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Thoracic Surgery in Indian Armed Forces - Revisited

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Abstract: ***Background: The birth of thoracic surgery in Indian subcontinent happened at this Hospital (i. e. Army Institute of Cardiothoracic Sciences, Pune) in 1945 when Maj John Leigh Collis of British army established the centre which then took off with various types of collapse surgery and resection surgery and continues even after introduction of chemotherapy for pulmonary tuberculosis. This study analyzes the institutional experience with pulmonary surgery over last 70 years. Material & Method: This is a single institute observational study with a retrospective analysis of the database. Results: A total of 19249 thoracic surgeries have been performed with the average morbidity and mortality comparable to international standards. Conclusion: This centre has pioneered the thoracic surgery in this sub - continent and continues to manage various thoracic cases with commendable success and acceptable rate of complications in the country.***

Keywords: Segmentectomy, Lobectomy, Pneumonectomy, Physiological Lung exclusion, Thoracic dead space management

1. Introduction

Pulmonary tuberculosis was the disease that initiated the birth of thoracic surgery near the end of the 19thcentury. Its incidence having been accelerated by the industrial revolution all over Europe with population shifts toward the cities, overcrowding and people living in generally poor hygienic conditions.

The treatment of tuberculosis in its infancy gave rise to the sanatoria system because it was felt that rest, nutrition and fresh air were beneficial in the treatment of tuberculosis. Surgery for tuberculosis began with collapse therapy[1]. The tuberculosis organism is an obligate aerobe and it was reasoned that by preventing oxygen from entering the cavities this would be beneficial in the treatment of patients with cavitary pulmonary tuberculosis. Various forms of collapse therapy have been thoracoplasty, wax or lucite ball plombage, phrenic nerve crush or interruption, pneumoperitoneum, and induced pneumothorax. Collapse therapy continued to be the treatment of choice for tuberculosis infections until chemotherapy with streptomycin and para - aminosalicylic acid (PAS) was introduced in 1945 and isoniazid in 1952.

Gradually, resectional surgery replaced collapse therapy as the primary surgical approach to patients with tuberculosis infections having residual destroyed lung or cavitary disease. With the introduction of rifampin in 1966 the need for surgery was markedly reduced and the sanatoria system gradually became extinct. Currents indications for surgical managementare complications of tuberculosis such as bronchiectasis, massive hemoptysis (>600 ml in 24 hours), empyema thoracic, bronchopleural fistula, to rule out the presence of cancer and occasionally decortication of a trapped lung and failure of medical therapy such as progressive disease, lung destruction, drug resistance, persistent sputum positivity, aspergillosis[2]. Patients with tuberculosis whose organism is resistant to both INH and rifampicin are classified as Multidrug resistant tuberculosis, (**MDR - TB)** whereasExtensively Drug Resistant Tuberculosis (**XDR - TB)** strains also show resistance to Fluoroquilonlones and Aminoglycosides or Capreomycin in addition to INH and Rifampicin[3].

The latest trends in thoracic surgery are more oriented to minimally invasive procedures such as physiological exclusion of lung, Mediastinoscopy, Video Assisted Thoracic Surgery (VATS) and Robotic surgery. The cardiothoracic applications of 3D and 5D printing is another milestone in diagnosing and planning the surgery for thoracic diseases.

Legacy of Thoracic Surgery in Armed Forces Medical Services

The birth of Thoracic surgery in Indian subcontinent happened in Military hospital, Aundh, Maharashtra which would later become Military Hospital (Cardiothoracic Centre), Pune. It was Maj John Leigh Collis who had worked as a thoracic surgeon in the midlands, Britain, during the World War - II, having posted as the first surgeon to this hospital, established the Dept. of Thoracic Surgery at the hospital. He performed the first lobectomy in the Indian subcontinent in the year 1945 and the first pneumonectomy in 1946[4]. He was succeeded by a number of Indian pioneers in the field of cardiothoracic surgery who carried on the legacy and put Thoracic and Cardiac Surgery on a sound footing in Indian Armed Forces.

The thoracic surgeries constituted the main workload of this Centre in the initial two decades, the details of which are graphically presented in graft 1. The pulmonary surgeries or proceduresmainly done were as a part of management for complications and sequelae of the infective lung diseases such asthoracoplasty, pneumonectomy, lobectomy, segmentectomy, decortication, adhesiolysis, diagnostic procedures i. e. thoracoscopy and bronchoscopy (graph 2).

However, due to improvement in the management of the bacterial lung diseases with ATT and antibiotics, requirement for the surgical management has tremendously reduced over last four decades (graph - 1 and table - 1).

