

# CAUSES AND OUTCOME OF PLEURAL EFFUSION IN CHILDREN IN A TERTIARY CARE HOSPITAL OF PESHAWAR, PAKISTAN

Zafar Iqbal<sup>1</sup>, Sher Ali Khan<sup>2</sup>, Zia Ullah<sup>3</sup>, Jamshed Alam<sup>4</sup>, Muhammad Umar<sup>5</sup>, Mohammad Yousaf Khan<sup>6</sup>

<sup>1-6</sup> Department of Pulmonology, Lady Reading Hospital, Peshawar – Pakistan.

**Address for Correspondence:**

**Dr. Sher Ali Khan**

Assistant Professor,

Department of Pulmonology, Lady Reading Hospital, Peshawar – Pakistan.

Email: sherali3870@gmail.com

Date Received:

January 01, 2019

Date Revised:

September 05, 2019

Date Accepted:

September 13, 2019

## ABSTRACT

**Objective:** To determine the causes and outcome of pleural effusion in children presenting to a tertiary care hospital.

**Methodology:** This cross sectional study was carried out in Department of Pulmonology, Lady Reading Hospital, Peshawar from August 2017 to August 2018. All the patients with age less than 15 years and having unilateral or bilateral pleural effusion were included in the study. All the children were assessed for the causes of pleural effusion. Pleural tap was performed and pleural fluid was sent for biochemical examination to determine whether the fluid was exudative or transudative. Pleural fluid was also sent for microbiological and cytological examination where, tuberculosis, other infection or malignancy was suspected. Data were recorded and analyzed using SPSS version 20.

**Results:** Total 82 cases of pleural effusion were enrolled of whom 51 (62.1%) were males. Pleural effusion was exudative in 67 (81.7%) cases while transudative in 15 (18.3%) cases. The most frequent cause of pleural effusion was parapneumonic effusion (60.9%) followed by congestive cardiac failure (15.8%), malignancy (8.5%), tuberculosis (4.8%), renal disease (2.4%) while (7.3%) cases remained undiagnosed. Regarding outcome, among 50 patients with parapneumonic effusion, 48 cases underwent tube thoracostomy, of which 36 cases received intrapleural streptokinase (SK). Among these 36 cases, 24 cases responded to SK while 12 cases underwent decortication.

**Conclusion:** Parapneumonic effusion is the most common cause of pleural effusion in children. Intra-pleural SK has good results in children and save many patients from surgery.

**Key Words:** Pleural effusion, Intrapleural streptokinase, Etiology, Pediatrics

This article may be cited as: Iqbal Z, Khan SA, Ullah Z, Alam J, Umar M, Khan MY. Causes and outcome of pleural effusion in children in a tertiary care hospital of Peshawar, Pakistan. *J Postgrad Med Inst* 2019; 33(3): 199-203.

## INTRODUCTION

Pleural space is a potential space between the parietal and visceral pleurae. This normal pleural space contains about 10 ml of pleural fluid because of balance between the hydrostatic and oncotic pressure in the visceral and parietal pleural capillaries. Pleural effusion is the collection of abnormal fluid inside the pleural cavity. There are two main types of pleural effusion i.e. transudative and exudative. Transudative pleural effusion results from imbalance between the vascular hydrostatic and oncotic pressure while exudative pleural effusion results from inflammatory processes of the pleura<sup>1,2</sup>. The incidence of inflammatory pleural effusion in children is 8.5 per 100,000<sup>3</sup>. There has been a 2.2 fold rise in the incidence of pleural infection between 1995 and 2003 in patients less than 19 years and a 1.2 fold rise in patients more than 19 years of age<sup>2</sup>. Heart failure and

malignancies are the leading causes of pleural effusion in adults while in children parapneumonic effusion are more common and account for majority of the cases followed by congenital heart disease and malignancies as rare causes<sup>4-7</sup>. The most common bacterium responsible for parapneumonic effusion is *Streptococcus pneumoniae* followed by *Staphylococcus aureus* and *H. Influenzae*<sup>8</sup>. It is rare for children to have an underlying lung disease, therefore, the prospects with treatment are always good. Children have got a high prevalence of pleural effusion but a low mortality rate<sup>9-12</sup>. The treatment of pleural effusion mainly consists of treating the underlying cause.

In case of significant pleural infection, chest tube is inserted in the pleural cavity and repeated taps are not recommended<sup>8</sup>. In loculated parapneumonic effusion or empyema with pleural thickening intra-pleural fibrinolytic therapy has been recommended. The success

rate ranges from 80-90%<sup>13-16</sup> with reduction in the hospital stay and mortality<sup>17</sup>. In case of failure of intra-pleural fibrinolytic therapy, other options are video assisted thoracoscopic surgery (VATS) and open decortication in advanced cases<sup>18</sup>.

