2021 Abstracts
American Association for Bronchology and Interventional Pulmonology

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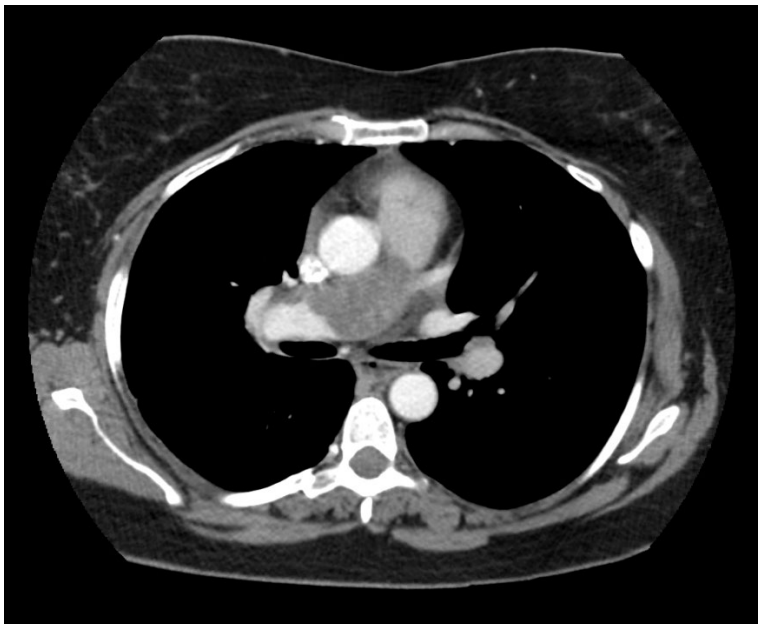
A case of misdiagnosed chronic thromboembolicpulmonary hypertension

Stephanie Baltaji, MD, Ahmed Virani, MD, Sohini Ghosh, MD

Intimal sarcoma arising from pulmonary artery (ISPA) is a rare cancer with high mortality[1]. Patients are often misdiagnosed at initial presentation[2]. We present a case of ISPA mimicking a pulmonary embolism (PE).

A 60-year-old female presented to clinic with an abnormal Computed Tomography (CT) of the chest suspicious for malignancy. Patient first had chest imaging one year prior when presenting with chest pain after a plane ride. She was diagnosed with an acute PE and remained on anticoagulation for a year. Hypercoagulable work up was negative and echocardiogram was unremarkable. After discontinuing rivaroxaban, she experienced worsening exercise tolerance. Repeat CT chest showed a soft tissue density in the mediastinum with narrowing of the pulmonary artery (PA), concerning for a neoplastic process prompting a pulmonary evaluation. Positron emission tomography scan was unremarkable and a perfusion scan showed non visualization of the entire right lung except the apex. Pulmonary angiogram had significant clot burden in the rightmain PA with no perfusion the right mid and lower lobes. All findings were consistent with chronic thromboembolic pulmonary hypertension (CTEPH). She was referred for pulmonary thromboendarterectomy. Intra-operatively she was found to have tumor between the right PA and left atrium, extending to the left PA. She underwent a pulmonary endarterectomy with tumor resection. Pathology showed a high grade intimalsarcoma.

ISPA is an uncommon mesenchymal cancer with an incidence of 0.001-0.03%[1]. Only a few hundred cases are reported[2]. Age at diagnosis ranges from 13 to 86 years[1]. Patients are often misdiagnosed with acute PE or CTEPH. The absence of clinical or radiologic improvement with anticoagulation are key diagnostic clues. Surgery remains the mainstay of treatment. The estimated survival without resection is 1.5 months and increases to 10 months after surgical intervention[3]. The role of chemotherapy and radiation remain unclear.



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A Case of Severe Pulmonary Alveolar Proteinosis Stabilized on Rituximab and GM-CSF Replacement Therapy

Anand Shah[1], Edward Pickering[1], Van K Holden[1], Faria Nasim[1], Nancy Hardy[1], Bruce Trapnell[2], Ashutosh Sachdeva[1]

[1]University of Maryland School of Medicine
[2]University of Cincinnati College of Medicine

Introduction: Pulmonary alveolar proteinosis (PAP) is characterized by the accumulation of periodic acid-Schiff positive lipoproteins in distal airspaces and alveoli with minimal inflammation and preservation of lung architecture. This results from abnormalities in surfactant production and clearance by alveolar macrophages. PAP is classified as autoimmune, hereditary, secondary, or congenital. Autoimmune PAP, which accounts for the majority of adult cases, is due to anti-GM-CSF antibodies preventing macrophage maturation. Diagnosis of autoimmune PAP is made by detection of anti-GM-CSF antibodies in blood, in combination with bronchoscopy findings. Whole lung lavage (WLL) is first-line therapy for patients with moderateto severe symptomatic PAP. Other treatment options include inhaled or subcutaneous GM-CSF, rituximab, or plasmapheresis.

Case Summary: A 34-year-old male presented for evaluation of dyspnea in 2014 and was treated for potential hypersensitivity pneumonitis without improvement. He underwent subsequent VATS biopsy that confirmed PAP. Serum anti-GM-CSF antibody was positive, initially to 138.3 mcg/ml and as high as 142.56 mcg/ml. He underwent sequential WLL and did well for one year. Over the following two years, he had worsening symptoms requiring near monthly WLL. Thus, he was treated with GM-CSF, rituximab, plasmapheresis, and one cycle ofcyclophosphamide, bortizumab, and dexamethasone. He had gradual improvement in symptomsand has since required only one WLL in the past three years, most recently in May 2021. He is currently maintained on inhaled GM-CSF and rituximab.

Conclusion: PAP is a spectrum of diseases resulting in the accumulation of PAS positive materials in the distal airways and alveoli causing dyspnea, cough, and sputum production. Autoimmune PAP results from antibodies against GM-CSF and is typically treated with WLLand GM-CSF[1]. We present a case of severe autoimmune PAP to illustrate the spectrum of disease and treatments available.

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A Case of Severe Radiation-Induced Airway Disease

Daniel Hernandez-Rojas, MD[1]; Alejandra Yu Lee-Mateus, MD[1]; David Abia-Trujillo, MB, MD[1]; Andras Khoor, MD[2]; Carlos Rojas, MD[3]; Sebastian Fernandez-Bussy, MD[1]

[1] Division of Pulmonary, Allergy and Sleep Medicine, Mayo Clinic Florida, Jacksonville, FL, USA
[2] Department of Laboratory Medicine and Pathology, Mayo Clinic Florida, Jacksonville, FL, USA
[3]Department of Radiology, Mayo Clinic Arizona, Phoenix, AZ, USA.

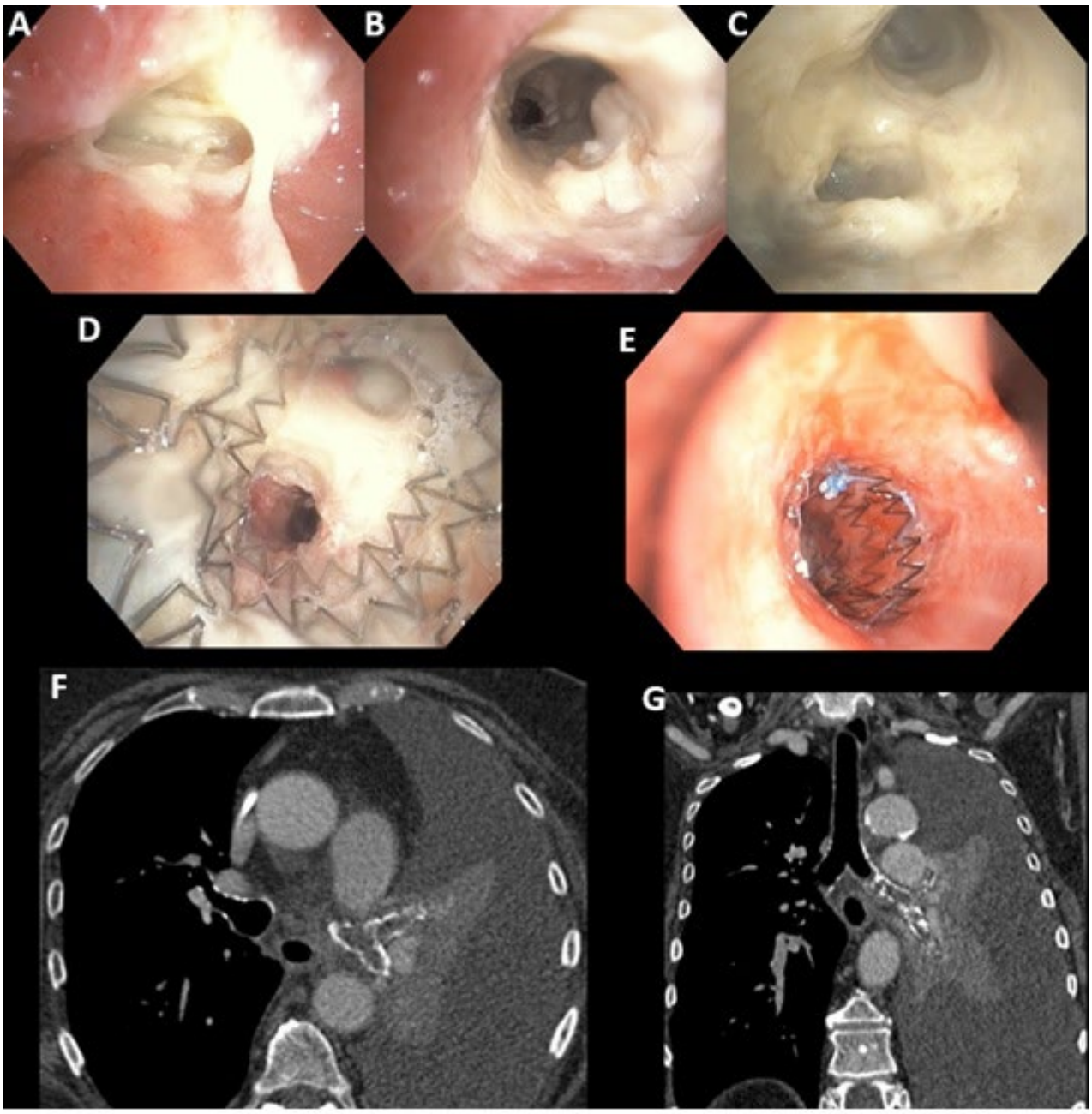
Introduction: Radiation-Induced Lung Injury (RILI) is a complication of radiation therapy that often presents with parenchymal involvement, but airway involvement is uncommon. It represents an exclusion diagnosis; making it necessary to rule out other pathologic entities. If parenchymal RILI is suspected, radiation pneumonitis changes are expected within 3 to 6 months post-radiotherapy, or radiation pulmonary fibrosis after 1 year. Airway involvement, known as Radiation-Induced Airway Disease (RIAD), is a spectrum of RILI that includes central airway stenosis, atelectasis, and necrosis. We present a case with severe radiation-field-limited airway injury.

Case Summary: A 68-year-old woman presented with metastatic non-small cell lung cancer arising from LB6 segment and eroding into the left main bronchus (LMB). She was previously treated with concomitant immuno-chemotherapy and radiotherapy. Her CT of the chest demonstrated low-density material filling the left mainstem bronchus and lobar branches. Complete atelectasis of the left lung and a large pleural effusion were seen. Combined rigid and flexible bronchoscopy revealed distal left mainstem bronchus occluded by endobronchial white cartilaginous debris. Flexible forceps and Argon Plasma Coagulation were used to perform tissue debulking and recanalization of the airway was achieved. The left upper and lower lobe takeoffs were visualized. Despite the tissue debulking, the airway appeared coated with this cast-like material. A fully covered hybrid stent was deployed in the LMB to prevent further airway collapse. Endobronchial biopsy pathology revealed fibrin, mucin, cartilage, and few inflammatory cells, negative for malignancy or infection.

Conclusion: RIAD is uncommon. Its nature remains incompletely explained. We hypothesize that direct tumor invasion into the airway is a required risk factor on its presentation. These tumor cells are potentially sensitized after chemo or immunotherapy with their subsequent muco-ciliary impairment and establishment of the injury. More cases are needed to stablish airway tumor invasion as risk factor for RIAD.

Figure Legends:
A. Proximal Left Main Bronchus (LMB) with endobronchial occlusion
B. Mid LMB showing a cast-like epithelial coated layer
C. Distal LMB with showing extension of this cast into the LUL and LLL
D. Distal end of the LMB hybrid stent maintaining LUL patency
E. Proximal end of the LMB hybrid stent
F, G. Axial and Coronal CT images demonstrates low density material filling the left mainstem main stem bronchus and lobar branches. There is associated complete atelectasis of the left lung

and a large pleural effusion.



A Custom Solution for a Challenging Fistula

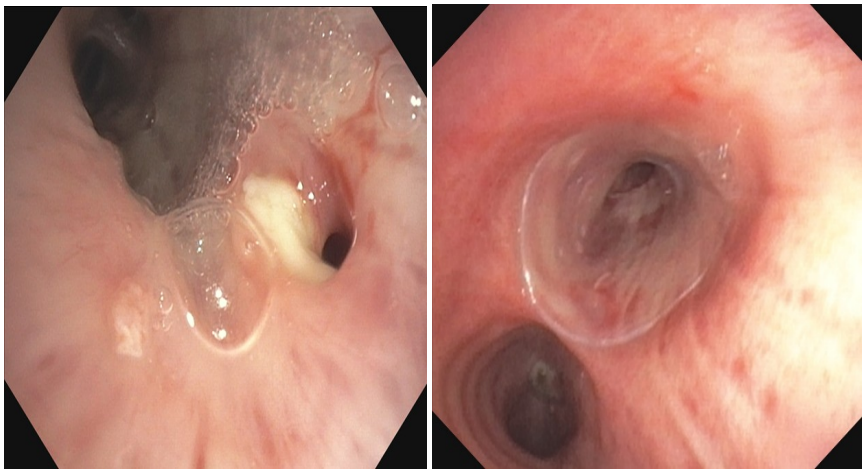
Jennifer D. Duke M.D., Sangita Goel M.D., Shanda Blackmon M.D., M.P.H., JohnMullon M.D., Ryan Kern M.D.

Introduction: This is a case of a patient with a bronchomediastinal fistula who underwent treatmentwith a custom-printed Y stent.

Case Description: A 63-year-old man with a history of locally advanced cT3N1M0 esophageal adenocarcinoma and large ascending aortic aneurysm presented to our institution for evaluation. He had been previously treated with neoadjuvant chemoradiotherapy followed by minimally invasive esophagectomy six months prior to presentation. His initial surgery was complicated by an anastomotic leak and treated with an esophagealstent that led to the development of a conduit-to-airway fistula. He underwent right thoracotomy, tracheoesophageal fistula takedown and repair, gastric conduit resectionand left neck diversion, and latissimus muscle flap repair with a postoperative course complicated by respiratory failure and septic shock requiring extracorporeal membraneoxygenation.

During evaluation for aneurysm repair, a computed tomography (CT) scan demonstrated concern for a residual bronchomediastinal fistula with a mediastinal and pleural fluid collection. He underwent a bronchoscopy which showed a fistula originating in the proximal bronchus intermedius immediately across from the right upper lobe bronchus. A CT-guided drain was placed into the mediastinal fluid collection which grew MSSA. Due to the fistula, it was not possible to maintain suction. A custom silicone stent was created using virtual modeling, 3D printing technology, and silicone molding with plans for temporary placement to aid in draining the mediastinal/pleural infection. The stent was deployed via rigid bronchoscopy with satisfactory fit in the rightmainstem, the upper lobe and bronchus intermedius which successfully occluded the bronchomediastinal defect. A subsequent CT scan demonstrated appropriate placementof the stent. He was discharged on IV antibiotics, JP bulb suction, and home nebulizer therapy.

Conclusion: Custom Y stents may provide additional interventions for patients at high risk for openrepair of bronchomediastinal fistula.



A Novel Case of Extrinsic Central Airway Obstruction due to an Aortic Aneurysm

[1]Trevor de Sibour, BS, [1,2]Jonathan S. Kurman, MD, MBA, [1,2]Bryan S. Benn, MD, PhD
[1]Medical College of Wisconsin, [2]Division of Pulmonary and Critical Care Medicine

Introduction: Central airway obstruction (CAO) due to an aortic aneurysm (AA) is uncommon. We present a case of CAO due to an AA and review the multidisciplinary treatment approach utilized.

Case Report: A 61-year-old female with a history of AA after aortic valve and ascending aorta replacements with type A aortic dissection extending to the right iliac artery presented for electiveleft subclavian transposition prior to eventual aortic arch replacement. After anesthesia induction,difficult ventilation with low tidal volumes developed thought secondary to severe bronchospasmand possible extrinsic CAO of her trachea from her AA (Figure 1A). The procedure was aborted.

Two months later, the procedure was reattempted with the patient experiencing respiratory arrest after induction. Emergent peripheral VA-ECMO was established. Bronchoscopy confirmed extrinsic CAO with complete collapse of the distal trachea and bilateral mainstem bronchi (Figure1B). Initial attempt at airway stent placement was unsuccessful due to compressive effects of the AA, which prevented proper expansion of both silicone Y and hybrid metallic stents.

After multidisciplinary discussion, aortic arch replacement was performed two days later to alleviate her extrinsic CAO to facilitate airway stent placement. Six days later, fully covered stents(Merit Medical Endotek) were placed in the mainstem bronchi and trachea to restore airway patency (Figure 1C and 1D). Due to severity of her illness, tracheostomy placement was required.

Discussion: CAO due to an AA is exceedingly rare, with few cases in the literature. While the CAO was suspected after the initial surgical attempt, it was unfortunately neither recognized nor planned for prior to the second surgery, leading to the need for emergency stabilization with ECMO. After multidisciplinary discussion, airway patency was restored. Our case highlights the value in recognizing and assessing CAO prior to procedures and the benefit of a multidisciplinaryapproach for atypical and complex CAOs.

Figure 1: Central airway obstruction due to aortic aneurysm seen on CT chest (a, axial view of lung and soft tissue windows) and with bronchoscopy (b, view of the distal trachea with compressed mainstem bronchi) prior to and after airway stent insertion (c, view through the airwaystent in the distal trachea with airway stents present in the mainstem bronchi; d, axial view of lung and soft tissue windows with radiopaque object corresponding to tracheal stent).