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Surgical principles in pulmonary surgery are elimination of destroyed lung and at the same time, leaving enough viable lung tissue to have enough functional postoperative patient. Adequate nutrition is of paramount importance in preparation of patient with target albumin level of 3.0 gm/dl and haemoglobin level of 10 gm/dl.

Surgical procedures can be categorized into diagnostic procedures, resection procedures and collapse therapy. Diagnostic procedures include percutaneous needle biopsy, transbronchoscopic needle biopsy, supraclavicular thoracotomy, mediastinoscopy, thoracoscopy and closed pleural biopsy. Lung collapse procedurescommonlydone at this Centre include Phrenic nerve crush/interruption and Thoracoplasty which were performed till 1956 and 1991 respectively.

Resection procedures being done at this centre are as follow:

Segmentectomy

Segmentectomy, a form of resection popularized in the mid - 1900s, is an anatomic operation because it removes the segmental bronchus back to its primary branch, along with all of the lung parenchyma and lymph node groupings drained by the bronchus and its associated segmental pulmonary artery. This technique was first used for the treatment of pulmonary tuberculosis, bronchiectasis, and other suppurative pulmonary lesions. This technique is more commonly done for resection of lung tumours in present scenario[6].

Lobectomy

Lobectomy by hilar dissection, first reported by Blades and Kent in 1940 for the surgical treatment of bronchiectasis, is now performed most commonly for the definitive treatment of lung cancer[6]. The incision for lobectomy is usually a posterolateral thoracotomy because it allows greater exposure and maneuverability. The other approaches include anterolateral thoracotomy, median sternotomy except for the left lower lobe, and muscle - sparing lateral or axillary thoracotomy. Posterior thoracotomy, which was performed on a special operating table with the patient in prone position is now of historical interest. Video - assisted thoracoscopic (VATS) lobectomy is now a routine procedure in several institutions, especially for early - stage non - small - cell lung cancer (NSCLC) [7]. Key points in the performance of lobectomy are mobilization of the lobe, fissure dissection, and management of the vessels and bronchus. Steps of lobectomy differ for each type of lobectomy such as right or left upper lobectomy, right or left lower lobectomy, etc.

Pneumonectomy

Pneumonectomies at this Centre were more frequently done for extensive unilateral TB, extensive unilateral bronchiectasis, multiple lung abscesses and occasionally for fungal infection. Worldwide, more commonly employed for bronchial carcinoma. Special techniques include radical pneumonectomy, supra aortic pneumonectomy, Tracheal sleeve pneumonectomy and pleuropneumonectomy.

Stapled resections

Various types of stapled resections introduced in thoracic surgery have minimized the operating time, enhanced the efficacy of the operating team and early discharge from hospital. Stapled resection has wide range of application bothin VATS and conventional surgeries. Common procedures include stapled bullectomy, stapled segmentectomy, stapled lobectomy and stapled pneumonectomy.

Physiological exclusion of lung

Physiological exclusion of lung is performed by surgical interruption of the pulmonary artery and the bronchus keeping the pulmonary vein intact. This technique is a safe and effective method for controlling massive haemoptysis in cases where lung resection is technically hazardous and should be kept as an alternative or adjunct to anatomical lung resection in patients who are having prohibitive risk. Indications of this technique include longstanding bronchiectasis, chronic cavitary lung lesions and destroyed lung with dense fibrosis and vascular adhesions.

Introduction of minimal access techniques such as Video Assisted Thoracic Surgery (VATS) and Robotic Assisted Surgery has revolutionalised the era of thoracic surgery and are indeed appealing alternative to thoracotomy. Possible indications for pleuropulmonarysurgeries include pleruodesis in effusion and pneumothorax (thermal, chemical, mechanical, talc), bullous disease resection and ablation, wedge resection in earlystage cancer in high risk cases and even anatomical lung resections.

Management of dead space in thorax

The use of muscle flaps to fill space after lobectomies and pneumonectomies are done especially in cases of polymicrobial contamination or sputum positive at the time of surgery[5]. Omental flaps are also used to cover the bronchus in the absence of any muscle due to previous surgery. These procedures help prevent development of bronchopleural fistula. In case of massive contamination, the chest is left open (Eloesser procedure) which is packed with quarter strength Dakin's solution with Kerlix gauze and changed on daily basis for 5 to 6 weeks. When the chest is closed, assuming that intrathoracic chest wall is clean, Clagett's solution is left in the pleural cavity. Latissimus dorsi muscle is used whenever significant space has to be filled after the resection surgery or just to cover the bronchus and hilum. Occasionally, intercostal muscle may be used if only bronchial support is needed. Appropriate antibiotic therapy to be continued for 12 to 24 months post operatively. Single - lung ventilation using either a double - lumen tube or a bronchial blocker has made lung surgeries a technically easier procedure and should be used whenever possible.

