Pleural Empyema and Fibrinolytic Therapy in Children: A Single Center Experience

Çocuklarda Plevral Ampiyem ve Fibrinolitik Tedavi: Tek Merkez Deneyimi

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ABSTRACT

Objective: Pleural empyema (PE) is a serious complication of pneumonia and continues to be an important problem. Different treatment approaches are remarkable in many reports, but these do not provide strong evidence for ideal treatment. In this study, we aimed to evaluate our approach to the patients diagnosed as PE, and to demonstrate the experience of our center in the shadow of the not fully seated treatment approach in previously published studies.

Material and Methods: This is a retrospective study of 48 patients aged between 1-17 years from January 2011 to December 2016 in one center. Pre-admission status, risks and treatments of the patients, clinical and laboratory findings on admission, selected treatment approaches, especially the fibrinolytic therapy, and complications were evaluated.

Results: Tube thoracostomy was performed in 43/48 (89.6%). Patients treated with fibrinolytic therapy was 22 (45.8%) and the mean dose was 5.18±2.59 (1-9) in total. Fibrinolytic therapy was significantly higher in PE stage (II) than the other stages (p = 0.001). Intensive care need was 20.8% (n = 10) while total hospital stay was 23.58 ± 8.69 (3-47) days. Surgical intervention were required in five (10.4%) patients. There was no significant relationship between the operation and fibrinolytic treatment status of patients. The complication rate was 41.6% in total.

Conclusion: The therapeutic approach to PE in children is not standardized. As a result, each center seems to prefer applying its own treatment approach, considering previous experiences and results, like in our center.

Key Words: Children, Empyema, Fibrinolytic therapy, Pleural

ÖZ

Amaç: Plevral ampiyem (PA) pnömoninin ciddi bir komplikasyonudur ve önemli bir problem olmaya devam etmektedir. Farklı tedavi yaklaşımları yayımlanmış birçok raporda dikkat çekicidir, ancak ideal tedavi için güçlü kanıt sağlamamaktadır. Bu çalışmada, PA tanısı alan hastalara yaklaşımımızı değerlendirmeyi ve daha önce yayınlanmış çalışmalarda tam oturmamış tedavi yaklaşımı gölgesinde merkezimizin deneyimini sunmayı amaçladık.

Gereç ve Yöntemler: Bu çalışma Ocak 2011-Aralık 2016 tarihleri arasında tek merkezde izlenen 1-17 yaşları arasındaki 48 hastanın değerlendirildiği retrospektif bir çalışmadır. Hastaların başvuru öncesi durumları, riskleri ve tedavileri, başvuru sırasındaki klinik ve laboratuvar bulguları, seçilmiş tedavi yaklaşımları, özellikle fibrinolitik tedavi ve komplikasyonlar değerlendirilmiştir.

Bulgular: Tüp torakostomi 43/48 (% 89.6) hastaya uygulandı. Fibrinolitik tedavi ile tedavi edilen hastaların sayısı 22 (% 45.8) ve ortalama doz toplamda 5.18 ± 2.59 (1-9)'du. Fibrinolitik tedavi PA evre II'de diğer evrelere göre anlamlı derecede

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yüksekti (p = 0.001). Yoğun bakım ihtiyacı % 20.8 (n = 10) iken toplam hastanede kalış süresi 23.58 ± 8.69 (3-47) gündü. Beş hastada (% 10.4) cerrahi girişim gerekli oldu. Ameliyat ile hastaların fibrinolitik tedavi durumu arasında anlamlı ilişki bulunmadı. Komplikasyon oranı toplamda % 41.6'di.

Sonuç: Çocuklarda PA'da tedavi yaklaşımı standardize edilmemiştir. Sonuç olarak, her merkez bizim merkezimizde olduğu gibi önceki deneyimleri ve sonuçları göz önünde bulundurarak kendi tedavi yaklaşımını uygulamayı tercih ediyor gibi görünmektedir.

