Research Paper

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# Assessment of Lung Function Improvement Among Paediatric Empyema Thoracis Cases after Definite Intervention- A Study from Tertiary Care Hospital of Central India

Medical Science

**KEYWORDS :** Empyema thoracis, Thoracostomy, Decortication, Raipur, Chhattisgarh

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## ABSTRACT

***Introduction***- *Empyema is never a primary disease, often it is difficult to arrive at primary focus of infection, through pleural cavity is the root of pus, the respiratory and cardiovascular system are severely affected. Pus anywhere in the body must be drained more so when it is in the pleural cavity. Collection of pus and consequent compression on the lung leads to cardiopulmonary embarrassment. When acute or chronic, early diagnosis and quick treatment must be the aim. Acute empyema is treated by immediate aspiration of pus and instillation of antibiotics into empyema cavity. This pus is sent for culture and sensitivity. Aspiration is repeated every day and patients are explained breathing, exercises to promote early expansion of lung.With the above background the present study was conducted to assess the lung function improvement among paediatric Empyema Thoracis cases after definite intervention.*

*Material and method-The present prospective study was conducted in department of general surgery, Pt. J.N.M. Medical College and Dr BRAM hospital, Raipur (C.G.), India during study period November 2013 to October 2014.40patients according to above mentioned inclusion and exclusion criteria getting admitted during the study period was be taken under the study. Written and informed consent was taken from each patient to participate in the study.*

***Results***- *In our study of 40 cases, it was found that mean age of presentation of empyema for ICD insertion was 6.6 yrs and decortications was 6 yrs. In our study of 40 cases, it was found that 22 (55%) patients were male & 18(45%) were female. In our study patient who underwent thoracostomy MRC dyspnea score was: - 7 (29%) patient was in score 0, 14 (58%) patient was in sore 1 and 3(13%) patient was in score 2. Mean hospital stay was 7 days after ICD insertion and 5 days after decortication. In our study 24 patient who underwent thoracostomy having mean duration of post operative fever was 7.6 day.*

***Conclusion***- *This study was prospective study of two mode of treatmenti.e., chest tube insertion and decortications. Many prospective randomized studies of decortications have shown that there is good outcome decrease in hospital stay, duration of post operative ICD insertion, post operative fever, better MRC dyspnea score and pulmonary function assessment. After decortication radiologic assessment shows clear lungs field, decrease pleural thickness, improve mediastinal shift, overcrowding of rib and scoliosis.*

**Introduction**

Ever since the days of Hippocrates Empyema thoracis has been known as pus in the pleural cavity. Empyema thoracis is a pyogenic or suppurative infection of the pleural space. Empyema is the most common exudative type of pleural effusion[1].

Empyema is never a primary disease, often it is difficult to arrive at primary focus of infection, through pleural cavity is the root of pus, the respiratory and cardiovascular system are severely affected. For centuries Empyema thoracis has been recognized as a serious problem.

The development of antibiotic resistance has also added to the gravity of the condition. The situation has been made worse by the poor economic state and bad hygienic condition in our country.

The course and clinical manifestation has been altered by inadequate and improper use of antibiotics. Majority come with the history of mild temperature, cough and chest pain[2]. The patients cannot remember whether they had any respiratory infection or any septic focus previously, because the infection was having been controlled only to such an extent as to mark the seriousness of the disease.

In 1962, the American Thoracic society described the formation of an empyema thoracis along a 3 stage continuum.

Based on the disease pathophysiology, all empyema processes are exudates resulting from an inflamed pleural membrane from an adjacent pneumonia. In the early exudative phase (stage1) the empyema thoracis has a normal glucose and ph.

The intermediate fibrinopurulent phase (stage 2) is heralded by an increase in fibrin, polymorphonuclear neutrophil, and lactate deposition, loculation of fluid begin to form in the pleural space.