Figure 1A

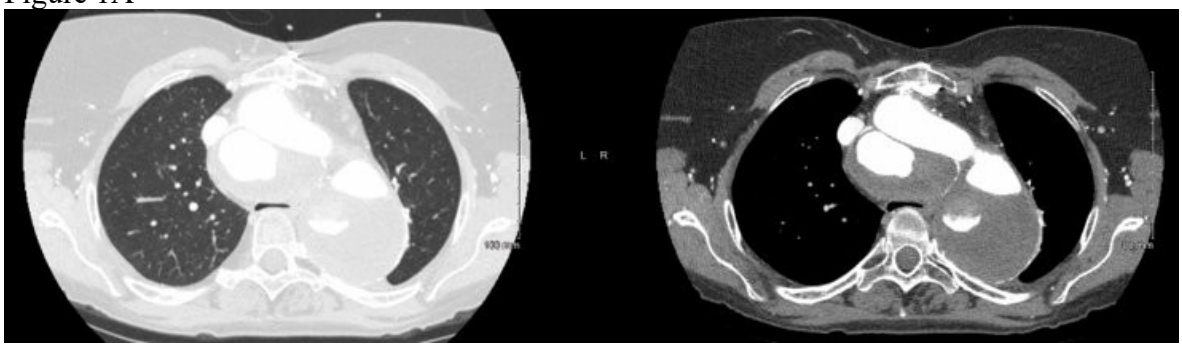


Figure 1B

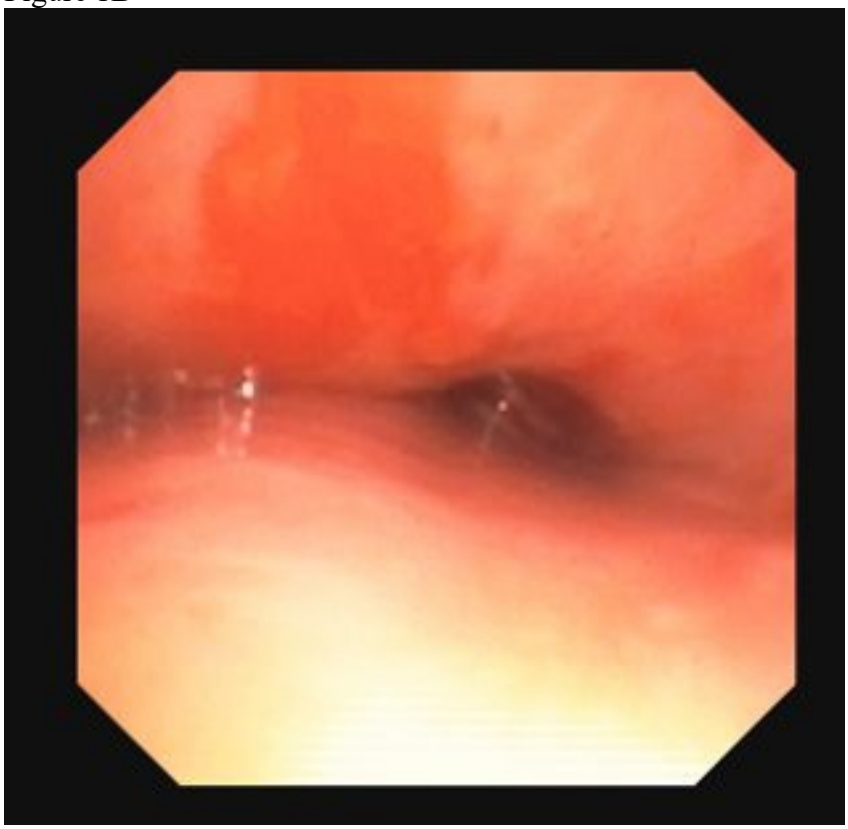


Figure 1C

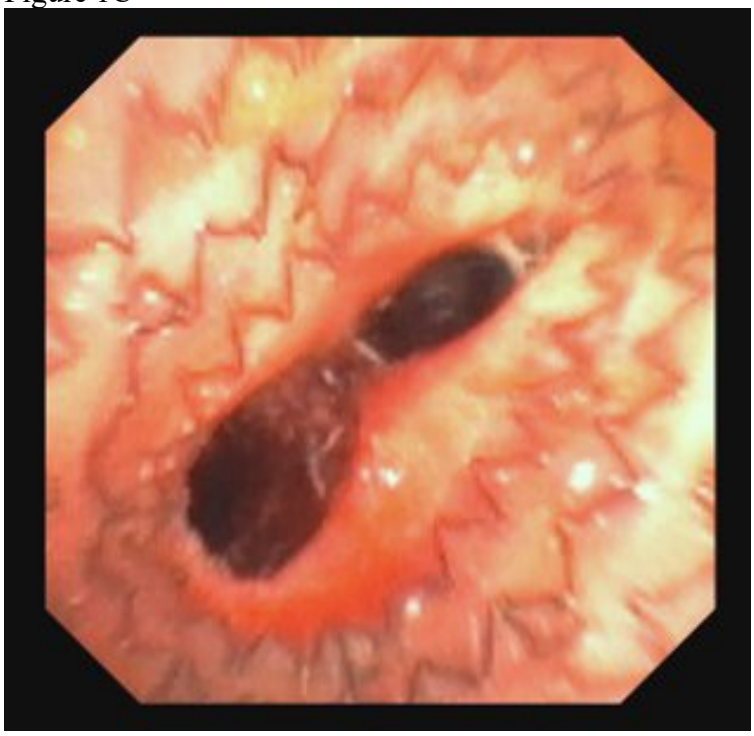
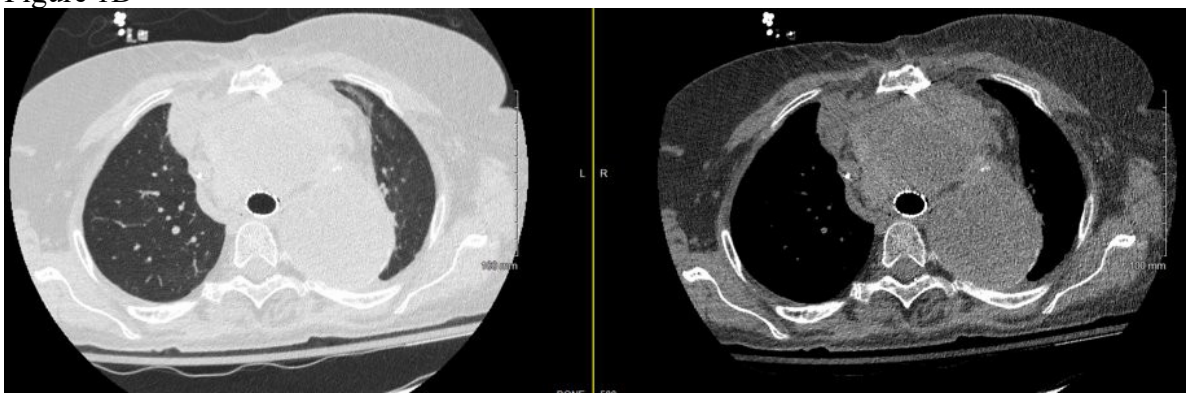


Figure 1D

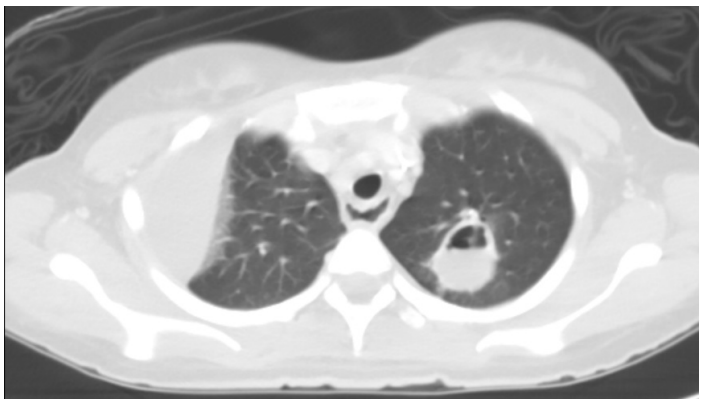


A Pleural Complication of Lemierre Syndrome

Samuel Dickey, MD

University of Maryland Medical Center

Lemierre syndrome consists of metastatic spread of septic emboli from a nidus of infection in the internal jugular vein to peripheral sites, including the lungs. This phenomenon occurred in a 27yo female with no significant past medical history who presented to an outside hospital with sore throat, cough, fever and chills, and pleuritic chest pain. She had right-sided neck swelling associated with pain and dysphagia thathad resolved several days before presentation. Diagnostic workup revealed leukocytosis, thrombocytopenia, multiple cavitary lung lesions, and a thrombus in the right internal jugular vein concerning for Lemierre syndrome. She was transferred to our quaternary care hospital due to worseningtachypnea. Blood cultures were positive for *Fusobacterium necrophorum.* CT chest showed large right- sided pleural effusion with associated right lower lobe consolidation. A 14 French chest tube was placed by interventional radiology. Initial output was approximately 900mL of serosanguinous fluid which represented a complicated pleural space on fluid analysis. The drainage improved her respiratory symptoms, but she continued to have bloody output from the chest tube and developed a new transfusion dependent anemia. Due to this complicated effusion secondary to Lemierre syndrome, five courses of TPA 5mg and Dornase 5mg were instilled into the pleural space, dwelled, and drained. The chest tube output continued to decrease with each day of therapy, and the patient's anemia stabilized without need for further transfusions. At follow-up two months after discharge, she reported exercise tolerance without significant dyspnea. CT chest showed small residual pleural effusion, and the team plans to follow with serial CT scans to resolution. This case highlights the role for intrapleural lytic therapy in a case of a complicated pleural effusion due to Lemierre syndrome without the need for more invasive thoracic procedures.



A rare benign tracheal tumor: hamartoma

Ekaterina Yavarovich, DO; Carla Lamb, MD

Introduction: Benign tracheal tumors are rare (10%) and are typically asymptomatic until significant central airway obstruction has occurred. We report a case of tracheal hamartoma successfully treated with flexible bronchoscopy using an electrocautery snare.

Case Summary: 67-year-old female with chronic obstructive pulmonary disease, obstructive sleep apnea andtobacco dependence presented with a persistent dry cough and a normal chest radiograph.
Due to the chronic cough a chest CT was performed that demonstrated a focal nodularity along the lateral mid tracheal wall. Flexible bronchoscopy under general anesthesia demonstrated a non-obstructing cauliflower polypoid lesion along the left lateral tracheal wall 3 cm above the main carina. Using an electrocautery snare on coagulation setting of 30 watts with short interval activations at the base of the lesion it was successfully completely excised. A 16 mm basket was used to capture the excised lesion and retrieve itfrom the airway. Given at the time of the removal of the lesion the histopathologic diagnosis was not known, mediastinal assessment with linear EBUS and transbronchial needle aspiration was performed at stations 7 and 4R with lymphocytes present with onsite cytology. Final pathology of the tracheal mass was consistent with hamartoma.

Conclusion: Tracheal hamartomas are rare with 20 cases in the reported literature and canmanifest with varying degree of respiratory symptoms.[1] Due to the slow growing nature symptoms are typically gradual but can lead to fatal airway obstruction due to mechanicalobstruction from the tumor. Based on the location of the tracheal lesion early flexible or rigid bronchoscopic therapies with thermal ablation modalities and manual debulking are lifesaving and curative in the majority of cases of tracheal hamartomas.

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A rare case of necrotizing tracheitis successfully managed with spray cryotherapy

Mridul Gupta MBBS, Michal Senitko MD, and George E Abraham III MD

Section of Interventional Pulmonology, Division of Pulmonary, Critical Care & Sleep Medicine, University of Mississippi Medical Center, Jackson, MS USA.

Background: Necrotizing tracheitis is a rare cause of critical central airway obstruction. It can arise as a sequela of bacterial or fungal infections. Non-infectious etiologies include endotracheal intubation, smoke inhalation, and autoimmune disorders.

Case Report: A 55-year-old man presented with severe sepsis and acute hypoxemic respiratory failure requiring mechanical ventilation. Endotracheal intubation was described as difficult. Sepsis was attributed to Methicillin resistant Staphylococcus Aureus pneumonia. On hospital day 4 he was extubated and developed stridor and hemoptysis shortly thereafter. A CT scan suggested narrowing of the proximal third of the trachea [Figure 1]. Bronchoscopy revealed circumferential necrotic tissue approximately 3 cm in length causing up to 75% occlusion. The diseased mucosa was subjected to rigid mechanical debridement followed by spray cryotherapy [Figure 2B]. Histopathology revealed granulation tissue with fibrinous exudate without any microorganisms or granulomas. A silver stain was negative. Repeat bronchoscopy with spray cryotherapy was performed at one and three week intervals. No evidence of residual tracheal disease or stenosis was noted during surveillance bronchoscopy at 60 days [Figure 2C].

Conclusion: Necrotizing tracheitis is a rare complication of endotracheal intubation that has been reported in intubation periods as short as 18 hours.[1] Immunocompromised status, diabetes, prolonged intubation, and traumatic intubations are risk factors. Cryoprobe recanalization has been described previously in a case of Aspergillus tracheitis.[2] To our knowledge this is the first reported case of spray cryotherapy use in the management of necrotizing tracheitis.

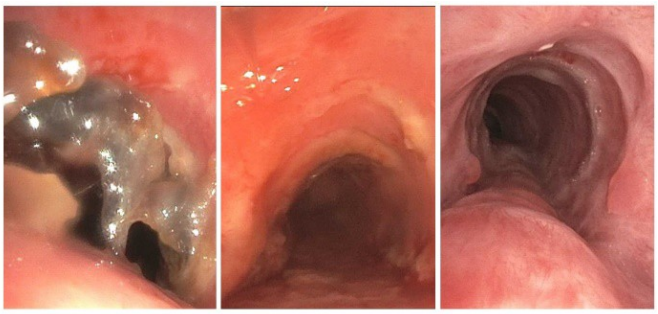

Figure 2A Figure 2B Figure 2C

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A Unique Complication of Bronchoscopic Lung Volume Reduction – Bullitis!

Moeezullah Beg MD, Benjamin Stephens MD, Aristides Armas Villalba, MD and Philip G. Ong MD

University of Texas Health San Antonio

Introduction: Bronchoscopic lung volume reduction (BLVR) is a relatively new therapeutic modality for symptomatic patients with emphysema phenotype of COPD with severe hyperinflation. Althoughpneumothorax is a well-known complication, bullitis has not been reported as a complication before . Here, we report a case series of three patients who developed bullitis after they underwentBLVR.

Case Summary: Case 1: A 59-year-old man with severely symptomatic COPD underwent BLVR to treat the left upper lobe (LUL) with 5 Zephyr® valves. He developed a pneumothorax immediately thereafter,which was treated with a chest tube. He reported increased shortness of breath 11 days after the procedure. Chest x-ray revealed a thin-walled cavitary lesion with an air-fluid level (Figure 1).
Computed tomography (CT) of the chest showed a partially fluid-filled bulla in the LUL (Figure1).
Case 2: A 70-year-old woman with severely symptomatic COPD underwent BLVR to treat theright upper lobe and right middle lobe with 5 Zephyr® valves. She developed a large right pneumothorax which resolved with chest tube placement. Chest CT during the hospital admission revealed a RUL partially fluid-filled lesion consistent with bullitis (Figure 2).
Case 3: A 66-year-old man with severely symptomatic COPD underwent BLVR with three Zephyr® valves to LUL. A chest x-ray obtained 7 days after the procedure revealed an opacity with air fluid level. This was subsequently confirmed to be a partially fluid-filled bulla on the CTof the chest.

Conclusion: Pneumothorax is a well-known complication with BLVR. To our knowledge, this is the first reported case series of bullitis developing as a complication from BLVR. This finding could represent a pathophysiologic process occurring in the ipsilateral untreated lobe that may contribute to development of pneumothorax after the procedure. Further investigation regardingthe significance of this process may be needed in the future.

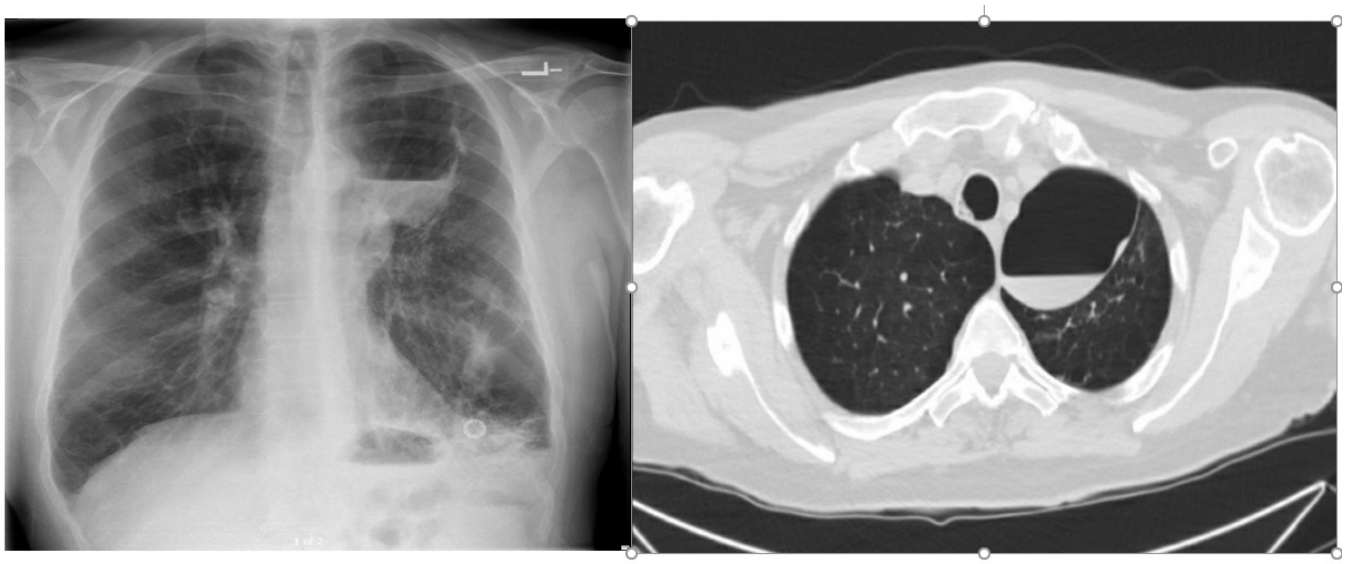


Figure 1. Chest X-Ray with thin-walled cavitary lesion with an air fluid level and Chest CT with a partially fluid filled bulla in the left upper lobe.