Anahtar Sözcükler: Çocuklar, Ampiyem, Fibrinolitik tedavi, Plevral

INTRODUCTION

Pleural empyema (PE) characterized by pus and bacteria in the pleural space, is a serious complication of pneumonia, and continues to be an important problem in the world despite the significant decline in pneumonia-related mortality and morbidity in recent years (1, 2). The incidence of PE is rising in both developed and developing countries in both adults and pediatric populations, and this data was supported by studies from many countries, even it has also been reported in a study from Scotland that the frequency has increased almost 10 times since 1998 (2-4). PE may be very difficult to treat for clinicians due to the lack of easy resorption with antibiotics and frequent drainage requirements, and also the possibility of progressing to more severe complications such as necrosis, cavitation, or fistulas in the thoracic cavity (5).

Different treatment approaches, including antibiotics alone or in combination with chest drain placement and surgical approaches, are remarkable in many reports of different centers, but do not provide strong evidence in establishing the ideal treatmentof PE (5,6). Thoracentesis, tube thoracostomy, video-assisted thoracoscopic surgery (VATS), thoracotomy, open drainage can be used in the drainage of infected liquid as well as fibrinolytic treatment can be applied in order to maximize expansion in the lung and to increase the fluidity of the pus (5-7). However, there is no consensus on 'which treatment approach should be followed in which stage in which patient'. While VATS is expressed as the gold standard for operative approach by some authors due to the minimally invasive procedures and low morbidity, infusion of fibrinolytic solutions to the intrapleural space has been shown quite effective in fibrin dissolution and treatment in multiple studies (8-13). But, there is no consensus on the application of fibrinolytic therapy in terms of age, dose, number of applications and duration. As a consequence of all of these, the approach to the patient with PE is usually shaped by the previous experience of the clinician and the center. In this study, we aimed to evaluate our approach to the PE diagnosed patients and to demonstrate the experience of our center, in the shadow of the not fully seated treatment approach in previously published studies.

MATERIAL and METHODS

Forty-eight children diagnosed with PE from January 2011 to December 2016 in Ankara Hematology Oncology Children's Training and Research Hospital were retrospectively examined. The descriptive characteristics of the patients such as age and gender, the history and season they were diagnosed with, and the risk factors (the immunization status, the histories of pneumonia and hospitalization, and underlying disease) were recorded. Complaints on admission, total symptom duration prior to admission, antibiotic use and duration before admission, and physical examination findings were evaluated. Laboratory studies on admission (hemogram, liver and kidney function tests, C reactive protein, erythrocyte sedimentation rate, blood culture), pleural fluid analysis (pH, density, glucose, protein, LDH, cell count, Gram and Giemsa smears, and culture), and imaging (x-ray, ultrasonography [USG] and computed tomography [CT] of thorax) findings were recorded. Transudate and exudate separation of pleural fluid were performed according to the Light criterias, and especially LDH, glucose, density and pH values. Macroscopically purulent appearance, or positive Gram stain/culture, or pleural fluids with if pH <7.2, LDH >1000 IU/L, and glucose <40 mg/dL, were interpreted as PE (14,15). The classification of the PE on admission was made as; stage (I) exudative (clear fluid with a low white cell count, normal pH and low LDH [< 1000 IU/L]), stage (II) fibrinopurulent (increased white cell count, low pH [< 7.2], high LDH [> 1000 IU/L] with fibrin deposition leading to septation and loculation), stage (III) organised (thick, non-elastic pleural peels) (16). Treatment approaches; duration of antibiotics (parenteral and peroral), chest tube drainage (if applied) and duration, type of fibrinolytic treatment (if applied) with number of doses and duration, and type of operation (if applied) were evaluated. Length of hospital stay, complications, and need of intensive care were recorded. The data were compared both within themselves and according to the PE stage.

The applications of closed chest tube drainage were performed by the interventional radiology and pediatric surgery departments. For the patients scheduled to receive fibrinolytic therapy, a pigtail catheter (Cook Critical Care; Cook Incorporated; Bloomington, IN) was inserted by the department of interventional radiology. A 16-20F silicone tube thoracostomy catheter was fitted to the patients who had to undergo urgent intervention or who were not scheduled to receive fibrinolytic therapy, by pediatric surgery department. The size of tubes were determined according to the patient size and difficulty of debridement. Chest tubes were removed when there was no sign of any air leakage and drainage output was less than 1-2 mL / kg per day for last 24h. Ultrasonography was performed before the procedure to confirm that the fluid is not loculated or the drain is not blocked.

