Perioperative Pneumoperitoneum to Prevent Space and Air Leak after Lobectomy Operations

Alper Toker, MD; Şükrü Dilege, MD; Korkut Bostancı, MD; Göksel Kalaycı*, MD*
İstanbul University, Faculty of Medicine, Department of Thoracic and Cardiovascular Surgery
** İstanbul University, Faculty of Medicine, Department of Surgery.*

Abstract

In patients undergoing lung resections like lobectomy or bilobectomy, prolonged air leak is one of the major complications, which commonly exists with residual airspace.

We performed 48 lung cancer lobectomy in the first 6 months of 1998. Out of those 48 patients, 14 patients' remnant lungs failed to fill the hemithoracic cavity under 30 cm H2O pressure after resection. We applied perioperative pneumoperitoneum (pnp) to this subset of patients.

Patients were analysed retrospectively according to age, gender, preoperative Forced Expiratory Volume in one second, coexisting diseases, the length of chest tube drainage and reabsorbtion time of pneumoperitoneum. Surgical technique was described.

The mean Forced Expiratory Volume in one second of the patients was 2034 cc. The mean length of the tube drainage was 2,18 days.

Results showed that patients who had predisposing factors for prolonged air leak and air space did not have this complication, if the pneumoperitoneum procedure had been applied. The method seemed safe, cheap, effective and not time consuming.

Turkish Respiratory Journal, 2000;1:9-11

Key words: *Lobectomy, Air space, Pneumoperitoneum*

Introduction

Prolonged air leak which is almost always associated with residual pleural space, is one of the major morbid complications of pulmonary resections. The incidence of pleural space and air leak after lung resections changes with the underlying disease, nature of lung and the type of resection. Prolonged air leak is the result of raw parenchymal surfaces after lobectomy operations and with complete reexpansion of lung and obliteration of pleural space, leakage commonly stops in 2-3 days (1). The prevention of air leak begins in the operating room with meticulous surgical technique. Nature helps the residual lung to fill the pleural space by aproximating ribs of the operated side, by the shift of the mediastinum and by the elevation of the diaphragm unless each had been operated or fixed by other causes. The incidence of prolonged air leak is around 15,2% in large series (2). 10-30% of the lung resections were reported to develop a pleural space postoperatively. 80% of these were generally reabsorbed within 4 weeks, 90% of them would disappear within a year. 9% of them were recognized to persist for 1 to 10

Correspondence: *Dr Alper Toker,*
İnönü cad. Yıldız sok. STFA Blokları
B/6 blok No:13 Kozyatağı, 81090-İstanbul

E-mail: aetoker superonline.com

years and 5% of them were reported as becoming infected (3,4).

The aim of this study was to discuss the effects of perioperative pneumoperitoneum in the risk group patients for prolonged air leak and space.

Materials and Methods

Between January 1st 1998 and June 1st 1998 we had performed 48 lobectomy operations for lung cancer. Out of those 48 patients, 14 patients' remnant lungs had failed to fill the half of the hemitoracic cavity under 30 cm H_20 pressure before closure of thoracotomy. We applied perioperative pneumoperitoneum (pnp) to this subset of patients. The need for pnp procedure was decided by a single surgeon (GK). All patients were extubated in the operating room. None of them needed mechanical ventilation in the postoperative period. All patients received intensive pulmonary physiotherapy. Patients were recorded according to age, gender, coexisting diseases, preoperative forced expiratory volume in one second (FEV1), reabsorbtion time of the pneumoperitoneum, presence of residual air space in postoperative chest X-Rays and the length of chest tube drainage for air leak. Prolonged air leak was defined as the leakage of air following lobectomy operations that required drainage for more than 7 days. Bronchial closures were done manually in 6 patients and bronchial staplers were used in 8 patients. The parenchymal stapler device was not applied at fissure separation.

All patients had alveolar leakage under 30 cmH20 pressure and none had bronchial stump leakage. One purse string suture was inserted on the anterolateral part of the diaphragm. A stab wound was made on the diaphragm within the purse string suture, dilated and a 10 F feeding tube with a 3 way stopcock behind was inserted below the diaphragm. With the aid of a 50 ml syringe, 800 ml of air was given under the diaphragm. The feeding tube was drawn back and the suture was ligated.

Results

The mean age of the group was 61 years (48-82years). 2 of the patients were female (14.28%). Preoperative mean FEV1 of the group was 2034 cc (1250cc-2400cc). Coexisting diseases were: chronic obstructive pulmonary disease (COPD) in 5 (35.71%) patients, sequela of pulmonary tuberculosis 3 (21.4%) patients, myocardial infarction 2 (14.28%) patients, active tbc 1 (7.14%) patient and diabetes mellitus 1 (7.14%) patient. The types of resections were: left upper lobectomy: 3 patients, left lower lobectomy: 4 patients, right upper lobectomy: 2 patients, right lower lobectomy: 3 patients, right lower bilobectomy: 2 patients. The mean length of the air leak was 2.18 days (12 hours - 4 days). The mean reabsorbtion time of the pneumoperitoneum was noticed to be 24 days (17 - 48 day). None of the patients were observed as having residual air space in their postoperative chest X-Rays. No postoperative complication occured.

