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THORACOTOMY VS VIDEO-ASSISTED THORACOSCOPY IN PEDIATRIC EMPYEMA



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ABSTRACT:

OBJECTIVE: Comparison of Outcomes between video-assisted Thoracoscopy surgery (VATS) and open thoracic surgery

METHODS: A prospective study was done in 42 patients referred to Department of Pediatric Surgery, between 2015 and 2017.

Patients were divided into two groups, thoracotomy (group I) and VATS (group II) randomly. Both groups were similar by terms of age, sex and comorbidities. Routine pre and post-operative workups ordered. Patients were followed up for a course of 90 days.

RESULTS: The mean operative time, average the drainage time, average length of hospital stay, duration of use of medicine to relieve the pain were longer in group I than group II. Death due to pulmonary complications during the first 30 days after the surgery was seen in one case in the group I.

CONCLUSION: It seems that the less invasive VATS procedure is a suitable technique for management of the patients with empyema.

INTRUDUCTION

Pleural empyema is defined as a purulent fluid accumulation in the pleural cavity. Common conditions associated with this disease include pneumonic processes in patients with pulmonary and malignant diseases, heart disease, diabetes, drug and alcohol abuse, neurological disorders, post-thoracotomy problems and immunological disorders(1)

The main pathophysiology of the empyema is associated with severe pneumonia and parapneumonic effusions(2). The mortality due to empyema is commonly associated with the severity of the disease. The incidence of this disease is 0.6%, but the death rate of up to 8% is also reported.(3)

In the 1960s, the American Thoracic Society (ATS) introduced three pathobiological stages that are associated with current conditions for empyema. Treatment varies according to the stages. Stage one which is commonly referred to as the Exudative stage and Parapneumonic effusion, happens in the first 24 to 72 hours and can typically be treated by using a simple drainage (including Thoracocentesis or placement of a chest tube) and administration of broad-spectrum antibiotics.

The second stage, also referred to as the Fibropurulent phase, lasts 7 to 10 days and is characterized by fibrin and liquid fluids containing a large number of PMN cells(4).

The third stage or the organized stage typically occurs within 2 to 4

weeks after the onset of the initial process.(5, 6) This stage is characterized by thickening of visceral & parietal pleural as a result of significant fibroblasts proliferation, resulting in a peel or organized pus which ultimately gets contact with visceral pleura, causing lung parenchymal entrapment.(7) Tube Thoracotomy is rarely able to evacuate pleural cavity in a child who has gone to advanced stages of the disease. (2)

Pediatricians have developed Thoracoscopic procedure for treatment of such pediatric patients. This less intrusive method allows complete discharge and washes the debris off the pleural cavity.(8)

It also seems that there are other benefits to this method, such as reducing the complications of the operation and reducing the length of hospital stay.(3)

AIM:

1. Review the advantages and disadvantages of the less invasive Thoracoscopic approach (VATS) over Thoracotomy in pediatric patients with empyema.

INCLUTION CRITERIA:

1. Children with Pleural empyema whose course of illness is less than 3 weeks.

EXCLUSION CRITERIA:

1. Children with Pleural empyema whose course of illness is more than 3 weeks

MATERIALS AND METHOD:

Patients

A prospective study that was conducted over a 2-year period (2015-2017) on 42 empyema patients referred to the pediatric surgery department of Mofid children's Hospital, Shahid Beheshti University, Tehran, Iran. After obtaining consent from their parents, patients entered the study. First they were randomly divided into two groups; Thoracotomy (group I) and VATS (group II). Twenty-one patients in group I (13 males, 9 females) with an average age of 6.34 and twenty patients in group II (12 males, 8 females) with an average age of 6. The mean clinical symptoms of patients were less than 15 days. The diagnosis of empyema was followed by 1-clinical symptoms such as cough, fever, chest pain and respiratory distress and observation of sputum or aspirated secretions from the lung.