Present status and Concerns

A retrospective audit of a closed population who underwent surgery for pleuro - pulmonary tuberculosis and the attendant complications over last one decade i. e.2007 - 2016 revealed a significant no. of relapse cases. A cohort of 174 people with established diagnosis of pleuro - pulmonary tuberculosis on ATT chemotherapy who underwent pleuro - pulmonary surgery were studied and shows that relapsed cases make up 81 % of total pulmonary surgeries of which 26% were already on 2nd line ATT. The average patient referral interval was 03 - 09 months and demographic

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distribution consists of 86% of male patients with a median age of 28 years. The spectrum of cases encountered consists of 141 cases of relapse cases, 26 cases of multi drug resistant and 03 cases of extensive drug resistant and 03 cases of multisystem tuberculosis. The clinical entities on referral to this centre include empyema, bronchiectasis, haemoptysis, bullous diseases, bronchopulmonary fistula, persistent sputum positive, Aspergilloma and other forms of destroyed lung. The most common thoracic surgeries offered were decortication, lobectomy and segmentectomy. However, the new modalities such as stapled bullectomy and physiological exclusion of lungwere also doneas and when the clinical scenario demanded.

2. Discussion

It is evident that good living standard, early detection and prompt management with ATT and antibioticshave led to drastic decline in the requirement of surgical intervention in respiratory diseases. However, surgery, in the form of salvage therapy is an invaluable adjunct to medical therapy when addressing treatment failure of Tuberculosis and other respiratory diseases. Moreover, early referral for surgical management makes a significant difference in the ultimate outcome and early fitness of the patients to be able to return to work which is of paramount importance in a society.

With the resurgence of Mycobacterium tuberculosis in urban areas and the development of drug - resistant atypical strains, salvage surgical techniques such as segmentectomy, stapled bullectomy and physiological exclusion of lung remain important to the eradication of suppurative disease while maximally preserving a normally functioning lung. These modalities are also used in patients with severe Aspergillosis, pulmonary mycotic infections and congenital lesions and intralobar lung cysts including congenital adenomatoid diseases of the lung.

3. Conclusion

The study concludes that despite the advanced development in ATT/Antibacterial chemotherapy, considerable number of relapse cases still occur in our society, most probably due to prolong treatment course, poor compliance and lack of education. The study also shows that early referral for salvage therapy leads to not only early recovery but also lesser resection and better preservation of viable lung volume, thus, postoperatively functional and fit individuals. While updating with latest advances in thoracic surgery, this Centre has tackled various forms of respiratory related diseases with acceptable mortality and morbidity (graph no 6).

Hence, while more glamorous cardiac surgery takes the lead, we cannot neglect the various aspects of the pulmonary surgery, especially in our country where there is rampant cases of treatment failure andrelapses, and especially in our organization where one cannot afford to lose efficient manpower which is the fighting force.

4. Conflicts of interest

The authors have none to declare.

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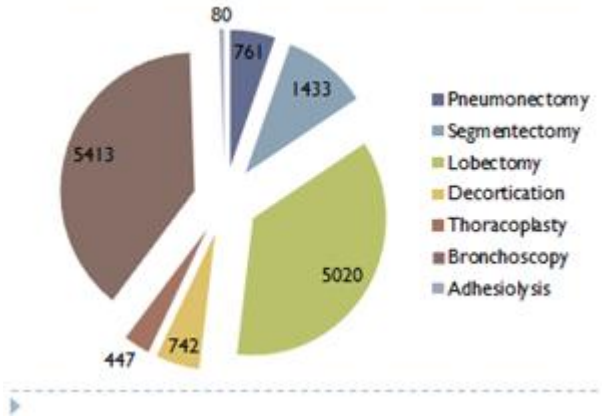
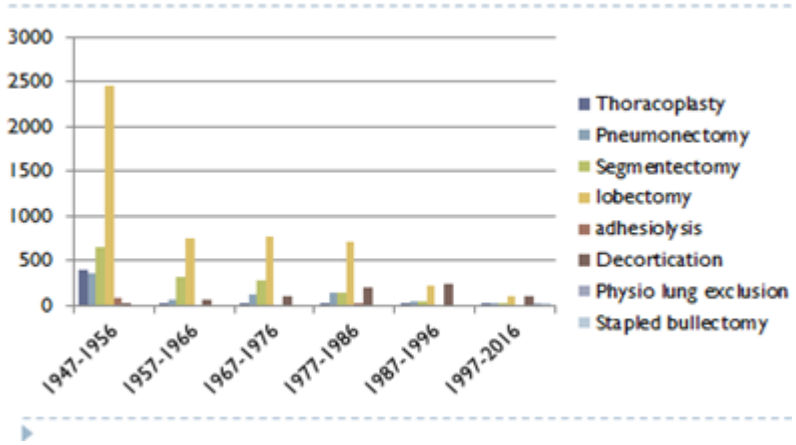
Tables and Graphs