Regarding pediatric pleural effusion, extensive work has been done in developed countries on the subject and data is available in international literature but for developing countries we have limited data. This study was aimed to determine the causes and outcome of pleural effusion in pediatric population in our set up.

## METHODOLOGY

This cross sectional study was conducted in the Department of Pulmonology, Lady Reading Hospital, Peshawar from Aug 2017 to Aug 2018. Eighty two children less than 15 years old and having pleural effusion were admitted through OPD and Emergency Department. Written informed consent was taken for inclusion in the study. Ethical approval was taken from the Ethics Committee of Post Graduate Medical Institute Peshawar. Pleural tap was performed in patients and pleural fluid was sent for biochemical examination to determine whether fluid was exudative or transudative. Pleural fluid was also sent for microbiological and cytological examination where, tuberculosis, other infection or malignancy was suspected. Pleural biopsy was also taken

where needed.

Baseline hematology, urea, creatinine and urine D/R were performed. Additional investigations which were performed included CT scan of chest, echocardiography, renal ultrasound, sputum for acid fast bacilli (AFB), AFB culture, sputum & pleural fluid culture and sensitivity, lymph node excisional biopsy and fine needle aspiration cytology (FNAC) and 24 hours urinary protein.

Data were recorded and analyzed using SPSS version 20. Qualitative variables like gender, age, symptoms and causes were presented as frequency and percentage.

## RESULTS

During the study period, 82 children with pleural effusion were admitted to the Department of Pulmonology. There were 51 (62.1%) males and 31 (37.9%) females. Their age ranged from 2 to 15 years. Age distribution is shown in Table 1.

The most common symptom found in these children were cough (82%) followed by fever (71%), dyspnoea (62%), chest pain (55%), anorexia (25%) and weight loss (17%).

Pleural effusion was exudative in 67 (81.7%) cases while transudative in 15 (18.3%) cases. The most common cause of transudative pleural effusion was heart failure (Table 2).

**Table 1: Age distribution of study cases (n=82)**

Age Groups (Years)	Frequency	Percentage
2-5	11	13.4
6-10	42	51.2
11-15	29	35.3
Total	82	100

**Table 2: Causes of exudative and transudative pleural effusion of study cases (n=82)**

Variable	Frequency	Percentage	
Exudative Pleural Effusion (n=67)	Pneumonia	50	60.9
	Malignancy	7	8.5
	Undiagnosed	6	7.3
	Tuberculosis	4	4.8
Transudative Pleural Effusion (n=15)	Congestive Cardiac Failure	13	15.8
	Renal Disease	2	2.4
Total	82	100	

**Table 3: Culture and sensitivity pattern of study cases (n=40)**

Microorganism	Frequency	Percentage
No Growth	30	75
MRSA	06	15
Streptococcus pneumoniae	02	5
Klebsiella pneumoniae	02	5
Total	40	100

Among the 50 cases of parapneumonic effusion, 40 samples of pleural fluid were sent for culture and sensitivity (C/S). Seventy five percent samples showed no growth of microorganism. Culture and sensitivity pattern is shown in Table 3.

Out of 50 cases of parapneumonic effusion, 48 children underwent tube thoracotomy and streptokinase (SK) was administered in 36 cases. Among these 36 cases, 24 showed good response in terms of pleural fluid drainage and lung expansion while in 12 cases there was still localized pleural effusion with pleural thickening and non-expanding lung; so they were referred to thoracic surgeon for decortications.

Seven cases turn out to be malignant, in which 5 were referred to oncology department for further management and one patient with malignancy expired during hospital stay while one left the hospital against the medical advice. In transudative effusion, 13 cases were having cardiac problems and two were having renal diseases which were referred to the concerned specialties for further care.

## DISCUSSION

Pleural effusion is a common clinical presentation among children and adults in both developing and developed countries. Pediatrics pleural effusion is an abnormality which frequently develops due to collection of fluid in the pleural space. The prognosis of pleural effusion in children directly depends on the features of underlying disorders and the treatment approach. In this regard, infection based effusion can be successfully treated with antimicrobial agents. Most viral effusions usually resolve spontaneously. Generally, in untreated cases of pleural effusion, serious complications of empyema are expected. The most common symptoms observed in our study were cough, fever and dyspnea, which is in agreement to the previous studies<sup>19</sup>.

The cause of pleural effusion is mostly malignancy in developed countries while infection is the leading cause in developing or underdeveloped countries<sup>20-22</sup>. Present study suggested 65.7% of the pleural effusion as sec-

ondary to infections.

