RESEARCH BRIEF

Clinico-bacteriological Profile and Outcome of Empyema

D NARAYANAPPA, N RASHMI, NA PRASAD, AND *ANIL KUMAR

*From the Departments of Pediatrics, and * Pediatric Surgery, JSS Medical College and Hospital, JSS University, Mysore, Karnataka. India.*

Correspondence to:
Dr D Narayanappa, No.534, 'Sinchana', 15th main, 5th Cross, Saraswathipuram, Mysore 570 009, Karnataka. India.
sinchabhi
Received: June 18, 2012;
Initial Review: November 23, 2012;
Accepted: January 28, 2013.

Empyema thoracis is a common cause of morbidity in children. We conducted a prospective observational study in 50 children (age 0-15 y) diagnosed with empyema to study its clinico-bacteriological profile and outcome in a referral hospital. *Staphylococcus aureus* was the most common causative organism, most of them being MRSA, followed by Pneumococcus and *Pseudomonas*. Primary video-assisted thoracoscopy appeared to be a good mode of management with lesser duration of hospital stay. However, the number of children undergoing this procedure was very less, to come to any conclusion.

Key words: *Empyema thoracis, MRSA, Video-assisted thocacoscopy.*

It is estimated that 0.6% of childhood pneumonias progress to empyema, affecting 3.3 per 1,00,000 children [1]. *Staphylococcus aureus* is the commonest causative organism in developing countries. There are no universally accepted guidelines for its management in children. Treatment options include antibiotics alone or in combination with chest tube drainage, intrapleural fibrinolytics, VATS (video assisted thoracoscopic surgery), and open decortications [2,3]. Not many studies are available regarding optimal management of empyema in children. We conducted this observational study to delineate the clinico-bacteriological profile of empyema and its outcome with different modes of management.

METHODS

This study was conducted in the Department of Pediatrics, JSS Medical College Hospital between September 2008 to September 2010. Fifty children admitted to J.S.S. Hospital, Mysore, with the diagnosis of empyema in the age group between 0 to 15 years, with diagnosis of empyema according to ICD-10 code J869 were included [4]. Children with empyema thoracis secondary to trauma/ thoracic surgery/oesophageal rupture were excluded. Informed parental consent was taken and relevant data were collected in a preformed proforma. Institutional ethical clearance was obtained.

All children were subjected to investigations like complete blood count, ESR, blood culture and sensitivity, Mantoux test, sputum for acid fast bacilli (if available) and C-reactive protein. Pleural fluid collected with aseptic precautions by thoracocentesis or during the time of insertion of intercostal tube for drainage bottle was analyzed for cell type and count, pH, glucose, LDH levels, Gram's and AFB stain and culture and sensitivity for aerobic bacteria. Chest *X*-ray, ultrasound scan of chest and CT scan of thorax were done wherever necessary. The mode of management in these cases (indications for) was decided based on algorithm in ***Fig.* 1** [2]. All the patients were followed up after 1 month of discharge. Outcome was assessed in terms of clinical and radiological clearance. Pulmonary function test (PFT) was performed in children who were above 6 years of age at follow up. Statistical methods like frequencies, descriptive, crosstabs, chi-square test and analysis of variance were used to analyze the data, employing the SPSS 11.0 package.

RESULTS

Out of the 50 cases studied, majority (90%) were in the age group of 0-5+years (mean age: 3y). Males were more commonly affected. All children had fever and cough, 35(70%) had hurried respiration, 4 (8%) had abdominal pain, 4(8%) had chest pain and 2 (4%) of them had ear discharge. 38(76%) of children had tachypnea, 26(52%) had tachycardia, 46 (92%) children had dullness on percussion. Diminished breath sounds were noted in 43(86%) children. Pleural fluid Gram stain positivity was seen in 17 cases and isolation of organism by pleural fluid culture was possible in only 20(40%) cases, of which 2 cases had received prior antibiotics. Contingency coefficient of pleural fluid culture positivity between children who had received prior antibiotics and those who had not received any, was 0.132, which was statistically insignificant.

Of 15(30%) cases of pleural fluid culture proven *Staphylococcus aureus* isolation, 4 (26.6%) were