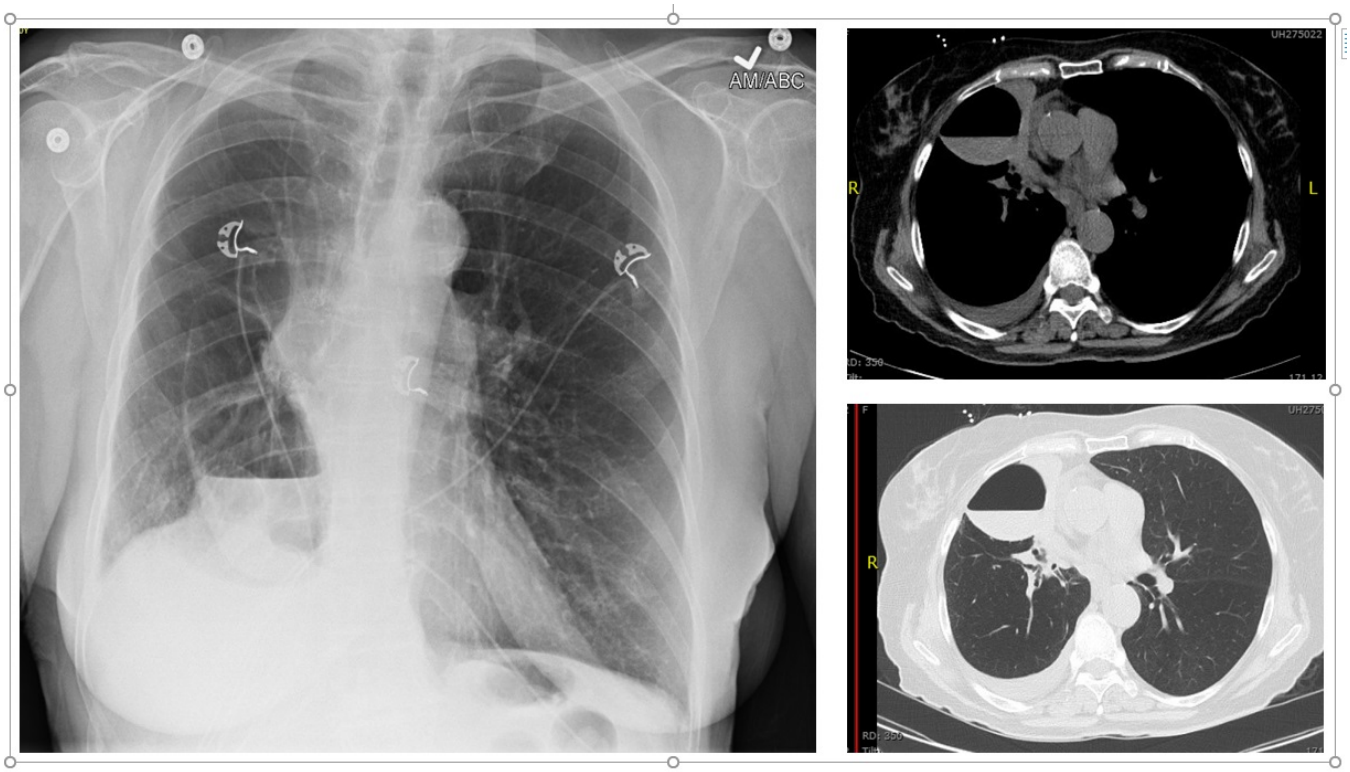


Figure 2. Chest X-ray and CT scan of the chest demonstrating the bullae with an air-fluid level in right upper lobe.

Airway to Heaven

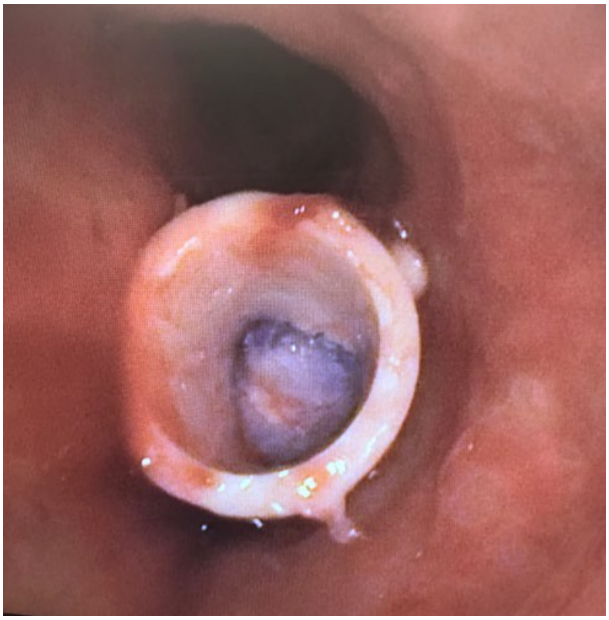
Derek Moore MD, Stephanie Baltaji MD, Sohini Ghosh MD
Allegheny Health Network

Introduction: 72-year-old male with history of metastatic right lower lobe (RLL) squamous cell carcinoma presenting with respiratory distress and large pneumothorax requiring multiple chest tubes and intubation Here we describe a case of a RLL bronchopleural fistula treated with a modified stentfor palliation.

Procedure: Bronchoscopic evaluation of the airway revealed necrotic RLL mass, consistent with patient's known pathology. Methylene-blue dye test confirmed this to be the source of his persistent airleak. Lesion was not amenable to stenting therefore a 16mm x80mm silicone covered metal stent was placed from the trachea into the distal left mainstem bronchus to occlude the entireright lung. Deployment was successful, but a complete seal was not achieved, and air leak persisted. This stent was removed. A silicone Y-shaped Dumond® stent was then modified byinvaginating and suturing the right limb shut. Unfortunately, this was unable to be loaded and deployed. Lastly a 15mm (length) x 16mm (diameter) silicone stent was modified using a segment of polytetrafluoroethylene (PTFE) vascular prosthetic graft. This was cut into a flat circle to fit over the orifice of the stent and sutured using 3-0 prolene in a running fashion.

Dermabond® was applied to the suture line. After drying, the suture line was tested with saline and showed no leak. The stent was then oriented in the airway and deployed with the blinddistal end seated in the right mainstem. After deployment the patient's air leak completely resolved and patient was successfully extubated and discharged to hospice.

Conclusion: Using this method, our patient was able to be extubated post-procedure and discharged to hospice where he passed away days later. This case provides a template to seal a bronchopleural fistula in a difficult anatomic location for non-surgical patients.



Bilateral transudative effusions from different etiologies: A case of Aspergillus fumigatus pleuritis following single lung transplantation.

Cristina Salmon, MD, Allan Ramirez, MD.
University of Louisville, Department of Pulmonary, Critical Care and Sleep Medicine.

Introduction: Fungal infections are mostly common within the first year following lung transplant. We describe a case of a patient who rece**ived a sin**gle lung transplantation with chronic rejection complicated by bilateral pleural effusion, both of which were from different etiologies.

Case Summary: A 71-year-old female status post left single lung transplant for idiopathic pulmonary fibrosis, who was being followed as outpatient for surveillance and severe chronic rejection, was hospitalized for generalized fatigue and shortness of breath. Computed Tomography (CT) of the chest was performed demonstrating bilateral moderate pleural effusion and nodular opacities on right upper lobe. Meanwhile, the patient had been treated with broad-spectrum antibiotics. The patient underwent a right-sided thoracentesis and then a left-sided thoracentesis the following day. Pleural fluid studies from both fluid analyses revealed transudative effusion by Light's criteria. Right sided effusion was predominantly neutrophilic (89%), Lactate Dehydrogenase (LDH) was 125U/L and pleural fluid protein level was 2.0 g/dL. Left sided effusion demonstrated monocyte/macrophage predominance (79%), LDH 96U/L and protein level of 1.6 g/dL. Cholesterol and triglyceride levels in both fluids were normal. Due to progressive decline in overall status, the patient was started on antifungal coverage, however on day 5 post-thoracentesis culture identified mold and a few days later Aspergillus fumigatus was reported.

Conclusion: Aspergillus fumigatus has been described as the most common pathogen causative of invasive lung infection following lung transplantation and most of these will present during the first year after transplant. Candida spp in the other hand is not limited to parenchymal disease, usually can cause fungemia, mediastinitis and pleural space disease.

Most of the literature mentions either parapneumonic or empyema related effusions and it is still unclear why the fluid analyses in this case report are consistent with a transudative effusion in the setting of active fungal pleuritis.

Bronchoscopic Outcomes after Tracheobronchoplasty in patients with Severe Expiratory Central Airway Collapse

Alejandra Yu Lee-Mateus, MD[1]; Juan C. Garcia-Saucedo, MD[1]; David Abia-Trujillo, MB, MD[1]; Ian A. Makey, MD[2]; Mathew Thomas, MD[2]; Sebastian Fernandez-Bussy, MD[1]

[1] Division of Pulmonary, Allergy, and Sleep Medicine, Mayo Clinic Florida, Jacksonville, FL, USA
[2] Department of Cardiothoracic Surgery, Mayo Clinic Florida, Jacksonville, FL, USA

Background: Expiratory Central Airway Collapse (ECAC) presents with limited treatment options. For severe disease that significantly impairs quality of life, Trachebronchoplasty (TBP) is currently the definite treatment choice. TBP consists of stabilizing the membranous wall of the intrathoracic trachea to limit the expiratory collapse, and it can be performed as an open surgery or via robotic assistance. Previous studies have reported outcomes of TBP for ECAC, but they have not compared the percentage of airway collapsibility after the procedure. We determined dynamic bronchoscopy findings as an objective measure to compare airway collapsibility observed in patients with severe ECAC before and after TBP.

Methods: We performed a retrospective cohort study of 18 patients who underwent TBP as definite treatment for severe ECAC from February 2019 to February 2021. A comparison was performed between the percentages of airway collapsibility noted at each airway segment in dynamic bronchoscopies before and after TBP. Patients were stratified into two groups depending on the surgical approach implemented: robot-assisted TBP or open TBP.

Results: A total of 18 patients were included (mean age: 60 years; 56% female; 67% never smokers). The mean reduction of airway collapsibility was 18.2% between pre-TBP and post-TBP dynamic bronchoscopy findings. The average reduction of collapsibility by airway segment was 2.7% at the cricoid, 20% at the middle trachea, 21.7% at the distal trachea, 17.8% at the left main bronchus, 25% at the right main bronchus, and 22.2% at the bronchus intermedius. Between pre-TBP and post-TBP dynamic bronchoscopies, we found a statistical difference among the median collapsibility in the middle trachea (70% vs. 65%; P <.01), distal trachea (90% vs. 60%; P <.01), left main bronchus (90% vs. 70%; P <.01), right main bronchus (90% vs. 60%; P <.01), and bronchus intermedius (95% vs. 60%; P <.01). Robot-assisted TBP was performed in 5 patients and open TBP in 13 patients, with a mean reduction of airway collapsibility of 21% and 17.2%, respectively.

Conclusion: Our findings confirm that TBP significantly improves bronchoscopic airway collapsibility in patients with severe ECAC, potentially translating into better patient-centered outcomes.

Case Report – Fully Covered SEMS are an Option for Broncho-Pleural Fistula

Michael J. Kaster MD, Zachary Depew MD DAABIP, Suchitra Pilli MD MPH DAABIP

Division of Pulmonary, Critical Care and Sleep Medicine Creighton University, Omaha, Nebraska Michael.J.Kaster@gmail.com

Introduction: A 60-year-old male with history of tobacco use (40 pack years), tiny pulmonary nodules, Barrett's esophagus was diagnosed with esophageal adenocarcinoma, underwent esophagectomy, pyloroplasty and jejunostomy on 1/21/20, complicated by chylothorax requiring VATS and thoracic duct ligation on 2/3, followed by pneumothorax with persistent air leak in a right-side chest tube.

Case Summary: Brown chest tube output was noted on the right. EGD was performed and esophageal stent was placed for presumed defect. Patient developed severe ARDS with persistent air leak on the right. A bronchoscopy showed left mainstem posterior wall defect with purulent mucus. Right mainstem intubation resolved the air leak, confirming left to right broncho-pleural fistula as etiology. Cultures grew multidrug resistant pseudomonas.

Due to worsening ARDS, Veno-Venous ECMO was initiated. On 2/10, bronchoscopy showed LC1 to main carina distance 40 mm, distal end of defect to main carina 20 mm and proximal endof defect to main carina 5 mm. A fully covered 14 x 40 mm self-expanding metal stent (SEMS) was placed in the left main stem on V-V ECMO on 2/12.

A bronchoscopy was performed on day 3 for stent mucus clearance. V-V ECMO was decannulated. He required frequent bronchoscopy for suctioning. The esophageal stent and chesttubes were removed, tracheostomy placed, and patient quickly weaned to trach collar. Repeat bronchial cultures were negative. Patient went to rehab and discharged home on 4/2. Patient hadtwo outpatient ER visits for tracheal obstruction requiring suctioning. On 5/7, patient was taken to the OR and underwent EGD and bronchoscopy with left main stem stent removal and decannulation of tracheostomy.

Conclusion: Fully covered SEMS are an option for main stem and tracheal wall defects. The defect healed with stent placement, antibiotics, and mucus clearance avoiding surgery.

IgG4 related disease presenting in the lungs and delayed diagnosis in pancreatic cancer

David Roelofsz, MD; dmrhx4@mailumkc.edu , Hussein Asad, MD; asadh@umkc.edu

Introduction: We are presenting the case of a man found to have lung mass in setting of previous pancreaticcancer diagnosis. Lung biopsy indicated IgG4 related disease. In reviewing his pancreatic mass pathology, malignancy was negative, which brings about strong suspicion that his mass was influenced by IgG4 disease.

Case Summary: A 64-year-old man presented to the emergency department with syncope, hemoptysis, night sweats, and abnormal weight loss over 2 months. He has a past history of pancreatic cancer diagnosed in 2018 with 1.3 x 1.0 cm mass status-post distal pancreatectomy and splenectomy in 2018. CT scan of the chest revealed a spiculated left upper lobe lung nodule and enlarged axillary lymph node, for which IR and pulmonology were consulted. IR performed biopsy of left upper lung nodule as well as axillary lymph node. He was discharged from the hospital pendingbiopsy results, which found changes consistent with IgG4 related disease (IgG4-RD); the axillarylymph node showed reactive changes. His IgG antibodies were universally elevated, with IgG of2,601, well above the cutoff of this laboratory of 600-1540. He was seen in the pulmonology clinic with PFTs showing ILD, felt to be related to IgG4-RD. He was started on prednisone with good clinical improvement. Upon reviewing his previous diagnosis of pancreatic cancer in 2018,it is likely that patient had undiagnosed IgG4 at that time as the source of his mass, as pathology returned negative for malignancy.

Conclusion: IgG4 disease is an immune mediated fibroinflammatory condition that commonly affects the pancreas, retroperitoneal structures, and in this case, the lungs. This case report exemplifies importance of early recognition of IgG4-RD. Given his pancreatic biopsy results, thispatient could've potentially avoided risk and morbidity of surgery with early diagnosis.

Complications and Outcomes in Endobronchial Valve Placement for Bronchoscopic Lung Volume Reduction: Insight from the Food and Drug Administration Manufacturer and User Facility Device Experience (MAUDE)

Presenting author: See-Wei Low, MD*
Co-Authors: Justin Z Lee, MD^, Rodrigo Cartin-Ceba, MD*, Kenneth K. Sakata, MD*, FabienMaldonado MD‡, Karen L. Swanson, DO*

* Division of Pulmonary Medicine, Mayo Clinic Arizona, Phoenix, Arizona
^ Department of Cardiovascular Medicine, Mayo Clinic, Rochester, Minnesota
‡ Department of Medicine, Pulmonary & Critical Care Medicine, Vanderbilt University School of Medicine, Nashville, Tennessee

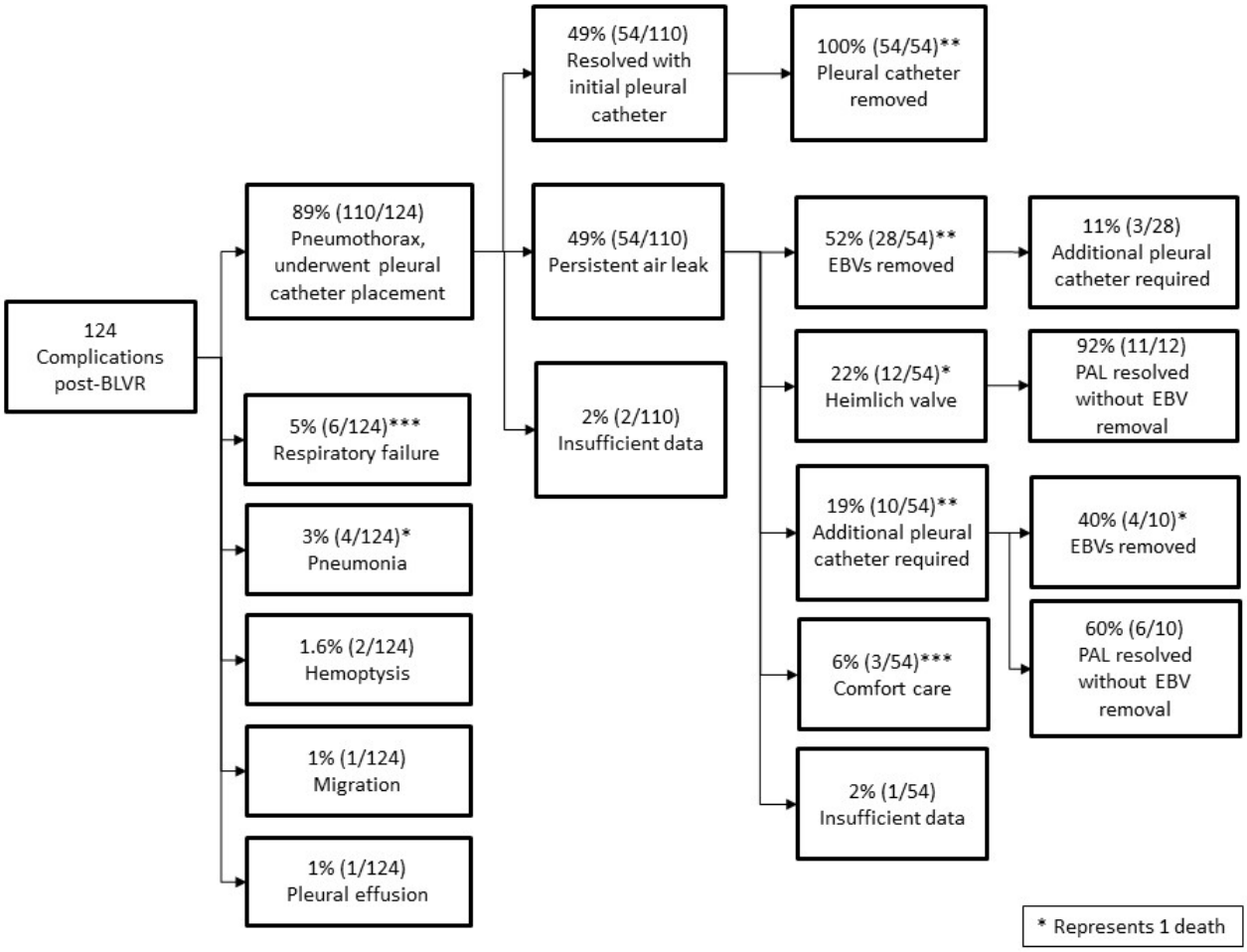
Background: Bronchoscopic Lung Volume Reduction (BLVR) is a minimally invasive bronchoscopic procedure aimed at reducing hyperinflation and air trapping via introduction of endobronchial valves (EBVs) in targeted airways to promote atelectasis and improve diaphragm mechanics. Real-world data outside of clinical trials on safety and outcomes of EBV for BLVR are limited.

