



# Surgical management of upper- and lower-lobe bronchiectasis without middle lobe involvement: is middle lobectomy necessary?

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**Abstract** Postoperative quality of life is a crucial factor in decisions regarding surgical management of bronchiectasis. The goal of surgical treatment in such cases is to eradicate diseased portions of lung while preserving as much healthy lung parenchyma as possible. The volume of remaining lung must be sufficient to fill the pleural space. In patients with bronchiectasis, it is extremely unusual to have upper- and lower-lobe involvement without middle lobe involvement. A normal-sized middle lobe alone is usually not adequate to fill the right hemithorax. When the disease involves both the upper and lower lung lobes, surgeons must assess whether pneumonectomy is required. Herein, we describe the case of a patient with bronchiectasis who was successfully treated with upper and lower lobectomy and preservation of the middle lobe.

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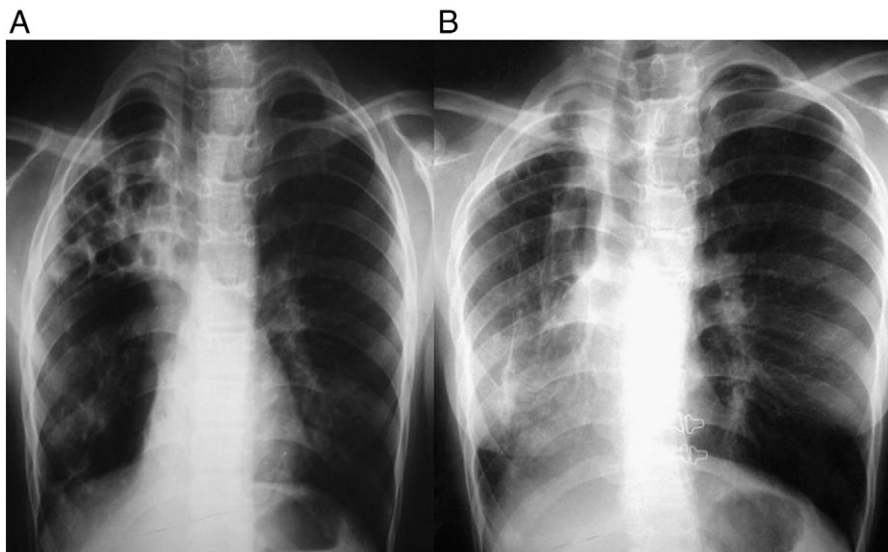
Postoperative quality of life is a crucial factor in decisions regarding surgical management of bronchiectasis. The goal of surgical treatment in such cases is to eradicate diseased portions of lung while preserving as much healthy lung parenchyma as possible. The volume of remaining lung must be sufficient to fill the pleural space. In patients with bronchiectasis, it is extremely unusual to have upper- and lower-lobe involvement without middle lobe involvement. A normal-sized middle lobe alone is usually not adequate to fill the right hemithorax. When the disease involves both the upper and lower lung lobes, surgeons must assess whether pneumonectomy is required. Herein, we describe the case of a patient with bronchiectasis who was successfully treated with upper and lower lobectomy, and preservation of the middle lobe.

## 1. Case report

A 13-year-old girl presented with hemoptysis. She exhibited growth-developmental retardation and had significant recurrent lung infections and productive cough for 5 years. On physical examination, auscultation of the right chest revealed bronchial breath sounds as well as diffuse rhonchi and crackles over the entire right lung field. Results of routine laboratory tests were normal. A chest radiograph showed cystic changes in the upper portion of the right lung (Fig. 1A). Chest computed tomography (CT) revealed cystic bronchiectasis in the right upper lung lobe and atelectasis in the right lower lung lobe (Fig. 2A). Bronchoscopic findings were normal. Pulmonary function tests were not obtained because the patient was uncooperative during testing. The patient was treated with a 10-day course of antibiotic therapy and chest physiotherapy. She underwent right posterolateral thoracotomy at which time her middle lung lobe was

