

## Original Research Article

# Outcomes of pleural decortication in a tertiary care hospital of Telangana state

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### ABSTRACT

**Background:** The objective of the study was to study the clinical profile, incidence of postoperative complications in patients undergoing pleural decortication.

**Methods:** The subjects for the study were selected from the cases admitted in a single unit of Department of Cardiothoracic Surgery, Nizam's Institute of Medical Sciences, Hyderabad during the period of 2016 to 2018 and due ethics committee approval was taken. Collection of data is done from the database including admission record, ICU charts, discharge records and follow-up records. 50 patients underwent surgery. Outcomes and complications were analyzed for 3 years duration.

**Results:** 50 patients were included in this study with different aetiologies that required pleural decortication. The average age of patients in our study was 34 years. Most patients in our study were male (80%) and had history of infection with tuberculosis (42%) and pyogenic (28%) infection. A few patients had history of trauma (12%). Most of the patients suffered from cough (88%), dyspnoea (74%), fever (82%) and haemoptysis (22%). The common postoperative complications we encountered were pleural air leak (37.5%) bleeding (25%) infection (25%) and recurrence (2%). Overall morbidity from pleural decortication was seen in 16 patients, and there was no mortality.

**Conclusions:** The most common reason for pleural decortication is still empyema thoracis secondary to infection in the developing countries. Tuberculosis is still the most common cause leading to fibrothorax requiring pleural decortication followed closely by pyogenic lung infections and trauma.

**Keywords:** Decortication, Tuberculosis, Trauma

### INTRODUCTION

The pleural fluid, if not drained would evoke inflammatory response which causes fibrin deposition causing pleural thickening leading to formation of fibrothorax.<sup>1</sup> Decortication of pleura improves the ventilator function of the lung. It was described by Fowler and Delorme independently and thus carries the eponym Fowler-Delorme decortication.<sup>2,3</sup>

Although in the developed countries traditional indication of decortication has changed from infection to trauma, in the developing countries infection still remains the predominant cause followed by trauma.<sup>4,5</sup>

In decortication the thickened pleura is incised and peeled off. If the underlying visceral pleura is adherent to the underlying lung, it is imperative to correctly identify the plane for extirpation, otherwise injury to pulmonary parenchyma could result in severe bleeding and air leak.<sup>5</sup>

The complications of the procedure include occurrence of sepsis, wound infection, postoperative bleeding, air leaks and bronchopleural fistulas, major mediastinal vascular injuries, diaphragmatic injuries and phrenic nerve injuries. The incidence of these complications can be reduced with proper diagnosis, patient selection, meticulous preoperative preparation, thorough counselling, surgical expertise, use of better antimicrobial agents and intense post op rehabilitation.<sup>6</sup>

With the advent of video assisted thoracoscopy significant improvement in the management of these patients is seen. Remarkably a smaller incision and shorter operative time have led to overall reduction in morbidity in area of pain.

With better infection control regimens, compliant antituberculosis programmes, the incidence of infective etiology has drastically come down. In recent times more patients present with chest traumas a cause for hemothorax.<sup>7</sup> These cases if not managed adequately would lead to fibrothorax and require a decortication.<sup>8</sup> The present study plans to analyze the clinical profile of patients who are undergoing pleural decortication, and their morbidity and mortality.

Although the collections in pleural cavity could be pus (pyothorax or empyema), blood (hemothorax), serous fluid (hydrothorax) or chyle (chylothorax), any delay in clearing them through closed drainage would lead to empyema thoracis/fibrothorax, requiring open/VATS decortication. The infections of pleural cavity caused mainly by bacteria.<sup>9-12</sup> The most common isolates being, as found by Wang et al were *Staphylococcus aureus*, *Streptococcus pneumonia*, *Escherichia coli*, *Mycobacterial tuberculosis*, *Aerobacter aerogenes* and *Proteus*.

With advent of wide spectrum of antibiotics-medical treatment has become an integral part of the empyema treatment. The cases where debris remains in the pleural cavity following medical management, surgical clearance is required. Although decortication is a procedure with a good success rate there are some common complications which can arise, such as bleeding, wound infections, postoperative pain, air leak ranging from mild leak to fistula formation and recurrence of infection in lung. According to Sengupta et al, these complications are not uncommon and easily treatable with an eye to detect those at the earliest.<sup>14</sup> Majority of these subside without any residual effects.

## METHODS

The subjects for the study are selected from the cases admitted in a single unit of Department of Cardiothoracic Surgery, Nizam's Institute of Medical Sciences (NIMS), Hyderabad during the period of 2016 to 2018 after applying the defined inclusion and exclusion criteria and getting approval from ethical committee of NIMS.

