

Pneumonectomy for Benign Lung Disease

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Objective: This study was done to define morbidity and mortality of elective pneumonectomy for benign lung disease, as well as to recommend safety measures. **Design:** An observational descriptive study. **Place and Duration of study:** Department of Cardiothoracic Surgery, Postgraduate Medical Institute, Lady Reading Hospital, Peshawar from June 2002 to September 2004. **Material & Methods:** Thirty six patients received elective pneumonectomy. Male : Female 21 : 15. Age range was 4 months to 72 years. Past recurrent or new pulmonary tuberculosis was seen in 33/36 patients. Thirty one patients had chronic hemoptysis, while 6 had massive hemoptysis while thirty two had end stage destroyed lung. Left : Right ratio was 24: 12. Double lumen endotracheal tube was used in 32 cases. Standard transpleural pneumonectomy was done in all cases with slight head down tilt of the table. Bronchial closure was done in 2 layers with interrupted Prolene 2/0 & 4/0. Single unclamped chest drain was put in all cases and removed after 24 hours. **Results:** Thirty day mortality was 1/36 (2.7%). Morbidity included post pneumonectomy BPF 2, post pneumonectomy empyema 3 and wound infection 1. Both bronchopleural fistula and post pneumonectomy empyema were treated by tube thoracostomy initially, while 2 patients subsequently required additional thoracostoma and later space closure. Of these 1 went on to have thoracoplasty. **Conclusion:** Pneumonectomy proved effective therapy for end stage destroyed lungs with active / recurrent hemoptysis, but post pneumonectomy empyema and BPF are serious complications. Early clamping of the bronchus and avoiding bearing of bronchus reduce morbidity. There is no need to clamp the chest drain, which should be removed after 24 hours. **Keyword Words:** Pneumonectomy, Benign Lung Disease.

Graham and Singer, in St. Louis, reported the first successful removal of entire lung for cancer in 1933. As noted by Baue (1984), Graham preferred the term pneumonectomy to describe this operation. He did not dissect the hilar structures, preferring to transfix the hilar vessels and bronchus as they emerged from mediastinum. Important as this landmark operation was, our modern technique of pneumonectomy owes to the dissection method first undertaken in 1930 by Churchill in Boston, as he and his association recorded in 1950¹. Extensive parenchymal destruction of the lung by inflammatory disease is uncommon in Western practice, but quite common in our practice. Pakistan has the fifth highest tuberculosis burden in the world. Benign lung destruction is most often caused by tuberculosis and its sequelae, and can give rise to chronically morbid and sometimes acute life threatening complications. These include recurrent infection, acute suppurative complications including lung abscess and empyema, septicemia, and often chronic intermittent or massive hemoptysis¹.

Pneumonectomy remains the treatment of choice provided the other lung is healthy enough, and the patient generally fit enough, especially PFT's (pulmonary function tests) and nutritional status, to withstand the procedure. Pneumonectomy for inflammatory lung disease is a very different surgical experience than pneumonectomy for bronchogenic carcinoma². Here most of the anatomy is distorted by adhesions, making dissection very difficult. In addition handling of the lung results in blood and secretions spilling over to opposite lung, leading to hypoxia and at times cardiac arrest. This is in contrast to carcinoma patients where there are seldom any adhesions, not much adverse effects of handling the lung and

generally a fairly well preserved anatomy making dissection more or less a text book affair³.

Here we would like to share our experience of elective pneumonectomy for benign lung disease, with all its hazards and pitfalls, along with our recommendations.

Material and methods:

Thirty six patients underwent elective pneumonectomy for benign lung disease from June 2002 to September 2004. Male: Female was 21: 15. Age range was 4 months to 72 years with a mean age of 45.6 years. All patients had preoperative workup comprising routine investigations of FBC, BCP, Hepatitis screen, Chest x-ray and specialized investigations comprising PFT (30/36), CT thorax 34/36, Arterial Blood Gases (6/36). Sputum for AFB 30/36. After pulmonologist and anesthetic assessment, all patients were cross matched for 4 unit blood. Double lumen endotracheal tube was used in 32/36 cases. All patients were positioned in standard posterolateral thoracotomy position, but with a head down tilt. During opening posterolateral thoracotomy Serratus Anterior was preserved by reflecting forwards. Standard transpleural pneumonectomy was done in all cases. In all cases bronchus was clamped as early as possible to reduce spill over whether a double lumen was in place or not. In all cases chest wall was initially packed while dissecting, to make haste to clamp the main bronchus. Hemostasis of chest wall was done after removal of the lung. Frequent suction down the ET tube was greatly facilitated by head down tilt. Throughout the procedure SO₂, Pulse, BP, ECG was continuously monitored by anesthetist. After removal of the lung bronchus was closed in 2 layers with interrupted Prolene 2/0 and 4/0, and finally stump checked for leaks by inflating under saline to 40cm

