Nigerian Journal of Paediatrics, 1 (1), 20.

Empyema in Childhood: A Review of 116 Cases

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Aderele, W. I., Stevenson, C. E. and Antia, A. U. (1974). *Nigerian Journal of Paediatrics*, 1 (1), 20. **Empyema in Childhood: A Review of 116 Cases.** 116 cases of empyema in children between the age of 2 months and 11 years admitted to the department of paediatrics during a period of 8 years are reviewed. The condition accounts for 1.0 per cent of annual admissions into the paediatric wards.

All ages are affected, but there is a strikingly high incidence in children under the age of two years. Staphylococcus pyogenes was the commonest causative organism; it was resistant to penicillin in a majority of the cases. The factors which tend to predispose children to the condition and also influence its course and prognosis include malnutrition, recent measles infection and the presence of anaemia. The recommended method for pleural drainage is thoracotomy and under-water seal drainage.

EMPYEMA, by which is meant a collection of significant purulent fluid in the pleural cavity is a world-wide paediatric problem (Hendren, and Haggerty, 1958; Koch, Carson, and Donnell, 1959; Bechamps, Lynn, and Wenzl, 1970). The incidence of this condition in developing countries with widespread infectious agents and malnutrition seems to be higher than in technically developed countries. The purpose of the present retrospective study is to examine the clinical pattern, causes, and factors which may influence the course, prognosis and mortality in this condition.

Materials and Method

The case notes of children with pleural effusion admitted to the department of Paediatrics, University College Hospital (U.C.H.), Ibadan, from 1964 to 1972, were reviewed. Diagnosis in each case was made from the clinical features and chest radiological findings, and confirmed by paracentesis thoracis. Data abstracted from the case notes included age, sex, weight, nutritional status, temperature, tuberculin skin test (Heaf), packed red cell volume (PCV), total and differential white blood count and bacteriological report of pleural aspirate and blood culture.

Results

There were 116 children, aged 2 months to 11 years, consisting of 75 males and 41 females, (a sex ratio of 1.8:1). This number represents one per cent of the total number of admissions to the department during the period covered. Fig. 1 shows the number of cases admitted per year for the period of the study. It will be seen that there is a gradual increase in the number of cases over

the years. According to available records, there were 2 cases admitted in 1964, while 34 cases were admitted in 1972. The age distribution (Fig. II) shows that 85 (73 per cent) of the patients were between the age of one month and 3 years, while only 16 (14 per cent) were 5 years old and above. Empyema occurred on the left side of the chest in 70 cases (60.3 per cent), on the right in 43 (37.1 per cent) and bilateral in 3 (2.6 per cent).

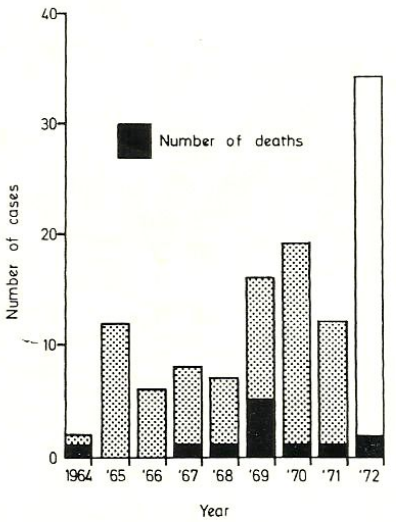

Fig. 1 Number of cases of empyema admitted per year for the period 1964–72.

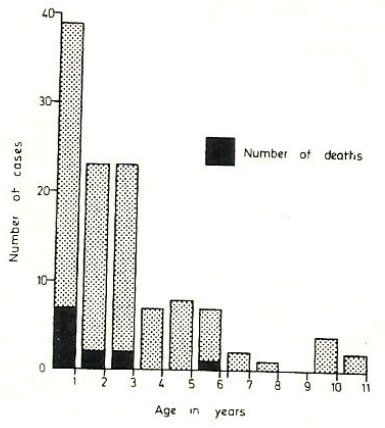

Fig. 2 Age distribution of 116 children with empyema.