Table 1: Decade wise distribution of thoracic surgeries conducted

Year↓	Pneumonectomy	Segmentectomy	Lobectomy	Decortication	Thoracoplasty	Phrenic crush	Bronchoscopy	Adhesiolysis	Total
1947-1956	761	1433	5018	742	394	86	5327	80	13841
1957-1976	72	311	746	70	7	46	2018	58	3328
1977-1986	147	152	701	184	20	0	48	2	1255
1987-1996	50	40	229	249	18	0	12	0	598
1997-2016	11	10	98	105	2	0	3	0	229
Grand total	1041	1946	6787	1350	441	132	7408	140	**19251**



Graph 2: Spectrum of thoracic surgeries over last 50 years



Graph 1: Trends of thoracic surgeries over past 70 years

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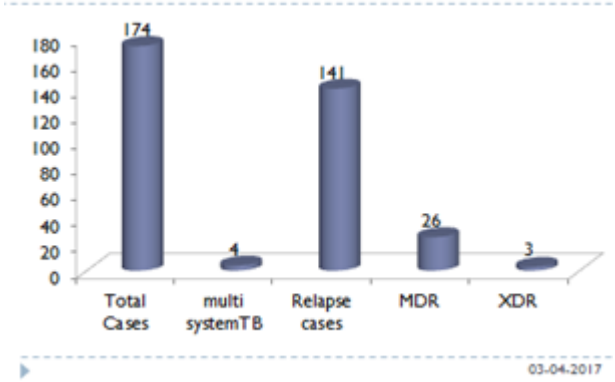
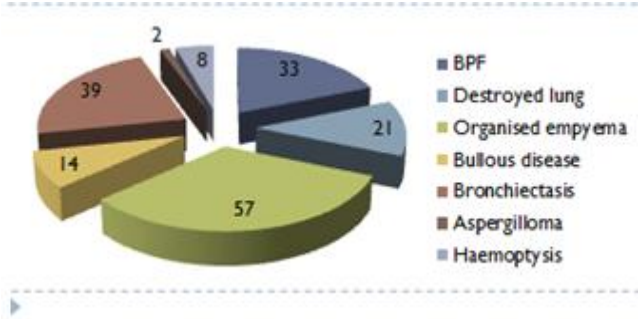
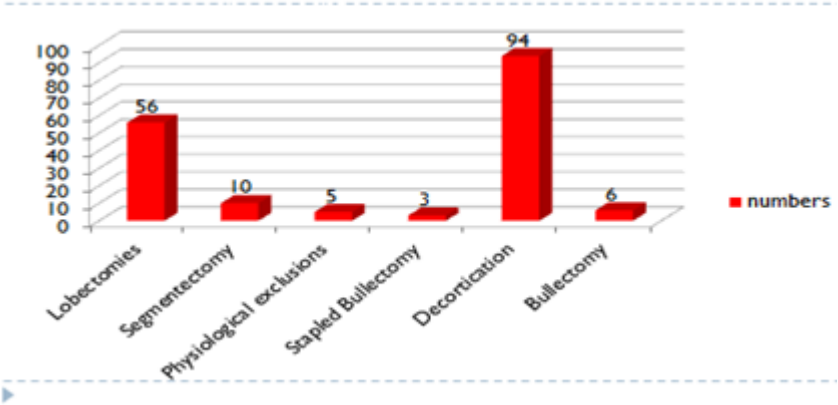


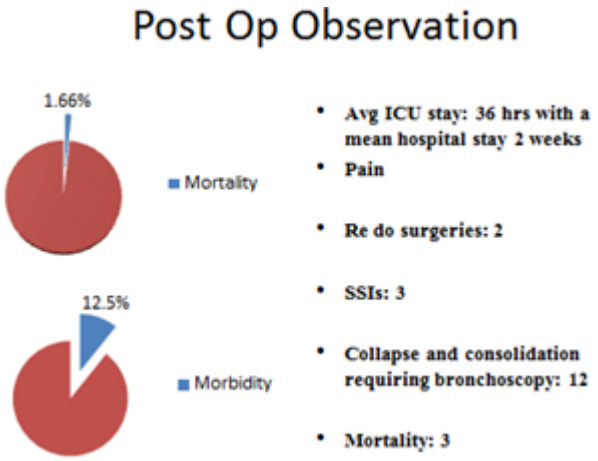
Graph 3: Cases of treatment failure & on second line ATT



Graph 4: Referrals received during 2007 - 2016



Graph 5: Thoracic surgeries conducted at this centre during the years 2007 - 2016



Graph 6: Morbidity & mortality following thoracic surgeries over the last decade

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