Our indications for fibrinolytic treatment, in patients without a contraindication, included the presence of septations or loculations identified by imaging or a pleural sampling compatible with stage (II) or over PE. Intrapleural fibrinolytic doses were administered in follows; tissue plasminogen activator (tPA) 0.1 mg/kg with a maximum of 3 mg mixed in 10–30 mL of normal saline with 60-minute dwell time (the patient is positioned within the time the tube is closed) and maximum 9 doses (every 8 hr, daily 1-3 doses), urokinase 10000 units in 10 mL of normal saline for children <1 year old and 40000 units in 40 mL of normal saline for children >1 year old with 4-hour dwell time and maximum dose of 6 (every 12 hr, daily 1-2 doses), and streptokinase 15 000 U /kg in 50 mL of normal saline with 2-hour dwell time and maximum doses of 3-5 (every 24 hr, daily 1 dose) (17-19).

Statistical analysis was performed with the Statistical Package for the Social Sciences version 17.0 (SPSS Inc., Chicago, IL, USA, 2009). Continuous variables were specified as arithmetical means with standard deviations (SD). While numerical data were compared between the two groups, t-test was applied to the normal distributions in independent groups, and Mann Whitney U test was applied to those who did not normally disperse. Qualitative variables were compared with chi-square or Fisher's exact test. Normal distribution suitability was audited with Shapiro Wilk's test and histograms. A p value of < 0.05 was considered statistically significant.

RESULTS

Important descriptive informations of the patients is listed in Table I. No significant difference was found between PE stages according to past hospitalization history ($p = 0.593$), immunization status ($p = 0.876$), history of pneumonia ($p = 0.762$), and underlying disease ($p = 0.627$).

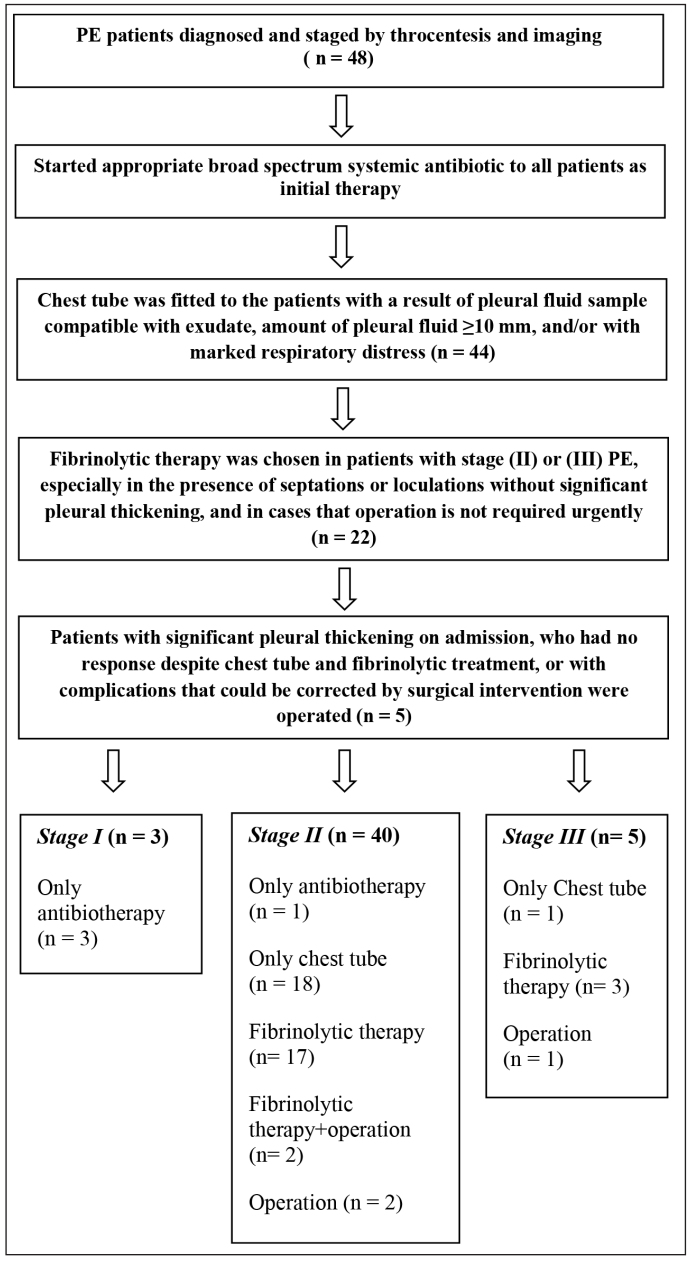
Chest x-ray and thorax USG were applied to all patients, but thoracic CT were required in 52% (n = 25). The presence of pleural septa in thorax USG was determined in 31 (64.6%) patients. Laboratory results on admission were also listed in Table I. Positivity in blood culture was 8.3% (n = 4), whereas 12.5% (n = 6) in pleural fluid culture. All of the microorganisms that were yielded in the blood were *Streptococcus pneumonia*, while the distribution of microorganisms in pleural fluid culture were *S. pneumonia* (n = 3), α-hemolytic streptococcus (n = 2) and *Shawanella putrefaci* (n = 1). Comorbid diseases detected during follow-up of the patients are immunodeficiency (n=3), tuberculosis (n=2), and influenza (n=1). Tube thoracostomy was performed in 89.6% (n = 43) patients and with a mean duration of 10.72 ± 5.67 (2-26) days. Chest tube was fitted by interventional radiology to 18 (41.8%) patients and by pediatric surgery to 25 (58.2%) patients. The chest tube of four patients with tube catheter insertion was replaced with a pigtail catheter to administer fibrinolytic therapy. The chest tube of six patients