Retrospective collection of data is done from the database including admission record, operation theatre record, ICU charts, discharge records and follow-up notes. The number of patients included in the study were 50 for whom outcomes and complications of surgery were analyzed and followed up for 3 years duration. Patients with cardiac conditions, active infection and bleeding disorders were excluded from the study.

The patients underwent laboratory and radiological studies apart from routine investigations to assess the general health condition and fitness for surgery. These include sputum for acid fast bacillus and Gram stain, chest X-ray, CT scan, pulmonary function test, bronchoscopy and in some case thoracoscopy. The data was analyzed using percentages.

All patients underwent pleural decortication through posteral thoracotomy. The thickened visceral pleura which was attached to the lung parenchyma was removed completely with a combination of blunt and sharp dissection. The entire lung was freed of the peel and then allowed to expand to check for the completeness of decortication. Parenchyma air leaks were checked and if major leak occurred, they were sutured.

## RESULTS

A total of 50 patients with fibrothorax with a restricted lung expansion of various etio-pathologies were operated between 2016 to 2018. In our study there a male preponderance n=40 (80%). The average age of presentation was 34 years, ranging between 20-40 yrs.

**Table 1: Age distribution (n=50).**

Age (in years)	No. of cases	Percentage (%)
10-20	02	4
21-30	13	26
31-40	14	28
41-50	10	20
51-60	07	14
61-70	04	08
<b>Total</b>	50	100

**Table 2: Sex distribution (n=50).**

Sex	No. of cases	Percentage (%)
<b>Male</b>	40	80
<b>Female</b>	10	20
<b>Total</b>	50	100

Twenty-one (42%) patients presented secondary to tubercular pathology. Fourteen (28%) patients presented secondary to pyogenic pathology, 9 (18%) patients had mixed infection and 6 (12%) patients had trauma.

The majority of the patients, 44 presented with cough (88%) and 41 with fever (82%) 37 with dyspnoea (74%) and 11 with hemoptysis (22%).

**Table 3: Etiology.**

Etiology	No. of cases	Percentage (%)
<b>Tubercular</b>	21	42
<b>Pyogenic</b>	14	28
<b>Mixed</b>	9	18
<b>Trauma</b>	6	12

**Table 4: Symptoms (n=50).**

Symptoms	No. of cases	Percentage (%)
<b>Fever</b>	41	82
<b>Cough</b>	44	88
<b>Dyspnoea</b>	37	74
<b>Hemoptysis</b>	11	22

Six patients had history of broncho pleural fistula where secondary infection with mixed organisms leads to the development of empyema. One patient had a history of promyelocytic leukemia where he developed pleural effusion which got secondarily infected and lead to the development of fibrothorax. Our study also included one patient with chronic kidney disease with pleural empyema. One patient who was operated for coronary artery disease (CABG) developed left pleural collection (hematogenous) which formed a layer around the left lung preventing the lung expansion, underwent decortication.

There was a significant preponderance of right side (n=35) (70%). All the patients in our study group were given a trial of drainage with insertion of intercostals chest drain. All the patients had diagnosis established by HRCT and were treated preoperatively with antibiotics (variable duration).

The common complication we encountered in our study were air leaks (37.5%) (n=6). Air leaks that persisted beyond 4 days were taken into consideration. Only one patient had prolonged air leak for 6 days. All the air leaks were managed conservatively with prolonged placement of underwater seal intercostals chest drain. One more common complication encountered was early postoperative bleeding (n=4). Patients whose bleeding exceeded more than one litre in 24 hours were taken as complication of bleeding. Four patients with bleeding complication were treated with blood products. All the patients were given preoperative antibiotic prophylaxis with 3<sup>rd</sup> generation I.V cephalosporins for 3 days. The pleural fluid culture and sensitivity was done for all the cases and appropriate antibiotic initiated as soon as the microbiology report was done. But four patients had infectious complication with wound infection and spikes of sepsis with fever. All the four were treated with prolonged course of antibiotics and had infection under control.

Because of the extensive adhesion one patient had injury to phrenic nerve which was diagnosed later on x-ray and

confirmed by ultrasound. The patient did not experience any severe dyspnoea but was advised to do good chest physiotherapy and had no limitation in their day to day activity.

We had a case of recurrence where the lung was not fully expanded and patient had complaints of cough and dyspnoea which on evaluation showed a layer of fibrous peel preventing the lung from expansion. The patient was reoperated and following decortication recovered.