Objective: To assess complications and outcomes of patients undergoing EBV placement for BLVR.

Methods: We queried the U.S Food and Drug Administrations (FDA) Manufacturers and User Device Experience (MAUDE) database from May 2019 to June 2020 for medical device reports involving the placement of EBV for BLVR. Events were reviewed independently by two physicians (SWL, JZL) to identify instancesand outcomes of complications.

Results: During the study period, we identified 124 cases of complications during the implantation of EBV for BLVR. The most common complication was pneumothorax (89% of complications (110/124), all patients requiring pleural catheter placement. Among those, 49% of the pneumothorax (54/110) resolved without additional intervention while in 49% (54/110), there was persistent air leak (PAL) requiring additional intervention. In 52% of the PAL (28/54), repeat bronchoscopy was performed to remove the valves. In 22% (12/54) of the PAL, a Heimlich valve was placed, and the patients were discharged with subsequent follow-up with the plan to remove the pleural catheter. Among those, 92% (11/12) of had resolution of the PAL at follow-up without EBV removal. In 19% (10/54) of patients with PAL, an additional pleural catheter was placed. Out of those who had additional pleural catheter placement and monitored in the hospital, 60% (6/10) had pneumothorax resolution without EBV removal. The other complications of EBV placement included respiratory failure (5% (6/124) of complications), pneumonia post-valves placement (3% (4/124) of complications), hemoptysis (1.6% (2/124) of complications), valve migration (1% (1/124) of complications), and pleural effusion (1% (1/124) of complications). There were 15 deaths out of 124 cases of complications, in 10 patients who experienced pneumothorax, in 3 cases related to respiratory failure, and in 1 case of perforated duodenal ulcer in a patient with pneumonia.

Conclusion: The analysis provides a profile of complications related to EBV for BLVR. Pneumothorax is the most common complication and in 65% of cases, it can be managed without removal of EBV. There were 15 deaths out of 124 cases of complications. Further studies to evaluate the outcomes of various managementstrategies following persistent air leak after EBV placement is important.


124
Complications post-BLVR
89% (110/124)
Pneumothorax, underwent pleural catheter placement
5% (6/124)***
Respiratory failure
3% (4/124)*
Pneumonia
1.6% (2/124)
Hemoptysis
1% (1/124)
Migration
1% (1/124)
Pleural effusion
49% (54/110)
Resolved with initial pleural catheter
100% (54/54)**
Pleural catheter removed
49% (54/110)
Persistent air leak
2% (2/110)
Insufficient data
52% (28/54)**
EBVs removed
11% (3/28)
Additional pleural catheter required
22% (12/54)*
Heimlich valve
92% (11/12)
PAL resolved without EBV removal
19% (10/54)**
Additional pleural catheter required
40% (4/10)*
EBVs removed
60% (6/10)
PAL resolved without EBV removal
6% (3/54)***
Comfort care
2% (1/54)
Insufficient data
* Represents 1 death

Concurrent BAP1-preserved and BAP1-mutated malignant melanoma clones - a case report

Linh H. Vu, M.D., Sangita Goel, M.D., John J. Mullon, M.D., Ryan M. Kern, M.D.

Division of Pulmonary and Critical Care Medicine, Mayo Clinic, Rochester, Minnesota, USA
Corresponding Author: Vu.Linh@mayo.edu

Recent research into malignant mesothelioma (MM) has identified some genetic predispositions linked to germline mutations, most commonly to BRCA1-associated protein (BAP1), a tumor suppressor gene [1]. In contrast to the conventionaltheory that most tumors are monoclonal in origin, emerging evidence suggests that MM can be polyclonal [2,3]. We present a case of MM with unilateral BAP1 expression and loss of expression in opposite hemi-thoraces.

Our patient is a 70-year-old man, retired plumber, with approximately 20-pack-year of cigar smoking, coronary artery disease, who presented with 6 months of progressive weakness and dyspnea. He was found to have bilateral, exudative, lymphocytic-predominant pleural effusions. Cytology showed reactive mesothelial cells and chronic inflammation but no malignant cells. The patient had symptomatic improvement, but also rapid fluid re-accumulation, requiring five thoracenteses over one month. PET-CT showed diffuse pleural uptake in the right hemithorax with focal areas of increased intensity and was associated with non-FDG avid left-sided pleural effusion. He underwent right thoracoscopy with parietal pleural biopsies that revealed malignant mesothelioma, epithelioid type with loss of BAP1 expression. Two weeks later, the patient had worsening left pleural effusion. Cytology from the left thoracentesis was markedly abnormal and suspicious for MM, but BAP-1 staining was retained. This was confirmed with a left pleuroscopy and pleural biopsies, which raised the possibility of two different mesothelioma clones. Of note, the patient's family history is significant for breast cancer in his mother. The patient had placement of tunneled pleural catheters and was started on combination nivolumab/ipilimumab as he was not a surgical candidate.

MM patients who are carrier of germline mutations have been reported to have a 7-fold increase in survival [4]. Our case suggests that further study into the genomic of MM is needed to guide prognostic discussion and therapeutic options, including surgical candidacy.

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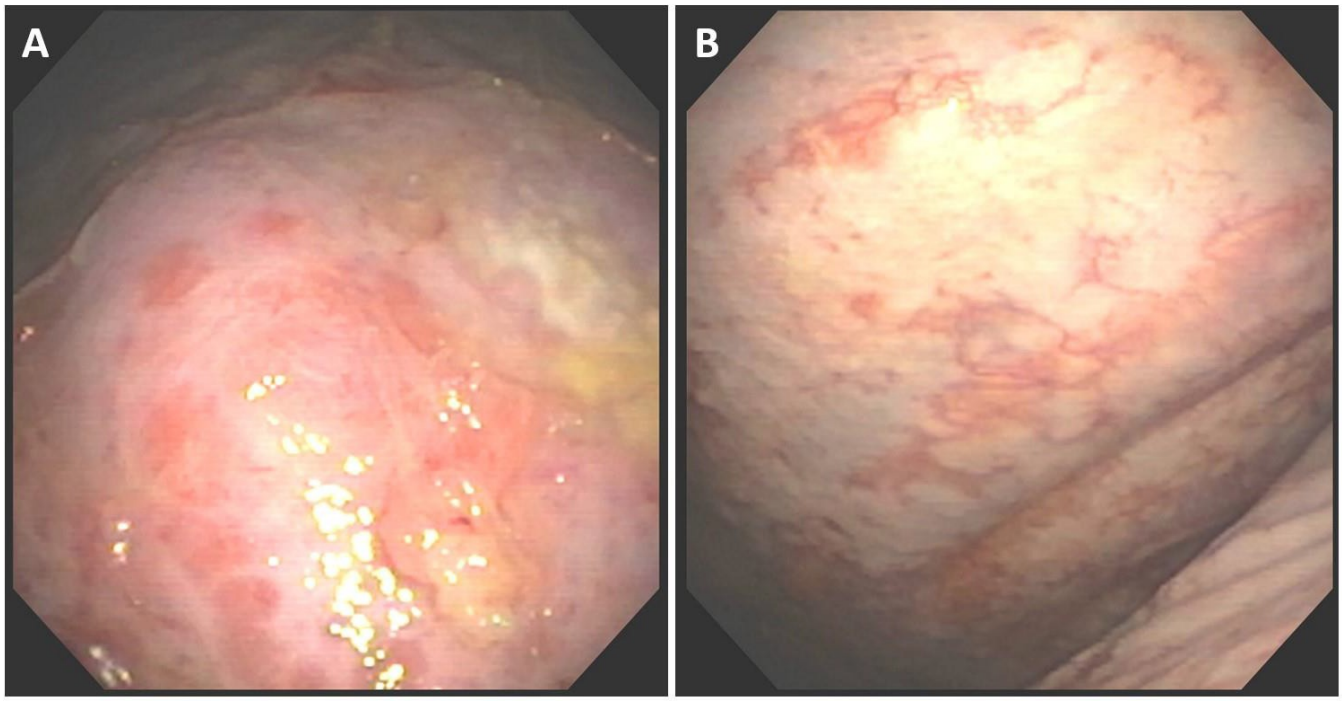

Figure 1 (A) Right pleural mesothelioma; (B) Left pleural mesothelioma

Cryoextraction of Blood Clots via Flexible Bronchoscopy in Patients on Extracorporeal Membrane Oxygenation Support

Jose A. Paul, Ashutosh Sachdeva, Ed Pickering, Faria Nasim, Van Holden

Background: The use of Extracorporeal Membrane Oxygenation (ECMO) support for critically ill patients has grown in the last decade. The multifactorial coagulopathy associated with ECMO can contribute to complications in the airway, such as bleeding leading to organized clot formation with subsequent airway obstruction. Flexible bronchoscopic cryotherapy has emerged as a modality to treat these challenging scenarios. We aim to characterize the safety and efficacy of cryoextraction of blood clots via flexible bronchoscopy in patients on ECMO support.

Methods: A retrospective review of all cryoextraction cases for bleeding at the University ofMaryland Medical Center between January 2016 to June 2020 was performed. Patient and procedural characteristics were obtained from chart review.

Results: Of the 74 cases reviewed, 20 patients were on ECMO support and underwent a total of33 cryoextraction procedures. Six (30%) patients underwent multiple cryoextraction procedures. Mean age of the patients was 44.9 □ 14.9 years. The one-year survival rate after the procedure was 45%, with a mean survival time of 1024.6 □ 52.5 days. All 33 cases were ventilator dependent with various ECMO support modalities. All procedures were performed bedside by interventional pulmonologists. Three-quarters of the cases had airway bleeding while on systemic anticoagulation. The 1.9mm cryoprobe was used in 11 cases (33.3%), the 2.4mm cryoprobe in 21 cases (63.6%), and both in 1 case (3%). The majority of the blood clots were in the lobar divisions (81%), followed by the left mainstem bronchus (45.5%), trachea (24.2%), and right mainstem bronchus (20.3%). Adjunct modalities were not required in 17 cases (51.5%), while the following were used in the remainder: balloon tamponade in 7 cases (21.2%), thrombin installation in 7 cases (21.2%), argon plasma coagulation in 4 cases (12.1%), and surgicel placement in 2 cases (6%). There were no significant hemodynamic complications related to the procedure, and all blood clots were successfully extracted per bronchoscopic visualization in all 33 cases (100%).

Conclusion: The use of flexible bronchoscopic cryoextraction of blood clots in critically ill patients on ECMO support is safe and effective. In addition, it can be performed at the bedsidein a timely manner. There is value in advanced interventional pulmonology techniques at high volume ECMO centers.

Diagnosis of Pulmonary Amyloidosis using Confocal Laser Endomicroscopy

Ali Sadoughi MD, Carla Rosenzvit MD, Shivani Singh MD PhD, Adam Gersten MD, and Sammar Alsunaid MD

Introduction: Confocal laser endomicroscopy (CLE) can be useful in diagnosis of different pulmonary pathologies. We present a case in which CLE helped detect pulmonary amyloidosis and optimizethe bronchoscopic biopsy.

Case Summary: 79-year-old female, ex-smoker with previous history of COPD, CHF, multiple myeloma, stem celltransplant, and questionable cardiac amyloidosis presented with dyspnea and hemoptysis. CT scan showed multiple ground-glass opacities and thickening of interlobular peri-bronchovascular septa.After treatment with antibiotics, some of the lesions resolved, but the left upper lobe lesion increased in size and density. Diagnostic bronchoscopy with radial EBUS (r-EBUS) guidance wasperformed. Initial inspection showed remnant of fresh blood in airways indicative of lesion's bleeding tendency. The lesion was found with multiple concentric r-EBUS views from different airways of the left upper lobe posterior segment. Then an AQ-Flex™ 19 Confocal Miniprobe™ (Cellvizio Endomicroscopy System Mauna Kea Technologies, Paris, France) was passed via scope's working channel. After injection of fluorescent dye, the Cellvizio images were captured while the probe moved in the areas of previously concentric r-EBUS view. Areas with dark "clumps" appearance by Cellvizio suggestive of conglomerate deposit of amyloid were identified.The Cellvizio probe was then removed and transbronchial needle aspirates and biopsies were performed in the identified areas. Pathology showed pale amorphous material, predominantly in perivascular areas, that stained with Congo Red and displayed "apple-green" birefringence underpolarized light, characteristic of amyloid deposition.

Conclusion: CLE provides real-time images of tissues with a resolution up to 3.5 µm. It has been reported to be useful in diagnosis and follow up of various pulmonary pathologies both diffuse and focal. Herewe report its usefulness in detecting pulmonary amyloidosis and optimizing the biopsy area by focusing on lesion parts with highest yield. It can potentially increase the diagnostic yield of bronchoscopy and decrease its complications.

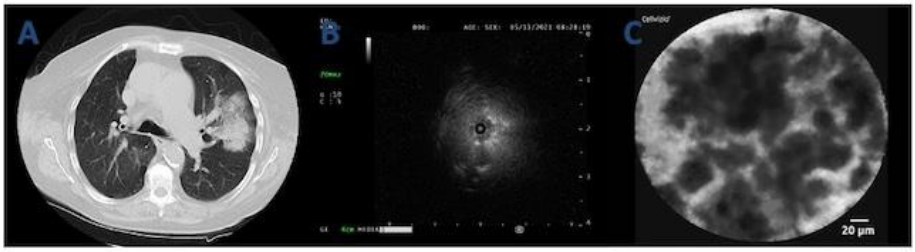

Figure 1: A. Axial CT image showing left upper lobe lesion B. Concentric lesion on rEBUS view C. CLE-Cellvizio image showing areas of dark "clumps" suggestive of abnormal tissue deposits.

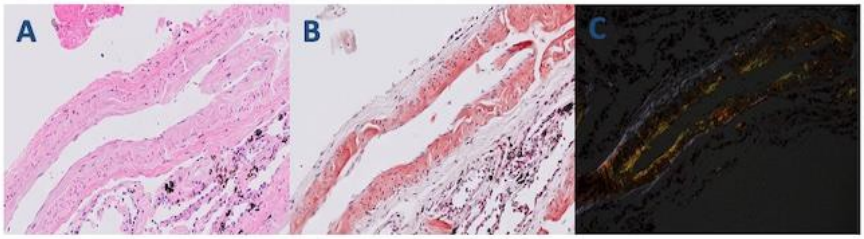

Figure 2: A. H&E stain showing pale, amorphous material suspicious for amyloid peri-vascularly B. Abnormal tissue picking up Congo red stain C. Polarized light of Congo Red stained area showing "apple-green" birefringence characteristic of amyloid. (slides courtesy of Dr. Adam Gersten)

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Don’t let the air out: experience with novel percutaneous tracheostomy techniqueleaving ETT balloon inflated in COVID-19 patients

D'Souza, Kenneth M.D., Obata, Reiichiro M.D., Durrance, Richard, M.D., Perwaiz, Muhammad, M.D

Background: Tracheostomy for ongoing respiratory support has become an important part of the weaning process for Coronavirus disease 2019 (COVID-19) patients requiring prolongedmechanical ventilation. Current guidelines consider tracheostomy a superspreading eventowing to aerosolization that unduly risks healthcare workers [1]. Recommendations to reduce increased risk exposure include enhanced personal protective equipment (PPE), confirmation of non-active disease, avoiding use of bronchoscope, and clamping the endotracheal tube during key steps in the procedure [2]. We developed a novel approachto reduce aerosolization by avoiding cuff deflation throughout the entire percutaneous tracheostomy procedure while maintaining superior visualization and minimal desaturation.

Methods: COVID-19 patients that were mechanically ventilated for a prolonged time period were evaluated for percutaneous tracheostomy. Our approach consisted of entering the bronchoscope through the endotracheal tube via the swivel adaptor sealed access, and withdrawing the tube without deflating the cuff, which provided optimal visualization and minimal desaturation. We defined desaturation as oxygen saturation less than 88% perioperative at any time. This technique was designed to prevent aerosolization to the operators involved while optimizing ventilatory support in the peri-procedure period.

Results: From January 6, 2021, to April 20, 2021, a retrospective review of COVID-19 patients who underwent percutaneous tracheostomy was performed. Of the 22 patients identified,16 males and 6 females had an average age of 66.7 years (SD± 10.17). The mean numberof ventilator days pre-procedure was 13.8 (SD± 4.07). Three patients had the endotracheal tube cuff deflated during the procedure, which caused desaturation in two cases (66.7%). Nineteen patients did not have the endotracheal tube cuff deflated during the procedure, which caused desaturation in four cases (21.1%). There were no reported patient complications, procedure interruptions, or COVID-19 symptoms or infections among any health care providers involved.

Conclusion: As a result of increased numbers of severe COVID-19 patients, percutaneous tracheostomy has been essential in liberation from mechanical ventilation. Tracheostomywas avoided early in the pandemic because fear of aerosolization that risked healthcare personnel. Our technique of avoiding cuff deflation reduces risk of health-care exposure,provides effective visualization, and minimizes desaturation during tracheostomy procedure.

Table 1.

	Cuff deflated	**Cuff inflated**
Number of Cases	3/22 (13.6%)	19/22 (86.4%)
Age	64.3 (SD± 11.02)	64.3 (SD± 10.02)
Male	2/3 (66.7%)	14/19 (73.7%)
Female	1/3 (33.3%)	5/19 (26.3%)
Average days on the Ventilator in total cases	13.8 (SD± 4.07)	
Average days onthe Ventilator in each arm	14 (SD± 6.56)	13.78 (SD±3.81)
Total number of desaturation	2/3 (66.7%)	4/19 (21.1%)
ETT Dislodgement	0/3 (0%)	0/19 (0%)
Procedure Interruption	0/3 (0%)	0/19 (0%)
Significant Bleeding	0/3 (0%)	0/19 (0%)

References:

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Durability of Effect in Zephyr Valve Treated Severe Emphysema Patients – Long-term Follow-up of Patients in the TRANSFORM RCT

Samuel V. Kemp, Dirk-Jan Slebos, Malgorzata Kornaszewska, Alan Kirk, Kris Carron, Lars Ek, Herve Mal, Christophe Pison, Nicola Downer, Gustav Broman, Kaid Darwiche, Jagan Rao, Ralf-Harto Hübner, Valéry Trosini-Desert, Ralf Eberhardt, Felix J. Herth, Eric Derom, Charles H Marquette, Narinder S. Shargill and Pallav L. Shah.

Background: Zephyr valve treated patients in the TRANSFORM Study[1], a multicenter randomized clinical trial were evaluated at 12-, 18- and 24 months post-treatment.

Aims and Objectives: Evaluate long-term effectiveness and safety of Zephyr Valve treated patients out to 24-months.

