

Routine reinforcement of bronchial stump after lobectomy or pneumonectomy with pedicled pericardial flap (PPF)

Abstract

The results of 25 cases underwent a pedicled pericardial flap coverage for the bronchial stump after lobectomy or pneumonectomy were compared with those of 25 patients who received no coverage for the bronchial stump. Operative and perioperative complications were recorded, and patients were followed up for a mean of 30 ± 15 days.

The analysis revealed that the routine coverage of the bronchial stump with a pedicled pericardial flap was a highly efficacious method in reducing the incidence of bronchopleural fistula after lung resections.

Introduction:

Although bronchopleural fistula (BPF) is a rare problem, occurring in 2% of cases of lung resection (up to 10% after pneumonectomy), yet it is associated, when it occurs, with mortality ranging from 15% to 75%, significant morbidity, and increased hospital stay for those who survive.⁽¹⁻³⁾ It leads to a number of life-threatening situations, such as aspiration of infectious fluid from the pleural cavity, pneumonia of the remaining lung, and infection of the pleural cavity followed by empyema⁽⁴⁾.

Many factors have been implicated in the development of postresection bronchopleural fistula. Local factors such as empyema, pneumonia, and bronchiectasis impair wound healing and end up in fistula formation. Prolonged postoperative mechanical ventilation or systemic infection with adult respiratory distress syndrome, as well as steroids, malnutrition, and age over 60 years are other predisposing factors.⁽⁵⁾ Technical factors thought to be associated with the development of bronchopleural fistula include devitalization and devascularization by excessive peribronchial dissection, excessively tight closure, and long bronchial stump. There is controversy regarding the contribution of mediastinal node dissection and the difference between stapled and handsewn closure of the bronchus as risk factors^(6&7).

The usefulness of bronchial stump reinforcement with viable tissues after a lobectomy or pneumonectomy procedure has been well documented. Different biological materials such as pleura, intercostal muscle, pericardial fat pad, diaphragm, azygos vein in case of a right-sided pneumonectomy, and pericardiophrenic pedicles have been used for such a prophylactic coverage^(8&9).

The use of a flap of pericardium in thoracic surgery was first described as an alternative method to the pericardial fat graft by Brewer and associates⁽¹⁰⁾ as early as 1953. Anderson and Miller⁽⁸⁾ later on have used this technique in different clinical situations, such as repair of tracheoesophageal fistulas, sleeve lobectomies, tracheal anastomosis, and extended pneumonectomies.

Bronchial reinforcement has been strongly supported in high-risk patients such as patients with bronchogenic carcinoma especially before administration of neo-adjuvant therapy, diabetic patients and Patients with a highly morbid pathology, such as tuberculosis^(11&12). However, it is still unclear whether reinforcement of the bronchial stump should be performed as routine in every patient and whether that would be of particular value for prevention of bronchopleural fistula after lobectomy or pneumonectomy.

Patients and methods

The aim of this retrospective study was therefore to analyze the results of bronchial stump coverage with pedicled pericardial flap (PPF) for prevention of bronchopleural fistula.

To investigate the efficiency of bronchial stump coverage with pedicled pericardial flap (PPF), 43 patients were included in the study. These patients received either lobectomy or pneumonectomy in the period between January 2011 to September 2013 by the same team in different hospitals. We divided the patients into 2 groups: Group A consisting of 19 patients in whom the bronchial stump was covered with a pedicled pericardial flap and group B consisting of 24 patients in whom the bronchial stump was not covered with any tissues. Operative and perioperative complications were recorded, and patients were followed up for a mean of 2 ± 1.5 months.

In **Group A** (PPF-Group) 12 were males and 7 were females with a mean age of 54.5 years. Diabetes mellitus was present in 6 patients (31%). Lobectomy was done in 15 of these patients and pneumonectomy was done in 4 cases. Indications

for lobectomy or pneumonectomy were lung malignancies in 63.1 .2% and benign diseases (e.g. bronchiectasis) in 36.9 %.Of the malignancy patients, 9 cases (47%) received some form of additional therapy (irradiation or chemotherapy), either alone or in various combinations. See table (1)

ITEM	Group A (19)
Sex	12 males & 7 females
Age (mean)	54.5
Diabetes mellitus	6 (31%)
Operations	
Lobectomy	15 (78.9%)
Pneumonectomy	4 (21.1%)
Indikations	
Malignancies	12 (63.1%)
Benign diseases	7 (36.9%)
Additional therapy	9 (47%)

While in the other group 15 were males and 9 were females with a mean age of 52.8 years. Diabetes mellitus was present in 6 patients (25%). Indications for lobectomy or pneumonectomy were lung malignancies in 66.6 % and benign diseases (e.g. bronchiectasis) in 33.3 %.Of the malignancy patients, 8 cases (33.3%) received adjuvant therapy (irradiation or chemotherapy), either alone or in various combinations.