Clinical features

Symptoms. The most common symptoms were breathlessness, cough and fever. The average duration of symptoms before hospitalization was 12 days for cough, 16 days for fever and 4 days for breathlessness. Other symptoms included loss of weight and chest pains, the latter being complained of by older children.

Signs. On admission 25 of the children were described as being seriously ill, 78 moderately ill, and only 5 were described as not being ill-looking. The general condition in the remaining 8 patients was not stated. A majority of the patients were poorly nourished. There were 14 patients (12.1 per cent) with kwashiorkor, 50 (43.1 per cent) with marasmus. Thus, a majority of the children in this series were those with marasmus. The physical findings in the chest were consistent with the presence of fluid in the pleural cavity. The average temperature was 38.3°C. (range 36.1–41.1°C); in eight patients however, the temperature was below 37°C.

Weight

The weights on admission for 98 patients (60 males and 38 females), between the age of 2 months and 5 years are shown in Fig. III. It will be observed that the weights in 83 (84.7 per cent) of the patients were below the established mean weights of local children from the low socio-economic families (Janes, 1970).

Recent past history

In thirty patients (25.9 per cent) history was obtained of a recent attack of measles (1--3 weeks) prior to the onset of the symptoms. Of these 30 cases 28 were malnourished (kwashiorkor 5, marasmus 23).

Causative organism

Diagnostic pleural aspiration was performed in all the cases, while blood culture was carried out in only 21 cases. Organisms isolated from either