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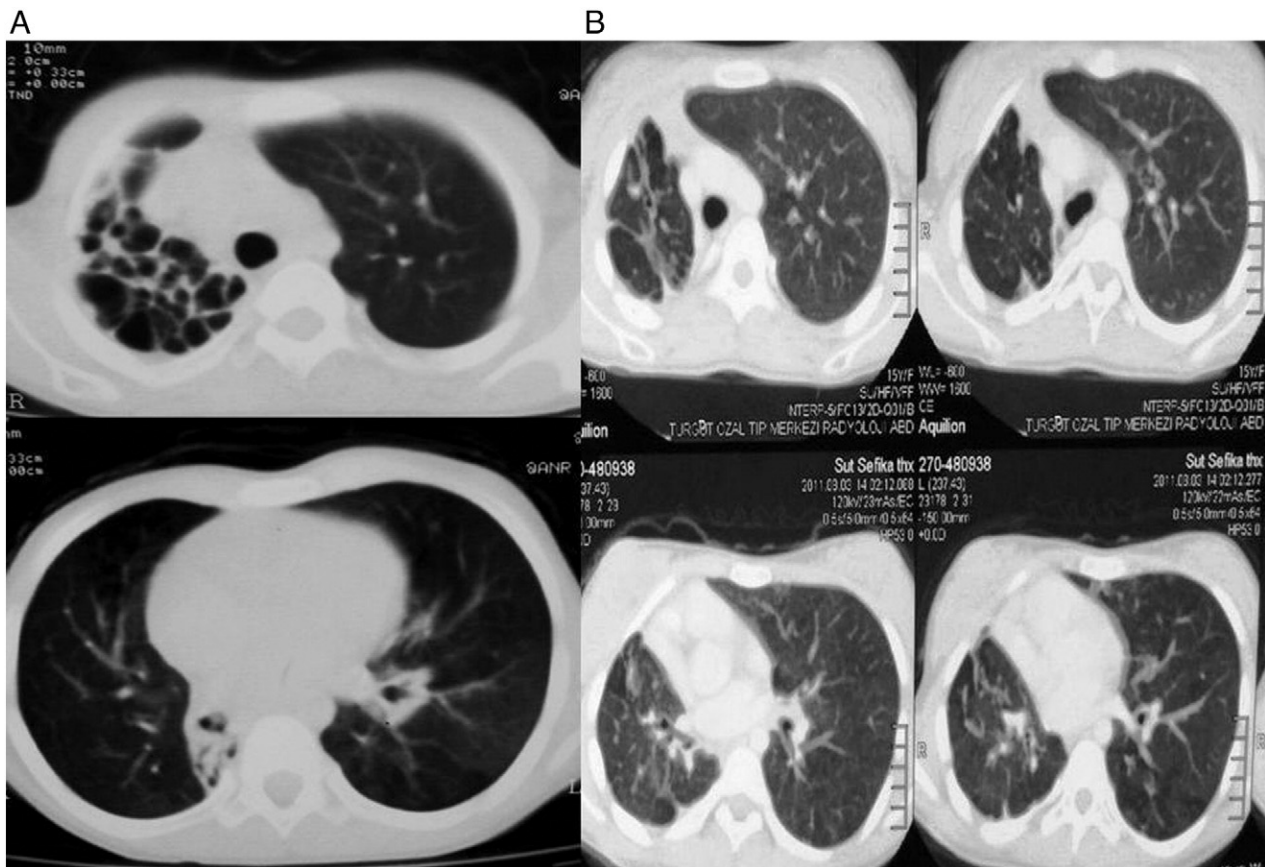
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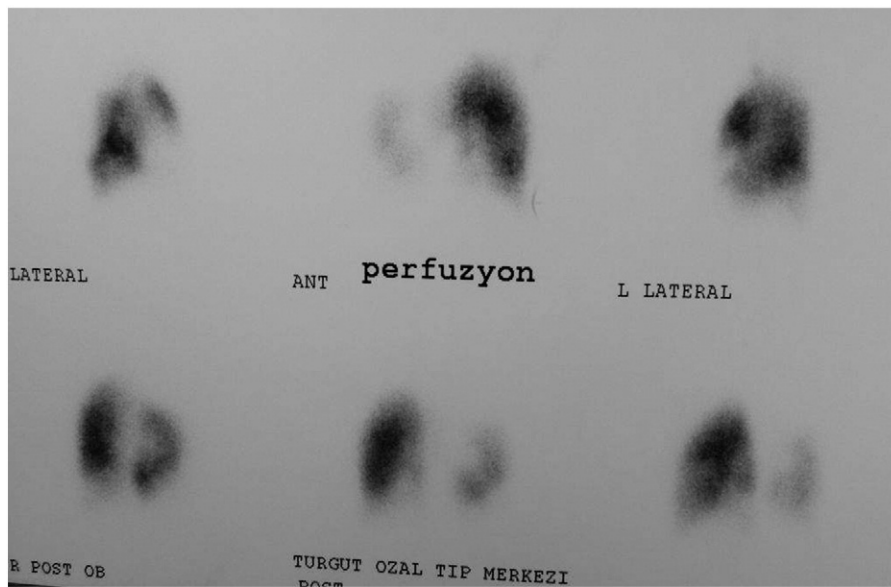
**Fig. 1** A, Cystic bronchiectatic changes in the upper portion of the right lung and volume loss in the right hemithorax. B, A follow-up x-ray 24 months after surgery showed that the middle lobe occupied the right hemithorax.

