

Current Surgical Interventions for Treating Tuberculosis: Exploring the Benefits and Risks

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Abstract

The main organs affected by the chronic infectious disease tuberculosis (TB) are the lungs. Although the main form of therapy for TB is medicinal, surgical intervention may be necessary if the disease is localized to a particular area of the lung and cannot be effectively treated with medicines alone. Segmentectomy, pneumonectomy, and lobectomy are the three primary surgical procedures used to treat TB, and video-assisted thoracoscopic surgery, a minimally invasive technique, enables the removal of the diseased tissue. The surgical removal of one of the five lung lobes is known as a lobectomy. When TB is limited to one lobe of the lung and cannot be adequately treated with medication alone, surgery is often undertaken. Candidates for lobectomy include patients with cavitory lesions larger than 4 cm, a persistent cough, fever, hemoptysis, bronchopleural fistula, or localized abscess formation. The risk of problems can be reduced with appropriate pre-operative assessment, surgical technique, and post-operative care. The surgical removal of the complete lung is known as a pneumonectomy. It is normally saved for TB cases where medicine is ineffective and the disease has spread to affect a significant area of the lung. Pneumonectomy may be an option for patients who have severe cavitory lesions, extensive lung damage, considerable main bronchus involvement, or consequences including bronchopleural fistula, severe hemoptysis, or localized abscess formation. Similar to lobectomy, the risk of problems can be reduced with good pre-operative assessment, surgical technique, and post-operative care. A segment of a lung lobe is surgically removed, a procedure known as a segmentectomy or partial lobectomy. When TB is confined to a particular area of the lung and cannot be properly treated with drugs alone, surgery may be an option. Segmentectomy may be beneficial for patients with a tiny cavitory lesion, localized fibrosis, or a cavitory lesion that cannot be removed in the upper lobe of the lung or who are unable to have more comprehensive surgery. Once more, minimizing the risk of problems can be achieved through good pre-operative assessment, surgical technique, and post-operative care.

Key words: Lobectomy, pneumonectomy, segmentectomy, surgical treatment, tuberculosis, video-assisted thoracoscopic surgery

INTRODUCTION

India has the greatest tuberculosis (TB) load in the world, making TB a serious public health issue in that nation. The World Health Organization (WHO) estimates that in 2020, India had 2.6 million cases of TB or around 27% of the world's TB burden. When pharmacological therapy alone is ineffective or there is a chance of serious consequences, surgical treatment for TB is often reserved as a last option.^[1] In India, specialized facilities with the equipment and knowledge to handle these cases are where most surgical operations for TB are carried out. The lobectomy, pneumonectomy, and segmentectomy are the three surgical techniques used most frequently

in India to treat TB. As a less intrusive surgical alternative for TB, video-assisted thoracoscopic surgery (VATS) has gained popularity in recent years.^[2] Overall, depending on the number of patients requiring surgery and the accessibility of specialist institutes to offer these services, the number of surgical treatments for TB in India may change from year to year. To lessen the burden of TB and the requirement

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for surgical procedures,^[3] it is crucial to maintain efforts to expand TB control programs in India, particularly enhancing access to diagnosis and treatment.

SURGICAL TREATMENT IN TB

TB is a bacterial infection caused by *Mycobacterium tuberculosis* that primarily affects the lungs but can also affect other parts of the body. While medical treatment is the mainstay of TB management, surgical intervention may be necessary in certain cases.^[4] In this review, we will discuss the surgical treatment options for TB.

INDICATIONS FOR SURGERY

Surgical intervention may be considered in the following scenarios:

1. Drug-resistant TB: Surgery may be recommended when the TB bacteria are resistant to the standard anti-TB drugs
2. Complications of TB: TB can lead to complications such as bronchopleural fistula, empyema, and lung abscess, which may require surgical intervention.^[5]
3. Diagnostic uncertainty: In some cases, it may be difficult to establish a diagnosis of TB and a surgical biopsy may be required for confirmation
4. Massive hemoptysis: Hemoptysis, or coughing up blood, can be a life-threatening complication of TB, and surgery may be necessary to control the bleeding.^[6]

TYPES OF SURGICAL PROCEDURES IN TB

Lobectomy is a surgical procedure that involves the removal of one of the five lobes of the lung. In the context of TB, lobectomy is typically performed in cases where the disease is localized to one lobe of the lung and cannot be effectively treated with medication alone. Lobectomy is indicated for patients with TB who have a cavitory lesion >4 cm in size, persistent cough, fever, hemoptysis, bronchopleural fistula, or localized abscess formation. In addition, patients with lung damage caused by TB may also benefit from lobectomy.^[7] Pre-operative evaluation before undergoing lobectomy, patients undergo a thorough pre-operative evaluation to ensure that they are good candidates for surgery. This typically involves a chest X-ray, CT scan, pulmonary function tests, and other imaging studies as needed. Patients are also evaluated for comorbidities such as heart disease or diabetes that may increase the risk of complications during surgery. Surgical technique during the lobectomy procedure, the surgeon makes an incision in the chest and removes the affected lobe of the lung. The bronchus and blood vessels that supply the lobe are carefully dissected and divided, and the remaining

