SURGICAL MANAGEMENT OF COMPLICATED PARAPNEUMONIC PLEURAL EFFUSION IN CHILDREN

ANCA BUDUSAN, IOAN PARAIAN, DOINA ZAMORA

Children's Hospital Cluj-Napoca, Iuliu Haţieganu University of Medicine and Pharmacy, Cluj-Napoca, Romania

Abstract

Aims. *We analyzed and examined the effect of different management strategies on short term outcomes for pediatric patients with parapneumonic pleural effusions.*

Patients and methods. *We retrospectively reviewed 16 cases of children admitted and treated in our department of pediatric surgery for empyema or pleural effusions for a period of 30 months.*

Results. *When chest drains are used alone, patients can make a complete recovery, even with the cost of longer hospital stay. Furthermore, some patients often require extensive surgical treatment as open thoracotomy with decortication due to failure to respond to chest-tube drainage.*

Conclusions. *Because of the relatively small number of patients with parapneumonic effusions and because of lack of modern possibilities that require expensive equipment, like VATS or fybrinolitic therapy, our study results are limited and need to be reviewed in time . Even so, results on short outcome are good, with low morbidity and mortality, but with higher costs.*

Keywords: children, empyema, surgery, drainage.

Aim

Parapneumonic effusion is an uncommon complication of childhood pneumonia, but still a common problem in many countries, since the optimal management remains controversial. Many treatment options are available; while most cases of parapneumonic pleural effusion respond to antibiotic therapy only, those who fail to medical treatment need antibiotic therapy and tube drainage, and a few cases require further surgical treatment as thoracotomy, pleural debridement, and decortication. Thoracocentesis alone may be sufficient for the exudative phase. In fibrino-purulent stage, a properly sized and well-placed tube thoracostomy with underwater seal is curative in most cases. Open surgery with decortications is indicated if there is no response with intercostals drainage procedure, in presence of underlying lung disease or persistently symptomatic effusion. Modern strategies include a conservative approach with use of chest drain and intrapleural fibrinolytic therapy and video assisted thoracoscopic therapy (VATS), but both are unavailable in our clinic at the moment. We reviewed our experience with a number of children with parapneumonic effusion or empyema who failed to respond to previous medical treatment, admitted over a time interval of 30 months. Our objectives were to gather data on the clinical presentation and to examine the effect of different management strategies on short term outcomes.

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Address for correspondence: anca21b@yahoo.com

Patients and methods

We performed a retrospective case note review of children admitted with parapneumonic effusion or empyema to the Department of Pediatric Surgery, Children`s Hospital, Cluj-Napoca, between January 2010 to July 2012 (30 months). The study was approved by the ethic board of our clinic.

Cases were selected by searching coded discharged medical records, and cases of pleural effusion which were not due to lung infection were excluded. A total of 16 children (9 girls and 6 boys) were treated for postpneumonic effusions or empyema in our Department of Pediatric Surgery, Children`s Hospital, Cluj-Napoca in the 30 months period of time. Diagnosis was established by case history, clinical features, Chest X-Ray (chest X-ray), ultrasound chest (US), and computer tomography scan (CT), where available.

Classification of postpneumonic effusion was made using ultrasound appearances as it follows: stage one refers to a fluid collection without loculations; stage

2 has fibrinous septations but no homogeneous echogenic loculations or thickened parietal rind, and stage 3 has a complex ultrasound appearance with multiple loculations and entrapped underlying lung [1]. Decisions regarding treatment options were taken by the clinician involved (pediatric surgeon).

In order to control the infection, the objectives of the treatment were:

- drainage of purulent fluid
- eradication of the sac to prevent chronicity
- re-expansion of the affected lung
- restore complete lung function

Drainage of the pleural cavity is an essential component in the treatment of large pleural effusions and is necessary for establishing re-expansion of the lung. The recommendation of chest drainage as treatment is easy for a child with moderate to severe respiratory distress, a large pleural effusion or sepsis. The decision is much more difficult in patients in the early stages with mild respiratory distress and small effusion because some of them will resolve spontaneously. The treatment options available today are:

- chest drain insertion alone
- chest drain with instillation of fibrinolytics - (not available in our clinic at this moment) [2]
- VATS (video assisted thoracoscopic surgery) – (not available)
- open thoracotomy and decortications, closure of fistula if necessary [3]

Patients were divided into groups according to the therapeutic procedure, as follows: chest drain alone or thoracotomy. We analyzed the length of hospital stay, the associated morbidity and mortality for both groups.