Table I: Descriptive informations, risk factors and laboratory results of the patients on admission.

Descriptives	Value
Age (year)	6.52 ± 4.71 (1-17)*
Gender	
Male	25 (52.1)†
Female	23 (47.9) †
Immunization status	
Pneumococcal vaccine	25 (52†
H. influenzae type b vaccine	25 (52) †
Tuberculosis vaccine	46 (95.7) †
Previous history of pneumonia	2 (4.2) †
Hospitalization for any reason	4 (8.3)†
Underlying chronic disease	6 (12.8)†
Antibiotic usage rate	30 (62.4)†
Symptom duration before admission (day)	8.48 ± 6.74 (2-30)*
Duration of antibiotic usage (day)	6.61 ± 4.7 (1-21)*
Laboratory results on admission	
White blood cell count (10^3/μL)	18 ± 7.2 (5.4-33.6)*
Hemoglobin (g/dL)	11.2 ± 1.6 (8.2-15.2)*
Platelets (10^3/μL)	399 ± 17.1 (115-969)*
C-reactive protein (mg/dL)	21.94 ± 12.4 (1.29-48.74)*
Erythrocyte sedimentation rate(mm/hr)	87.3 ± 17.83 (37-118)*
Dysfunction in renal tests	3 (6.25) †
Impairment in transaminases	8 (16.6) †
Hyponatremia	17 (35.4)†

**Mean ± SD, †n(%)*

Table II: Algorithm and distribution of the treatment options.



spontaneously dislodged, with most on the pigtail catheter (4/6 patients). The number of patients treated with fibrinolytic therapy (tPA, urokinase or streptokinase) was 22 (45.8%) and the mean dose was 5.18 ± 2.59 (1-9) in total. Distribution of fibrinolytic therapy and the doses were as follows; tPA 90.9% (20/22) and 5.3 ± 2.69 (1-9) doses, urokinase 4.5 % (1/22) and 6 doses, and streptokinase 4.5% (1/22) and 4 doses. Fibrinolytic therapy was significantly higher (19/22 patients) in PE stage (II) than in the other stages (p = 0.001).