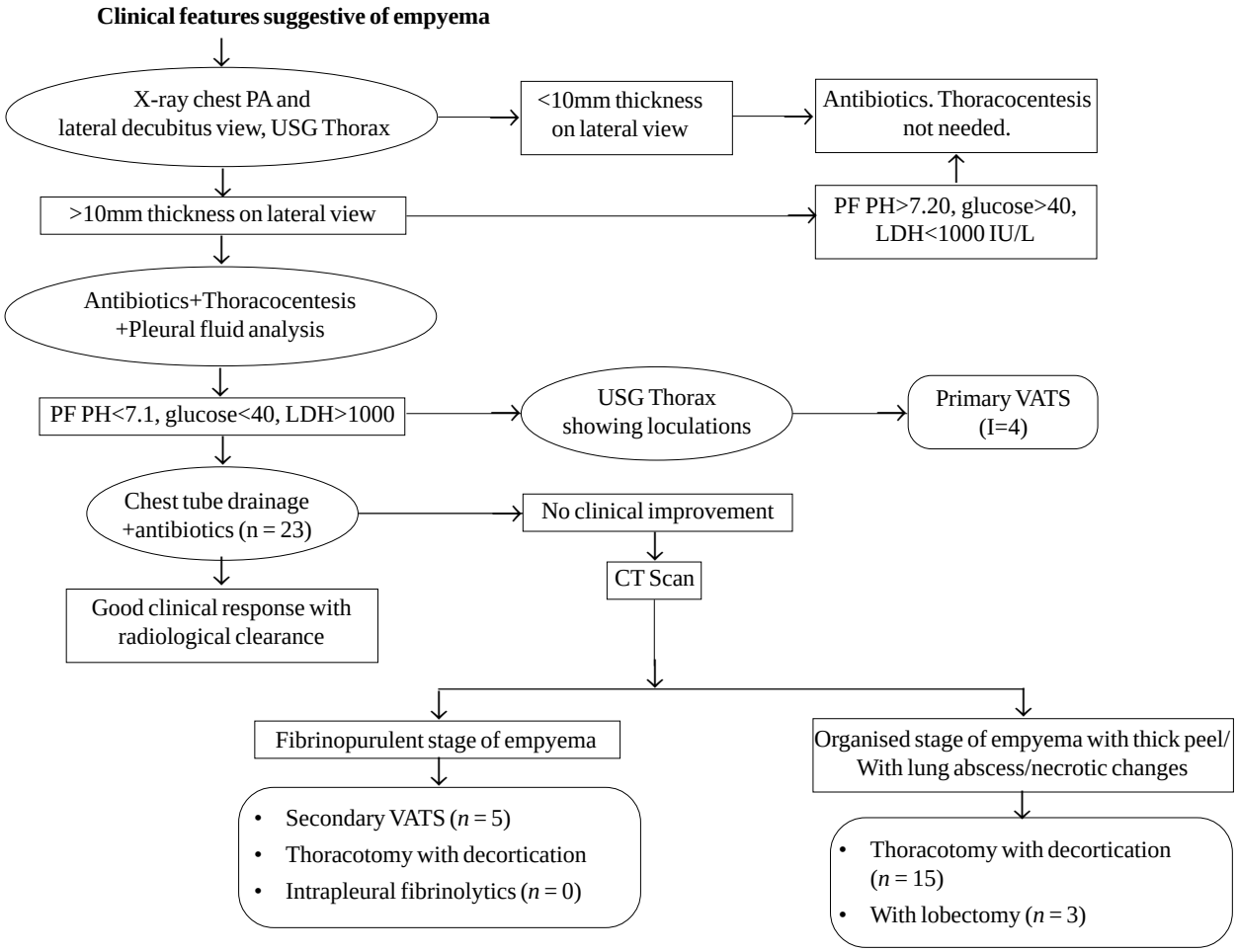

FIG. 1 *Algorithm for indications for different modes of management and details of different management strategies.*

methicillin resistant *Staphylococcus aureus* (MRSA). All 15 isolates were sensitive to linezolid and amikacin, 12 (80%) to clindamycin, 5 isolates to ceftriaxone and only 3(20%) to penicillin. 12(80%) isolates were resistant to penicillin, followed by 5(66%) to erythromycin and 3(20%) to ciprofloxacin. Out of 20 pleural fluid culture proven cases of empyema, 4(8%) isolates were Pneumococci. All were sensitive to linezolid and amikacin and 3(75%) isolates were sensitive to penicillin. One isolate showed growth of *Pseudomonas* which was sensitive to ceftazidime, cefotaxim, amikacin, ciprofloxacin and resistant to tetracyclines.

The management of all the 50 children is shown in Fig 1. The outcome measures included were mean duration of hospital stay and radiological clearance on follow up. The mean duration of hospital stay in different modes of management is depicted in ***Table* I.**

Of 23 cases who were treated with CTD and antibiotics alone, 17 came for follow up after 1 month, 88.2% of them showing good radiological clearance. 2 (11.8%) children had thickened pleura radiologically. In children managed with Primary and Secondary VATS, radiological clearance was 100%. Children undergoing thoracotomy with decortications showed 93.3% radiological clearance. Children managed by lobectomy had longer duration of hospital stay of 26.3 days (statistically significant by Scheffe's Post Hoc test) and all of them developed residual scoliosis at follow-up. However there was no statistically significant difference in radiological clearance between different treatment strategies. Only five children in the study group were eligible for pulmonary function test. 1 child was lost to follow up. PFT done in 4 patients who were more than 6 years were within normal limits.

One child aged 1 year in the study group expired due to development of sepsis (*Staphylococcus* aureus was isolated in blood culture) with DIC and meningitis.