2-By thoracocentesis (PH less than 7.2, glucose lower than 60 mg / dl, LDH greater than 1000Unit / L) 3-By chest High resolution computerized tomography (HRCT) and diagnosing loculated complex.

Pre operation workups included intravenous antibiotic therapies

and laboratory tests and chest high resolution computerized tomography (HRCT) which performed to determine the status of lung, mediastinum and plural localizations.

Subsequently, in the presence of respiratory distress and high fever prior to surgery, intercostal drainage (ICD) were embedded for patients.

Post operation workups included the continuation of intravenous antibiotics and Paracetamol until the fever was resolved, ICD exit and starting respiratory physiotherapy and chest x-ray on 2th post-operative day.

Then Patients were followed up for a course of 90 days on certain intervals in order to evaluate the results of the treatment and incidence of the complications and death.

Surgical Technique

All 42 patients underwent general Anastasia, using Double-lumen endotracheal, and In group I patients approached through posterolateral thoracotomy by incision of the fifth intercostal space proceeded down to parietal pleura and using a blade between curved hemostats to open the parietal pleura, using a Finochietto rib spreader to clear access to the surgical field and manual exploration was done to destroy plural septae and deliberated all fissures, and after complete decortications and full expansion of the lungs a large bore chest tube was inserted.

In group II, in lateral decubitus position First trocar was inserted from the fifth intercostal space along the mid-clavicular line I or from the entrance site of the previous chest tube. Additional trocars (two or three) were placed depending on the lung localizations. The gas pressure was adjusted to 5 mmHg at a rate of 1 L/ min. After dividing the adhesions by dissecting Forceps and using high pressure

Suctions to remove fibrin clots from all tissues and recesses and ensuring complete lung opening, a large bore chest tube was inserted through the site of the first input port under endoscopic vision.

Then all cases from both groups were sent to pediatric intensive care unit (PICU) until the patient's clinical conditions have been stabilized.

RESULTS

Parapneumonic effusion was the main cause of empyema in group I. The average duration of clinical symptoms in this group was 12 days. 14 patients had involvement on the right side, 7 cases had involvement on the left side and 1 had bilateral involvement. The average duration of surgery was 60 minutes. The median drainage time was 7 days. The average length of hospital stay was 23 days.

Similarly in group II Parapneumonic effusion and infection secondary to trauma related thoracic surgeries were the main causes of empyema in 18 and 2 cases, respectively. The average duration of clinical symptoms in this group was 11 days. The empyema in 12 patients was on the right side, in 7 cases on the left side and one case of bilateral.

In four cases ICD was inserted prior to the surgery. The average duration of surgery was 45 minutes. On average the drainage time was 5 days. The average length of hospital stay in group II was 13 days.

In the follow up of patients in two groups, 27.3% of patients undergoing Thoracotomy had a surgical wound infection and no case was seen in group II. ($p = .003$). Redo surgery due to lack of clinical improvement, was observed in 2 cases (9.1%) and 4 (20%) respectively, in group I and II. The incidence of pneumothorax immediately after pulling ICD was seen in 4 cases (18.2%) and 1 case (5%), respectively, in group I and II and by insertion of ICD problem was resolved.

Subcutaneous emphysema was seen in only one person in group I. The duration of admission in PICU was 5 days for group I and 2 days for group II ($p=0.005$).

The duration of use of medicine to relieve the pain was 10 and 5 days in the first and second groups respectively ($p=0.004$).

The amount of intra-operative bleeding which necessitated blood transfusion in 5 patients in group I but in none in group II.

And death due to pulmonary complications during the first 30 days after the surgery was seen in one case in group I.

