

Thoracoscopic Management of Complicated Parapneumonic Effusions in Young Children

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Objective: To evaluate the role of thoracoscopic management of complicated parapneumonic effusions (CPE) in very young children.

Setting: Division of Pediatric Surgery, Salmaniya Medical Complex.

Design: Very young children with complicated parapneumonic effusions were prospectively studied between January 2007 and December 2008.

Method: Eleven patients under the age of two year with the diagnosis of complicated parapneumonic effusions underwent thoracoscopic management. The patients had chest X-ray, Ultrasound and CT scan of the chest. The patients received antibiotic 3-6 weeks prior to thoracoscopy without improvement. The patients received fibrinolytic agent on the second postoperative day. Three trocars used, one 5 mm for the camera and two 5 mm for working forceps on semilateral position.

Result: Eleven cases of CPE were studied during a 2-year period; the age had ranged from 5 to 24 months (average 12 months). In 3 cases, Streptococcus pneumoniae was found from pleural fluid. Two cases have chest tube before thoracoscopy. Postoperative chest tube drainage had ranged from 3-20 days (average 5 days). Postoperative Febrile days had ranged from 1- 4 days (average 2 days). Post thoracoscopy hospital stay had ranged from 5-21 days (average 7 days). No intra-operative or postoperative major complications were encountered. Three cases developed minor surgical emphysema, which resolved spontaneously. Follow up ranging from 6-12 months (average 6 months) resulted normal recovery and good cosmesis.

Conclusion: In this study, the initial outcome of thoracoscopic management of complicated parapneumonic effusions in very young children was safe and effective. Randomized controlled study will lead to the development of standards therapy in these cases.

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In pediatric patients, parapneumonic effusion complicates pneumonia in 36% to 57%; the incidence ranges between 0.4 and 6.0 cases per 1000 pediatric admissions¹. Management of parapneumonic effusions remains controversial. Therapeutic options include antibiotics, thoracentesis, thoracostomy tube drainage, fibrinolysis, thoracoscopic surgery, and thoracotomy^{2,3}. The American Thoracic Society described the formation of a parapneumonic effusion along a 3-stage continuum⁴. Stage 1 is the early exudative phase; the parapneumonic effusion has a normal glucose and pH. Stage 2 is the intermediate fibrinopurulent phase, which is heralded by an increase in fibrin, polymorphonuclear neutrophils, lactic dehydrogenase, decreased glucose and pH. Because of the fibrin deposition, loculations of fluid begin to form in the pleural space. Stage 3 is the late organizing phase characterized by fibroblastic growth extending from the visceral and parietal pleurae, which causes the formation of a restrictive pleural peel that entraps the lung and impairs its function. Management of stage three is controversial.

The aim of this study is evaluate the role of thoracoscopic management of complicated parapneumonic effusions in very young children.

METHOD

A prospective study was conducted at Salmaniya Hospital between January 2007 and December 2008. Eleven patients were under 2 years of age suffering from complicated parapneumonic effusions were included in the study. The patients underwent thoracoscopic therapy followed by fibrinolysis for 24 hour. Two doses of Reteplase one unit in 50 ml normal saline was administered through the chest tube; each dose was calculated as one ml/kg. The patients had antibiotic for 3-6 weeks prior to thoracoscopy without improvement. Three trocars used, one 5 mm for the camera and two 5 mm for working forceps on semilateral position.

RESULT

Eleven cases of CPE were studied during a 2-year period. The patients' age had ranged from 5 to 24 months (average 12 months). There were seven males and four females. Seven cases had right pneumonia and four cases had left pneumonia. In 3 cases, Streptococcus pneumoniae was found in the pleural fluid. Two cases had chest tube before thoracoscopy. Postoperative chest tube drainage had ranged from 3-20 days (average 5 days). Postoperative febrile days had ranged from 1-4 days (average 2 days). One case required ventilation for 24 hour in intensive care unit. Post thoracoscopy hospital stay had ranged from 5-21 days (average 7 days). No intra-operative or postoperative major complications and mortalities were encountered. Three cases developed minor surgical emphysema, which resolved spontaneously. The patients did not require any opiates postoperatively. The Follow-up had ranged from 6-12 month (average 6 month). See Table 1, which summarizes the main data of the study. The patients achieved normal health. Plain X-ray was useful in showing opacity and obliteration of cost-phrenic angle. CT scan was definitive in showing consolidation and parapneumonic effusion with thickened pleural wall, see Figure 1 and 2.

Table 1: Summary of the Main Data of the Study

Age (months)	5 - 24 (average 12)
Sex	7 male/4 female
Site of pneumonia	7 right/4 left
Postoperative chest tube duration (days)	3 - 20 (average 5)
Postoperative hospital stay (days)	5 - 21 (average 7)
Major complications	0
Minor complications	3 cases (subcutaneous emphysema)
Mortality	0
Follow up (months)	6-12 (average 6)



Figure 1: Poster-Anterior Chest Radiograph Shows Radio-Opacity on the Left Side Indicating a Collection of Parapneumonic Effusion



Figure 2: CT Scan of the Chest Shows a Consolidation Area of the Left Lung with Effusion

DISCUSSION

The treatment of parapneumonic effusions has often included a primary non-operative regimen (antibiotics only or with thoracentesis or chest tube drainage). Although antibiotic administration and chest tube thoracostomy may be adequate therapy for stage I parapneumonic effusions, the presence of loculations and fibrinous adhesions in stage 2 and stage 3 often limits the success of this therapy. It is difficult clinically to differentiate between stage 1 and stage 2 of the disease. Thus, primary non-operative approach frequently results in prolonged hospitalizations. Many retrospective case studies have suggested that children who experience failure of conventional chest tube therapy exhibit improvement after thoracotomy or thoracoscopy, especially if the procedure is performed early⁵⁻¹⁰. Based on those studies, many pediatric surgeons have concluded that primary thoracoscopy is a better approach for children suffering from parapneumonic effusion³. A recent meta-analysis suggested that primary surgical intervention for pediatric parapneumonic effusions was the best approach¹¹. The management of parapneumonic effusions can be challenging and frustrating and can be difficult to assess, whether the effusion is free flowing (stage I) for which simple thoracostomy drainage could be adequate, or if it has already progressed to an effusion with multiple loculations (stage 2 and stage 3). For those reasons, the patients in this study had US and CT scan to differentiate between the various stages of parapneumonic effusions and to help localization of the trocars in thoracoscopic management.

During the present study, every patient had radiographic evidence of loculations with visual confirmation in surgery. A rational approach has been unclear because of the lack of prospective randomized trials. Maskell et al questions the efficacy of fibrinolytic therapy in parapneumonic effusions, but the meta-analysis by Avansino et al suggests a significant benefit of fibrinolysis in pediatric parapneumonic effusions^{11,12}. Ultrasound has been advocated to confirm the presence of an effusion because of its lower cost, greater availability, portability, flexible use of sedation, and lack of ionizing radiation; loculated effusions by ultrasound have correlated with exudative pleural chemistries¹³⁻¹⁶. However, sonography may not visualize all adhesions, which might influence the clinical outcome⁸.

CT scan is considered the most informative imaging modality to evaluate children with complicated parapneumonic effusions. CT scan requires sedation or general anesthesia. The advantages of CT scan are the excellent anatomical finding and the localization of the disease.

CONCLUSION

Thoracoscopic management in complicated parapneumonic effusion in very young children is safe and effective. A larger, multicenter randomized controlled study may be indicated to verify the treatment within this pediatric population.

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