Discussion

Air leaks and bronchopleural fistulas are different entities. Most air leaks are the result of inadequate or failed closure of distal bronchioles or alveoler spaces which almost cause no mortality but significant morbidity in a group of patients with abnormal compliance of the residual lung (2). Deslauriers (5) reported the value of the postoperative pneumoperitoneum to reduce the volume of the ipsilateral hemithorax, if a basiliar space was anticipated. Perioperative pneumoperitoneum after lung resections had been considered in the past and postoperatively after lung volume reduction operations recently (2,5,6). Extent of resection, abnormal compliance of the residual lung, underlying parenchymal diseases such as pulmonary fibrosis or emphysema would cause residual space problem. In addition, prior mediastinal radiation or prior surgery could predispose to space problem. Other factors included segmental bare surfaces, incomplete fissures and persistent air leaks. So we believe patients who were candidates for space problem could be identified during operation. If the patient's remnant lung had failed to fill the half of the hemitoracic cavity under 30 cmH_20 pressure before closure of thoracotomy, we applied perioperative pneumoperitoneum (pnp) to him/her. Of course this procedure could be done after lower lobectomies postoperatively on day 3-4. Lately, this percutaneous method has been presented by Carbognani (7) . And some other authors agreed on the effectiveness of the postoperative pneumoperitoneum for air leak treatment (8). We believed this procedure should be applied as soon as the surgeon noticed the patient was going towards prolonged air leak because the residual lung could form tight adhesiveness with thoracic wall and pnp would not help the remnant lung to move towards apex and apical leaks would continue. The advantage of perioperative pnp over postoperative pnp was the lung being free without any adhesiveness and the

diaphragm could push the lung towards the apex and postoperative pleurodesis occurs. We brought another concept into discussion by presenting our 14 presumed air space and air leak patients and defining them perioperatively and applying preventive measurement of intraoperative pnp. We noticed **1**: A shorter period of air leak than expected, **2**: No respiratory problem related to the procedure was noticed, **3**: Mean reabsorbtion time due to chest X ray was 3,5 weeks, **4**: The technique we described above was safe, cheap, effective and not time consuming, **5**: No pain related to the procedure was presented, **6**: A lesser amount of air was needed when compared to percutaneous methods. For the reasons described above we believe in the positive effect of perioperative pneumoperitoneum on decreasing prolonged air leak and postoperative space problem. As it can be noticed, the pnp group's mean FEV1 seemed to be lesser than the general thoracic surgery population, the mean length of air leaks in pnp group was in a normal range although the underlying lung of the population was worse than in common thoracic surgical patients. These findings were uneventful for such a subset of patients. Although there was not a control group for this study, it was known that; the incidence of prolonged air leak is around 15,2% in large series and 10-30% of the lung resections were reported to develop a pleural space postoperatively (2,3).

The other procedures offered to decrease the incidence of the prolonged air leak were: application of fibrin glue, the laser, pleural tent (2,9,10,11). In upper lobectomy or bilobectomy patients, it was reported that prolonged air leak was a major determinant of morbidity and hospital stay (12). From this study it was understood that the creation of a pleural tent at the time of upper lobectomy appears to significantly reduce chest tube time and shorten hospital stay (12). It was another offered procedure to reduce space problem. Some other methods like thoracoplasty, phrenic crush and diaphragmatic repositioning have not been considered in this paper. Postoperative measurements like medical support, changing the pressure applied to suction tubes, chemical pleuredesis, repositioning of the chest tube should always be considered for treatment of air leaks without pleural space. Thoracoscopic surgical treatment of secondary pneumothorax was reported to be less effective than that of primary pneumothorax. But videothoracoscopy could be applied for fibrin glue application, stapling of the residual air leak and decortication of any trapped lung (13).

As a result, all of the patients in the presumed prolonged air leak group did not face the morbid complication. And they did not need to have another surgical procedure for correction of the air leak problem. We believe this historical procedure could find a place in modern thoracic surgery.

References

1. Shields TW. General features and complications of pulmonary resections. Persistant air leak. In:Shields TW, Ed. General Thoracic Surgery, 4th ed Baltimore: Williams and Wilkins;1994, p. 406-7.
2. Rice TW, Kirby TJ. Prolonged air leak. Chest Surg Clin North Am 1992;2:803-11.
3. Silver AW, Espinas EE, Byron F. The fate of postresection space. Ann Thorac Surg 1966;2:311-26.
4. Barker WL, Iangston HT, Naffah P. Postresection thoracic spaces. Ann Thorac Surg 1966;2:299-310.
5. Deslauriers J. Indication for completion pneumonectomy. Ann Thorac Surg 1988;46:133-9.
6. Handy JR , Judson MA, Zellner JL. Pneumoperitoneum to treat air leaks and spaces after lung volume reduction operations. Ann Thorac Surg 1997; 64: 1803-5.
7. Carbognani P, Spaggiani L, Solli P, Rusca M. Pneumoperitoneum for prolonged air leaks after lower lobectomies. Ann Thorac Surg. 1998; 66: 600-12.
8. Hardy JR. To the editor. Ann Thorac Surg. 1998; 66: 600-12.
9. Fleisher AG, Evans KG, Nelems B. Effect of routine fibrin glue use on the duration of air leaks after lobectomy. Ann Thorac Surg 1990;49:133-7.
10. Lo Cicero J III, Hartz RS, Frederickson JW, et al. New applications of laser in pulmonary surgery: Hemostasis and sealing of air leaks. Ann Thorac Surg 1985;40: 546-53.
11. Miscall L, Duffy RW, Nolan RB, et al. Pleural tent as a simultaneous tailoring procedure in combination with pulmonary resections. Am Rev Tuber 1956;73:831-9.
12. Robinson LA, Preksto D. Pleural tenting during upper lobectomy decreases chest tube time and hospitalization days. J Thorac Cardiovasc Surg 1998;116:371-2.
13. Daniel MT, Wyatt DA. Pneumothorax and bullous diseases. In: Kaiser RL, Daniel MT Eds.Thoracoscopic Surgery. Library of Congress Catologing-in-Publication Data; 1993, p.85-96.