

Clinical profile of empyema in tertiary health care center, Hyderabad

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Abstract

Objective: Empyema thoracic is known to have a variable age group affection, causative agents and controversy regarding primary mode of management. The aim of this study was to study the epidemiology, management strategies including investigations and outcome of empyema in the children. **Methods:** A prospective study was done on all cases of parapneumonic empyema admitted to our hospital from February 2009 to April 2011. Diagnosis of empyema was confirmed by chest X-ray, pleural fluid analysis or radio-imaging. All children (depending on staging) were treated along with parental antibiotics and chest tube drainage either intrapleural urokinase or surgery (video assisted thoracoscopy surgery [VATS] or thoracotomy) according to British Thoracic Society guidelines. **Results:** Among study population, male to female ratio was 1.48:1. The most common age group affected was 1-5 years (mean 4.03 ± 3.30 years). Total 31.57% of the cultures were positive. The most common isolated organisms were Streptococci (38.9%) and Staphylococci (44.4%). Out of 57 children, 25 had Stage II of empyema while 32 had Stage III of empyema. There was a significant correlation between duration of illness (>7 days) and advancement in the stage of empyema ($p < 0.0001$). Only one child with Stage II of empyema required surgery while remaining all other (24 out of 25) were managed with thoracostomy and intrapleural injection of urokinase. Remaining 32 (18 VATS and 14 thoracotomy) patients with Stage III of empyema underwent primary surgical management. There was no significant difference in the duration of fever remission, total hospital stay or duration of IV antibiotics in children treated either with intrapleural fibrinolytics or surgical management. Overall outcome of empyema was excellent, mortality was less than 1.5%, with overwhelming sepsis. **Conclusion:** Staging of empyema at initiation of treatment helps in proper management of patients. Results with the use of intrapleural fibrinolytics were promising in the Stage II of empyema. As complications are very few, VATS is a safe procedure in experienced hands.

Key words: Empyema, Fibrinolytics, Thoracotomy, Video assisted thoracoscopy surgery

Empyema is a localized or free collection of purulent material in the pleural space formed as a result of a combination of pleural dead space, culture medium of pleural fluid and inoculation of the bacteria [1]. The cultures are sterile in 30-50% of the cases due to antibiotics [2-4]. *Staphylococcus aureus* is now the most commonly retrieved organism with increasing incidence of methicillin-resistant *S. aureus* (MRSA) [5]. It is an advanced parapneumonic effusion. While most cases would respond to antibiotic therapy, needle aspiration, fibrinolytics and intercostal drainage (ICD), few cases require further surgical management. There is general agreement that patients with empyema require a drainage procedure. However, differing definitions of “empyema” and differing opinions about the appropriate drainage procedure have contributed to the ongoing controversy about the management of these patients. In this study, we have followed British Thoracic Society (BTS) guidelines [6] for the diagnosis and management of empyema patients. We conducted observational perspective study to determine epidemiology, management strategies including investigations and outcome of empyema in the children.

METHODS

This study was done in a tertiary care referral pediatric hospital in Hyderabad between February 2009 and April 2011. All the children between 2 months and 18 years of age admitted to our hospital either directly or referred from another hospital with clinical signs suggestive of pneumonia were included in the study. Diagnosis of empyema was confirmed by chest X-ray, pleural fluid analysis or radio-imaging according to BTS guidelines. Those who have bronchopneumonia with just synpneumonic effusion, empyema thoracic secondary to trauma or surgery were excluded.

At the time of admission, detailed history was taken, and clinical examination was performed. Investigations like complete blood count, erythrocyte sedimentation rate, C-reactive protein, blood culture, Mantoux test, sputum for acid-fast bacilli (AFB) (if available) and chest X-ray were done. Pleural fluid was collected at the time of insertion of chest tube. Fluid was subjected to cell count, protein, sugar, AFB and Gram-stain and culture. In cases where dry tap was

present due to pleural peel or ultrasound suggestive of thick loculations, early surgical interventions were considered. Computed tomography (CT) scan chest was done whenever required. Patients who were referred from another hospital due to failure of primary treatment were reinvestigated and treated accordingly.

All the children were categorized into simple parapneumonic effusion (Stage I), complicated parapneumonic effusion (Stage II) or Organizational stage, (Stage III) [6,7]. Treatment protocol was followed according to BTS guidelines. Accordingly, patients with a preliminary diagnosis of Stage II of empyema were treated with intrapleural urokinase as a primary mode of treatment. Injection Urokinase was given twice daily for 3 days (total 6 doses) in a dose of 40,000 units in 40 ml normal saline (in children > 1 year or 10 kg) or 10,000 units in 10 ml normal saline (in children <1 year or 10 kg) with 4 h of indwelling time. After 3 had completed days of fibrinolytics, repeat chest X-ray was done to see the signs of resolution of collection. Antibiotics were continued until the patient is afebrile, white blood cell (WBC) count is normal, daily tube thoracostomy yield is <50 ml and radiograph shows considerable clearing.