**Table 5: Postoperative complications.**

Complications	No. of cases (n=16/50)	Percentage (%)
<b>Air leak</b>	6	37.5
<b>Bleeding</b>	4	25
<b>Infection</b>	4	25
<b>Injury to surrounding structure (phrenic nerve injury)</b>	1	6.25
<b>Recurrence (leading to surgery)</b>	1	6.25

## DISCUSSION

Decortication for the removal of the thickened pleura is still a common surgery performed. The etiologies have changed over time from infections to trauma in developed countries but majority are still caused by infections particularly in developing countries. The common etiology is development of empyema thoracis secondary to pulmonary diseases like pulmonary tuberculosis, pneumonia, bronchiectasis, lung abscess and chest wall diseases like thoracic wall abscess, penetrating wounds, osteomyelitis of ribs, thoracic vertebrae.

There is a clear male preponderance all over the world including India. In the study of Rajgopal et al there was a male to female ratio of 3:1 and the peak age was in the range of 21 to 40. In our study there is male preponderance of 80% (n=40) and age group ranged from 20 to 40 with average of 34 yrs. In a recent study conducted by Burgos et al there was an increase in the incidence of empyema both in community and in hospital acquired infections as well.<sup>16</sup> The likely causes implicated were the presence of diabetes mellitus, usage of steroids, immunocompromised states, and malignancies increased the risk of para pneumonic effusions which increased the risk of empyema.

The incidence of fibrothorax secondary to tubercular pathology is common and is said to be in range of 50-70% (including both mycobacterium tuberculosis and mycobacterium paratuberculosis). In a review of Savage et al the calculated incidence of culture proven tuberculosis in patients developing fibrothorax and requiring decortication was 65% (32 of 49 patients).<sup>17</sup> The study by Wen et al conducted in 2019 had reported a

decrease in the incidence of tubercular related fibrothorax but an increase in the pyogenic infective etiology more so in children.<sup>18</sup> A study conducted by Kundu et al in the Indian subcontinent region identified that of the 75 cases of empyema seen during their one and half year period 29 cases (38.7%) were of tuberculosis etiology and 46 (61.3%) were due to non-tubercular etiology with staphylococcus aureus being the most common.<sup>19</sup> All the patients were investigated for culture and sensitivity from the bronchial wash specimens taken during bronchoscopy. The common non tubercular organisms causing infection are staphylococcus, streptococcus and klebsiella pneumonia. In our study 42% (n=21) presented with tubercular etiology, 28% (n=14) with pyogenic pathology, 18% (n=9) had mixed infection and 6 cases (12%) were post trauma. Burford et al reported an increase in the post traumatic collections causing fibrothorax requiring decortication.<sup>5</sup> Wang et al conducted a study of 90 patients with lung abscess and demonstrated increased infection rates with aerobes like *Staphylococcus*, *Streptococcus* and *Klebsiella* than the anaerobes which were more common causes earlier.<sup>9</sup> Similarly Nicolini et al in their case series found an increase in the aerobic infections due to *Streptococcus* and *Klebsiella* especially in community acquired lung abscess.<sup>20</sup>

Schiza et al in their study on clinical presentations found patients had fever and cough as the most common presenting feature.<sup>21</sup> The major clinical presentation of the patients in our study was cough (88%), followed by fever (82%), dyspnoea (74%) and hemoptysis (22%). Majority of patients with empyema had recurrent episodes of fever and cough. Gregory from medical university of South Carolina in their study found that forty of the 43 (93%) patients had some symptoms related to empyema, with fever (65%) being the most common.<sup>13</sup>

The patients were initially managed medically, and later investigated and taken up for surgical intervention. Patients had a preoperative chest X-ray work up. As seen in the study of Stark et al, computed tomography was sufficient to identify the thickness of pleura in patients with fibrothorax which clearly correlated with the intraoperative findings. In our study all the patients had CT scan of the chest for the identification of the underlying pathology and planned for decortication.<sup>22</sup> We did not include pulmonary function tests in our study, as significant number of patients were not able to do the test correctly. Therefore, we relied on breath holding capacity, CT scan assessment of compensatory hypertrophy of the other lung segments. Moreover, the fact that the patient was able to ventilate without much difficulty preoperatively implied that release of the lung from fibrothorax only improved the function.

All our patients had attempts for drainage of pleural collection with tube thoracostomy either directly or under imageology guidance. In the initial stages of collection

when there is less fibrosis and more exudates, the fluid was drained by thoracocentesis or through inters costal chest drain. Luh et al in their study of parapneumonic effusion had 86.3% (202 in 234 patients) resolution of effusion by drainage without the need for the surgical intervention in the early stage of collection.<sup>23</sup> But there was significant increase in the requirement of surgical intervention in the patients who were in advanced stages of fibropurulent disease. Further in our study we had one patient of promyelocytic leukemia who developed pleural effusion. The effusion got secondarily infected and formed fibrothorax which needed decortication. In their study Nieves et al found that pleural effusions were one of the presenting features in leukaemias. These effusions are more common in solid tumours like lung cancer, breast cancer and lymphomas. Majority of these effusions were exudative and were treated with drainage either by tube or thoracocentesis. But when they were infected it resulted in severe fibrosis leading to fibrothorax which needed pleural decortication.