(H₂O) pressure. In 6 cases pleural flap was placed over the bronchial stump. Single chest drain was placed on underwater seal. It was never clamped and removed after 24 hours. Prior to closure cavity was washed thoroughly with saline. Wound was closed meticulously in layers with Vicryl No. 2. Third generation cephalosporin plus metronidazole were started at induction and continued for 5 days postoperatively. Patient was shifted to Thoracic ICU (Intensive Care Unit) for 24 hours, where pulse, BP, O₂, ECG and drainage were monitored. Low molecular weight heparin was used for DVT prophylaxis. Drain was removed after 24 hours, chest x-ray was done and patient shifted to HDU. Patient stayed in Thoracic HDU (High Dependency Unit) for 72 hours with monitoring of SO₂, Pulse, BP, temp, wound and chest. On 5th day patient was shifted to general ward and discharged on 10th postoperative day. Routine follow-up was first after 2 weeks, then one month, then 3 months, then 6 months and annually after that.

Results:

Out of thirty six patients in this study, 4 were children aged less than 10 years, (4 months – 7 years) while 32 were adults. Male : Female was 21 : 15 . Right : Left was 12 : 24. Thirty two adults had end stage destroyed lungs, while of the 4 children, 2 had congenital cystic bronchiectasis. 1 had post tuberculosis Bronchiectasis and 1 had a near drowning accident resulting in a hypoplastic / destroyed lung. 33 /36 had past, recurrent or new pulmonary tuberculosis (Table I). Age range was from 4 months – 72 years with a mean age of 42.6 years. Duration of ICU stay was 24– 48 hours with a mean of 24 hours. HDU stay was 72 hours while total postoperative hospital stay was 10 – 32 days with a mean of 14.2 days. Mean operative time was 96 minutes ± 18 minutes. Mortality was 1/ 36. This was a 54 years old gentleman with border line lung function, with recurrent massive hemoptysis, a totally destroyed post tuberculosis bronchiectatic right lung and early bronchiectatic changes in lingula, with mitral stenosis and LA clot. After failure of medical treatment and taking high risk consent from the family, he underwent right pneumonectomy. Initially he was stable and was discharged on 12th postoperative day. However on 27th postoperative day he suffered a CVA and died.

Morbidity was 6/36 (Table II) and included post pneumonectomy BPF (bronchopleural fistula) 2 (day 8 & 9) and post pneumonectomy empyema 3 (day 14, 18, 24) and wound infection 1 (day 4). Wound infection responded to changing antibiotics after C/S. The BPF and post pneumonectomy empyemas were treated by chest intubation and antibiotics after C/S. Two of the post pneumonectomy empyemas failed to respond and subsequently underwent thoracostoma formation; of these 1 cleared up and stoma was subsequently closed. In the other one the infection persisted and finally thoracoplasty was done 4 months after the initial pneumonectomy.

The pathologic findings in the resected pneumonectomy specimens were reviewed. The final diagnosis in 30/36 patients was end stage destroyed lung as a result of tuberculosis. Aspergillous infection of chronic cavities was present in 9/36 cases. Active pulmonary tuberculosis undiagnosed before operation, was found in 6 cases. 11 showed evidence of lung abscess.

Table 1: Preoperative data of patients (n=36)

Variable	n=
Sex	
Male	15
Female	21
Age	
4 months – 10 year	04
10 years – 20 year	09
21 years – 40 years	10
41 years – 60 years	09
61 years – 80 years	04
Side	
Left	12
Right	24
Presentation	
• End stage destroyed lung	32
• Congenital Cystic Bronchiectasis	02
• Hypoplastic Lung	01
• Post tuberculous Bronchiectasis	01
Investigations:	
• Pulmonary functions tests	36
• Sputum for AFB	30
• CT Thorax	34
Arterial Blood Gas Studies	06

Table II: Mortality and morbidity

Variable	n=
Mortality	01
Morbidity	06
Complications	
i. Bronchopleural fistula	02
ii. Postpneumonectomy empyema	03
iii. Wound infection	01

Discussion:

