mostly showed pleural effusion. Lung tap gives a better yield of etiologic agent than blood culture.

An increase awareness of SAP requires early recognition, choosing the correct antibacterial agent, treatment by decompression and pleural drainage and prevention of complications.

RECOMMENDATIONS:

This retrospective study has some limitations due to its retrospective nature such that we cannot draw straightforward conclusion. It is recommended that a prospective study on SAP be conducted in a longer period of time. A randomized clinical study has to be done to validate the significance of doing diagnostic lung puncture in- patients with pneumonia in giving us a clue of the etiologic diagnosis. It is also advocated to do a study correlating the clinical acumen of clinicians in diagnosing SAP. The WHO-ARI program should be disseminated since an increase awareness of pneumonia will lead to its early detection and appropriate treatment.

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