DISCUSSION

The Pleural empyema is defined as a purulent fluid accumulation in the pleural cavity. The main pathophysiology of the empyema is associated with severe pneumonia and parapneumonic effusion. Other predisposing conditions include the spread of infection through Mediastinal, Retropharyngeal or Paravertebral infectious processes. Empyema can also be caused by a direct trauma to Thorax.(1)

Mortality due to empyema is commonly associated with the severity of the disease and is reported to be less than 1% to more than 40% in patients with immunosuppression.(9). In the 1960s, the American Thoracic Society (ATS) introduced three pathobiological stages that are associated with current conditions forempyema. Stage 1, commonly referred to as the Exudative phase. The second stage, also referred to as the Fibropurulent phase, lasts 7 to 10 days and is characterized by fibrin and liquid fluids containing a large number of PMN cells. In this stage, the fluid is relatively acidic compared to the Exudative phase.(10, 11)

The main difference between this stage and the previous one is that the fluid is often compartmentalized due to multiple Septations. The third stage or the organized stage typically occurs within 2 to 4 weeks after the onset of the initial process.(5) This stage is characterized by thickening of visceral & parietal pleural as a result of significant fibroblasts proliferation, resulting in a peel or organized pus which ultimately gets contact with visceral pleural, causing lung parenchymal entrapment.(1, 7)

Video-assisted Thoracoscopic Surgery

Video-assisted Thoracoscopic Surgery is a semi-invasive technique that provides a wide-range view for the surgeon rather than classical thoracotomy to examine pathologic processes of the mediastinum, lungs and pleura in less time with less morbidity in order to diagnose and treat.(12, 13)

One of the other uses of VATS is the treatment of second stage of empyema, which is more effective than conservative treatments with antibiotic and drainage and has less complications than more invasive treatments such as Thoracotomy.(7) The first comparative studies between the two methods of VATS and Thoracotomy could be related to the 1990s, when Angelillo Mackinlay T and colleagues examined these two methods in patients with empyema after fibrinopurulent phase of pneumonia. In this study, they concluded that two treatments had the same level of success but had some advantages in discussing the extent of disease, hospitalization, and cosmetic issues for VATS.(14)

In the recent study, the rate of wound infection was significantly higher in the group I than in the group II ($p = .003$), and complications such as pneumothorax after discontinuing the ICD was higher in the group I than in group II.

In an article published in 2004 by MinchevTs and colleagues, they reviewed 359 empyema patients that had undergone thoracotomy or VATS during the years 1996-2003. In this study, shorter duration of chest tube drainage and a shorter duration of hospitalization were reported for VATS surgery method compared to Thoracotomy.(15)

In the recent study, the ICD duration and hospital stay in the group II were shorter than in group I. (p=0.007)

In a study by Goldschlager T et al in 2005, a retrospective study was conducted among children who underwent drainage and decortication using two methods of Thoracoscopy and Thoracotomy between 2000 and 2002. The study also showed that drainage by Thoracoscopy was an effective method for the treatment of empyema in pediatric patients.(16)

In another study by Stefani A in 2013, the researcher reviewed pre-operative conditions for choosing either of the two methods of VATS or Thoracotomy. The researcher concluded that delays in surgery, fever and pleural thickness were among the factors that could be used to predict the need to Thoracotomy.(17)

In the recent study also re-operation due to lack of improvement of clinical symptoms caused by thickening of the pleural membranes and lack of complete lung expansion, was higher in group II.

Another study by Samira Shojaee et al at Virginia University in 2015 on comparing medical and surgical treatments for the treatment of pleural diseases, introduced Thoracoscopy as a more effective method than Thoracotomy. Especially in intubated patients, in which reduced time of operation and decreased other complications of open surgery are effective in increasing their survival rate.(3)

In the recent study, the mortality rate following surgical complications were higher in Thoracotomy group.

Inasmuch as the length of hospital stay, admission in the intensive care units, use of narcotics, and rate of complications such as infection and anxiety of the patients are lesser in the group I it seems that Video-assisted Thoracoscopic Surgery is a safe and efficient procedure for treatment of the patients with empyema.

CONCLUSION

Regarding the comparison of the advantages and disadvantages of the mentioned approaches to the treatment of the empyema it seems that the less invasive Video-assisted Thoracoscopic Surgery procedure is a suitable technique for management of the patients with empyema especially in the early stages.

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