Methods: The TRANSFORM study enrolled 97 patients (58Male/39Female; mean age, 64.3±7.4yrs) with hyperinflation and severe heterogeneous emphysema confirmed by quantitative HRCT using a 2:1 randomization scheme (Zephyr Valve treatment plus optimal medical management (n=65) or optimal medical management alone (n=32) after confirmation of absence of collateral ventilation using Chartis). Enrolled subjects had baseline FEV_1, 30.5±8.9 % pred., RV, 246.6±48.5% pred.; and TLC, 138.4±17.0 % pred. Control group patients exited the study after the 6-month evaluation (data previously reported[1]), and Zephyr Valve treated patients were followed out to 24-months.

Results: Patients with complete data (no imputations) at 12-months (n=48), 18-months (n=40), and 24-months (n=39) were included in the analysis. Clinically and statistically significant improvements over Baseline were maintained out to 18 months for FEV_1, 15.72 ± 30.72% (p=0.003); SGRQ, -8.6 ± 10.7 points (p<0.001); 6MWD, 44.5 ± 63.6 m (p<0.001); RV, -740 ± 1100 mL (<0.001); and BODE Index, -1.12± 1.63 points (p<0.001). Clinically and statistically significant improvements were maintained at 24- months for FEV_1, 12.67 ± 32.15% (p=0.018); RV, -640 ± 1270 mL (p=0.004); and SGRQ, -8.9 ± 12.7 points (p<0.001). While improvements in the BODE Index was statistically significant at 24-months, p=0.013,the change of -0.78 ± 1.84 points was less than the MCID of -1 point. The most common adverse eventduring the period beyond 6-months out to 24-months was COPD exacerbation. There were 8 deaths during the 6- to 24-month period that were all deemed to be "Not related" to the Zephyr Valves (cardiac arrest, n=3; myocardial infarction, n=1; pneumonia, n=2; end stage respiratory disease, n=1; and hemoptysis in contralateral lung, n=1).

Conclusions: Patients with severe heterogenous emphysema treated with Zephyr Valves achieved durable reduction in hyperinflation out to at least 24-months with resultant improvements in lung function, quality of life and exercise capacity out to at least 18-months,and for lung function and quality of life out to at least 24-months, with an acceptable safety profile. The long-term benefits of the Zephyr Valve treatment are particularly remarkable given the degenerative nature of this disease and the expected decrease in these measures over 24 months.

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Institutional Affiliations of Authors for TRANSFORM ABSTRACT-AABIP2021

Site 11: Uppsala Dr. Gustav Broman Department of Pulmonary DiseasesUppsala University Hospital 751 85 Uppsala Sweden e-mail: Gustav.broman@akademiska.se Tel: 0046 (0)18-6114065	**Site 12: Lund** Dr. Lars Ek Department of PulmonaryDiseases Skåne University Hospital inLund 221 85 Lund Sweden e-mail: lars.ek@skane.se Tel: 0046 (0)46-177340	**Site 21: Gent** Prof. Eric Derom Univeristeit Gent Dienst Longziekten 7 K12 IEDe Pintelaan 185 9000 Gent Belgium e-mail: Eric.Derom@uzgent.beTel: 0032 (0) 9 332 2611
Site 22: Menen Dr. Kris Carron Department of PulmonologyAZ Delta Rijselstraat 71-73 8930 Menen Belgium e-mail: kris.carron@azdelta.beTel: 0032 (0) 56522270	**Site 32: Sutton-in-Ashfield** Dr Nicola Downer King's Mill HospitalMansfield Road Sutton-in-Ashfield Nottinghamshire NG17 4JLUnited Kingdom e-mail: nicola.downer@sfh-tr.nhs.uk Tel: 00 44 1623 622515	**Site 33: Glasgow** Mr Alan J. B. Kirk West of Scotland Regional Heart& Lung Centre Golden Jubilee National HospitalClydebank G81 4DY West Dunbartonshire Scotland, United Kingdom e-mail: Alan.Kirk@gjnh.scot.nhs.uk
Site 34: Sheffield Mr Jagan Rao Sheffield Teaching Hospitals NHS Foundation Trust Herries Road Sheffield S5 7AUUnited Kingdom e-mail: Jagan.Rao@sth.nhs.ukTel 00 44 114 2266811	**Site 35: Cardiff** Ms Margaret Kornaszewska University Hospital of Wales Department of CardiothoracicSurgery Cardiff CF144XW United Kingdom e-mail: mkorna@yahoo.comTel 00 44 (0) 796 290 20 46	**Site 36: London** Dr. Samuel Kemp The Royal Brompton Hospital &Harefield NHS Foundation TrustRoyal Brompton Hospital Sydney Street SW3 6NP London United Kingdom e-mail: S.Kemp@rbht.nhs.uk Tel: 00 44 (0)20 73 51 80 21
Site 41: Nice Prof. Charles-H Marquette Hospitalier Universitaire Service de Pneumologie Hôpital Pasteur - Pavillon H Centre Hospitalier Universitaire deNice 30 Voie Romaine CS 51069 06002 NICE cedex 1France e-mail: marquette.ch@chu-nice.fr Tel 00 33 (0) 4 92 03 88 83	**Site 42: Grenoble** Prof. Christophe Pison Chef de la Clinique Universitairede Pneumologie CHU de Grenoble CS10217 38043 Grenoble Cedex 09France e-mail: CPison@chu-grenoble.frTel 00 33 (0) 4 76 76 58 98	**Site 43: Paris, Bichat** Prof. Herve Mal Service de Pneumologie A,Hôpital Bichat 46 rue Henri Huchart 75877 Paris Cedex 18France e-mail: herve.mal@bch.aphp.frTel 00 33 1 40256438
Site 44: Paris, Pitié Salpétrière Dr Valéry Trosini-Desert Service de Pneumologie et Réanimation Unité d'Endoscopie bronchique Groupe Hospitalier Pitié Salpétrière47-83 boulevard de l'Hopital 75013 Paris France e-mail: valery.trosini-desert@psl.aphp.fr Tel 00 33 (0) 1 42 16 78 20	**Site 61: Heidelberg**Prof Felix Herth, Prof Ralf Eberhardt Thoraxklinik am Universitätsklinikum Heidelberg Amalienstr. 5 69126 Heidelberg Germany e-mail: felix.herth@med.uni-heidelberg.de Tel 00 49 6221 3961200	**Site 62: Berlin** Dr Ralf-Harto HübnerBerlin-Charité Charité Campus Virchow-Klinikum (CVK) Augustenburger Platz 1 13353 Berlin Germany e-mail: ralf-harto.huebner@charite.deTel 00 49 304 505 53
Site 63: Essen Dr Kaid Darwiche Ruhrlandklinik WestdeutchesLungenzentrum Tüschener Weg 40 45239 Essen Germany e-mail: kaid.darwiche@ruhrlandklinik.uk-essen.de Tel 00 49 201 433 4219	**Site 71: Groningen** Prof. Dirk-Jan Slebos Department of PulmonaryDiseases University Medical Center Groningen Postbus 30.001 700RB GroningenThe Netherlands e-mail: d.j.slebos@umcg.nlTel: 00 31 503612357	Narinder S. Shargill, PhDPulmonx Corporation 700 Chesapeake Drive Redwood City, Ca 94063 e-mail: nshargill@pulmonx.comTel: 1 925 895 5880

Dye Marking of Peripheral Lung Nodules in the Era of Robotic-Assisted Thoracic Surgery

Van K Holden, Shelby Stewart, Faria Nasim, Ngoc-Tram Ha, Edward Pickering, AshutoshSachdeva

University of Maryland School of Medicine

Background: Robotic-assisted thoracic surgery (RATS) is being increasingly utilized for management of early stage lung cancer or indeterminate pulmonary nodules in high-risk patients. Most of the limitations of VATS can be overcome with use of wristed instruments, in addition to magnified 3-D and high-definition imaging with RATS. Dye-marking or tattooing is particularly useful for smaller, peripheral lung nodules (PLN), given lack of haptic feedback with RATS. Technical advancements including incorporation of infra-red light source or FireFly™ fluorescence imaging allows identification of auto fluorescent agents such as indocyanine green(ICG). This makes ICG a preferred agent as the dye does not need to transcend the visceral pleura.

Methods: This is a single-center, retrospective review of prospectively collected data, of all patients undergoing ICG dye-marking prior to RATS for diagnosis and therapeutic managementof PLN or other reason from December 2018 to December 2019. All patients underwent guidedbronchoscopy using superDimension™ platform. The ICG dye was instilled using needle technique, via an extended working channel, either in or around the target site. Fluoroscopy was used in all cases and tissue sampling was performed in select cases prior to dye-marking. Patients immediately underwent RATS with FireFly™ fluorescence imaging. Success was definedas surgeon's ability to localize the site and presence of diagnostic tissue on wedge biopsy. The amount of dye instilled varied with the type of needle used. Patients either underwent resection or oncologic appropriate surgical treatment based on "frozen-section" diagnosis.

Results: A total of 14 cases were performed during this timeframe. All procedures were performed for PLN except one, which was done for localization of foreign body. Mean nodule size was 14.6 mm (6 - 25mm), and mean dye volume was 0.6 mL (0.375 - 1.3 mL). In 10/14 cases(71%), the dye was instilled at the target site. Tissue sampling was attempted in 5/14 cases (36%) prior to dye-marking. The procedure was successful in 85.7% of the cases. In 2 patients in which the dye could not identified on FireFly™, there was diagnostic tissue on wedge biopsy.

Conclusions: ICG dye marking has a high success rate for localization prior to RATS and can besafely performed using guided bronchoscopy. The total volume instilled may differ with the type of needle used.

Endobronchial carcinoid tumor with *Aspergillus* superinfection

Anne Reihman MD, Jared Lee MD, Rosane Duarte Achcar MD, Ellen Volker MD

Introduction: Pulmonary carcinoid tumors compromise approximately 2% of primary lung cancers. Endobronchial carcinoid tumors often lead to airway obstruction and post-obstructive pneumonia; superinfection of the tumor itself is rare. Here we present a case of endobronchial carcinoid tumor with *Aspergillosis sp.* superinfection.

Case summary: A 31yo female presented with 1-year history of difficult to control asthma. Physical examrevealed oxygen saturation of 86% on room air and decreased breath sounds in the left lung base. Chest CT showed a 15x11mm endobronchial mass in the left mainstem bronchus extending into the left lower lobe (LLL) bronchus complicated by LLL air trapping [Image 1].

She underwent bronchoscopy with endobronchial biopsy of an obstructing left mainstembronchus mass with areas of necrosis. Tumor debulking with Diode laser and electrocautery forceps was performed with improved patency of the left mainstem bronchus, but ongoing total obstruction of the LLL bronchus **[Image 1]**. Pathology demonstrated proliferation of neuroendocrine cells (synaptophysin+, chromogranin+, CD56+) with bland nuclear features and low proliferative marker (Ki67 3-5%) diagnostic of a typical carcinoid tumor. GMS-staining was positive for abundant fungal organisms with acute angles suggesting superinfection with *Aspergillus sp.* **[Image 2].** Patient was referred to both infectious disease and thoracic surgery. Voriconazole was initiated followed by left lower lobectomy. A 9mm tumor was resected with negative lymph node sampling yielding a final pathologic diagnosis of typical carcinoid Stage 1a (T1bN0M0) tumor and continued identification of *Aspergillus sp*.

Conclusion: Pulmonary carcinoid tumors involving the central airways commonly cause post- obstructive pneumonia but rarely can become superinfected. *Aspergillus sp.* and *Mycobacterium Tuberculosis* have been reported as etiologic organisms for superinfection. Concomitant *Aspergillus* infection can lead to initial misdiagnosis of carcinoid endobronchial tumors. Clinicians should be aware of possible superinfection of endobronchial carcinoid tumors and appropriate tests sent to ensure proper initial diagnosis and treatment.

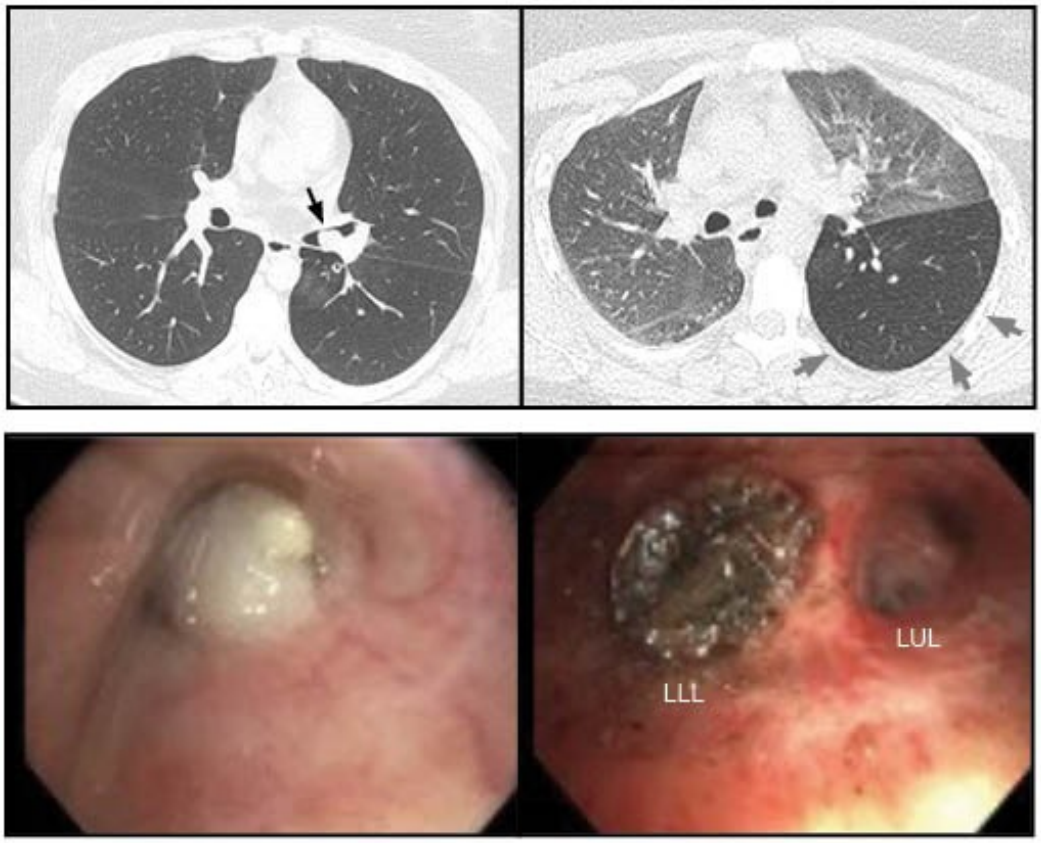

Image 1. *Top left:* CT scan of the lungs showing obstructing left mainstem endobronchial nodule (black arrow). *Top right:* Expiratory images showing significant leftlower lobe air trapping (gray arrows) as a result of the endobronchial mass obstructing the left lower lobe bronchus. *Bottom left*: Bronchoscopic views of an obstructing left mainstem endobronchial mass with proximal areas of necrosis. *Bottom right:* Improved patency of the left mainstem bronchus after tumor debulking, but with ongoing obstruction of the left lower lobe

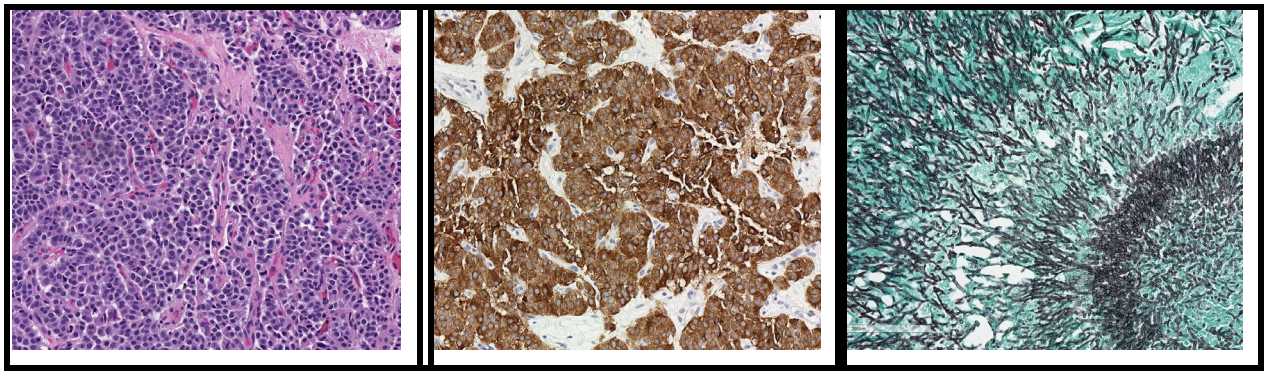

Image 2. Pathology from endobronchial biopsies demonstrated proliferation of neuroendocrine cells with bland nuclear features on H&E stain (*left*). Cells stained positive for synaptophysin (*middle*) confirming the diagnosis of typical carcinoid tumor.GMS stain (*right*) demonstrated abundant acute angle branching fungal organisms consistent with *Aspergillus sp* infection of the endobronchial tumor.

Endobronchial hamartoma – a coincidence finding

Sónia Guerra, Catarina Cardoso, Sandra Figueiredo, Adriana Magalhães

Centro Hospitalar Tondela-Viseu, Viseu, Portugal

Introduction: Endobronchial hamartoma (EH) is a rare, benign tumor of mesenchymal tissue origin that may present with symptoms of obstructive pneumonia, pulmonary atelectasis or incidentally. It occurs more commonly in males with peak incidence in 60-70 years old. The treatment is usually conservative by endoscopic excision, being surgical resection reserved for larger tumors, post-obstructive lung injury or recurrent pneumonia. EH has very low risk of malignancy and recurrence.

Case summary: A 63-years-old male, former smoker (35 pack-years), worker in a factory, was admitted at urgency department after falling from height with impact on the dorsal region which caused persistent chest pain. He had no dyspnea, cough or wheezing. No loss of consciousness. No previous respiratory infections or other respiratory disease. No history of gastric aspiration or dysphagia. Chest radiograph showed right lower lobe opacity, suggestive of pulmonary atelectasis. Chest-CT scan revealed obstruction of a segmental bronchus of right inferior lobar bronchus (RILB) by 2 cm lesion with fat density with distal consolidation area. Flexible bronchoscopy confirmed the presence of obstructive polypoid lesion with sharply defined margins in lateral basal segmental bronchus of RBILD. Bronchial biopsies were not sufficient for diagnosis. The patient underwent rigid bronchoscopy and the lesion was partially removed by laser photocoagulation and mechanical debridement. Revaluation was performed one month after by flexible bronchoscopy and complete removal was achieved using photocoagulation laser. Histological exam presented fibromyxoid and adipose components, suggestive of hamartoma. The patient maintained asymptomatic in follow-up.