Mean antibiotherapy durations during follow-up were; parenteral 22.67 ± 8.36 (2-47), followed oral theraphy 9.21 ± 3.74 (5-21) and total therapy 28.93 ± 9.56 (2-57) days. Intensive care need was 20.8% (n = 10) while total hospital stay was 23.58 ± 8.69 (3-47) days. Thoracotomy / decortication or VATS were required in five (10.4%) patients. Three of these patients (for cystectomy in one patient with cyst hydatid, for lung abscess in one patient, and for decortication in one patient) underwent thoracotomy, and two underwent VATS. The algorithm of our center's treatment approach and the distribution of treatment options by stage are summarized in Table II. There was no significant relationship between surgical approach and fibrinolytic treatment status of the patients (p = 0.747). The complication rate was 41.6% (n = 20) in total. In the fibrinolytic group, this rate was 59.1% (n = 13). A significant difference was not found between treatment options in terms of intensive care need (p = 1) and complication rates (p = 0.064). However, considering the variety of complications, there were significantly more types of complications in patients treated with fibrinolytic therapy (p = 0.018). But, when complications only related to fibrinolytic therapy (such as intrapleural bleeding, leakage from the chest tube or severe chest pain during application) were overlooked, there was no difference in the complication variety between the two groups receiving and not receiving fibrinolytic therapy (p = 0.72). Disease or treatment related complications and comparison of patients according to fibrinolytic treatment status are listed in Table III.

DISCUSSION

According to the study results, it can be said that PE, which is seen more frequently in children younger than 5 years (1, 4), affects older than 5 years of age children in our center. Since 2008, the conjugate pneumococcal vaccine has been included in the national vaccination schedule of Turkey, and most of the children under the age of 5 in our country are immune to pneumococcus. This may be releated to the low pneumococcal immunization rate of children in the study and to the detection of age-average over 5 years. Because the majority of the patients were admitted during stage (II) PE, this study can be considered as a stage (II) PE experience. Our hospital is a reference center for pediatric diseases and the patients are usually referred to us after they are evaluated by centers in the lower stages. Probably most of the patients with stage (I) PE had been examined and treated at the primary referral centers, and then the patients cured without requiring referral to upper center. This procedure explains why the children in the study were mostly in stage (II) PE. Similarly, a long symptom duration, a high antibiotic usage rate, and a long duration of antibiotic use, which are pre-admission findings, are considered as related to the procedure described.

Patients suspected of having PE as a result of history, physical and laboratory findings and direct radiographs deserve further imaging radiologically (3). Ultrasonography is often used at every step of PE because of its ease of accessibility, reliable demonstration of loculations and septations in the thoracic cavity, ease of access and safety in thoracentesis, and safe placement

Table III: Disease- or treatment-related complications.

Complication	%(n)	Patients with fibrinolytic therapy (n = 22) % (n)	Patients without fibrinolytic therapy (n = 26) % (n)
Treatment-related			
Drug eruption	4.16 (2)	0 (0)	7.69 (2)
Antimicrobial bile mud / stone	4.16(2)	9 (2)	0 (0)
Serious chest pain during fibrinolytic application	2.08 (1)	4.54 (1)	0 (0)
Leak from chest tube during/after fibrinolytic application	2.08 (1)	4.54 (1)	1 (0)
Intrapleural bleeding after fibrinolytic application	6.25 (3)	13.6(3)	0 (0)
Bronchopleural fistula	2.08 (1)	0 (0)	3.84 (1)
Pneumothorax	2.08 (1)	4.54(1)	0 (0)
Disease-related			
Pneumotocel	2.08 (1)	9 (2)	0 (0)
Parenchymal giant cyst	2.08 (1)	0 (0)	3.84 (1)
Myocarditis	2.08 (1)	0 (0)	11.5 (3)
Lung abscess	8.33 (4)	4.54 (1)	0 (0)
Relapse	2.08 (1)	4.54 (1)	0 (0)
Death	2.08 (1)	0 (0)	3.84 (1)
Multiple complications (same patient)	10.4 (5)	18.1 (4)	3.84 (1)

and follow-up of chest tubes (1,3,5). Contrast-enhanced thorax CT provide detailed information on parenchymal complications such as a pulmonary abscess, and position of chest drains but it do not predict the stage of the parapneumonic effusion like USG, and necessity of surgical intervention (3,20). Therefore, CT is less frequently used in follow-up of PE than USG (21). Similarly in our center, USG was found to be preferred more frequently in follow-up of PE by clinicians according to CT.

