ROBOTIC TRACHEOBRONCHOPLASTY PERFORMED FOR POST-PNEUMONECTOMY TRACHEOBRONCHOMALACIA-INDUCED COUGH

A reproducible operative roadmap for single-lung tracheobronchomalacia

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WHY THIS CASE

- Severe dynamic airway collapse approximately 8 months status post right pneumonectomy.
- Severe dynamic collapse of the trachea and left main bronchus on bronchoscopy
- No extrinsic compression.
- Refractory to maximal medical therapy.

PRACTICE GAP

Post-resection cough is routinely attributed to reflux, asthma, or infection.
Severe TBM after pneumonectomy is rare, underrecognized, and treatable.

DIAGNOSTIC PATHWAY

Refractory cough / dyspnea after pneumonectomy

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Dynamic Expiratory CT Chest + Flexible Bronchoscopy

↓

Severe dynamic collapse · Exclude extrinsic compression & competing etiologies

↓

Robotic tracheobronchoplasty

Dynamic expiratory CT ≥50% caliber loss = TBM · Flexible bronchoscopy with forced expiration = diagnostic gold standard · Severe = high-grade collapse (≥75%)

ROBOTIC OPERATIVE ROADMAP

1 REOPERATIVE ACCESS
Right chest: 4 robotic ports (4th–10th ICS) + assistant port at the 10th ICS

2 ADHESIOLYSIS & EXPOSURE
Open scar capsule. Intrathoracic trachea → Carina.

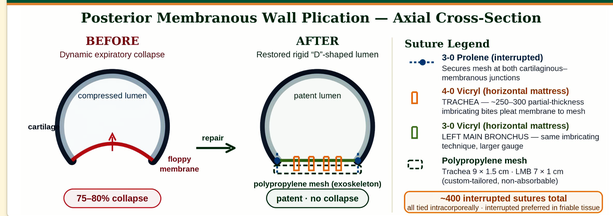
3 ESOPHAGEAL MOBILIZATION
Loop esophagus on a Penrose and retract off the trachea.

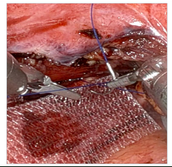
4 TRACHEAL MESH PLICATION
Tailored mesh + partial-thickness mattress sutures.

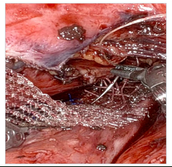
5 LEFT MAIN BRONCHUS & CARINAL BRIDGE
Second mesh to LMB. Bridge the carina by extending the mesh over the short right main bronchial stump.

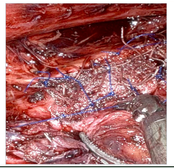
6 COMPLETION BRONCHOSCOPY
Patent · No collapse · No full-thickness suture.

AIRWAY RECONSTRUCTION









Fundamental principle: tack the redundant posterior membrane out of the lumen, using the mesh as an exoskeleton
Partial-thickness bites strengthen the wall without penetrating the mucosa · mesh width ≈ native membranous span to avoid luminal stenosis

MESH RECONSTRUCTION

Membranous wall splinted with tailored polypropylene mesh from thoracic inlet to distal left main bronchus (LMB). Around 400 interrupted sutures tied intracorporeally.

- **Trachea (9 × 1.5 cm):** interrupted 3-0 Prolene along the cartilaginous-membranous junction. 250–300 partial-thickness 4-0 Vicryl horizontal-mattress bites imbricate the redundant membrane to the mesh. Mesh bridged across the carina over the right bronchial stump.
- **LMB (7 × 1 cm):** interrupted 3-0 Prolene margins and interrupted 3-0 Vicryl horizontal-mattress imbricating sutures.

TECHNICAL PEARLS

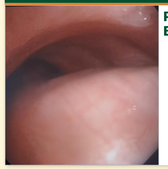
Airway plan: advance the single-lumen ETT cuff distal to the planned repair.
Reoperative entry: open the scar capsule deliberately.
Esophageal loop early: with a Penrose through a separate stab incision for hands-free posterior airway exposure and orientation.
Mesh sizing: match the span. Never oversize.
Friable membrane: favor interrupted over running sutures in steroid-weakened, friable tissue. Take partial-thickness imbricating bites.
Verify: completion bronchoscopy is mandatory.

TAKE HOME To the best of our knowledge, this is the first successful case of a robotically performed tracheobronchoplasty following right pneumonectomy for a chief complaint of recalcitrant cough. Tracheobronchomalacia belongs in the differential for any post-resection patient with unexplained recalcitrant cough. A minimally invasive robotic approach enables precise dissection and extensive posterior airway reconstruction in extreme reoperative anatomy with durable symptomatic and anatomic improvement at eight months.