Baseline characteristics for all the children with empyema treated with only antibiotics, intercostal tube drainage with fibrinolytics or surgical management were compared with each other using Chi-square test or fisher exact test. The significance level for all the tests is set at $p < 0.05$. Follow-up of all patients was done after 1 month to check for clinical and radiological clearance.

RESULTS

Out of 57 cases studied, majority (57%) were in the age group of 1-5 years (mean age 4.03 ± 3.30 years). Males (61%) were more affected than females. Both sites of the lung were involved equally while 2 cases had bilateral involvement. Incidence of disease is maximum in February (20%) and more in children with malnutrition (42%).

Most common presenting complaints were cough (98.00%), fever (96.48%), breathlessness (61.40%) and chest pain (10.52%). Duration of fever before presentation was one week in 35.71% of patients, 1-2 weeks in 47.21% of patients and more than 2 weeks for 16.08% of the patients. Out of 30 patients having long duration (more than 7 days) of illness, 25 (80%) were found to have Stage III of empyema. Out of 27 patients

having short duration (<7 days) of illness, 20 (74%) were found to have Stage II of empyema. Duration of illness (>7 days) was very significantly related to advancement in the stage of empyema ($p < 0.0001$).

On pleural fluid culture, gram stainable organism was found in only 18 (31.58%) patients. Totally, 16 out of 18 had Gram-positive (88.89%) bacilli, while Gram-negative (11.11%) organism was rarely found (2 out of 18). In only 18 (31.57%) cases, cultures were positive. Out of these, 38.9 % of the cultures grown streptococci while staphylococci were seen in 44.4% cases. Three of the patients had isolated *Acinetobacter*, *Enterococci* or *Enterobacter* species, all of them were treated at referral hospital with interventional management *i.e.* ICD. In this study, bacterial culture sensitivity report by BACTEC technique showed that all streptococci are sensitive to third-generation cephalosporins and respiratory fluoroquinolones. These were moderately sensitive to penicillin and macrolides. Staphylococci organisms were ampicillin and penicillin resistant. There is moderate sensitivity toward third-generation cephalosporins. Out of 8 positive cultures, 1 had MRSA positive which was community acquired.

A total of 25 patients were treated with ICD and intrapleural urokinase as the primary mode of management. After completion of the treatment, one had persistent necrotizing right upper lobe consolidation (necrotizing pneumonia) that required thoracotomy with upper lobectomy. Totally, 20 children required primary decortication without trying chest tube in view of negative or minimal aspirate, but radiological investigation revealed solidified pleural material with significant compression of the lung. Remaining 12 children had failure of primary treatment (ICD + IV antibiotics) required surgical management either video assisted thoracoscopy surgery (VATS) or thoracotomy (Figs. 1 and 2).

Antibiotic was continued until the patient is afebrile, WBC count is normal, tube thoracostomy yield is <50 ml of fluid per day and radiograph shows considerable clearing. We found no significant difference between patients managed with fibrinolytics or surgically with respect to fever remission time in the hospital, duration of hospitalization and duration of IV antibiotics.

Mean duration of hospital stay was found 12 days. Surgically treated children required significantly ($p = 0.0067$) shorter duration of oral antibiotics as compared to fibrinolytics

Duration in days	Medically managed		Surgically managed		Student t-test
	Chest tube drain (n=25)		VATs (n=18)	Thoracotomy (n=14)	
Fever remission time in hospital	4.52±3.016		4.22±2.73	5.5±3.27	p=0.234
Duration of hospitalization	11.64±4.06		12.05±4.37	11.64±3.94	p=0.837
Duration of IV antibiotics	12.44±4.24		12.38±4.52	11.85±5.27	p=0.735
Duration of oral antibiotics	8.2±5.50		4.16±2.74	5.85±4.47	p=0.0067