Finally in the late organising phase (stage 3), fibroblastic growth extending from the visceral and parietal pleura causes the formation of a restrictive pleural peel that entraps the lungs and impairs its function[3]

Chronic empyema is the outcome of improper management in the acute stage. The disability produced by the persistence of chronically infected pleural space is very grave. It can only be attributed to some error or neglect in early stages of pleural suppuration.

Fifty years ago Stephen Paget[4] wrote in this connection: "One might add a score of cases to show that an unhealed empyema is a rule, the direct result of the patient's neglect or the surgeon's delay, or of inadequate and useless surgery.

Pus anywhere in the body must be drained more so when it is in the pleural cavity. Collection of pus and consequent compression on the lung leads to cardiopulmonary embarrassment. When acute or chronic, early diagnosis and quick treatment must be the aim. Acute empyema is treated by immediate aspiration of pus and instillation of antibiotics into empyema cavity. This pus is sent for culture and sensitivity. Aspiration is repeated

every day and patients are explained breathing, exercises to promote early expansion of lung.

In case where there is much thickening of the pleura, decortication is the treatment of choice. It allows delicate parenchyma of lung to expand. It is a restrictive lungs disease[5]

There are various outcomes when seen in follow up like scoliosis which develops due to massive pleural massive effusion or due to restrictive lung effects, there are various complications like rib crowding, mediastinal shift are also a major complication due to empyema thoracis. Pleural thickening was also present[6]. There are various treatment modalities for these like tube thoracotomy, VATS, chest tube drainage[7].

With the above background the present study was conducted to assess the lung function improvement among paediatric Empyema Thoracis cases after definite intervention in a tertiary care hospital of Raipur city (C.G.), India.

**Material and method-**

The present prospective study was conducted in department of general surgery, Pt. J.N.M. Medical College and Dr BRAM hospital, Raipur (C.G.), India during study period November 2013 to October 2014.

**Criteria of selection**

- Patients – Age between 5 to 14 yrs of age.
- All proved cases of disease who got admitted to hospital for empyema thoracis
- Patients with known case of immunocompromised and malignancy not included.

40 patients according to above mentioned inclusion and exclusion criteria getting admitted during the study period was be taken under the study. Written and informed consent was taken from each patient to participate in the study. Detailed history was recorded from each patient pertaining to the onset and duration of the present complaints. Physical examination was done on all the patients, including general and systemic examination. All the routine investigations including X- Ray chest and USG thorax was are done on the cases. All cases except multiloculated cases are managed by chest tube insertion and cases in whom multiloculation, bronchopleural fistula were subjected to thoracotomy.

X-ray chest and CT thorax was done at interval of 6 week and 6 month follow up and post procedural radiological finding as lungs field, pleural thickness, mediastinal shift, overcrowding of rib and scoliosis are assessed.

**Results-**

In our study of 40 cases, it was found that mean age of presentation of empyema for ICD insertion was 6.6 yrs and decortications was 6 yrs. In our study of 40 cases, it was found that 22 (55%) patients were male & 18(45%) were female. The commonest symptom was fever which was present in all (100%) patients, followed by cough (87.5%), dyspnoea (85%), and chest pain (32.5%). Right chest was involved in 25 (62.5%) patients followed by left chest in 11(27.5%) and bilateral chest involvement in 4 (10%) patients. In our study 40% of the patients underwent decortication & ICD insertion was done in 60% of patients. **[Table-1]**

In our study patient who underwent thoracostomy MRC dyspnea score was: - 7 (29%) patient was in score 0, 14 (58%) patient was in sore 1 and 3(13%) patient was in score 2. The patient who underwent decortications MRC dyspnea score was: - 11 (65%) patient was in score 0, 4 (25%) patient was in score 1 and 1 (10%) patient was in score 2. **[Table-2]**

Mean hospital stay was 7 days after ICD insertion and 5 days after decortication. In our study 24 patient who underwent thoracostomy having mean duration of post operative fever was 7.6 day. And of 16 patients who underwent decortications having mean duration of fever was 6.9 days. **[Table-3]**

In 24 patient who underwent thoracostomy - at discharge clear lungs field was 1(4.16%) , at 6 week clear lungs field was 13(54%) , at 6 month clear lungs field was 18 (75%). (In 16 patient who underwent decortications)- at discharge clear lungs field was 5(31.25%), at 6 week clear lungs field was 10 (62.5%), at 6 month clear lungs field was 14(87.5%).