In the study of Salik et al patients with bronchopleural fistula and empyema were having more fulminant infection with a mixture of both aerobic and anaerobic organisms underwent decortication and bronchopleural fistula closed with Elosser flap technique.<sup>24</sup> We had 6 patients of bronchopleural fistula (BPF) where secondary infection with mixed organisms leads to the development of empyema leading to formation of fibrous peel around the lung. These patients presented with recurrent cough, fever and dyspnea. The presence of infection in these patients was treated with antibacterials as majority were mixed and resistant infections. All the patients were taken up for open decortication and the bronchopleural fistula identified and closed with Elosser flap technique.

Iyer et al in their review found postoperative air leak as common complication.<sup>25</sup> In our study we found pleural air leaks of 37.5% (n=6) that persisted for 4 days. All the air leaks were managed conservatively with the placement of underwater seal intercostal chest drain. We had 4 patients with early postoperative bleed of more than 1 litre in 24 hours and they were managed conservatively by transfusion of blood and blood products. One of our postoperative patients of CABG had an increased bleeding post op for which he had to be given blood transfusion and managed conservatively. He was on antiplatelet therapy which was stopped 1 week before surgery. He developed organised hemothorax which caused lung restriction. Patient was further investigated with CT scan and found to have thickened pleura. The patient was taken up for open decortication and was discharged without any symptoms.

Although most of the decortication surgeries involve removal of fibrous layer and pyogenic tissue the incidence of wound site infection was found to be remarkably low. In their study Toomes et al found that 8.7% of patients with wound infection complications 1.2% with air leaks and 1.2% with recurring empyema.<sup>26</sup>

In our study only 4 (8%) patients developed wound site infection complications. All the patients were given 3<sup>rd</sup> generation I.V cephalosporins preoperatively to contain infection. All the patients pleural fluid culture and sensitivity was done and appropriate antibiotic was initiated. All the four patients were given antibiotic course of postoperatively for 10-14 days and were monitored for leukocyte counts, fever spikes until the infection subsided.

Diaphragmatic palsy due to phrenic nerve injury was seen in one patient and which was diagnosed on 3<sup>rd</sup> postoperative day. Mandoorah et al in their study identified that phrenic nerve injury was common in thoracic and cardiac surgery as the phrenic nerve was near to the dissection area of internal mammary artery and attaches to hilar region of lung in decortication.<sup>27</sup> In the study of Trip et al of iatrogenic phrenic nerve injury there was a 14% incidence of phrenic nerve injury.<sup>28</sup> As these are majorly unilateral they don't cause severe life threatening complications as seen in bilateral injury. We had one patient of diaphragmatic palsy due to phrenic nerve injury which was detected on chest X-ray and confirmed by ultrasound. The patient was managed conservatively with respiratory physiotherapy and was able to do his day to day activities without any restriction.

Our study had only one patient with recurrence, where the patient presented with cough and dyspnoea after 4 weeks of surgery. On evaluation showed presence of restricted lung with a thick layer formation. Yuchiario et al showed that there is a 4 to 16% chance of recurrence in cases of empyema thoracis treated by open decortication. The rate of recurrence was higher in case of patients who had prolonged infection and malnourished patients.<sup>29</sup> Following open thoracotomy and decortication the incidence of recurrence is very low. Our patient was improved with nutrition and given antibiotic coverage and reoperated. The patient had a prolonged stay of 14 days and recovered completely.

In the study of Christopher et al which reviewed 7316 patients undergoing decortication for empyema between 2009 to 2016 they had mortality of 228 patients (3.1%).<sup>30</sup> In our study we had no mortality which clearly makes decortication a safe and effective procedure for the treatment of fibrothorax.

## CONCLUSION

The most common reason for pleural decortication is still empyema thoracis secondary to infection in the developing countries. Tuberculosis is still the most common cause leading to fibrothorax requiring pleural decortication followed closely by pyogenic lung infections and trauma. Open pleural decortication provides more complete removal of thick fibrous tissues providing good improvement in patient symptoms. Pleural decortication is associated with low morbidity and mortality. Recurrence of empyema thoracis following

pleural decortication and surgical wound site infection is remarkably low.

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