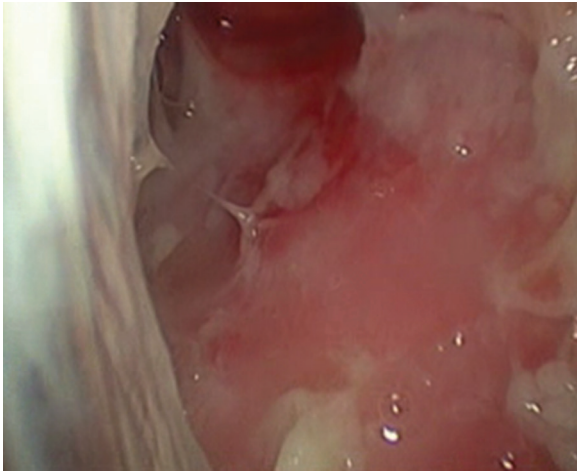


Figure 1: Multiple thick loculated slough in the pleural cavity

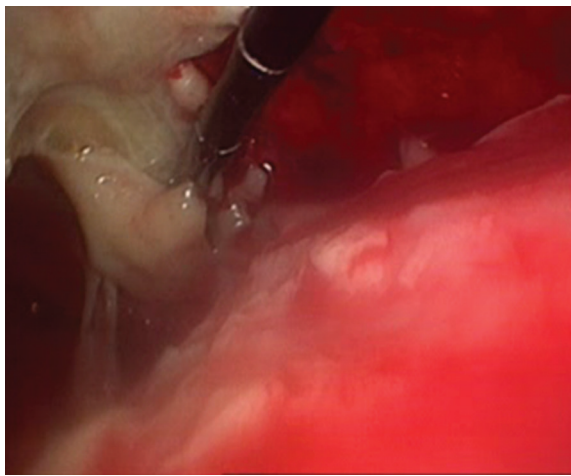


Figure 2: Pleural peel being removed thoracoscopically

group. Out of 57 patients, 1 child died due to *Acinetobacter* sepsis. Overall outcome of empyema is excellent, and mortality was 1.5% due to overwhelming sepsis.

DISCUSSION

This study reports similar epidemiological profile including age group, sex, nutritional status, seasonal variation and clinical presentation of the disease as noted by other studies in same geographical area [1,3,8-11]. Duration of the illness and stage of the disease are significantly correlated. We observed that more than 60% of the children who were referred from other hospitals had organized stage of the empyema requiring surgery. All children who presented with more than 7 days of illness and partially treated with only antibiotics found to have advanced stage of disease. Timely institution of proper management prevents the need for any surgical intervention and avoids long-term morbid complications.

Although pleural fluid is often sterile due to prior administration of antibiotics, it must be sent for culture. In our study, 31.57% cultures were positive with streptococci and

staphylococci being the common organisms. Culture of the one child grown MRSA that was community acquired. Similar results are seen in previous studies that showed that cultures were sterile in 30-50% of the cases due to prior antibiotics exposure and *S. aureus* was the most commonly retrieved organism [12-14]. The increasing incidence of methicillin-resistant staphylococci has been reported [5,15]. In this study, bacterial culture sensitivity report by BACTEC technique showed that all streptococci are sensitive to third-generation cephalosporins and respiratory fluoroquinolones. Parenteral therapy should be continued for 48-72 h after abatement of fever, and then oral therapy can be used to complete the course [9].

We found that all the patients had evidence of fluid on X-ray while 15 children on X-ray had presented with “white out” lungs. In children with Stage II of empyema showed hypoechoic lesion with thin septations. In this study, 20 children were managed with early surgical intervention, who showed thickened pleura with multiple internal echoes on ultrasound. In all of them thickness of pleura was >2.5 mm and later on found to have Stage III (organizational stage) of empyema. Sonography can distinguish solid from liquid pleural abnormalities with 92% accuracy compared to 68% accuracy with chest X-ray, when results of both are combined, accuracy rises to 98% [16].

Out of 57 children, CT scan was done in 37 children, and only 8 scans showed positive “split sign” (thick pleural peel). In remaining patients, CT failed to provide any additional information as compared to USG. All features on CT are being highly suggestive but non-specific for empyema rather than sterile pleural effusion [17-19]. Considering the risk of radiation exposure and need of intravenous contrast, use of CT scan to diagnose empyema is not advocated.

In our study, only one child with Stage II of empyema required surgery while remaining all other (24 out of 25) were managed with thoracostomy and intrapleural injection of Urokinase. Similar results occurred in 118 patients with complicated pleural fluid collections studied by Moulton et al. [20] full clinical recovery in 111 patients (94%). Bouros et al. [21] evaluated low-dose Urokinase in 20 patients with pleural effusion and empyema and showed the success of low-dose Urokinase, and the low cost is comparable to that of streptokinase without any significant complications.

There are no evidence-based criteria to guide the decision on when a child should proceed to surgery [6]. Early use of VATS enhances the chance of full expansion of the collapsed lung, and drainage of the empyema fluid is significantly improved when performed under direct vision [22-24]. We found no significant difference between patients managed only with chest drain or surgical management. In a study done by Satpathy et al. [10], mean duration of hospital stay was 12 days and fever remission time was significantly less in chest drain group. In our study, surgically treated children required

significantly ($p = 0.0067$) shorter duration of antibiotics as compared to chest drain group. Similar results were seen in the study by Satpathy *et al.* [10], where combined duration of IV and oral antibiotics was lesser in the thoracotomy group.

CONCLUSION

To conclude, our observation suggests that results with the use of intrapleural fibrinolytics are promising in Stage II of empyema. As complications are very few, VATS is a safe procedure in experienced hands. Where fibrinolytics or VATS are not freely available or feasible, decortication remains a valuable and indispensable tool.

CONTRIBUTORS

FS, PK: Conceived and designed the study. RK: Acts as guarantor; KS: Was responsible for collection of data; KS, PK: Was responsible for analysis of the data and drafting the paper; FS: Participated in protocol development and helped in drafting the paper. The final manuscript was approved by all the authors.

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