lung tissue is re-expanded. The incision is closed with sutures or staples, and a chest tube is inserted to drain any fluid or air that may accumulate in the chest cavity.^[8] Following lobectomy, patients require close monitoring in the post-operative period. Chest radiographs are obtained to ensure adequate lung expansion and to monitor for the development of any complications. Patients are also monitored for signs of infection, bleeding, or other complications. Pain management and respiratory therapy are provided to aid in recovery. The most common complications of lobectomy for TB include bleeding, infection, and air leaks. However, with proper pre-operative evaluation and management, these complications can be minimized and most patients can expect good outcomes. Lobectomy is a valuable option for patients with localized TB who do not respond to medical therapy or who develop complications. However, as with any surgical procedure, there are risks associated with lobectomy, and patients should be carefully evaluated to ensure that they are good candidates for surgery.

Pneumonectomy is a surgical procedure that involves the removal of the entire lung. It is typically reserved for cases of TB that cannot be effectively treated with medication alone and where the disease has spread to involve a large portion of the lung. Pneumonectomy is indicated for patients with TB who have large cavitory lesions, widespread lung damage, or significant involvement of the main bronchus. It may also be considered in cases where there are complications such as bronchopleural fistula, massive hemoptysis, or localized abscess formation.^[9] Before undergoing pneumonectomy, patients undergo a thorough evaluation for surgery. This typically involves a chest X-ray, CT scan, pulmonary function tests, and other imaging studies as needed. Patients are also evaluated for comorbidities such as heart disease or diabetes that may increase the risk of complications during surgery. Surgical technique during the pneumonectomy procedure, the surgeon makes an incision in the chest and removes the entire lung. The bronchus and blood vessels that supply the lung are carefully dissected and divided, and the remaining lung tissue is re-expanded. The incision is closed with sutures or staples, and a chest tube is inserted to drain any fluid or air that may accumulate in the chest cavity.^[8] Patients require close monitoring in the post-operative period. Chest radiographs are obtained to ensure adequate lung expansion and to monitor for the development of any complications. Patients are also monitored for signs of infection, bleeding, or other complications.^[10] Pain management and respiratory therapy are provided to aid in recovery. The most common complications of pneumonectomy for TB include bleeding, infection, and air leaks.^[11] In addition, patients who undergo pneumonectomy may experience shortness of breath or reduced exercise tolerance due to the loss of lung function. However, with proper pre-operative evaluation and management, these complications can be minimized. Pneumonectomy is a valuable option for patients with extensive TB who do not respond to medical therapy or who develop complications.

Segmentectomy, also known as partial lobectomy, is a surgical procedure that involves the removal of a segment of a lobe of the lung. In the context of TB, segmentectomy may be considered in cases where the disease is localized to a specific segment of the lung and cannot be effectively treated with medication alone. Segmentectomy may be indicated for patients with TB who have a small cavitory lesion, localized fibrosis, or a non-resectable cavitory lesion in the upper lobe of the lung.^[12] In addition, patients who are unable to undergo more extensive surgery, such as lobectomy or pneumonectomy, may benefit from segmentectomy.^[13] Before undergoing segmentectomy, patients are examined by chest X-ray, CT scan, pulmonary function tests, and other imaging studies as needed. Patients are also evaluated for comorbid condition to minimize complications during surgery. Surgical technique during the segmentectomy procedure, the surgeon makes an incision in the chest and removes the affected segment of the lung. The bronchus and blood vessels that supply the segment are carefully dissected and divided, and the remaining lung tissue is re-expanded. The incision is closed with sutures or staples, and a chest tube is inserted to drain any fluid or air that may accumulate in the chest cavity. After segmentectomy, patients require close monitoring in the post-operative period. Chest radiographs are obtained to ensure adequate lung expansion and to monitor for the development of any complications. Patients are also monitored for signs of infection, bleeding, or other complications. Pain management and respiratory therapy are provided to aid in recovery. The most common complications of segmentectomy are similar to other surgical procedures. However, with proper pre-operative evaluation and management, these complications can be minimized. Segmentectomy is a viable option for patients with localized TB who do not respond to medical therapy or who develop complications.

VATS is a minimally invasive surgical technique used in the treatment of TB that allows for visualization and access to the thoracic cavity using a camera and specialized instruments inserted through small incisions.^[14] VATS has been increasingly used in the management of TB due to its benefits over traditional open surgery, including less pain, shorter hospital stay, and quicker recovery. VATS may be indicated for patients with TB who have localized disease in the lung, pleura, or mediastinum. It is often used for diagnostic purposes, such as obtaining a lung biopsy to confirm the presence of TB or to identify drug-resistant strains of the bacteria. VATS may also be used for therapeutic purposes, such as removing localized lesions or abscesses that cannot be treated effectively with medication alone. Patients undergo a thorough pre-operative evaluation similar to other surgery. This typically involves a chest X-ray, CT scan, pulmonary function tests, and other imaging studies as needed. Patients are also evaluated for comorbidities that may increase the risk of complications during surgery.