In 24 patients who underwent thoracostomy - at discharge pleural thickening was 83.33%, at 6 week pleural thickening was 45.83%, and at 6 month pleural thickening was 20.83%. In 16 patients who underwent decortications - At discharge pleural thickening was 50%, at 6 week pleural thickening was 18.75%, at 6 month pleural thickening was 6.25%.

In 24 patient who underwent thoracostomy - at discharge mediastinal shift was 4(16.66%), at 6 week mediastinal shift was 2(8.33%) , at 6 month it was 1(4.16%). (In 16 patient who underwent decortications)- at discharge mediastinal shift was 2(12.5%) , at 6 week mediastinal shift was 1(6.25%), at 6 month mediastinal shift was 0(0%).

In 24 patient who underwent thoracostomy - at discharge rib overcrowding was 14(58.33%) , at 6 week rib overcrowding was 7(29.16%) , at 6 month rib overcrowding was 4(16.66%). (In 16 patient who underwent decortications)- at discharge rib overcrowding was 6(37.5%), at 6 week rib overcrowding was 3(18.75%), at 6 month rib overcrowding was 1(6.25%)

In 24 patient who underwent thoracostomy - At discharge scoliosis was 16.6%, at 6 week scoliosis was (8.33%), and at 6 month scoliosis was 1 (4.16%). (In 16 patient who underwent decortications) - At discharge scoliosis was 2(12.5%), at 6 week scoliosis was 1(6.25%), and at 6 month scoliosis was 0 (0%). **[Table-4]**

**Table-1. Background variables of the study subjects**

| Variables | No. (%) |
|---|---|
| **Mean Age During The Procedure** | |
| ICD Insertion | 6.6 Yr |
| Decortication | 6 Yr |
| **Sex** | |
| Male | 22(55%) |
| Female | 18(45%) |
| **Clinical Presentation** | |
| Fever | 40(100%) |
| Cough | 35(87.5%) |
| Dyspnoea | 34(85%) |
| Chest Pain | 13(32.5%) |
| **Side Of Chest Involvement** | |
| Right | 25 (62.5%) |
| Left | 11 (27.5%) |
| Bilateral | 4 (10%) |
| **Procedure performed** | |
| ICD Insertion | 24 (60%) |
| Decortication | 16 (40%) |

**Table -2 MRC (Modified Medical Research Council) Dyspnoea Score after Intervention**

| MRC DYSPNEA SCORE | Thoracostomy(ICD) | Decortication |
|---|---|---|
| 0 | 7(29%) | 11(65%) |
| 1 | 14(58%) | 4(25%) |
| 2 | 3(13%) | 1(10%) |
| 3 | 0 | 0 |
| 4 | 0 | 0 |

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**Table -3. Mean duration of ICD removal and Post Operative Fever**

| Procedure | Mean (in days) | 95% Confidence Interval (C.I.) |
|---|---|---|
| **Duration of ICD removal** | | |
| Thoracostomy(ICD) | 7 | 6.64-7.35 |
| Decortication | 5 | 4.5-5.4 |
| **Post Operative Fever** | | |
| Thoracostomy(ICD) | 7.6 | 7.1-8.2 |
| Decortication | 6.9 | 6.4-7.3 |