Conclusion: The authors present a case of EH found incidentally despite radiological appearance of post- obstructive pneumonia. Since it was a small lesion in an asymptomatic patient, endoscopic resection using laser photocoagulation was successfully performed, with complete lung expansion after procedure.

Endobronchial Tumor with Ball Valve Mechanism, A Real Airway Emergency

Andrew Talon[1], MD Sreeja Biswas Roy[2], MD Muhammad Z. Arif[1], MD, Saad Alkhider[1], MD, Ali I. Saeed[1,3], MD

[1]Internal Medicine, Creighton University School of Medicine Phoenix Regional Campus, Valleywise Health Medical Center, St. Joseph's Hospital and Medical Center, Phoenix, AZ
[2]Pulmonology and Critical Care Medicine, Mayo Clinic, Phoenix, AZ
[3]Interventional Pulmonology, Norton Thoracic Institute, Phoenix, AZ

Introduction: Central airway obstruction (CAO) from tumor can be life threatening requiring emergent tumordebulking or airway stenting. Airway obstruction of the right main stem with ball valve mechanism of the left main stem with occlusion has not been reported.

Case Summary: A 61-year-old woman with COPD and recent diagnosis of a right hilar mass presented to a regional hospital with worsening dyspnea and hemoptysis. She underwent emergent intubationfor impending respiratory arrest. The patient was ventilated with PRVC, FiO2 100%, PEEP 8. Her ABG showed pH 7.21, pCO2 67. A flailing tumor was seen in the lower trachea with ball valve occlusion of the left main bronchus and complete occlusion of the right main stem. Endoscopic resection was accomplished using electrocautery snare and cryoprobe. The distal BIshowed evidence of extrinsic compression. A 7 x 22 mm iCAST stent was placed at the BI and upsized with balloon to 9 mm. APC and T-1470 LiteTouch laser were used for hemostasis and tumor destruction. Biopsy revealed high grade sarcomatoid renal cell carcinoma. Patient was extubated and discharged on chemoradiation.

Conclusion: The patient was at high risk of asphyxiation due to tumor occlusion of the left airway and bleeding associated with tumor excision. Rigid bronchoscopy (RB) has been preferred for airwaycontrol in CAO. RB was not used in our case due to high minute ventilation from mixed respiratory/metabolic acidosis. The patient did receive one ampule of bicarbonate to provide timefor tumor removal. We did not have the opportunity for upfront use of laser or APC due to high O2 requirements. Tumor retrieval with flexible bronchoscopy (FB) may take longer, but there is no interruption in ventilation. Removal of the tumor with cryoprobe was preferred due to the riskof asphyxia. FB can be safely used in resection of large endotracheal tumors.

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Endobronchial Valves for Management of Persistent Air Leaks in COVID-19 Patients: A Case Series

Lisa Jarnagin and Raed Alalawi

Division of Pulmonary and Critical Care, Banner University Medical Center Phoenix

Background: Pneumothorax and subsequent persistent air leaks (PALs) are a known complication in COVID-19 with likely a multifactorial etiology given the diagnosis in both ventilated and non-ventilated patients. The incidence, however, remains unclear [1]. Treatment modalities for PALs in this population, including endobronchial valves, is described only in case reports within the literature [2, 3]. We present a case series of patients with persistent air leak secondary to COVID-19 infection treated with Spiration Valve System at a single academic center.

Methods: A retrospective chart review of patients hospitalized with COVID-19 undergoing endobronchial valve placement for the indication of persistent air leak from July 2020 to April 2021 at Banner University Medical Center Phoenix was performed. Only patients with pneumothoraces and subsequent persistent air leak within the first four weeks following their initial positive COVID test were included.

Results: A total of 10 patients were reviewed, 7 of which met inclusion criteria with a COVID positive test within four weeks of their initial pneumothorax. Ages ranged from 23 to 73 with malepredominance (86%). All patients were intubated at time of initial pneumothorax, with an averageof 13 days between date of admission and pneumothorax. One patient was on venous-venous extracorporeal membrane oxygenation (ECMO) prior to the procedure. Median time between pneumothorax and placement of endobronchial valve for PAL was 27 days. All patients were treated with Spiration Valve System endobronchial valves with a range of 2 - 6 valves placed. Only the patient on ECMO required bilateral valve placement and underwent repeat bronchoscopyfor valve evaluation and replacement. All patients had a significant reduction of air leak. Three patients, including the patient on ECMO, were successfully extubated and subsequently dischargedon supplemental oxygen.

Conclusion: While surgery remains the gold standard for treatment of PALs, the literature provides minimal guidance regarding alternative options in poor surgical candidates [4, 5]. Patientsrequiring ICU level care for COVID-19 are rarely surgical candidates given their active and severedisease, and thus non-surgical options are necessary. Furthermore, those with pneumothorax appear to have a higher mortality. Endobronchial valves are a viable option for PALs in this population and help to subsequently wean patients from the ventilator in the right candidates. Further studies are needed to help characterize the ideal candidate, and prognosticate survival in patients with COVID-19 and pneumothorax.

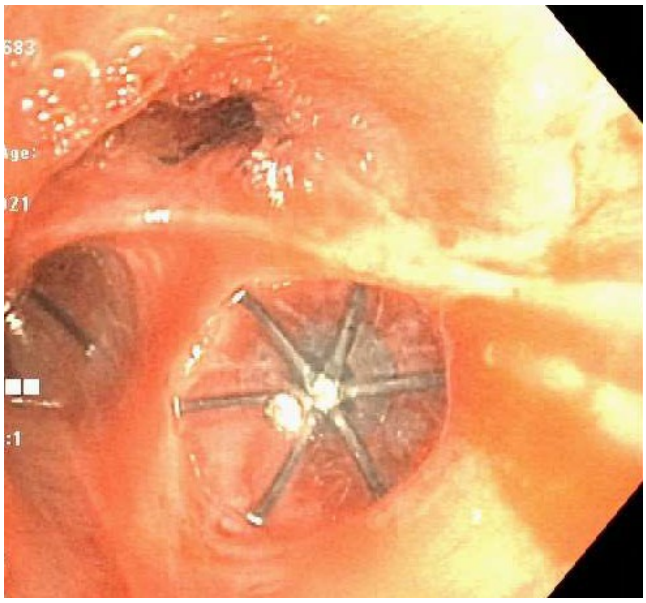

Figure 1: Spiration endobronchial valve placement within the RUL of a COVID-19 patient withpersistent air leak.

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Estimating the learning curve of LungVision System

Matthew Nobari MD, Kelly Ball NP, Russell Miller MD, George Z. Cheng MD PhD
Interventional Pulmonology, Division of Pulmonary Critical Care and Sleep Medicine, UCSD, San Diego CA.

Background: The inability to visualize the tool inside suspicious pulmonary lesions (SPL) during biopsy is a significant limitation of Navigation Bronchoscopy. The LungVision system (Body Vision Medical Ltd, Israel) enables real-time, CT-like imaging using C-Arm Based Tomography (CABT) during bronchoscopy. When incorporating a novel technology, learning curve will influence workflow efficiency and clinical outcomes. Hence, it is essential to have an accurate estimate of the time needed to reach proficiency.

Methods: Physician performed peripheral bronchoscopy on a preoperative CT scan uploaded in LungVision Planningsoftware. The LungVision augmented fluoroscopy platform was used to navigate to the SPL as found through CABT imaging. Lesion location was verified by radial EBUS (rEBUS) and/or tool at lesion confirmation was performed with CABT. Endpoints for analysis included tool at lesion success rate, time to complete application-specific steps in the workflow (including registration of LungVision imaging with preoperative CT, navigation to the lesion and tool at lesion confirmation with CABT) and, as a marker for learning effects, the number of LungVision-related questions physicians asked of the Body Vision Medical clinical applications representative during the procedure.

Results: Here we present the interim findings from the first 17 consecutive cases of a planned prospective fifty- patient study, with one of the physicians in the study performing nine and the second physician performing eight of the procedures. The patients had a mean age of 72.5, and 71% were female. Five of the lesions (29.4%) were located in the RUL, 6 (35.3%) in the LUL, 2 (11.8%) in the RML, 2 (11.8%) in the RLL, and 2 (11.8%) in the LLL. Average size of the lesions was 18.2 mm. Navigation to the SPL was verifiedby rEBUS in 75.0% of cases. Tool at lesion was confirmed by CABT in 81.2% of cases. A best fit trend line for the average number of questions asked by each of the two physicians who performed the LungVision procedures suggests that a pulmonologist may reach full proficiency at utilizing the LungVision System and Procedural Kit without manufacturer representative support in 9 to 12 procedures performed on a biweekly basis.

Conclusion: The high degree of localization with successful tool at lesion confirmation using the LungVision system demonstrates the clinical application of this technology. Moreover, learning effects did not have a negative impact on clinical outcomes. Data suggests that physicians can become facile in using LungVisionin a very short period of time.

Evaluation of Deployment Capability and Accuracy of a Novel, Outside the Scope (OTS), Fully Detachable, Catheter Deployment System for Targeting ofPeripheral Lung Lesions via Flexible Bronchoscopy: An Ex-Vivo Human Lung Model Study

Taha Huseini MBBS FRACP[1], Stephan Adamour Soder MD[1], Amit Katz MD[1], Pasquale Ferraro MD[1], Edwin Lafontaine MD[1], Jocelyne Martin MD[1], Basil Nasir MD[1], Teresa Mihalik[2], Moishe Liberman MD PhD[1]

[1] Centre de Recherche de Centre Hospitalier de l'Université de Montréal (CR-CHUM), Montréal,Canada
[2] Agile MV Inc., Montréal, Québec, Canada

Background: Endobronchial approaches to ablative therapy in malignant lung nodules is of growing interest in the treatment of lung cancer. For safe and effective trans-bronchial ablation, not only does the catheter need to be delivered precisely to the lesion of interest, but it should also be free from the bronchoscope to allow formultiple catheter insertions and scope freedom throughout the procedure for both safety and visualization.

A novel, fully-detachable, disposable, outside the scope (OTS) probe system (Detachable OTS Platform, Endocision; Montreal, Quebec, Canada) which attaches to a flexible bronchoscope was developed. Using this system, the operator can deploy the probe in the target bronchus and completely detach it from the scope. The aim of this study was to demonstrate the endobronchial deployment accuracyand feasibility of an OTS, detachable, simulated ablation catheter driven to peripheral lung targets in an ex-vivo human lung model.

Methods: Explanted lungs from consented lung transplant recipients (clinicaltrials.gov NCT04722432) were attachedto a 9.0Fr endotracheal tube for mechanical ventilation. A 14Fr Fogarty balloon catheter inserted 3cm deepfrom the pleural surface was used as a simulated target in the lung parenchyma. The balloon was inflated with 2cc of iohexol contrast and position was confirmed with fluoroscopy.

A 1.7mm(5.0Fr) simulated ablation catheter was positioned outside the flexible bronchoscope, attached distally and aligned to the tip of the scope using the detachable OTS system (Figure 1). Under fluoroscopic guidance, the bronchoscope and the attached catheter were driven towards the target and oncethe tip of the catheter was confirmed within the target, the detachable OTS system was released and the probe was detached from the scope. The bronchoscope was retracted and fluoroscopy was used to confirmthe position and stability of the catheter tip during multiple cycles of ventilation.

Results: A total of 10 peripheral targets were simulated (LUL=2, LLL=2, RUL=2, RML=1, RLL=3) in 5 explant lungs (right=3, left=2). The accuracy of the deployment method was measured by fluoroscopy (Figure 2). We successfully deployed the catheter with its tip positioned at a distance of less than 5mm from the targetand confirmed stability during multiple cycles of ventilation.

Conclusion: A novel, detachable, OTS system can be successfully deployed in peripheral parenchymal lung targets withpotential clinical applications. It has potential implications for advanced flexible and robotic bronchoscopydevice delivery for multiple procedures where scope freedom is advantageous.

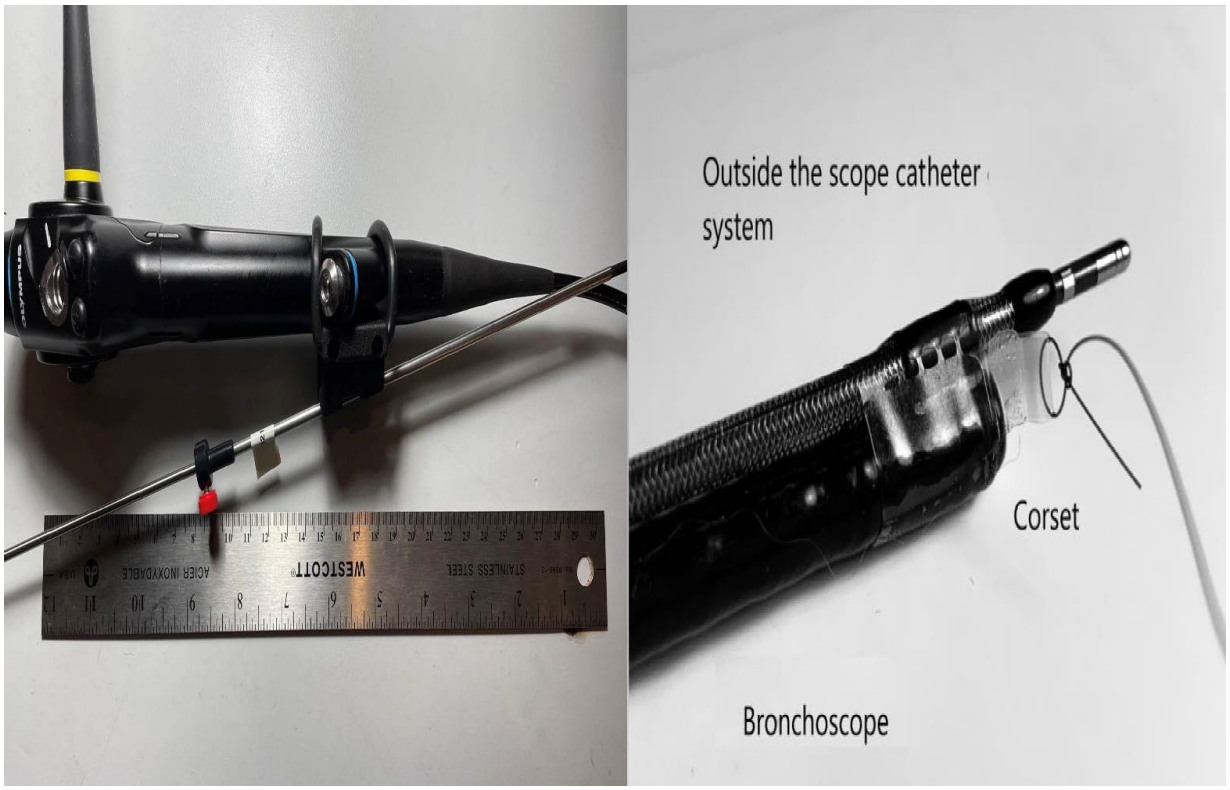
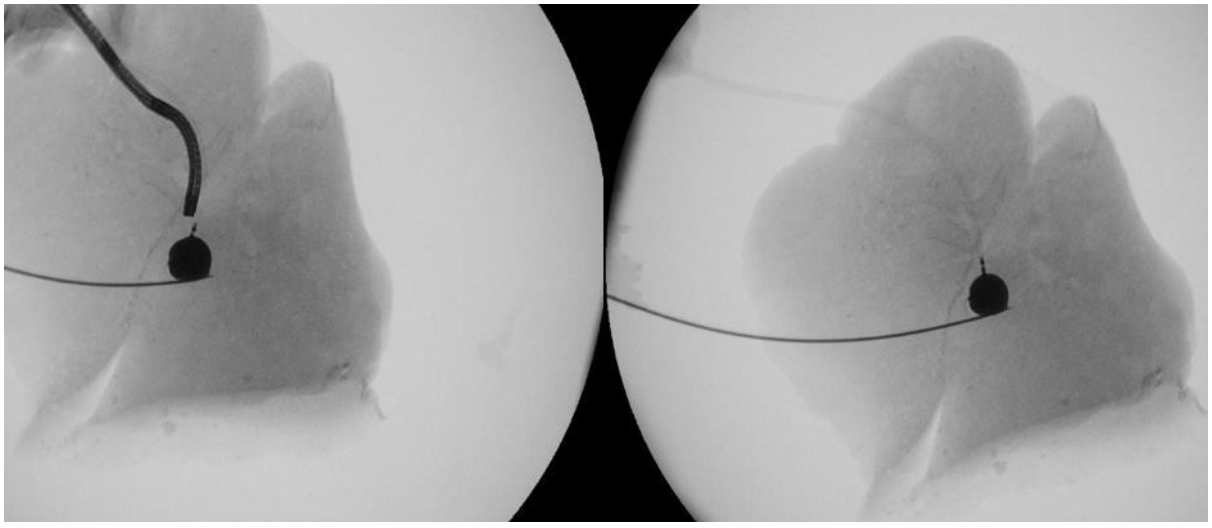


Figure 1: Outside the scope (OTS) detachable catheter system attached to the bronchoscope with arubber clip at the top (left) and aligned at the bottom with a detachable corset (right).



2a 2b

Figure 2a: Contrast filled simulated target lesion in left lower lobe, bronchoscope and simulatedcatheter attached OTS in close proximity to the target lesion.
Figure 2b: Bronchoscope has been retracted and simulated catheter stays in stable position.