assessed as having adequate volume to fill the right pleural space. With this confirmed, we performed right upper and lower lobectomies and preserved her middle lobe. Combined

sharp and blunt dissection along the interlobar plane were performed to separate the lobes. We avoided using a stapling device because this might have limited expansion of the



**Fig. 2** A, Chest CT revealed (a) cystic bronchiectasis in the right upper lung lobe and (b) bronchiectatic shrunken right lower lung lobe. B, A follow-up chest CT 24 months after surgery showed that the middle lobe occupied the right hemithorax, and there was minimal mediastinal shift.



**Fig. 3** Perfusion scintigraphy showed that the preserved middle lobe was performing 21% of the patient's total residual respiratory function.

middle lobe. After dividing the arteries and veins of the upper and lower lobe, the bronchi of the upper and lower lobe were transected, leaving a stump of sufficient length to achieve closure without impinging on the middle lobe bronchus. The bronchus stump was closed manually using 3/0 polyester sutures. Just before chest closure, the remaining lung tissue was inflated and inspected to ensure correct anatomical position without torsion. No further manipulation to avoid torsion was performed, anticipating that scarring would prevent this from occurring. Histopathologic examination of the resected lung showed bronchiectasis and chronic inflammation in the lower lung lobe and bronchiectasis and honeycomb formation in the upper lobe.

The patient's postoperative course was complicated by retention of bronchial mucus, and her chest radiograph showed complete consolidation of the right hemithorax. This was managed by repeated therapeutic bronchoscopy on the second, fourth, fifth, and seventh postoperative days. She was discharged in good health on postoperative day 20. A follow-up chest radiograph and CT 24 months after surgery showed that the middle lobe filled the right hemithorax and that there was minimal mediastinal shift (Figs. 1B and 2B). At this time, the patient had no respiratory symptoms, and her postoperative Forced Vital Capacity (FVC) and Forced Expiratory Volume in the first second (FEV1) were 1550 and 1400 mL, respectively. Perfusion scintigraphy showed that the preserved middle lobe was performing 21% of the patient's total residual respiratory function (Fig. 3).