**Table-4. Outcome after Intervention**

| Procedure | At Discharge | After 6 week | After 6 month |
|---|---|---|---|
| **Clear Lung** | | | |
| Thoracostomy(ICD) | 1(4.6%) | 13(54%) | 18(75%) |
| Decortication | 5(31.25%) | 10(62.5%) | 14(87.5%) |
| **Pleural Thickening** | | | |
| Thoracostomy (ICD) | 20(83.33%) | 11(45.83%) | 5(20.83%) |
| Decortication | 8(50%) | 3(18.75%) | 1(6.25%) |
| **Mediastinal shift** | | | |
| Thoracostomy(ICD) | 4(16.66%) | 2(8.33%) | 1(4.16%) |
| Decortication | 2(12.5%) | 1(6.25%) | 0 |
| **Overcrowding of rib** | | | |
| Thoracostomy(ICD) | 14(58.33%) | 7(29.16%) | 4(16.66%) |
| Decortication | 6(37.5%) | 3(18.75%) | 1(6.25%) |
| **Scoliosis** | | | |
| Thoracostomy(ICD) | 4(16.6%) | 2(8.33%) | 1(4.16%) |
| Decortication | 2(12.5%) | 1(6.25%) | 0(0%) |

**DISCUSSION**

In our study of 40 cases, it was found that mean age for ICD insertion was 6.6 years and decortication was 6 years. **Akin Ersalan balci et al (2002)[8]**- observed the mean age to be 8.1 years for ICD insertion and 10.2 years for the patients who have undergone decortications for a age group of 3-14 yrs. **Karannin I Erdogan Karranian A et al (2004)[9]**- observed the mean age for decortications in a age group of 4-12 yrs was 3.9 yrs. **Satpati et al (2005)**[10]-observed mean age for ICD insertion for a age group of 0-15 yrs is 4.6 yrs.

In our study of 40 cases, it was found that 22(55%) patients were male & 18(45%) were female. **Akin Ersalan balci et al (2002)[8]**- observed 68.18% males and 31.81% females in their study. **Baranwal et al (2008)[11]**- observed an equal sex ratio in their study. **Karanin I et al (2004)[9]**- observed an equal sex ratio in their study. **Satpati SK et al (2005)[10]**- observed a 49%males and 51% females in their study.

In our study, the commonest symptom was fever which was present in all (100%) patients, followed by cough (87.5%), dyspnoea (85%), and chest pain (32.5%). **Gupta AK et al (1998)[12]**- observed cough to be the commonest symptom, it was seen in 90%, followed by fever (80.6%), dyspnoea (60%). **Satpati et al (2005)[10]**- observed the most common symptom to be dyspnoea (88.6%), followed by fever (77.3%), cough (71.6%) and chest pain (24.5%). **Karannin I et al (2004)[9]**- The most common symptom was fever. **Cekirdekci et al (2000)[13]**- Most common symptom was fever, observed in 87 % patients. Cough was seen in 79% cases and dyspnoea in 58% cases. **Demirhan et al (2008)[14]**- commonest symptom was fever which was seen in 91 % cases followed by cough (81%), Dyspnoea (68%).

In our study right chest was involved in 25 (62.5%) patients followed by left chest in 11(27.5%) and bilateral chest involvement in 4 (10%) patients. **Cekidekci et al (2000)[13]**- observed right side chest involvement in 26% cases, left side involvement in 70% cases and bilateral involvement in 4%. **Karannin I et al (2004)[9]**- observed right side involvement in 60% cases and left side chest involvement in 40% cases. **Baranwal et al (2008)[11]**- observed right chest involvement in 68% cases, left side was involved in 27% cases and bilateral chest involvement in 5 % cases. **Demirhan et al (2008)[14]**- Right side chest involvement was seen in 64% cases and left side involvement was seen in 36% cases.

In our study 40% of the patients underwent decortication & ICD insertion was done in 60% of patients. **Anil kumar, satish kumar aggarwal et.al[15]**2013. study on 25 patient, treated with injectable antibiotics and chest tube drainage. **A K Baranwal et al[11] Feb 2003**- a total of 265 children TD was used in 92% of fibropurulent cases, and was successful in 79%. Of 48 patients with failed TD 12 needed decortications; limited thoracotomy was sufficient in remaining 36. **Mariya lorena Corazon v Rodriguez et al[16]**Philippine general hospital manila Philippines studies in 31 patients from 1989 to 2003, all patient thoracostomy performed, 64% did not achieve full lung expansion radiologically after 3 week. Most (71%) patient converted to open drainage. **Mohammad vaziri et al[17]** .October 2011. Study in 112 patient multiloculated empyema was documented in 45 patients (40%). Insertion of chest tube was first procedure in 103 patient (92%),19 patient (17%) were treated by thoracotomy, 10 patient (8.9%) had fibrinolytic therapy, 8 patient underwent VATS and16 patient (14.3%) had subsequent radiologic-guided drainage. thoracotomy- decortications was successful in 90% of patient undergoing surgery and the least successful intervention was tube thoracotomy alone.

