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Concurrent tracheobronchoplasty and bilateral lung transplant for obstructive lung disease

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Key words: lung transplant, tracheobronchomalacia, tracheobronchoplasty, mesh, airway.

Abbreviations:
COPD, chronic obstructive pulmonary disease
CT, computed tomography
TBM, tracheobronchomalacia
TBP, tracheobronchoplasty
PDS, polydioxanone
Central Message: Tracheobronchoplasty at the time of lung transplantation is technically feasible. Tracheobronchomalacia is not an absolute contraindication for lung transplantation.

Central Picture: Completed mesh tracheobronchoplasty of the trachea and right and left mainstem airways.
A 70-year-old male with oxygen-dependent chronic obstructive pulmonary disease (COPD) presented to our lung transplant clinic with progressive dyspnea and chronic cough. A computed tomography (CT) demonstrated partial collapse of the right upper lobe prompting awake bronchoscopy. The cartilaginous trachea was found to be malacic with a redundant membranous portion. During expiration, there was near complete collapse of the trachea and bilateral mainstem airways, establishing the diagnosis of tracheobronchomalacia (TBM) (Figure 1A). The patient was deemed a candidate for transplantation, however, given that unrepaired TBM would result in outflow obstruction of the implanted allografts, the patient was listed for bilateral lung transplantation with concurrent tracheobronchoplasty (TBP). IRB approval was not required; patient gave informed consent for publication of this case report.

After acceptance of suitable allografts, we first performed a polypropylene mesh TBP via a right posterolateral muscle-sparing 4\textsuperscript{th} interspace thoracotomy (Figure 2). The azygous vein was divided and the posterior mediastinal pleura was dissected to expose the trachea from the thoracic inlet to the distal bilateral mainstem airways. Dissection lateral to the airway was limited to avoid devascularization. The airway was measured and the mesh downsized to restore the coronal diameter. Two separate mesh segments were utilized; one that was placed along the entire length of the intrathoracic trachea and carried down the right mainstem airway, and a separate segment that stabilized the left mainstem airway. The mesh was secured to the cartilaginous membranous junction and carina with interrupted prolene sutures. The posterior membranous portion of the airway was plicated with a series of partial-thickness prolene sutures affixed to the mesh. After TBM repair, the right pneumonectomy and lung implantation was performed via the thoracotomy access. The bronchial anastomosis was completed in a running fashion with polydioxanone (PDS) suture just distal to the end of the right mainstem mesh. Once
completed, the thoracotomy was closed, the patient positioned supine, and the left
pneumonectomy and implantation was completed in a similar fashion via a left anterolateral
thoracotomy. The patient was extubated on postoperative day one, transitioned to room air by
day two, and discharged on day 13 after a non-complicated hospital course. One month after
surgery, bronchoscopy revealed a widely patent trachea (Figure 1B) and mainstem airways
without expiratory collapse, and patent, well-healing, bilateral bronchial anastomoses. These
findings were redemonstrated on bronchoscopy one-year after transplantation. Notably, there
was no stenosis at the anastomoses and no regions of mesh erosion.

Tracheobroncomalacia is a dynamic collapse of the trachea and mainstem bronchi during
exhalation attributed to a combination of weakened cartilage and tissue redundancy. The
technique of TBP with mesh reinforcement has been shown to effective method of treatment in
select patients [1, 2]. In patients with end-stage COPD and TBM, lung transplantation may be
deemed prohibitive given that dynamic obstruction remains proximal to the implanted allografts.
To our knowledge, this is the first report of concomitant TBP performed at the time of lung
transplantation. We conjecture that concomitant severe TBM at the time of lung transplantation
is rare, and that previously, these patients were not listed. Equally, it is likely that a number of
patients with mild-to-moderate disease have been transplanted without TBP. In this report, we
performed TBP due to severity of the patient’s TBM and given the potential added morbidity,
would only consider this procedure for end-stage disease. While concurrent TBP at the time of
lung transplantation increases operative complexity and duration, it is technically feasible, and in
this case, provided an excellent clinical result. While further surgical experience is warranted and
patient selection requires a thoughtful assessment, TBM is not an absolute contraindication for
lung transplantation.
References:


Figure Legend

Figure 1: Bronchoscopic images of the trachea pre (A) and post (B) tracheobronchoplasty.

Figure 2: Intraoperative view of the completed tracheobronchoplasty of the trachea and right and left mainstem airways.