Expiratory Central Airway Collapse Severity Score, A Call Out for a New Definition

David Abia-Trujillo, MB, MD[1]; Alejandra Yu Lee-Mateus, MD[1]; Juan C. Garcia-Saucedo, MD[1]; Omran Saifi, MD[2]; Neal A. Patel, MD[1]; Sebastian Fernandez-Bussy, MD[1]

[1] Division of Pulmonary, Allergy, and Sleep Medicine, Mayo Clinic Florida, Jacksonville, FL, USA
[2] Department of Radiation Oncology, Mayo Clinic Florida, Jacksonville, FL, USA

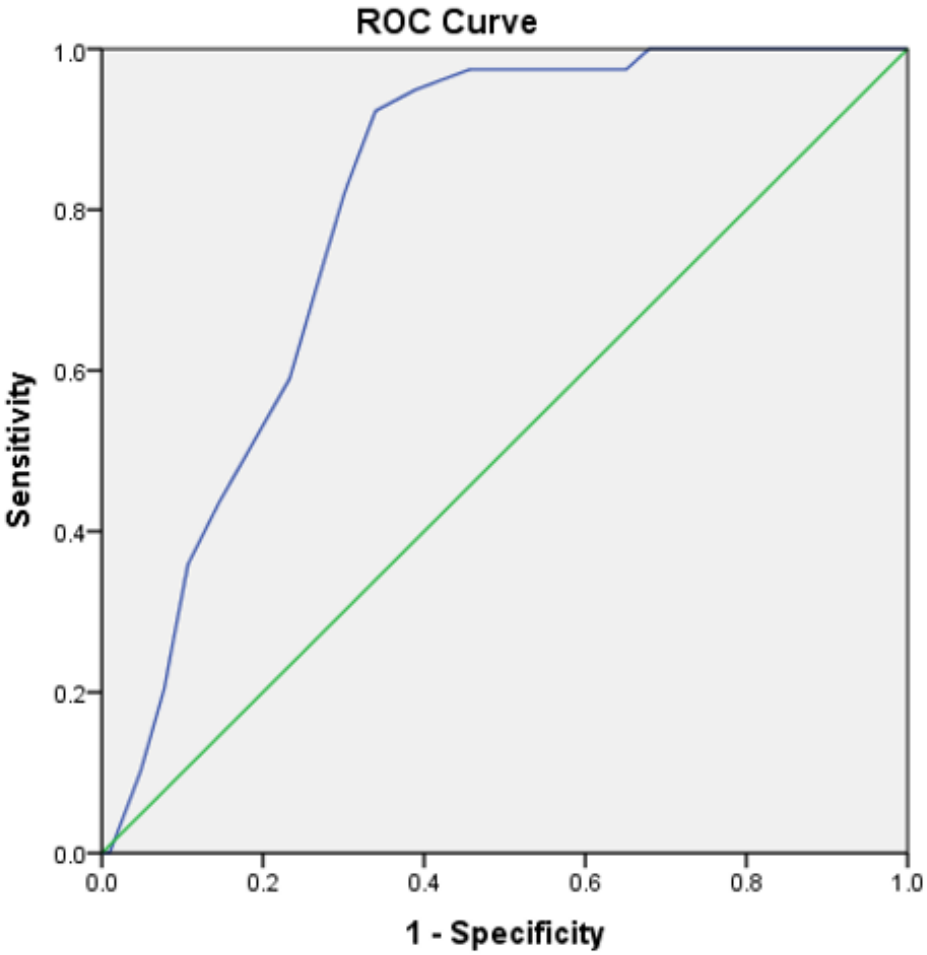
Background: Expiratory Central Airway Collapse (ECAC) is a pathophysiologic entity that is incompletely understood. Its diagnosis and treatment hold criticisms among the pulmonary community and this, in part, is due to its lack of standardized approach. Its current severity evaluation is based on individualized determinations of the collapsibility of the central airway upon forced exhalation at six different levels without an overall assessment of the severity of the disease. The overall disease severity determination that merits a stent trial remains unstandardized and a more holistic approach is needed. Our study strives to establish an overall severity index to guide the management of this challenging pathologic entity.

Methods: This is a retrospective cohort study of patients who underwent dynamic bronchoscopy for evaluation of ECAC from January 2019 to February 2021. Each airway segment was given a numeric value based on the degree of collapsibility: zero points for less than 70%, one point for 70-79%%, two points for 80-89%, and three points for over 90% airway collapse. One extra point was assigned if the patient had a confirmed history of Obstructive Sleep Apnea (OSA). These "severity points" were added and designated as an overall severity score (OSC). A subgroup analysis was performed in the patients considered to have severe ECAC, defined as those patients who required a stent trial with uncovered self-expandable metallic stents. The SC were added to generate a total score that helped us predict the need for a stent trial. A receiver operator characteristic (ROC) curve with the corresponding area under the curve (AUC) and 95% CI was generated to compute sensitivity and specificity across all the possible threshold values for the continuous variable of interest.

Results: A total of 142 patients were reviewed (median age: 64.5; 69% females; 35.2% former smokers; 71.8% OSA). Our Scoring System for Stent Trial differentiated severe from non-severe ECAC based on the corresponding AUC: 0.81, 95% CI: 0.730–0.88, p <.001. A total score cutoff of 9 has a sensitivity of 95% and specificity of 61% for predicting severe ECAC and the need for a stent trial.

Conclusion: The results of our study suggest that a scoring system based on numerical values for segmental airway collapsibility can be a reliable tool to assess the overall severity of ECAC and the potential need for a stent trial.

Figure 1: ROC for the total ECAC severity score



Flying Blind? There's a Way: Acute Hypoxia Workup of the Morbidly Obese Patient

Dr. Kevin Chan, Dr. Naila Javaid, Dr. Jose Medrano, Dr. Lynne Le, Rita Alajajian PharmD, Dr. Justin Thomas

Corresponding Author Email and Institute
kevin805@gmail.com from Eisenhower Health
Njavaid@eisenhowerhealth.org from Eisenhower Health
jmedrano@eisenhowerhealth.org from Eisenhower Health
lle@eisenhowerhealth.org from Eisenhower Health
rita.alajajian@cshs.org from Cedars-Sinai
JThomas2@eisenhowerhealth.org from Eisenhower Health

Introduction: Obesity is rising in prevalence in the USA, with projections indicating that by 2030 half the US population will be considered obese of which 10% will be considered morbidly obese. The morbidly obese patient presents a unique challenge in medicine, particularlyif they exceed the weight limits of the gold standard imaging devices needed for diagnosis. Interventional pulmonology may offer alternative methods of work-up.

Case Summary: 29-year-old male presents with worsening lower extremity and scrotal swelling and redness and also with dyspnea. He is morbidly obese with a BMI of 90 kg/m2. He is atrucker leading a sedentary lifestyle though was able to ambulate normally.

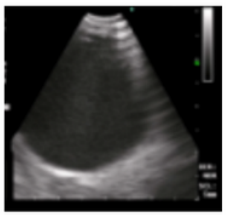
Vitals notable for RR of 28-32, HR 120s, and O2 Sat 75% on room air. Improved with supplemental oxygen. Labs significant for troponin 0.120 ng/ml, BNP 319 pg/ml, d-dimer 1.52 mg/L FEU. Chest radiograph nondiagnostic. Patient's body habitus precluded CTand MRI imagery; local animal theme parks were contacted but refused due to liabilityissues. ECG showed normal sinus rhythm with poor R-wave progression.

Differentials included pulmonary embolism, pneumonia, heart failure. He was started onantibiotics, heparin drip, and furosemide. Initially responded, but then developed worsening hypoxic hypercapnic respiratory failure requiring endotracheal intubation. A transthoracic echo was done but the imaging was poor, so transesophageal echo was performed which showed severely reduced right ventricular systolic function. There wasconcern regarding using weight-based protocols for heparin dosing in this patient: he was receiving 2 liters daily from heparin infusions, so interventional pulmonology was consulted to consider central endobronchial ultrasound to rule out central pulmonary emboli. No central, lobar or segmental emboli were found (Figure 1); anticoagulation was discontinued.

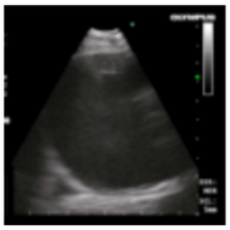
The leading diagnosis was right heart failure and pulmonary hypertension in the settingof morbid obesity and chronic obesity hypoventilation syndrome and the patient was carefully diuresed. He was extubated after net removal of 12 liters of fluid and was ableto be discharged home after further diuresis.

Conclusion: The morbidly obese patient can be difficult to evaluate when gold standard imaging modalities are excluded or nondiagnostic. Here, interventional pulmonology can be used to rule out pulmonary emboli in order to facilitate de-escalation of treatment giventhe large amounts of fluid the patient was receiving from anticoagulation.

Left main pulmonary artery



Right main pulmonary artery



Lobar branches of right sided pulmonary artery

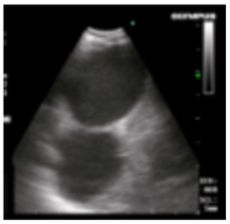


Figure 1: Clear pulmonary arteries by EBUS

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Histoplasmosis as a cause of positive ANCA: case report

Hussein Asad, MD, Matthew Aboudara, MD

Antineutrophil cytoplasm antibodies (ANCA) testing is usually performed to support the diagnosis of ANCA-associated vasculitis (AAV) that encompass Granulomatosis with polyangiitis(GPA), microscopic polyangiitis (MPA), eosinophilic granulomatosis with polyangiitis (EGPA).
However, other conditions can be associated with ANCA positivity, including but not limited to autoimmune diseases, malignancies, interstitial lung disease and infections.

We are reporting a case of a 40 y/o male with no significant previous medical history who presented to the ED for right sided chest pain and underwent a CT chest that was evident for multiple pulmonary nodules as well as hilar and mediastinal lymphadenopathy. The patient hada full workup including ANA panel, blood cultures, ESR, CRP, and ANCA. Serum MPO AB and PR3AB were both elevated. He was referred to interventional pulmonology for EBUS and Navigational biopsies. The patient had navigational bronchoscopy done with biopsies of the largest nodule evident on CT chest in the RML. He also had biopsies from station 7 and 4R via EBUS. The pathology was negative for malignancy however showed non caseating granuloma with multi nucleated giant cell formation along with fungal elements that had a positive GMS stain suggestive of histoplasmosis. His serum histoplasma AB immunodiffusion was done whichwas positive for M band. Patient was diagnosed with histoplasmosis and was started on Antifungal therapy.

The link between ANCA positivity and infection with histoplasmosis has been reported in the literature. A literature review showed a single case report of disseminated histoplasmosis andANCA positivity in a pediatric patient that was treated with liposomal amphotericin B and itraconazole with improvement of his signs and symptoms.

It is imperative to realize that ANCA positivity can be a result of other conditions besides AAVand hence testing should be based on clinical judgement.

How does ROSE affect EBUS negative predictive value?

Francisco Neri, Maria Alvarenga Santos, Vera Martins, Margarida Aguiar, SofiaTello Furtado

Background: Endobronchial ultrasound-guided transbronchial needle aspiration (EBUS-TBNA) is an essential tool for lung cancer staging. Rapid on-site evaluation (ROSE) can increase EBUS-TBNA diagnostic yield. In our facility, since the Covid19 pandemic, efforts were made tominimize the risk of exposure of health care professionals and ROSE was suspended.

The purpose of this study was to evaluate the negative predictive value (NPV) of EBUS- TBNA in lung cancer patients who were surgical candidates and the influence of ROSE on its diagnostic accuracy.

Methods: A retrospective analysis of patients who underwent EBUS for lung cancer staging in our hospital was made, and those in which surgery was performed were selected and separated in two groups: before Covid19 pandemic and with ROSE (group one: March 2019 – March 2020); during the pandemic, without ROSE (group two: March 2020 – March 2021). The demographic features, diagnostic approach, and time between EBUSand surgery of both groups were evaluated and NPV was calculated.

Results: 123 EBUS were performed, 75 in lung cancer patients. 53 patients were not surgical candidates and were offered other treatment. 1 was lost to follow up.

In the remaining 21 patients who underwent surgery after EBUS, 12 performed EBUS with ROSE (group one) whereas 9 did not (group two). Most were male (66.7% in both groups) with a similar average age (65.1±7.5 and 63.2±6.2 years, respectively). The mostcommon type of lung cancer was adenocarcinoma (7/12 and 8/9).

In group one, 1 patient had reduced node dimension and was not punctured. TBNA wasperformed in 11 patients and all punctured lymph nodes were negative. On subsequential surgery 3 patients had positive lymph nodes. Thus, NPV was 75% in this group. Mean time between EBUS and surgery was 66.2±25.7 days.

In group two, 2 patients had reduced node dimension and were not punctured. All the7 EBUS-TBNA punctured lymph nodes were negative, and 3 patients had positive nodes on surgery, with a NPV of 66.7%. Mean time was 49.8±23.2 days between procedures.

Conclusion: In our study there was a trend in favor of using ROSE when performing EBUS-TBNA, sincethe NPV was higher in that group. However, the small sample analyzed was an importantlimitation of this study, thus contributing to a NPV inferior of what has been published.The increased time between EBUS and surgery can also contribute to a lower NPV and needs to be improved.

Hyperbaric Oxygen Therapy for Treatment of Early Dehiscence After Tracheal Resection

Ngoc-Tram Ha, MD[1], Hatoon Abbas, MBBS[1], Elizabeth Guardiani[2], MD, Shelby Stewart, MD[3], Faria Nasim MBBS[1], Edward Pickering, MD[1], Ashutosh Sachdeva, MBBS, Van Holden, MD[1]

[1]Division of Pulmonary, Critical Care, and Sleep Medicine, Department of Medicine, University of Maryland School of Medicine

[2]Division of Otolaryngology, Department of Surgery, University of Maryland School of Medicine

[3]Division of Thoracic Surgery, Department of Surgery, University of Maryland School of Medicine

Introduction: The management of tracheal stenosis varies based on the degree of stenosis, presence of complex features, etiology, and severity of symptoms. Therapeutic bronchoscopic modalities include steroid injection, radial incisions, balloon dilation, cryotherapy, and stent placement. Tracheal resection is the preferred definitive treatment in selected patients with complex tracheal stenosis or those refractory to bronchoscopic intervention. Despite having success rates >90%, tracheal resection can be complicated by granulation tissue, infection, and dehiscence in up to 8% of patients. Herein, we describe the use of hyperbaric oxygen therapy (HBOT) in the treatment of early dehiscence after tracheal resection.

Case Summary: A 41-year-old woman with history of asthma, obesity, obstructive sleep apnea, and prolonged hospitalization for COVID-19 pneumonia complicated by acute respiratory distress syndrome requiring venovenous extracorporeal membrane oxygenation support and tracheostomy with eventual decannulation presented with dyspnea on exertion two months after discharge. Furtherwork-up, including a CT neck and subsequent bronchoscopy revealed a 6 mm stenosis that was 2.5 cm in length, complex, multi-level, and associated with malacia. She was treated with electrocautery radial incisions, balloon dilation, and cryotherapy with moderate improvement. She subsequently underwent definitive management with tracheal resection and primary anastomosis. Bronchoscopy two weeks later demonstrated early stages of dehiscence along the anterior aspect of the tracheal anastomosis (Fig 1). She was started on nebulized tobramycin and had a total of 11 sessions of HBOT with marked improvement (Fig 2).

Conclusion: A retrospective review of 23 patients who received HBOT (median of 9.5 sessions) as part of themanagement of tracheal anastomotic problems resulted in healing in 87% of patients. Thus, HBOT can significantly aid in the treatment of anastomotic complications with good outcome, similar to that in our patient. Proposed mechanisms of action are rapid granulation, early re- epithelialization, and angiogenesis.

Figure 1:

Tracheal anastomosis with granulation tissue and visible sutures

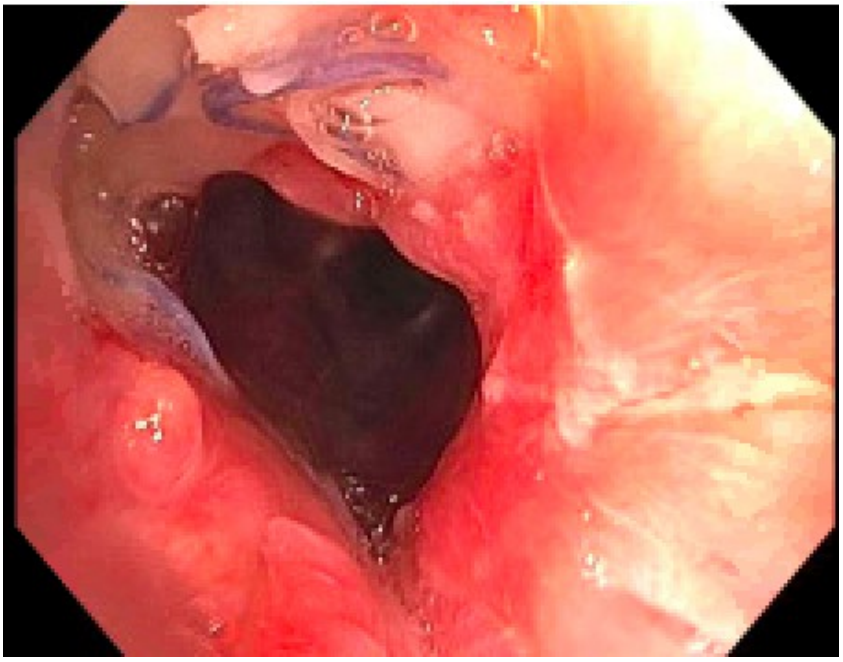
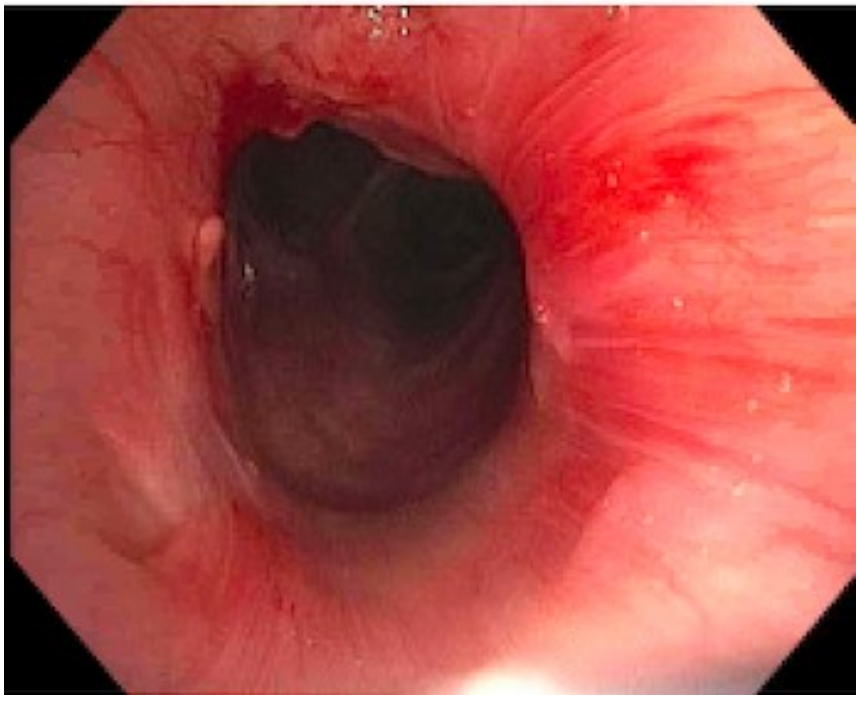


Figure 2:

Tracheal anastomosis post hyperbaric oxygen therapy



ICU bronchoscopy: quantifying variation in practice patterns

Max T. Wayne, MD[1]; Daniel Molling, MS[2]; Doug Arenberg, MD[1]; Jose DeCardenas, MD[1,3]; Hallie C. Prescott, MD, MSc[1,2]

[1]Division of Pulmonary and Critical Care Medicine, Department of Internal Medicine, University of Michigan, Ann Arbor, MI
[2]VA Center for Clinical Management Research, Ann Arbor, MI
[3]Section of Thoracic Surgery, Department of Surgery, University of Michigan, AnnArbor, MI

Background: Case series and clinical experience suggest that hospitals vary widely intheir use of bronchoscopic procedures in the intensive care unit (ICU), with some hospitals incorporating bronchoscopy into routine care for all patients with acute respiratory failure but others reserving the procedure for rare circumstances only. We sought to quantify variation in the use of ICU bronchoscopy, hypothesizing that there would be large variation in practice patterns between hospitals.