Mean hospital stay was 7 days after ICD insertion and 5 days after decortication. **Hoff et al (1991)[18]** in a series of 61 children reported that resolution of disease process were more prolonged in patients managed by chest tube alone (16.8 days in hospital) than resolution after thoracotomy (6.7 days). **Carey et al (1998)[19]** reported in a series of 22 children with empyema who underwent thoracotomy, had their mean hospital stay of 4 days. **Ozeetik and Pothula et al (2004)[20]** in their study reported that decortication decreases the hospital stay. **Karranin I et al (2004)[9]** observed the mean hospital stay in ICD insertion to be 15.4 days and 9.5 days in patients who underwent decortications. **Satpaty et al (2005)[10]** observed mean hospital stay in ICD insertion to be 13.3 days and 12.8 days in patients who had decortication. **Baranwal et al (2008)[11]** observed mean hospital stay in ICD insertion to be 23.2 days and 27.7 days in patients who had decortication. **Gupta AK et al (2008)**[12] observed in a series of 60 pediatric patients of empyema thoracis, thoracotomy and decortications had a rapid recovery and decreased length of hospital stay.

In our study 24 patient who underwent thoracostomy having mean duration of post operative fever was 7.6 day. And of 16 patients who underwent decortications having mean duration of fever was 6.9 days. **David shoseyov[35]et al.** (CHEST 2002; 121:836-840) study on 32 patients who underwent thoracostomy reported mean duration of post operative fever was 8.2+_4.5. **Eyal cohen[36]etal.** NOV 2012 study on 88 patient. Mean duration of post operative fever after thoracostomy was 7.8 days. **Anil kumar[15]et al.** 2013. Study on 25 patients, following thoracostomy median duration of post operative fever was 12 days. **Prema Menon[37]et al.** Journal of Indian Association of Pediatric Surgeons, Vol. 15, No. 1, January-March, 2010,

Report of 125 patient treated by decortications. Mean duration of post operative fever was 2 days.

In our study lung function was increased from baseline level after procedure. Finding of the other studies were also supported the same. [3, 21-33]

In our studies, out of 24 patient following thoracostomy 28% (7) patient having dyspnea score 0. 57% (14) having dyspnea score 1, 14 %( 3) having dyspnea score 2. following decortications out of 16 patient 65%(11) having dyspnea score 0 ,25%(4) having dyspnea score 1 , 10% (1) having dyspnea score 2 . **Christian casali [34]et al.** Italy.2009 studies 119 patient, in 68% decortications were

performed. 40 patient (66%) having score 0, 14 patient (24%) having score 1, 0% having score 2, 6 patient (3%) having score 3, 0% having score 4. **Mohammad vaziri and ommolbanin Abed[17] et al.** October 2011. 19 patient who underwent thoracotomy, subjective patient, MRC degree 1 was in5 (25%) patient, MRC degree 2 was in 2 (10%) patient,

In our study out of 40 patients, in 24 patients who underwent thoracostomy mean duration of ICD removal is 7 day. In 16 patients who underwent decortications mean duration of ICD removal is 5 days. **Anil kumar[15]et al.** 2013. study on 25 patient, following thoracostomy median duration of chest tube insertion was 8 days (5-45).in 17(68%) patient chest tube duration was <8 day. In 5 (20%) patient chest tube duration was 20%; in 3 (12%) patient chest tube duration was 30 days. **A K BARANWAL[11]et al 2003.** Duration of ICD removal after thoracostomy was 10-15 days. Out of 243 patient 223 underwent close tube drainage which was successful in 175 patient, 41 had their tube removed on 5th day and 92 patient by 10th day. **Christian casali [34]et al.** Italy.2009 the study included 119 patient 68 patient underwent decortications, mean duration of ICD removal after decortications was 5.7 days. **Mohammad vaziri and ommolbanin Abed[17]et al.** October 2011. Study in 112 patient, Median duration of ICD removal after decortication was 15 days.