Surgical technique during VATS, the surgeon makes several small incisions in the chest wall and inserts a camera and specialized instruments into the chest cavity. The camera provides a clear view of the affected area, and the instruments are used to remove any diseased tissue or perform other necessary procedures. VATS can be used for a variety of procedures, including biopsy, pleurodesis, lung resection, and abscess drainage. Patients require close monitoring in the post-operative period. Patients are also monitored for signs of infection, bleeding, or other complications. Pain management and respiratory therapy are provided to aid in recovery. The most common complications of VATS for TB include bleeding, infection, and air leaks. VATS is a minimally invasive surgical technique that can be used for both diagnostic and therapeutic purposes in the management of TB. With proper evaluation and management, most patients can expect good outcomes.

DISCUSSION

The life of a person after surgical treatment in TB

Life of a person depends on various factors such as the extent of the disease, the type of surgery performed, the person's overall health, and the effectiveness of the treatment. In general, after surgical treatment for TB, a person may experience some pain and discomfort for a few days or weeks.^[16] They may need to stay in the hospital for a few days or longer, depending on the type of surgery and their recovery progress. They may also need to take medications to manage pain and prevent infection. Once a person is discharged from the hospital, they will need to continue taking antibiotics as prescribed by their doctor. They will also need to follow-up with their doctor regularly for checkups and monitoring of their recovery. In some cases, a person may experience complications after surgery, such as bleeding, infection, or breathing problems. These complications can prolong the recovery process and may require additional medical interventions. After a person has recovered from surgery and completed their antibiotic treatment, they can resume their normal activities. However, they may need to make some lifestyle changes to prevent further infections, such as avoiding close contact with people who have TB and maintaining good hygiene practices. It is important to note that surgical treatment for TB is usually reserved for cases where medication alone is not effective or where there is a risk of severe complications. With proper treatment and care, many people can recover from TB and lead normal, healthy lives. One study shows that morbidity and mortality among PTB patients who underwent surgery in our setting were comparable with other study settings. It also shows that most surgery for PTB is indicated at a late, advanced stage of disease, as a last resort. Further studies should investigate the programmatic challenges of surgery for PTB in a nationally representative sample of patients and the effectiveness of elective PTB surgery in the treatment outcomes of multidrug-resistant (MDR)-TB in controlled

Table 1: Outcomes of surgical interventions in PTB patients in Mumbai, India, 2010–2014^[15]

| Characteristics | Patients (n=85) n (%) |
|------------------------|-----------------------|
| Surgery Complication | 17 (20.0) |
| Wound infection | 5 (29.4) |
| Bronchopleural fistula | 4 (23.5) |
| Bleeding | 2 (11.8) |
| Bronchoaspiration | 2 (11.8) |
| Myocardial infarction | 1 (5.9) |
| Not available | 3 (17.6) |
| Reoperations | 12 (14.1) |
| Thoracoplasty | 5 (41.7) |
| Wound debridement | 4 (33.3) |
| Thoracotomy | 3 (25.0) |
| Death | 5 (5.9) |

PTB: Pulmonary tuberculosis

trials [Table 1]. To improve access to surgical care for PTB, we need to detect MDR-TB early; expand access to TB culture and conventional or molecular DST, such as Xpert; increase awareness among physicians regarding the possibility of early referral for surgical evaluation for PTB; reduce the interval between hospital admission and surgery; and strengthen referrals and communications between the surgery department and the TB program, including data sharing.^[15]

CONCLUSION

When medication-only treatment for localized TB is ineffective, surgical intervention may be necessary. With the right pre-operative assessment, surgical technique, and post-operative care, patients can generally anticipate positive outcomes after lobectomy, pneumonectomy, segmentectomy, and VATS. Patients should, however, undergo a thorough evaluation to make sure they are suitable candidates for surgery and that the advantages of surgery outweigh the dangers. While a pneumonectomy removes the entire lung, a lobectomy only removes one lobe of the lung. Segmentectomy is a more cautious method that includes removing only the damaged portion of the lung. Using a few tiny incisions in the chest, VATS, a minimally invasive technique, enables the removal of diseased tissue. Compared to open surgery, this method is associated with less post-operative discomfort and a shorter hospital stay. To guarantee sufficient lung expansion following surgery and to keep an eye out for the emergence of any issues, post-operative chest radiographs should be taken. Furthermore, it is important to keep an eye out for any recurrence-related symptoms in the patients. Surgical treatment for TB is a viable alternative for patients who fail to respond to conventional therapy or who develop problems.

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