The majority of pneumonectomies in the West are performed for lung cancer. Occasionally, they perform pneumonectomy for bronchiectasis or for a lung destroyed by chronic suppuration. End stage destroyed lung, mostly as a result of tuberculosis is fairly common in our practice. Pakistan has the fifth highest tuberculosis burden in the world. These patients mostly present with recurrent / chronic massive hemoptysis, recurrent chest infections, chronic ill health, chronic chest pain, aspergillous infections and suppurative complications⁵. Pneumonectomy proved expeditious and effective management for this group of patients. The 30 day mortality rate of 3% compares favorably with modern day pneumonectomy rates^{6,7,8}. Ginberg and associates⁸ report an average 5% mortality rate for left pneumonectomy, and

up to 15% for right resections. Past series of pneumonectomy for both inflammatory and malignant disease indicates mortality rates ranging from 6% - 25%^{7,8,9}. Stevens et al¹⁰ has reported 3.1% mortality rate for elective pneumonectomy for inflammatory lung disease. Destroyed lung caused by tuberculosis is an end stage phenomenon prone to serious complications. The involved lung is nonfunctional with demonstrable absent perfusion and ventilation. It is nonetheless richly vascularized by systemic arterial connections²⁻⁴. This neovascularization is effected by the bronchial arterial system and includes the adjacent intercostal arteries, branches of the subclavian, axillary, pericardial, diaphragmatic, and esophageal arteries. Thin-walled new vessels bleed readily as evidenced by the commonness of chronic, recurrent, and often massive hemoptysis¹¹.

The cavitated and bronchiectatic areas of these destroyed lungs are prone to recurrent bacterial infection and occasionally to the acute suppurative complications of infection such as lung abscess and associated empyema. A further complication is fungus infection (aspergillus) of chronic posttuberculous cavities. Reactivated or undiagnosed and thus untreated tuberculosis is a further major problem and should be actively investigated and treated before operation^{12,13}.

The occurrence of bronchogenic carcinoma associated with chronic destroyed lung reminds us of the small, but definite, risk of cancer in these patients^{14,3}. Lung cancer is 20 times more frequent in the scarred lungs of persons with tuberculosis than in the general population^{15,4}.

During opening, Serratus Anterior was preserved by reflecting forwards. When the chest is opened, usually lung is found severely stuck to chest wall mediastinum & diaphragm. Main aim is to clamp main bronchus ASAP and therefore all adhesions are quickly freed with sharp dissection. Chest wall is packed and proper hemostasis secured after removing the lung. Until the bronchus is clamped & even afterwards, frequent suction of ET tube is essential to prevent spill over. This is greatly facilitated by head down tilt. As staplers are expensive interrupted Prolene 2/0 & 4/0 were used to close bronchus in 2 layers.

Double lumen endotracheal tube was used in almost all of our patients. During surgery head down position, frequent suction of endotracheal tube and invasive monitoring was done. Pleural cavity was washed with saline & bronchial stump checked. Meticulous closure of thoracotomy wound with Vicryl 2 & a preserved Serratus anterior resulted in better wound healing. Single chest drain connected to underwater seal, for 24 hours to reveal any hemorrhage was done in all cases. Drain was not clamped as in inflammatory lungs, mediastinum is already fixed and clamping only conceals internal hemorrhage. It is removed as early as 24 hours to avoid ascending infection. Postoperatively these patients are monitored in ICU and HDU. Chest physiotherapy and early mobilization is encouraged.

There have been few publications of large pneumonectomy series for benign post inflammatory lung disease in recent decades. Stevens and associates¹⁰ report on 64 patients with two perioperative deaths caused by massive endobronchial spillage. Odell and Henderson reported a mixed pneumonectomy series of 251 cases (67.3 % tuberculosis, 24% bronchiectasis and necrotizing pneumonia).

The presence of a destroyed post inflammatory lung in a patient who is free of symptoms has not been in the past an immediate indication for operation. This was largely because of the expected excess mortality and morbidity¹⁶. Because of the documented serious complications that will inevitably arise from these post inflammatory residuals, we recommend in accordance with others^{1-3, 8, 10,11} elective pneumonectomy for these patients. Elective pneumonectomy done in the absence of serious infective complications for active hemoptysis, and when nutritional status is good, promises further improvements in the mortality and morbidity of this patient group^{3,18,19}. The prophylaxis and prevention of postpneumonectomy empyema after pneumonectomy for inflammatory disease deserves the highest treatment prioritization^{6,18,20}.

Conclusion:

Pneumonectomy is most efficacious treatment for symptomatic patients with destroyed lungs. We recommend use of double lumen tube, head down tilt, preserving Serratus Anterior, early clamping of bronchus, packing of chest wall till lung is out, 2 layered closure of bronchus with interrupted Prolene 2/0 & 4/0, reinforcement with pleural flap, meticulous closure, and an unclamped underwater seal for 24 hours, to reduce morbidity and mortality of this high risk group of patients.

Acknowledgments: The writer thanks Dr. Muhammad Shoab Nabi, Assistant Professor Thoracic surgery for study design and statistical analysis.

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