In the study, rates of positive gram smear of pleural fluid, and positive cultures of both pleural fluid and blood were noted fairly low. The high rate and long duration of antibiotic usage before admission to our center were thought to be related with culture and smear negativities. Despite the introduction of the pneumococcal vaccines in many countries, *S. pneumoniae* remains the most common etiology of pediatric PE (3, 22). In accordance with this fact, the most frequently detected microorganism was *S. pneumoniae* in our study, despite the 13-valent conjugate pneumococcal vaccine routinely administered in our national vaccination shedule. Underlying conditions such as congenital anomalies, immunodeficiencies or more rare infections, that PE can be accompanied, should be kept in mind and investigated in suspected cases (23). Comorbid diseases such as immunodeficiency and pulmoner tuberculosis were detected in some of our patients that were suspected and examined.

The principal aim of PE treatment to control the infection is to remove the infected material as in all locale infections. One-time or recurring evacuations by thoracentesis, or long-term drainage method by a tube-catheter are frequently used for this purpose (10, 11). Because of high re-intervention rates recurrent thoracentesis is rarely preferred, and tube drainage is now more commonly used method considering similar complication rates, effectivity and lengths of stay (24). Recurrent thoracentesis is not preferred by our center and tube thoracotomy is performed at a high rate of 90%. Since the tube thoracostomy method is more preferred, the main issue is the correct catheter size. The reason of the controversy is the fear that small diameter catheters will be easily blocked due to dense pus or septations, and will not provide adequate drainage. Indeed, the need for regular flushing of the drain is expected to be high due to the possibility of occlusion in small diameter catheters (25). Due to the fact that this concern has not been formally proven, historically large-scale catheterization has begun to slip towards the use of smaller-size catheters. Even in some studies, no significant differences were found in the in terms of chest tube catheter size and outcomes of the patients (26, 27). Although there is still no consensus for optimal tube size, smaller guide-wire-inserted chest tubes has been proposed in the initial PE treatment choice because of less pain and improved patient comfort (15, 28). Use of small-size tubes is recommended that has been shown to be more effective with fibrinolytic application, when loculated and septated PE is concerned (29). In the case of a clinical instability or a condition requiring urgency, large-size catheters were applied to patients, in our center. On the general tendency, we preferred small-diameter catheter insertion when urgent intervention or operation are not requiring, and fibrinolytic therapy is going to be prescribed. We think that follow-up of the PE patients with a small diameter catheter is the ideal method

in the pediatric patient group, because of reducing the pain as much as possible and allowing children to be mobile easily. In relation to the comfort provided, it was seen that the small-size tubes were spontaneous dislodged more due to the ease of movement for children, in our study. The possibility of blockage and kinking seems to be the most important disadvantages for small-size tubes. These problems will be less likely to occur with regular flushing and careful follow-up (25). In our series these two complications were not observed in any patient.

Fibrinolytics break down the fibrin, which is a result of the inflammatory reaction in the pleural space in empyema and increases fluidity of the pus and facilitates drainage (17). Fibrinolytic therapy has been shown to be superior to chest tube drainage alone in many studies (10, 12, 13). The common fibrinolytic drugs are urokinase, streptokinase and tPA, in clinical practice (7, 11, 12). There is no evidence that any one of these fibrinolytics are more effective than another, and this situation is mentioned in the guidelines (12,15). In some studies with no strong evidence, urokinase was found more effective in relieving pleural thickening and in drainage than tPA, interestingly (7). The use of fibrinolytics in early fibrinopurulent phase was found more effective (12,13). For example, a controlled study of Maskell et al that fibrinolytic therapy were applied in the late phase was showed no significant improvement in PE with intrapleural streptokinase administration (26). In our study, patients were treated with fibrinolytic therapy at an early stage of PE (stage II). Fibrinolytics have been reported to cause fever, pleural pain, bleeding or allergic reactions. The contraindications of intrapleural fibrinolytic administration are not clearly defined, other than a previously known allergy to fibrinolytics (7,12). The most common allergic reactions are observed with streptokinase, and less than the others with urokinase (26). It has been reported that streptokinase does not cause systemic fibrinolysis, local hemorrhage and change in any index of coagulation after intrapleural single dose or cumulative dose administration (1,7). In our study, fibrinolytic-related complications including serious chest pain during application in one patient, leaking from chest tube during / after application in one patient, intrapleural bleeding after application in three patients and bronchopleural fistula in one patient have been observed. Prolong fibrinolytic treatment is considered critically because of the bleeding possibility and the discussions on the potential for bronchopleural fistula opening (3,7). We treated our patients with short-term fibrinolytic therapy (no more than nine doses).