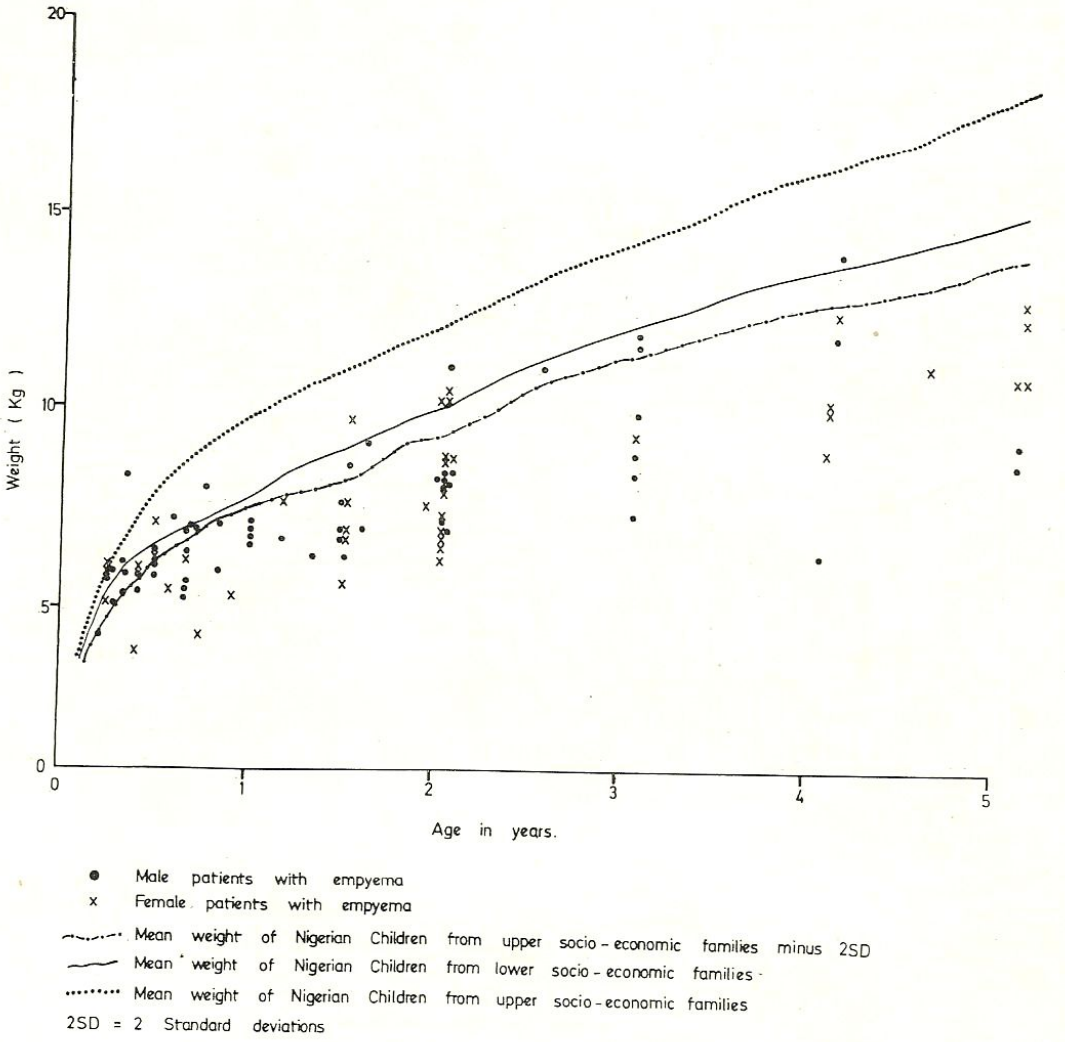

Fig. 3 Admission weights of the children with empyema compared with normal weights of Nigerian children from upper and lower socio-economic families.

the pleural aspirate or blood culture or from both specimens (Table I) included Staphylococcus pyogenes, 44 cases (37.9 per cent), Pneumococcus, 4 (3.4 per cent), Klebsiella and H. influenzae 3 each, (2.6 per cent) Pseudomonas and Staphylococcus + Pneumococcus, 2 each (1.7 percent), and proteus, 1 case (0.9 per cent). No organisms were isolated from the remaining 57 cases (49.2 per cent). Of the 21 blood cultures, 5 yielded the same organisms (staphylococcus 3; pneumococcus 1; H. influenza 1) as those isolated from the pleural fluid.

TABLE I

Organisms Isolated From 116 Children with Empyema

Organism	*No. of cases*	*per cent of total*
Staphylococcus pyogenes	44	37·9
Pneumococcus	4	3·4
Klebsiella	3	2.6
Haemophilus influenzae	3	2.6
Pseudomonas	2	1.7
Staphylococcus + pneumococcus	2	1.7
Proteus	1	0.9
Sterile	57	49·2
Total	116	100.0

Haematocrit

The mean packed red cell volume (haematocrit) for the series was 30 per cent (range 12–42 per cent). In 22 patients the haematocrit was below 25 per cent.

Tuberculin test

(Heaf and/or Mantoux). The result of this test was available in eighty-two patients. The Heaf test was grade II-III positive in only three patients who also showed significant reaction to Mantoux test.

Management

Specific management consisted of evacuation of the pus from the pleural space, administration of antibiotics and blood transfusion.

Thoracotomy and underwater-seal tube drainage of the pleural cavity was carried out in 70 patients. In the remaining 46 patients a single or repeated needle aspiration of the pus was undertaken. Because of unsatisfactory pleural drainage due to thickened and fibrotic pleura, 'decortication' of the lung was subsequently performed in seven of the patients who were treated initially by thoracotomy and tube drainage, and in three others treated initially by needle aspiration. Rib-resection was performed in 5 cases with osteomyelitis of the ribs. One child with klebsiella infection underwent unilateral pneumonectomy, and another child with staphylococcal epidural abscess had laminectomy.