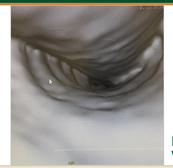
CLINICAL COURSE

1. **Right pneumonectomy** — *Apr 2024 · Dr. Sylvin*
2. **Recalcitrant cough & dyspnea** — *+ 8 months*
3. **Dynamic CT & Flexible bronchoscopy** — *Severe symptomatic TBM*
4. **Robotic tracheobronchoplasty** — *Feb 2025 · Dr. Dylewski · da Vinci Xi. OR 7 hours. EBL 200 cc. Extubated in OR. No intraop complications*
5. **POD 1 Uneventful · POD 2 Discharged home** — *Chest tube out POD 1, unremarkable CXR. Alert and ambulating*
6. **8-Month Follow-up · Symptoms improved, stable repair** — *Dynamic CT: stable repair · No collapse, stenosis, or recurrence*

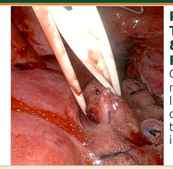
INTRAOPERATIVE HIGHLIGHTS



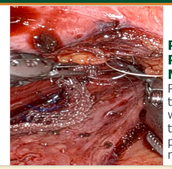
PREOP BRONCHOSCOPY



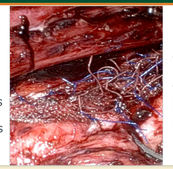
PREOP VIRTUAL CT



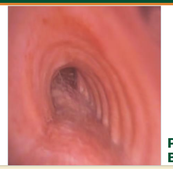
POSTERIOR TRACHEA EXPOSED & ESOPHAGEAL RETRACTION
Circumferential tracheal mobilization: esophagus looped with a Penrose drain exteriorized through a separate stab incision.



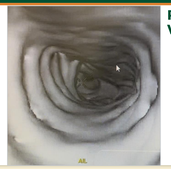
POSTERIOR MESH PLICATION ON MEMBRANOUS WALL
Polypropylene mesh secured to the posterior membranous wall. Interrupted partial-thickness imbricating sutures pleating the redundant membrane.



IMBRICATING MATTRESS BITE
3-0 Prolene (blue) along the cartilaginous-membranous junction and 4-0 Vicryl (white) horizontal-mattress bites imbricate the redundant membrane to the mesh



POSTOP BRONCHOSCOPY



POSTOP VIRTUAL CT

SCAN FOR MORE

ABSTRACT

BACKGROUND. Tracheobronchomalacia is an uncommon but debilitating cause of dynamic airway obstruction. Symptoms can include cough, wheezing, and dyspnea, and the condition is often underreported, especially after lung resection. Surgical tracheobronchoplasty is a complex airway operation and the robotic approach has gained popularity in recent years.

METHODS. A 75-year-old woman developed progressive dyspnea, cough, and expiratory airway collapse eight months after right pneumonectomy. Extensive workup for post-pneumonectomy cough was pursued. Dynamic CT imaging and bronchoscopy demonstrated severe tracheobronchomalacia with dynamic collapse of the intrathoracic trachea and left main bronchus without extrinsic compression. After failure of conservative management, robotic tracheobronchoplasty was performed through a reoperative thoracic approach. The posterior membranous airway was reinforced from the thoracic inlet to the distal left main bronchus using tailored mesh and extensive interrupted suturing to restore airway rigidity while preserving luminal diameter. Intraoperative bronchoscopy confirmed airway patency.

RESULTS. Robotic dissection and reconstruction were completed successfully in a right post-pneumonectomy chest without intraoperative complications. The patient was extubated in the operating room and had an uncomplicated index hospitalization. At eight-month follow-up, the patient reported marked improvement in dyspnea, exercise tolerance, and quality of life with marked improvement in cough. Interval dynamic CT imaging and bronchoscopy demonstrated a stable airway without dynamic collapse or stenosis.

CONCLUSIONS. This case demonstrates the feasibility of robotic tracheobronchoplasty for severe tracheobronchomalacia in a right post-pneumonectomy patient. A minimally invasive robotic approach allowed precise dissection and extensive airway reconstruction in a complex reoperative setting, resulting in durable symptomatic and anatomic improvement. Tracheobronchomalacia should be considered as an etiology for recalcitrant cough after lung resection. Robotic tracheobronchoplasty following lung resection, even pneumonectomy, can safely be performed with excellent results.

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DISCLOSURES

No financial relationships or commercial support. Generic device only; no brand promotion.
Off-label use of polypropylene mesh for tracheobronchial splinting.
All operative images and video footage are original, de-identified, and used with appropriate permission for educational presentation

Abstract