In infections, pneumonia is the most common cause of pleural effusion in children accounting for about 50-70% in literature<sup>22</sup>. Present study supported this with 60.9% of the cases, secondary to pneumonia. This study also supports that pediatrics pleural effusion is more common in boys than in girls and also in younger children in comparison with older ones<sup>23</sup>. In children with parapneumonic effusion, the pleural fluid that was sent for culture and sensitivity, showed no growth in 75% of cases. This could be due to the previous use of antibiotics in primary or secondary care centers. Tuberculous pleural effusion is common in adults, while pulmonary tuberculosis is the main manifestation of the disease in children<sup>24</sup>. The incidence of tuberculous pleural effusion is about 4.9% in children as reported in previous studies<sup>24,25</sup>, while in our study it was 4.8%. Other causes of pleural effusion like CCF, renal disease and malignancy were also observed in our study which are the established causes of pleural effusion in children.

The most frequent therapeutic measure carried out was intravenous antibiotic therapy. In contrast to the study of Bose et al<sup>26</sup>, in which only 50% of the children underwent tube thoracostomy, more children underwent the procedure in our study. The reason being that more children had complex and complicated parapneumonic effusion in our study. Empyema thoracis is parapneumonic effusion in which there is pus inside the pleural cavity. Although it has got low mortality (20%) as compared to adults<sup>26</sup> but if not treated on time it may progress to complication like thick pleural peel over the lung not allowing the lung to expand, broncho-pleural fistula, septicemia and dissection through the chest wall (empyema necessitans). Treatment options are chest tube insertion with or without fibrinolytics like instillation of intrapleural streptokinase, VATS and decortication.

A meta analysis of 10 trials showed that intrapleural fibrinolytics not only decreases the need for decortication and VATS but also reduces the duration of hospitalization<sup>14,27</sup>. Ekingeen et al<sup>28</sup> observed the success rate of intrapleural fibrinolytic therapy from 72-96%. Our study

showed the success rate of 66% of intrapleural SK. This may be due to the advanced and late phase of empyema cases in our study in which the success rate decreases. No major complications were observed during tube thoracostomy or intrapleural SK administration. Two prospective randomized trials compared thoracoscopic decortication to the tube thoracostomy with fibrinolysis for empyema in children<sup>29,30</sup>. Sonnpa et al<sup>29</sup> randomized 60 children with empyema to receive either per cutaneous chest drain with intra pleural urokinase or primary VATS. No significant difference between the two groups was found in length of hospital stay or radiological outcome at six months after intervention.

## CONCLUSION

The most common cause of pleural effusion in pediatric age group is para-pneumonic effusion in contrast to adults where literature has shown TB and malignancy to be more common. Intra-pleural SK has good results in children and save many patients from surgery.