All children required associated supportive therapy; which includes measures meant to help:

- children should have supplemental oxygen if their saturation is below 90-93%
- sometimes children needed intubation and ventilation for respiratory support
- other standard therapy included: fluid replacement, antipyretics and analgesia
- the child is encouraged to early mobilization and deep breathing and coughing
- the child needs adequate analgesia to allow painless respiration and mobilization

All children with empyema received antibiotic intravenous therapy in high dose and important to ensure pleural penetration. Initially, in the absence of a positive culture the choice is dependent on local bacterial causes of community acquired pneumonia and local antibiotic policy will vary. Initial empirical choice of antibiotics should cover at least streptococcus pneumoniae and staphylococcus aureus. The presence of pneumatoceles on chest X-ray raises the suspicion of S. aureus or S. pneumoniae. Antibiotic therapy is important to ensure pleural penetration using high doses by intravenous administration in the early stages of the disease. Once a child has been free of fever for 24 hours, antibiotics can be given orally, for at least 7 days and up to 6 weeks of oral therapy [4].

Initially, all 16 patients underwent closed intercostals drainage with a chest tube attached to an underwater seal system. The chest tubes were inserted in the operating room, under intravenous sedation, using fully monitoring equipment. Chest tubes were introduces in fourth or fifth intercostal space mid-clavicular or anterior axilar line, under general anesthesia.

Persistent fever is the commonest indication of possible treatment failure, caused by either incorrect antibiotic choice or failure of the antibiotics to penetrate the infected lung tissue or cavity. However, it is recognized that in some cases it will persist for many days due to lung necrosis and inflammation rather than continued sepsis. In these circumstances, a decrease in WBC and CPR is reassuring. A CT scan is indicated for persisting fever and a rise in WBC and CPR, to exclude a pulmonary abscess or other collection of pus which may not be visible on a chest X-ray. Cavitary necrosis, necrotizing pneumonia and pneumatoceles may be present on CT scans and are often a complication of empyema. Necrotizing pneumonia may result in a prolonged hospital stay but still the outcome is good [5].

Another potential complication is a lung abscess. Due to the risk of bronchopleural fistula, most physicians recommend treatment with prolonged antibiotics. A bronchopleural fistula occurs occasionally following the insertion of a chest drain or surgery, for the treatment of empyema, due to the fragility of lung parenchyma, which leads to a persistent air leak, in these cases, negative suction on chest drain is best avoided, to improve the chance of tissue healing. Surgical intervention is very rare needed, to repair the fistula. A few patients (4) whose chest X-ray or CT showed severe pleural thickenings, loculated empyema and trapped lung with poor clinical recovery went through thoracotomy with decortications (group II). The pleural space was entered through the fifth or sixth intercostals space, with rib resection. The intrapleural debris, fibrin mass and all pus were evacuated and the fibrinous peel on the surface of the visceral and parietal pleura was carefully removed. If needed, a fistula was closed. After performing a meticulous bleeding control, two chest tubes were inserted into the pleural space for underwater drainage, with low negative pressure (-15 to 20 cm H_2O).

Video-assisted thoracoscopic surgery (VATS) was not performed because of a lack of technical facilities. Intrapleural fibrinolytic treatment was never used, because of higher costs. Early intervention with the use of VATS in the treatment of empyema in children may reduce hospital costs by shortening hospital stay. A treatment algorithm is described in literature [6].

Once a patient had no oxygen requirement, the chest

tube had been removed and oral antibiotics administered for 24 hours, he/she could be discharged. Percutaneous drains are less invasive and painful and thus encourage mobilization and may aid recovery. Insertion of the tube needs general anesthesia, sedation or local anesthesia [7]. Chest drains can be removed if there is less than 1-2 ml/kg fluid per 24 hours. The presence of the drain in the pleural cavity itself causes irritation and increases production of pleural fluid and therefore it is not advisable to wait until there is no fluid drainage before removing the drain. A chest X-ray should be performed following removal; the presence of some air in the pleural space is not uncommon, and is usually reabsorbed in time.