Broad-spectrum antibiotics (erythromycin, tetracycline, ampicilin, cloxacilin and chloramphenicol) administered singly or in combination were the initial drugs of choice. Appropriate antibiotic was subsequently substituted for the initial drug after the sensitivity report was available. In addition to these broad-spectrum antibiotics, anti-tuberculous drugs were administered to three patients with significant reaction to tuberculin test. Staphylococcus pyogenes, the commonest causative organism in the series, was most frequently sensitive in vitro to chloramphenicol, tetracycline, streptomycin and erythromycin. In only five cases was the organism sensitive to penicillin. Prior to 1972 there was only one case of tetracycline-resistant strain of staphylococcus, while in 1972 there were four cases. The only instance of chloramphenicol-resistant staphylococcus was also encountered in 1972.

Blood transfusion was given to 56 (48.0 per cent) patients. The anaemia in a majority of these patients occurred during the second week of hospitalization.

Complications

The complications (Table II) were either spontaneous or iatrogenic. The commonest complication was pneumothorax, occurring spontaneously in 27 patients, and iatrogenic in 20 others following thoracotomy or needle aspiration. Of the 27 spontaneous cases of pneumothorax, the causative organisms were staphylococcus pyogenes (15), pseudomonas (2) and proteus (1). No organism was isolated in the remaining 9 cases. Other complications included osteomyelitis of the ribs, empyema necessitans, epidural abscess with paraplegia, broncho-pleural fistula, lung destruction, pneumomediastinum and subcutaneous emphysema.

TABLE II

Complications In 116 Cases of Empyema

Complication	*No. of cases*
Pneumothorax:	
Spontaneous	27
iatrogenic	20
Osteomyelitis of the ribs, subcutaneous emphysema + pneumothorax	5
	3
Subcutaneous emphysema	2
Emphyema necessitans	3
Miscellaneous	7

Mortality

Twelve patients (eight males and four females) died, a mortality rate of 10.3 percent. The following factors appear to have influenced the mortality in the present series:

Nutritional status

Malnutrition (kwashiorkor three, and marasmus six) was present in nine (75 percent) of the 12 patients.

Age

There were 39 children under the age of one year, and of these, death occurred in seven (18 per cent). There was no death in the age group three to five years.

Causative organism

The organisms isolated from four of the 12 deaths were staphylococcus (two), klebsiella (one) and pneumococcus (one). No organism was isolated from the remaining eight patients.

Measles

There were 30 patients with a recent past history of measles, and three of these were among the 12 deaths.

Method of management

Five (6.6 per cent) of the 70 patients treated by under-water seal drainage died, while seven (15 per cent) of the 46 treated by needle aspiration died.

Staphylococcal empyema

The ages of 44 children with staphylococcal empyema are shown in Fig. IV. It will be observed that 27 (61.4 per cent) of the patients were under the age of 2 years.

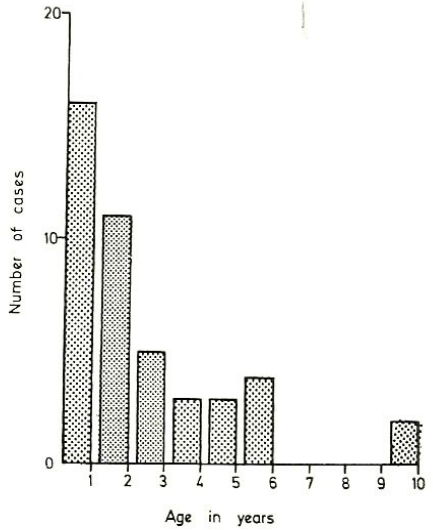

Fig. 4 Age distribution of 44 children with empyema caused by Staphylococcus pyogenes.

Discussion

This retrospective study has confirmed that empyema is a common paediatric problem in Nigeria, representing about one per cent of the total paediatric admissions into the University College Hospital. The condition is also associated with a high mortality, being 10 per cent in the present series.

Sex incidence was equal. All ages are affected, but the peak incidence was between one and 3 years. There is, however, a strikingly high incidence in children under the age of two years. Other workers (Oliver, Smith, and Clatworthy, 1959; Huxtable, Tucker, and Wedgwood, 1964; Bechamps, Lynn, and Wenzl, 1970), have also reported a high incidence of empyema in children under the age of two years.