In our study out of 40 patient 24 patient who underwent thoracostomy and 16 patient underwent decortications .CECT THORAX done to see lung field and pleural thickening in those patient who underwent decortication and X-RAY CHEST was done in all patient who underwent thoracostomy and decortications to see lung field, pleural thickening, mediastinal shift, rib crowding and scoliosis .follow up done after 6 week and 6 month.

**Anil kumar[15]et al.**2013. Study on 25 patient who underwent thoracostomy. In follow up CECT THORAX and X-RAY CHEST done and radiological findings are in percentage:

1.) Clear lungs field- at discharge = 4% , at 6 week = 52%,
2.) Pleural thickening- at discharge =84%, at 6 week =44%
3.) Mediastinal shift –at discharge =16% , at 6 week =4%
4.) Overcrowding rib –at discharge =60% , at 6 week =32%
5.) Scoliosis –at discharge =16% ,at 6 week =8%

**Christian casali [34]et al.**2009 studies 119 patient, in 68% decortications were performed. On follow up 88% patient shows complete radiological re-expansion of lungs. John Alfred Carr et al [38] **June 2011, from** 2006 to 2010 there were 478 patients admitted after sustaining chest trauma and 25 (5%) developed an empyema. The definitive treatment was decortication in 15 patients (60%) and chest tube or catheter drainage in 10 (40%). After chest tube drainage, the lung volume increased on average by 751 cubic centimeters (range, 99 to 1,982 cc). After decortication, the lung volume increased on average by 1,519 cc (range, 616 to 2,916, p = **0.02). Prema Menon[37]et al.** 2010, Studied on 125 patient, Lungs expanded after decortication was 43.4%

**Conclusion**-

This study was prospective study of two mode of treatment i.e., chest tube insertion and decortications. Many prospective randomized studies of decortications have shown that there is good outcome decrease in hospital stay, duration of post operative ICD insertion, post operative fever, better MRC dyspnea score and pulmonary function assessment. After decortication radiologic assessment shows clear lungs field, decrease pleural thickness, improve mediastinal shift, overcrowding of rib and scoliosis. In our series of 40 patients there was no morbidity and mortality. From the observed result it was evident that chest tube insertion was requiring longer hospital stay, longer duration of chest tube insertion, longer duration of post operative fever and poor post procedural radiological outcome .

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Eyal cohen, MD, Msc; sanjay mahant,MD, Msc; Sharon D, Dell, MD; Jefferey Traubici, MD; Alejandra Ragone; Anu Wadhwa, MD, Med; Bairbre Connolly, MB; Michael Weinstein, MD . NOV 2012 | 37.Journal of Indian Association of Pediatric Surgeons, Vol. 15, No. 1, January-March, 2010, pp. 9-14 Original ArticleSurgical management and outcome analysis of stage III pediatric empyema thoracisPrema Menon1, K.L.N. Rao1, Meenu Singh2, MA Venkatesh1, RP Kanojia1, R Samujh1, AK Saxena3, YK Batra4John Alfred Carr et al : Computed Tomographic Modeling Before and After Treatment for Posttraumatic Empyema: Early Decortication Is Superior to Catheter Drainage;The Annals of Thoracic SurgeryVolume 91, Issue 6, June 2011, Pages 1723–1728 . | 38. John Alfred Carr et al : Computed Tomographic Modeling Before and After Treatment for Posttraumatic Empyema: Early Decortication Is Superior to Catheter Drainage;The Annals of Thoracic SurgeryVolume 91, Issue 6, June 2011, Pages 1723–1728 .