Oral antibiotics should be continued at home for at least one week and may be continued for up to 6 weeks. A follow-up chest X-ray should be performed at weeks 4 and 6 to ensure that resolution occurs. This X-ray will not be normal yet, despite complete clinical recovery of the child, in most cases some residual thickening is present even 6 weeks after discharge. Further imaging studies are needed only if there is persistent lobar collapse or there are ongoing clinical symptoms [8,9].

Results

The most common symptoms and signs at admission in our groups were: fever (87.5%), cough (81.25%), dyspneea (56.25%), lethargy (25%), decrease appetite (25%) and abdominal pain (12.5%). There were 6 right-sided, 9 left-sided pleural effusions and 1 bilateral effusions. Pleural fluid culture was positive in 3 (18.75%) patients. The most frequently identified micro-organism was S.aureus. The rest were difficult to identify because patients previously received antibiotics for the treatment of pneumonia at a different medical unit or at home where the disease started.

Initial treatment with chest tube drainage alone was successful in 12 (75%) patients, representing group I. In the 4 patients (25%) in which the treatment failed, open thoracotomy and decortications was applied (figure 1).

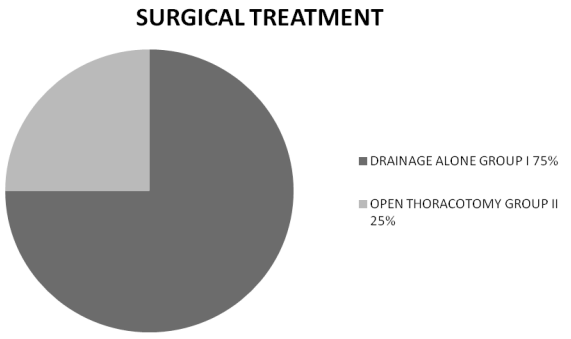

Figure 1. Surgical treatment of parapneumonic effusion in children.

The median hospital stay was 15.5 days in group I and 24.25 days in group II.

In our group of 16 pediatric patients, we had no mortality. Morbidity referred to presence of bronchopleural fistulas which were identified by the presence of air in pleural space (hydropneumothorax), and were treated using only underwater sealing drainage (4 cases in group II) or by closing fistula during thoracotomy (1 case in group II) and one case of lung abscess in group I, treated only with antibiotics, with good outcome.

Discussions

This study provides a retrospective review of the management of a group of children with parapneumonic effusion over a short time interval.

When chest drains are used alone, patients can make a complete recovery, even with the cost of longer hospital stay. Furthermore, some patients often require extensive surgical treatment as open thoracotomy with decortication due to failure to respond to chest-tube drainage. Of the 16 children who had an intercostals chest drain, 4 (25%) returned to the operating theatre for a thoracotomy. This outcome significantly prolongs the length of stay and involves a second anesthetic.

Antibiotics were given during the entire period of hospital stay, at high costs.

Organisms were identified in just a few cases, because children were previously treated for respiratory infections at home or in a different medical center, without microbiological studies.

Length of hospital stay was longer for children who had open thoracotomy with decortication, because they were previously treated with chest-drain tubes, with poor outcome or results. There are studies in literature showing short hospital stay for children who had open thoracotomy as first treatment, immediately after admission, as compared to those who had chest-tube drainage but this remains controversial.

The instillation of intrapleural fibrinolytics such as urokinase or tissue plasminogen activator through chest drains shortens hospital stay when compared with chest drain alone [10]. It is thought that fibrinolytics act by breaking down fibrin bands which cause loculations of the empyema, thus improving drainage of the infected material by chest tube and also clearing pleural drainage and re-establishing pleural circulation. Open thoracotomy is not recommended as first option for treatment of childhood empyema as it has been superseded by the use of VATS. The advantages over open surgery are that it is minimally invasive and the small scars limit tissue damage. It offers the advantage of better visualization of internal structures. The disadvantages are that the equipment is expensive and requires surgical expertise, which may not be available in all medical centers.

Conclusions

We need to gain more experience to properly identify the optimal time for performing open thoracotomy, with low costs and to reduce suffering and long hospital stay for our patients. Still, the majority of them will need only drainage with good outcome on short and long term, since it is well known that children have a greater capacity to resorb thickened pleura than adults [11]. Maybe in the future we will be able to perform instillation of fibrinolytics or even VATS to improve our results by decreasing morbidity and shorten hospital-stay.

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