It is worthy of note that although in a majority of the patients, the symptoms of cough and fever lasted for over two weeks, medical attention was not sought until the onset of breathlessness. The average duration of this symptom in most of the patients was four days. In this series, the most striking physical finding outside the thoracic cavity was the poorly nourished condition in a majority of the patients. Frank kwashiorkor occurred in 12.1 per cent and marasmus in 43.1 per cent of the cases. According to the weights 84.7 per cent of the children were below the established mean weights of local children from the low socio-economic families. Similar high incidence of malnourished state among children with pneumomediastinum and pneumothorax has been reported by Familusi and Bohrer (1972).

Factors which tend to influence the incidence, severity, course and mortality include age, malnutrition, anaemia, recent measles infection and the causative organism. The highest incidence of staphylococal infection in the present series occurred in children under the age of 2 years; the mortality was also highest in this age group. Malnutrition, anaemia, and a recent measles infection tend to lower the body's resistance, thus predisposing the children to pyogenic organisms.

It is worthy to note the high incidence of penicillin-resistant staphylococcus in the present series. This organism was resistant to penicillin in 88.6 per cent of the cases. This situation might be attributed to the indiscriminate and widespread use of penicillin by both qualified and unqualified persons.

The management of empyema deserves special comment. As has been shown in this study nearly half of the patients received blood transfusion because of moderate or severe anaemia. The role of anaemia seems to be twofold. First, the presence of anaemia may tend to lower the body's resistance to infection, thus initiating the empyema. Secondly, the continuous existence of anaemia in established empyema would aggravate the condition and contribute to high mortality. The method employed in the removal of pus from the pleural space is important with regard to the outcome. In the present series the mortality among those treated by thoracotomy and underwater seal drainage was 6.6 per cent, while among those treated by simple repeated needle aspiration it was 15 per cent. In a majority of local children with empyema the pus in the pleural cavity is usually very thick, because of the long delay between the onset of the illness and the time of hospitalization. Satisfactory evacuation of the pus can hardly be achieved by simple needle aspiration. It is therefore, recommended that in every child in whom significant empyema is present the method of choice in evacuating the pus should be thoracotomy and underwater seal drainage. Indeed, this method of management has also been recommended by Magovern and Blades (1958).

REFERENCES

Bechamps, G. J., Lynn, H. B. and Wenzl, J. E. (1970). Empyema in children: Review of Mayo Clinic experience with non-tuberculous empyema 1935–1965. *Mayo Clinic Proceedings*, **45,** 43–50.

Familusi, J. B. and Bohrer, S. P. (1972). Pneumomediastinum and pneumothorax in childhood. *Z. Tropenmed. Parasit.* **23,** 211–220.

Hendren, W. H. (III) and Haggerty, R. J. (1958). Staphylococcal pneumonia in infancy and childhood. *J.A.M.A.*, **168,** 6 16.

Huxtable, K. A., Tucker, A. S. and Wedgwood, R. J. (1964). Staphylococcal pneumonia in children: long term follow-up. *Amer. J. Dis. Child.* **108,** 262–269.

Janes, M. D. (1970). The effect of social class on the physical growth of Nigerian Yoruba children: *In* Proceedings of the African Regional meeting. "Epidemiology in Africa", Ibadan. *Bull-Int. Epidemiol. Ass.* **20,** 127 136.

Koch, R., Carson, M. J. and Donnell, G. (1958). Staphylococcal pneumonia in children. *J. Paed.* **55,** 473–484.

Magovern, G. J. and Blades, B. (1958). Staphylococcal Empyema: *J.A.M.A.*, **168,** 365–369.

Oliver, T. K., Smith, B. and Clatworthy, H. W. J. (1959). Staphylococcal Pneumonia: Pleural and Pulmonary Complications. *Ped. Clin. N. Amer.* **6,** 1043–1054.