Another effective drainage method is thoracoscopy in poorly drained or localized PE (9). Thoracoscopy removes pleural loculations with blunt and sharp dissections, and simultaneous biopsy or decortication can be performed if necessary (10). Good clinical results can be obtained when applied in early stage with VATS which is a safe and effective method (8). In a rewiev in 2010, Scarci et al. (30) claimed that early VATS (or thoracotomy if VATS is not possible) leads shorter hospitalisation stay. Thoracotomy is major thoracic surgery that is not recommended in impaired or deprived patients. All fibrous tissue on the visceral pleura, thickened parietal pleura, all debris in the pleural space and pus are cleared, so the underlying lung becomes expansive (10,11). Generally, VATS is the preferred method as it is equally effective but less invasive than thoracotomy. But in about 20% of patient, VATS is inadequate and conversion to thoracotomy may be required (11). The role of primary surgical treatment in PE is unclear. In fairly limited randomized controlled trials, any evidence to support a better clinical outcome or any therapeutic differences from VATS compared to fibrinolytic therapy were not determined in children with PE, except the higher procedure cost with VATS (18, 31). There are also studies that emphasize that intrapleural fibrinolytic therapy should be avoided, due to the ineffectivity in reducing mortality, in the need for surgical drainage, or in the length of the hospital stay (26). Preference tends to vary center to center, and surgical intervention usually occurs after a failed medical treatment or with late stages, like our center (29,30). Because we have selected patients in terms of treatment approach, fibrinolytic therapy was given to the patients who are also likely to go to surgery, in early stages. For this reason, the chances of our patients going to the operation reduced, and the only patients who were admitted late stages or who had failed medical treatment (antibiotic or fibrinolytic) were operated.

This study has some limitations. Our study is not a population-based and multi-center study so it is inadequate for providing extensive results. Also, it is impossible to compare treatment methods, because the treatment of the cases is based on the clinician's decisions and preferences. Similary, most statistical comparisons are underpowered releated to small number of cases.

Given all treatment modalities, the only unchanging and definitive treatment approach in PE is the necessity of starting appropriate broad spectrum systemic antibiotics without delay (15). Multidisciplinary approach involving infectious diseases, pulmonology, radiology and surgery clinics should also be remembered in the ongoing dynamic process. The guideline by the Pediatric Infectious Diseases Society and the Infectious Diseases Society of America stated that the choice of drainage procedure depends on local expertise in infants and children older than 3 months of age. Because, all drainage methods (chest thoracostomy, tube drainage with the addition of fibrinolytic agents, and VATS) have been demonstrated to be effective, and are associated with decreased morbidity compared with chest tube drainage alone. Placement of a chest tube without fibrinolytic agents was suggested as the first treatment option in the absence of septation and loculation (32). According to the British Thoracic Society guideline for children, intrapleural fibrinolytics are recognized to shorten hospital stay and are recommended for any complicated PE (thick fluid with loculations) or empyema (overt pus). If medical treatment and drainage methods are inadequate, or if the sepsis continues with the persisting pleural collection early surgical approach should be considered. In symptomatic patients, thoracotomy and decortication may require in organised empyema (33).

But, it is noted that there is no indication for the routine use of intrapleural fibrinolytics by adult guideline of British Thoracic Society for pleural infection (15).

CONCLUSSION

The therapeutic approach to PE in children is not standardized, and available studies and guidelines are generally based on consensus opinions because of inadequate evidence. Variations in management of PE are clearly visible. As well as the general management, the individual necessity, timing, duration and results of each treatment approach are still being questioned. As a result, each center seems to prefer to apply its own treatment approach, considering previous experiences and results, like in our center. Therefore, the goal of this study is to contribute to the literature and improve the knowledge about this issue by presenting the results of our treatment approach rather than providing a definite approach model and a clear algorithm in the treatment

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