## 2. Discussion

The aim of surgical intervention in cases of severe bronchiectasis is to improve quality of life and treat complications such as empyema, recurrent hemoptysis, and lung abscess. In children, growth retardation caused by

chronic pulmonary infection should also be considered an indication for operation [1]. The principal goal of surgical resection in these cases is to excise all bronchiectatic segments while preserving healthy lung parenchyma. After resection, the lung tissue that remains must be sufficient to fill the pleural space. In patients who undergo lower and middle lobectomy of the right lung or lower lobectomy and lingulectomy of the left lung, usually 2 or 3 preserved segments are adequate to fill the hemithorax; however, typically, the pleural space is not filled by expansion of a normal-sized middle lung lobe alone. The insufficient size of the remaining middle lobe may result in residual space problems (such as continued air leakage, prolonged fluid drainage, empyema) and also predisposes the remaining lobe to undergo torsion. In the postoperative period, we focused on the possibility that lobar torsion might occur, and the patient was monitored by paying close attention to any change in clinical symptoms and findings noted on chest radiographs regarding this potential complication.

The middle lung lobe is the lobe that most commonly undergoes torsion because it is more mobile than the other lobes and more likely to twist on its narrow and slender pedicle, as noted in a survey by Wong and Goldstraw [2]. In a 7-case series of torsion of a residual lung lobe after pulmonary resection, postoperative radiographs showed pulmonary infiltration and volume loss in 5 cases and opacification of the lobe in 2 cases [3]. Atelectasis is the most likely etiology of these radiographic findings, as was the situation in our patient. However, in contrast to outcomes with atelectasis, tracheobronchial suctioning will not resolve the opacity that typifies radiographs of a torsed lung. In cases of middle lobe torsion, bronchoscopy may identify a distorted, narrowed, or compressed airway orifice. When torsion of the lobe is suggested by the clinical, radiographic, and bronchoscopic findings, immediate reoperation is

indicated. If lobar torsion is recognized early, before infarction occurs, the lobe can be stabilized in its proper position [4]. However, if the lobe is not viable, the problem may be successfully managed with lobar resection or complete pneumonectomy [3,4].

It has been suggested that children tolerate pneumonectomy well and experience less functional disability than adults [1,5]. It is important, however, to recognize that even in childhood, pneumonectomy has a larger negative impact on physical aspects of health-related quality of life than a lobectomy [6]. The major complications after pneumonectomy in children are similar to those that occur in adults [5]. Preserving the middle lung lobe contributes substantially to postoperative respiratory function and avoids the complications of pneumonectomy. A 30-year follow-up study of children and adolescents revealed that, after lung resection in childhood, compensatory growth occurs as bronchopulmonary development continues [7]. Therefore, it should be kept in mind that compared with adults, in children, the pleural space previously occupied by resected portions of lung is more likely to be filled by healthy middle-lobe segments.

Odell and Crause [8] described 2 patients similar to our case who were successfully treated with upper and lower lobectomy for bronchiectasis preserving the middle lobe. They suggested that, in carefully selected cases, it is possible to preserve a normal middle lobe when the right upper and lower lobes are bronchiectatic and atelectatic [8]. Otgün et al [1] also described that a patient with bronchiectasis was similarly treated with upper and lower bilobectomy sparing the middle lobe. In a more recently reported case, a patient who had lung cancer was initially treated with right upper lobectomy but later required removal of the right lower lobe as well [9]. The patient's right middle lung lobe was

preserved, and the authors speculated that emphysematous changes in the middle lobe might decrease volume mismatch between the middle lobe and the thoracic cavity [9].

In select cases, the middle lung lobe can be preserved when right upper and lower lobectomies are necessary. Children have the potential for compensatory growth of the remaining lung tissue, and this can help fill the pleural space. It is important to consider preserving the middle lobe whenever possible because, as compared with pneumonectomy, this option offers advantages of residual respiratory function and better quality of life.

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