WHAT THIS STUDY ADDS?

- The most common cause of empyema in children is *Staphylococcus aureus*, with increasing prevalence of MRSA.

DISCUSSION

We observed that empyema occurs most commonly in the under-five age group, and the clinical presentation comprise of, tachypnea, tachycardia, dull note on percussion and diminished breath sounds, as also noted in other studies [5-13]. Only 40% of the cases in our study were confirmed by a positive pleural fluid culture. Girod, *et al.* reported states that diagnosis made only by biochemical criteria may represent an early empyema that may be amenable to a nonsurgical treatment [14]. However, the yield of pleural fluid culture also depends on the strength and quality of the culture media. Causative organisms in our study were also similar to that reported earlier from other developing countries [5-9]. Most of the isolates of *Staphylococcus* (MRSA) were sensitive to linezolid and amikacin. Other studies however have showed good sensitivity to third generation cephalosporins, cloxacillin and gentamicin [6,8].

Most of the children in the study were managed by chest tube drainage, followed by different other modes depending on their response. Only four children underwent primary VATS, and showed good outcome in terms of lesser duration of hospital stay and complete radiological clearance on follow up. However, the number was too low to come to any conclusion regarding it's superiority over other modes. Studies from India and other countries showed varied outcomes with respect to radiological clearance, chest deformity and mortality [5-10, 13], which are comparable to those from our study.

TABLE I MEAN DURATION OF HOSPITAL STAY (UNIT?HOURS/ DAYS) IN DIFFERENT MODES OF MANAGEMENT

	Numbers n (%)= 50	*Mean (SD)*
CTD + antibiotics	23 (46)	106 (2.92)
PRIM VATS	4 (8)	8.5 (1.73)
CTD + antibiotics + Secondary VATS	5 (10)	15.0 (4.85)
CTD + antibiotics + Thoracotomy with decortication	15 (30)	15.5 (5.01)
CTD + antibiotics + Thoracotomy + Lobectomy	3 (6)	26.3 (6.11)
Total	50 (100)	13.3 (5.7)

With respect to duration of hospital stay, significant difference was noted between primary VATS and other modes (P<0.001).

Contributors: ND: Guarantor, overall co-ordinator and revised the manuscript for intellectual content. NR: Conception, literature search, manuscript writing and critical revision. PNA: Concept, data acquisition and manuscript writing. AMG: Surgical management and literature search.
Funding: None; *Competing interests*: None stated.

REFERENCES

1. Kumar V. Epidemiological methods in ARI. Indian J Pediatr. 1987;54:205-11.
2. Singh M, Singh SK, Choudhary SK. Management of empyema thoracis in Children. Indian Pediatr. 2002;39:145-57.
3. Balfour-Lynn IM, Abrahamson E, Cohen G, Hartley J, King S, Parikh D, *et al*. BTS guidelines for management of pleural infection in children. Thorax. 2005;60:il-2l.
4. Light RW. Parapneumonic effusions and empyema. *In*: Light RW. Pleural Diseases, 3rd *edn*. Baltimore: Williams and Wilkins; 1995. p. 129-53.
5. Kumar L, Guptha AP, Mitra S, Yadev K, Pathak IC, Walia BS, *et al*. Profile of childhood empyema thoracis in north India. Indian J Med Res. 1980;72:854-9.
6. Padmini R, Srinivasan S, Puri RK, Nalini P. Empyema in infancy and childhood. Indian Pediatr 1990;27:447-52.
7. Ghosh S, Chakraborty CK, Chatterjee BD. Clinicobacteriological study of empyema thoracis in infants and children. J Indian Med Assoc. 1990;88:189–90.
8. Mishra OP, Das BK, Jain AK, Lahiri TK, Sen PC, Bhargava V. Clinico-bacteriological study of empyema thoracis in children. J Trop Pediatr. 1993;39:380-1.
9. Baranwal AK, Singh M, Marwaha RK, Kumar L. Empyema thoracis: a 10 year comparative review of hospitalized children from south Asia. Arch Dis Child. 2003;88:1009-14.
10. Satpathy SK, Behera CK, Nanda P. Outcome of parapneumonic empyema. Indian J Pediatr. 2005;72:197-9.
11. Adeyemo AO, Adeyujigbe O, Taiwo OO. Pleural empyema in infants and children: analysis of 298 cases. J Natl Med Assoc. 1984;76:799-805.
12. Chonmaitree T, Powell KR. Parapneumonic pleural effusion and empyema in children: Review of a 19-year experience 1962-1980. Clin Pediatr (Phila). 1983;22:414-9.
13. McLaughlin FJ, Goldmann DA, Rosenbaum DM, Harris GB, Schuster SR, Strieder DJ. Empyema in children: clinical course and long term follow up. Pediatrics. 1984;73:587-93.
14. Girod CE, Neff TA. How to manage parapneumonic effusion/empyema. J Respir Dis. 1994; 15:35-44.