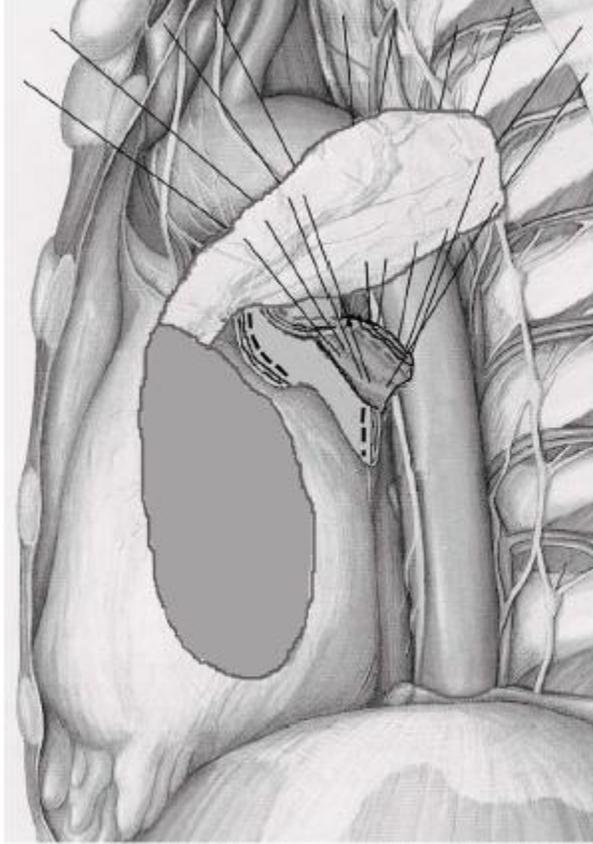
Tumor negativity of resection margins was ensured by histologic examination of all patients in both groups.

Surgical Technique

Closure of the bronchus: Bronchial stump closure was performed with simple interrupted sutures using non-absorbable sutures (Ethibond 3/0) in all patients, approximating the membranous and the cartilaginous portions of the bronchus. The bronchial stump was then checked for air leakage with 30 cm H₂O sustained airway pressure.

Coverage of the bronchus in Group A: A flap of the anterolateral pericardium, pedicled at its cranial , caudal or medial parts (according to the location of the stump) with or without inclusion of the phrenic vessels and measuring approximately 4-6 cm, was prepared. The flap was attached caplike over the bronchial stump with numerous simple stitches of 4/0 proline. (Fig1). In all

patients, the resulting defect in the pericardium was not reconstructed.



Results

In Group A (pedicled pericardial flap-Group), Perioperative mortality occurred only in one patient (5%) who died from pulmonary embolism on the 6th postoperative day. No case of bronchopleural fistula occurred during the entire outpatient follow-up period. Supraventricular tachyarrhythmia occurred in 2 patients (10%), and was successfully managed pharmacologically in both of them. In the other group, Perioperative mortality occurred in 4 patients (16.6%). In these patients, causes of death were: multiorgan failure due to sepsis in 2 patients (8%), tumor progression in one patient (4%), and other causes (renal) in one patient (4%). Bronchopleural fistula occurred in two patients in this group. It is worth noting that one of those 2 patients developed a BPF on the 10th postoperative period with 2ry hemorrhage after right upper lobectomy and was managed by 2ry suturing and re-enforcement of the bronchial stump with PPF. The other patient developed empyema after left pneumonectomy and fortunately responded successfully to chest tube drainage and vigorous parental antibiotic therapy.

Comment

A large number of publications have dealt with the problem of bronchial fistula after lobectomy or pneumonectomy, and many emphasized on the need for bronchial stump coverage especially in high risk patients⁽¹³⁾. Till recently (2012) we concentrated on adequate closure of the bronchial stump after pulmonary resections in all patients we operated, but with the increase of our personal experience with bronchopleural fistula after lobectomy or pneumonectomy we began to re-enforce the bronchial stump in all cases, as avoidance of this problem is always better than its treatment. Since then, our preferred technique for bronchial stump coverage has been the use of a pedicled pericardial flap, and the purpose of this paper is now to review the results achieved with the use of this particular technique.

Conclusion

According to our experience bronchial stump reinforcement should be routinely performed in all patients who are undergoing a lobectomy or pneumonectomy especially on the right side, as on the left side the bronchial stump is protected by the surrounding tissues and the neighboring aortic arch). This technique is proved to be feasible, safe and effective; also it does not increase operative time or surgical trauma.

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