## REFERENCES

- Efrati O, Barak A. Pleural effusions in the pediatric population. *Pediatr Rev* 2002; 23:417-26.
- Jaffé A, Balfour-Lynn IM. Management of empyema in children. *Pediatr Pulmonol* 2005; 40:148-56.
- Cruz AT, Starke JR. Clinical manifestations of tuberculosis in children. *Paediatr Respir Rev* 2007; 8:107-17.
- Finley C, Clifton J, Fitzgerald JM, Yee J. Empyema: an increasing concern in Canada. *Can Respir J* 2008; 15:85-9.
- Rabe KF, Hurd S, Anzueto A, Barnes PJ, Buist SA, Calverley P et al. Global strategy for the diagnosis, management, and prevention of chronic obstructive pulmonary disease: GOLD executive summary. *Am J Respir Crit Care Med* 2007; 176:532-55.
- Fletcher M, Leeming J, Cartwright K, Finn A. Childhood empyema: limited potential impact of 7-valent pneumococcal conjugate vaccine. *Pediatr Infect Dis J* 2006; 25:559-60.
- Givan DC, Eigen H. Common pleural effusions in children. *Clin Chest Med* 1998; 19:363-71.
- Balfour-Lynn IM, Abrahamson E, Cohen G, Hartley J, King S, Parikh D et al. *Thorax* 2005; 60 (Suppl I):i1-21.
- Eastham KM, Freeman R, Kearns AM, Eltringham G, Clark J, Leeming J et al. Clinical features, aetiology and outcome of empyema in children in the north east of England. *Thorax* 2004; 59:522-5.
- Buckingham SC, King MD, Miller ML. Incidence and etiologies of complicated parapneumonic effusions in children, 1996 to 2001. *Pediatr Infect Dis J* 2003; 22:499-503.
- Byington CL, Korgenski K, Daly J, Ampofo K, Pavia A, Mason EO. Impact of the pneumococcal conjugate vaccine on pneumococcal parapneumonic empyema. *Pediatr Infect Dis J* 2006; 25:250-4.
- Davies HE, Davies RJ, Davies CW. Management of pleural infection in adults; British Thoracic society pleural disease guidelines 2010. *Thorax* 2010; 65:41-53.
- Kurt BA, Winterhalter KM, Connors RH, Betz BW, Winters JW. Therapy of parapneumonic effusions in children: video-assisted thoracoscopic surgery versus conventional thoracostomy drainage. *Pediatrics* 2006; 118:e547-53.
- Singh M, Mathew JL, Chandra S, Katariya S, Kumar L. Randomized controlled trial of intrapleural streptokinase in empyema thoracis in children. *Acta Paediatr* 2004; 93:1443-5.
- Sonnappa S, Cohen G, Owens CM, van Doorn C, Cairns J, Stanojevic S et al. Comparison of urokinase and video-assisted thoracoscopic surgery for treatment of childhood empyema. *Am J Respir Crit Care Med* 2006; 174:221-7.
- Thomson AH, Hull J, Kumar MR, Wallis C, Balfour Lynn IM. Randomised trial of intrapleural urokinase in the treatment of childhood empyema. *Thorax* 2002; 57:343-7.
- Lewis KT, Bukstein DA. Parapneumonic empyema in children: diagnosis and management. *Am Fam Physician* 1992; 46:1443-55.
- Scarci M, Raveglia F. Lung decortication for pleural empyema. *Shanghai Chest* 2017; 1:1-3.
- Ütine GE, Özçelik U, Kiper N, Doğru D, Yalçın E, Çobanoğlu N et al. Pediatric pleural effusions: etiological evaluation in 492 patients over 29 years. *Turkish J Pediatr* 2009; 51:214-9.
- Agossou M, Bashi BJ, Azon-Kouanou A, Zannou DM, Ade G. Pleural effusion at the Internal Medicine Unit. Centre National Hospitalier Universitaire, Cotonou Benin. *Afr J Respir Med* 2013; 9:17-8.
- Koffi N, Aka-Danguy E, Kouassi B, Ngom A, Blehou DJ. [Etiologies of pleuritis in African milieu. Experience of the Cocody Pneumology department (Abidjan-Côte d'Ivoire)]. *Rev Pneumol Clin* 1997; 53:193-6.
- Antunes G, Neville E, Duffy J, Ali N. BTS guidelines for the management of malignant pleural effusions. *Thorax* 2003; 58:ii29-38.

23. Freij BJ, Kusmiesz H, Nelson JD, McCracken GH Jr. Parapneumonic effusion and empyema in hospitalized children; a retrospective review of 227 cases. *Pediatr Infect Dis* 1984; 3:578-91.
24. Mirsha OP, Kumar R, Ali Z, Prasad R, Nath G. Evaluation of polymerase chain reaction and adenosine deaminase activity for the diagnosis of tuberculous effusion in children. *Arch Dis Child* 2006; 91:985-9.
25. Cruz AT, Starke JR. Clinical manifestations of tuberculosis in children. *Paediatr Respir Rev* 2007; 8:107-17.
26. Bose K, Saha S, Mridha D, Das K, Mondal P, Das I. Analysis of outcome of intrapleural streptokinase in pediatric empyema thoracis even in advanced stages: A prospective study. *Iran J Pediatr* 2015; 25:e3154.
27. Nie W, Liu Y, Ye J, Shi L, Shao F, Ying K et al. Efficacy of intrapleural instillation of fibrinolytics for treating pleural empyema and parapneumonic effusion: a meta-analysis of randomized control trials. *Clin Respir J* 2014; 8:281-91.
28. Ekingen G, Guvenc BH, Sozubir S, Tuzlaci A, Senel U. Fibrinolytic treatment of complicated pediatric thoracic empyemas with intrapleural streptokinase. *Eur J Cardiothorac Surg* 2004; 26:503-7.
29. Sonnappa S, Cohen G, Owens CM, van Doorn C, Cairns J, Stanojevic S et al. Comparison of urokinase and video-assisted thoracoscopic surgery for treatment of childhood empyema. *Am J Respir Crit Care Med* 2006; 174:221-7.
30. St. Peter SD, Tsao K, Spilde TL, Keckler SJ, Harrison C, Jackson MA et al. Thoracoscopic decortication vs tube thoracostomy with fibrinolysis for empyema in children: a prospective, randomized trial. *J Pediatr Surg* 2009; 44:106-11.

### CONTRIBUTORS

ZI conceived the idea, planned the study and drafted the manuscript. SAK, ZU, JA and MU helped acquisition of data, did literature search, statistical analysis and drafted the manuscript. MYK supervised the study and critically revised the manuscript. All authors contributed significantly to the submitted manuscript.