Methods: We identified all hospitalizations that received invasive mechanical ventilation(IMV) in the eICU Collaborative Research Database (eICU-CRD). The eICU-CRD is a publicly available ICU database that includes granular details of ICU admissions from 208 hospitals across the United States that used the Philips Healthcare telemedicine program in 2014-2015. We required a minimum of 3 data elements indicating receipt of invasive mechanical ventilation to identify our cohort, to account for inconsistencies in documentation. Hospitals with fewer than 25 mechanically ventilated patients during thestudy period were excluded to reliably measure variation across hospitals.
Bronchoscopy was identified through provider documentation and included only ifperformed after ICU admission. Our primary measure was the proportion of IMV hospitalizations that underwent bronchoscopy after ICU admission.

Results: Among 200,859 hospitalizations at 208 hospitals (2014-2015), 50,870 hospitalizations at 156 hospitals received invasive mechanical ventilation and were treated at a hospital with at least 25 IMV hospitalizations. The median age was 65 years, 56.9% were male, and 76.6% were White. Hospitalizations occurred across the United States (8.7% Northeast, 32.9% Midwest, 32.6% South, and 20.3% West) and 32.2% occurred at teaching hospitals. Median hospital length of stay was 8.1 days andin-hospital mortality was 17.6%. A total of 1,836 hospitalizations (3.6% of all IMV hospitalizations) underwent bronchoscopy. Across hospitals, the proportion of IMV hospitalizations receiving bronchoscopy ranged from 0% to 25.8% (median 2.1%) (**Figure 1**). Bronchoscopy rates varied by geographic region, ranging from 2.7% in theMidwest to 6.0% in the West.

Conclusion: In a nationwide sample of hospitals participating in telemedicine, there was more than 20-fold variation in the proportion of IMV hospitalizations that receivedICU bronchoscopy. The reasons for this variation are unclear, but the magnitude suggests differing practices (rather than merely differing case-mix). Future studies areneeded to better understand the variation and its impact on outcomes.

Figure 1: Caterpillar plot showing variation in proportion of patients receiving invasive mechanical ventilation undergoing bronchoscopy by hospital in 2014-2015

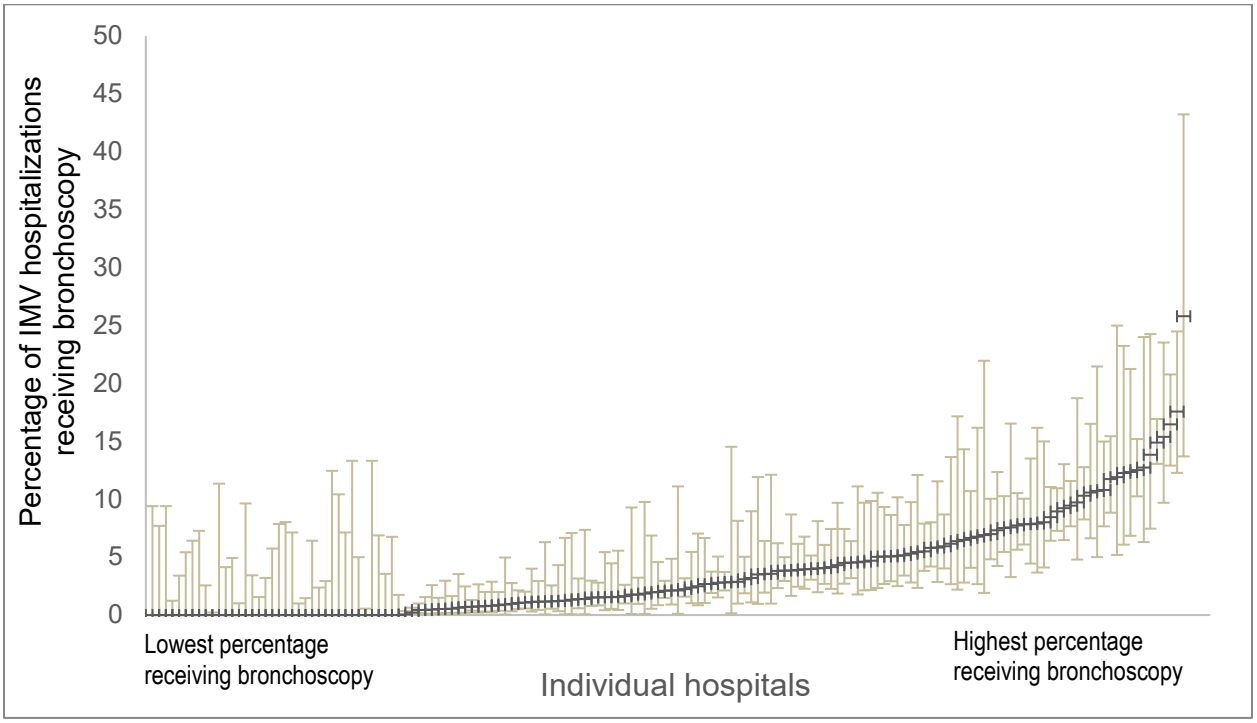


Figure 1 Legend: Caterpillar plot showing variation in the proportion of patients receiving invasive mechanical ventilation undergoing bronchoscopy by hospital in 2014-2015. Individual hospitals are ordered from lowest to highest percentage of patients receiving bronchoscopy. The proportion for each individual hospital is presented as a blue dot with corresponding 95% confidence intervals.

Incidence of Infectious Complications After Gloves-Only Ultrasound-Guided Thoracentesis

Anil Magge, Justin Goralnik, Charan Singh, Mark Metersky, Omar Ibrahim

Background: A thoracentesis is a pleural procedure that is commonly performed in the United States and can serve as both a diagnostic and a therapeutic tool for pleural effusions. Because thoracentesis is considered a sterile procedure, the physician is required to wash his or her hands and use a sterile technique. At the University of Connecticut Health Center's Department of Pulmonary Medicine and many institutions across the country, it is common practice to also wear a sterile gown, a mask, eye protection, and a cap. Little is known as to whether this extra protection has any added value in terms of preventing infectious complications or only increases the costs, time, and valuable protective equipment. Therefore, we performed a retrospective chartreview of 398 patients who underwent thoracentesis in the Department of Interventional Radiology with an abbreviated personal protective equipment that only involved sterile gloves.

Methods: Data was obtained from a retrospective chart review of patients who underwent ultrasound-guided thoracentesis by the Department of Interventional Radiology at the Universityof Connecticut Health Center between January 1, 2007 and December 31, 2017 utilizing only sterile gloves as PPE. Those who were classified as transudative effusions based on Light's criteria were further evaluated to determine whether they returned to the emergency department within four weeks of their thoracentesis and whether they had any infections of the skin or pleural space.

Results: Three hundred and ninety-eight patients who underwent ultrasound-guided thoracenteses were reviewed, of which 144 patients had transudative effusions. Among the patients who presented with transudative effusions, congestive heart failure was the most common etiology. Fifteen patients returned to the emergency department within four weeks ofthe original procedure, and six patients underwent repeat thoracentesis. None of these patientshad skin or pleural space infections.

Conclusions: To our knowledge, the present study is the first to detail aseptic techniques of ultrasound-guided thoracentesis. The results suggest that there is no difference in the incidence of pleural or skin infections following thoracentesis utilizing sterile gloves alone when comparedto using extra precaution with sterile gown, gloves, cap, and mask as PPE. Our study will requirelarger prospective studies to confirm these findings before we can recommend policy changes.

Machine learning models to predict failure in administration of intrapleural tPA/DNase in patients with complicated parapneumonic effusions /empyema: A multicenter study

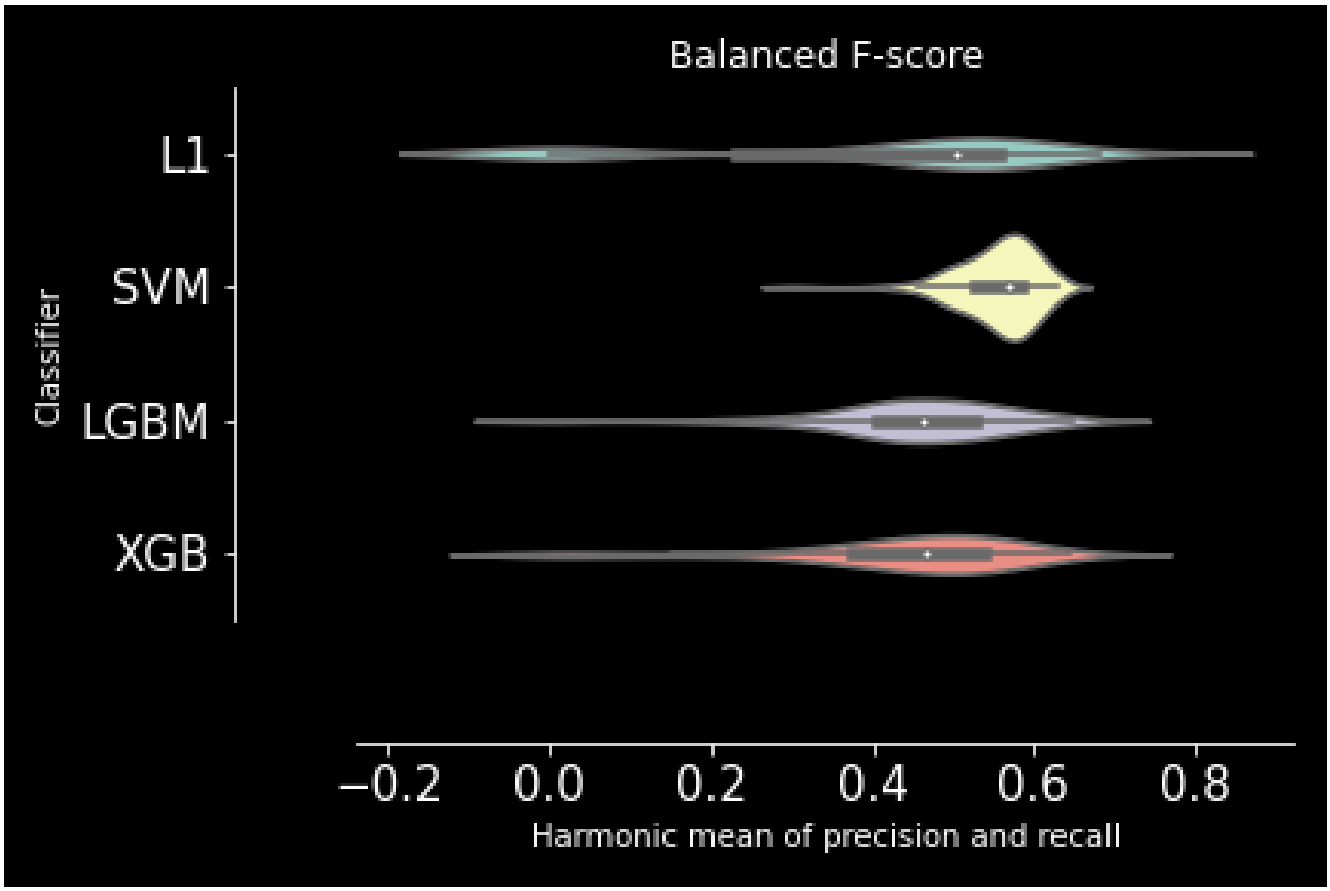
Danai Khemasuwan; Samira Shojaee; Chakravarthy Reddy; Christopher Gilbert; Jed Gordon, Akshu Balwan; Trinidad Sanchez; Billie Bixby; Jeffrey Sorensen; Candice Wilshire

Introduction: Intrapleural fibrinolytic therapy (IPFT) with tissue plasminogen activator (tPA) and deoxyribonuclease (DNase) has been shown to reduce the need for surgical intervention for complicated pleural effusion/empyema (CPE/empyema). For patients in whom tPA/DNase is likely to fail, however, receipt of this therapy may simply delay the inevitable. The goal of this study was to identify risk factors for failure of combined intrapleural therapy.

Methods: We performed a multicenter, retrospective chart review of patients who received intrapleural tPA/DNase for the treatment of CPE/empyema. Clinical variables included demographic data, radiographic parameters at time of diagnosis, and results from pleural fluid analysis. We compared four different machine learning classifiers ($L1$-penalized logistic regression, support vector machine, XGBoost and LightGBM) by multiple bootstrap-validated metrics, including F-beta (with recall weighted twice as heavily as precision) and area under the receiver operator characteristic (AUC) curve. Model hyperparameters were tuned using adaptive optimization (tree- parzan estimator), and variable importance was estimated by random permutation to rank the importance of 19 candidate clinical variables with respect to their ability to predict failure of tPA/DNase therapy. Data were randomly split into training and test setsusing an 80:20 ratio. Training data were further randomly split by the same ratio for hyperparameter tuning. The whole pipeline was repeated 200 times in order to derive distributionsfor evaluation metrics.

Results: We included 466 participants from five institutions across the United States. All participants in this study received IPFT with tPA/DNase for the management of complicated pleural effusions/empyema. Resolution of CPE/empyema with intrapleural tPA/DNase was achieved in 78% (n=365) of cases. Support vector machine (SVM) performed the best with F- beta of 57%, followed by XGBoost (F-beta 47%), and LGBM (F-beta 46%). Although the averageperformance of $L1$-penalized logistic regression was adequate (50% F-beta), it was highly unstable with F-beta ranging from 0 to 100%. Of the 19 candidate predictors of tPA/DNase failure, all models except $L1$ agreed that the single most important predictor was whether abscessor necrotizing pneumonia were present, followed by the presence of pleural thickening and protein pleural. ($L1$ ranked the presence of pleural thickening as most important.)

Conclusions: Our analysis based on a large, multicenter database demonstrated the presence of pleural thickening and abscess/necrotizing pneumonia helps to triage patients in whom IPFT is likely to fail and surgical management may be indicated. These results warrant further investigation and validation in a prospective study.


Balanced F-score
L1
SVM
LGBM
XGB
Classifier
−0.2
0.0
0.2
0.4
0.6
0.8
Harmonic mean of precision and recall

Management and Clinical Outcomes of Indwelling Pleural Catheters for Malignancy-Associated Pleural Effusions with Scheduled Follow up: A Retrospective Single Center Experience

K. B. Malcolm, E. J. Seeley, Y. B. Gesthalter

Background: Indwelling pleural catheters (IPCs) are tunneled catheters that are inserted into the pleural space to allow intermittent drainage of pleural fluid without repeated thoracentesis.They are increasingly being used worldwide as the first-line management for malignant pleural effusions (MPEs). Data supporting suitable post-placement follow-up or optimal frequency of drainage is lacking. In 2017, our institution established a dedicated pleural clinic to treat and manage patients with pleural disease. This study aims to characterize our early experience with the implementation of a dedicated pleural clinic on indwelling pleural catheter related outcomes including frequency of drainage, time to pleurodesis, all-cause mortality, and IPC related infection rates.

Methods: Data was collected in a retrospectively and cases were included if the IPC was placedbetween 1/1/2015 and 1/1/2021 (pre and post clinic initiation). Follow up until 2/1/2021 and history preceding the initial intervention were included.

Results: From 2015 to 2021 there were approximately 500 encounters for MPE with IPC in our hospital system. It is estimated that 20% of these encounters occurred with dedicated pleural clinic providers. Preliminary analysis from 1/1/19 to 2/28/19 showed 7 patients with MPE had encounters for IPC placement or removal. Of these patients, 3 were followed in the dedicated pleural clinic with an average of 4 follow-ups after IPC placement. All of these patients receiveddedicated educational packets and a catheter specific educational video link or DVD with a phone call from clinic staff on average one day after IPC placement. The average frequency of pleural drainage was 2.3 times per week and the average time to first clinic follow up after IPC placement was 18.3 days. All 3 of the patients achieved spontaneous pleurodesis on average 102.7 days after IPC. The remaining 4 patients were not followed in a dedicated pleural clinic and 0 of 4 patients achieved pleurodesis. There was no scheduled IPC follow-up and frequency of drainage was not documented. Average time to death after IPC placement in the non-dedicated pleural clinic was 14 days (4 of 4 patients deceased) and 309.5 days in the pleural clinic (2 of 3 patients deceased).

Conclusion: Preliminary data supports our hypothesis that the implementation of a dedicated pleural clinic may increase the rates of pleurodesis and may improve patient outcomes after IPCplacement when compared to non-dedicated pleural services.

Modified Approach to Fiducial Marker Placement in a Patient with Cecal Adenocarcinoma and Pulmonary Metastasis

Brian D. Tran MD[1], Paul M. Cusmano DO[1], Russell J. Miller MD[1,2], George Z. Cheng MD[2], Matthew M. Nobari MD[2]

[1]Department of Pulmonary, Sleep, and Critical Care Medicine, Naval Medical Center San Diego
[2]Division of Pulmonary, Critical Care, and Sleep Medicine, University of California San Diego

Introduction: Fiducial markers optimize stereotactic body radiotherapy (SBRT) by facilitating tumor tracking and precise radiation delivery. Computerized tomography-guided transthoracic placement of fiducial markers inlesions within the inner third of the lung field significantly increases the risk of complications including pneumothorax. We describe a technique for loading a gold fiducial marker into an endobronchial ultrasound (EBUS) needle for deployment into a centrally-located lesion.

Case Summary: A 60-year-old male with cecal adenocarcinoma was referred for fiducial marker placement intoa 2.4cmleft lower lobe perihilar pulmonary metastatic lesion with endobronchial invasion. Tumor was visualized within the lateral segmental bronchus of the left lower lobe under white light and was redemonstrated with EBUS. A 22-gauge Beacon™ Pre-Loaded Fine Needle EUS fiducial marker was incompatible with the EBUS working channel. Two solid gold fiducial markers were removed from the Beacon™ needle. One marker was loaded into a 21-gauge Olympus™ EBUS needle, secured with bone wax, and placed in the lesion with forward motion of the stylet under direct ultrasound and fluoroscopic guidance. The second marker was deployedin identical fashion. (Figure 1A and 1B)

Conclusion: In 2016, the estimated incidence of lung cancer in the United States was 224,390 and estimated mortality was 158,080. [1] Up to 25% of patients with stage 1A disease are medically inappropriate for surgery,decline operative intervention, or opt for non-surgical treatment. [2] Stereotactic body radio therapy is a viable therapeutic option for these patients with fiducial markers utilized to facilitate accurate targeting. Our case describes deployment of EUS fiducial markers via linear EBUS into a centrally-located lesion. The patient was successfully treated with SBRT for palliation. This case emphasizes the potential to combine diagnosis, staging,and fiducial marker placement into a single procedure and highlights the convenience and potential cost savings for proceduralists – particularly those with shared endoscopy spaces and resources.

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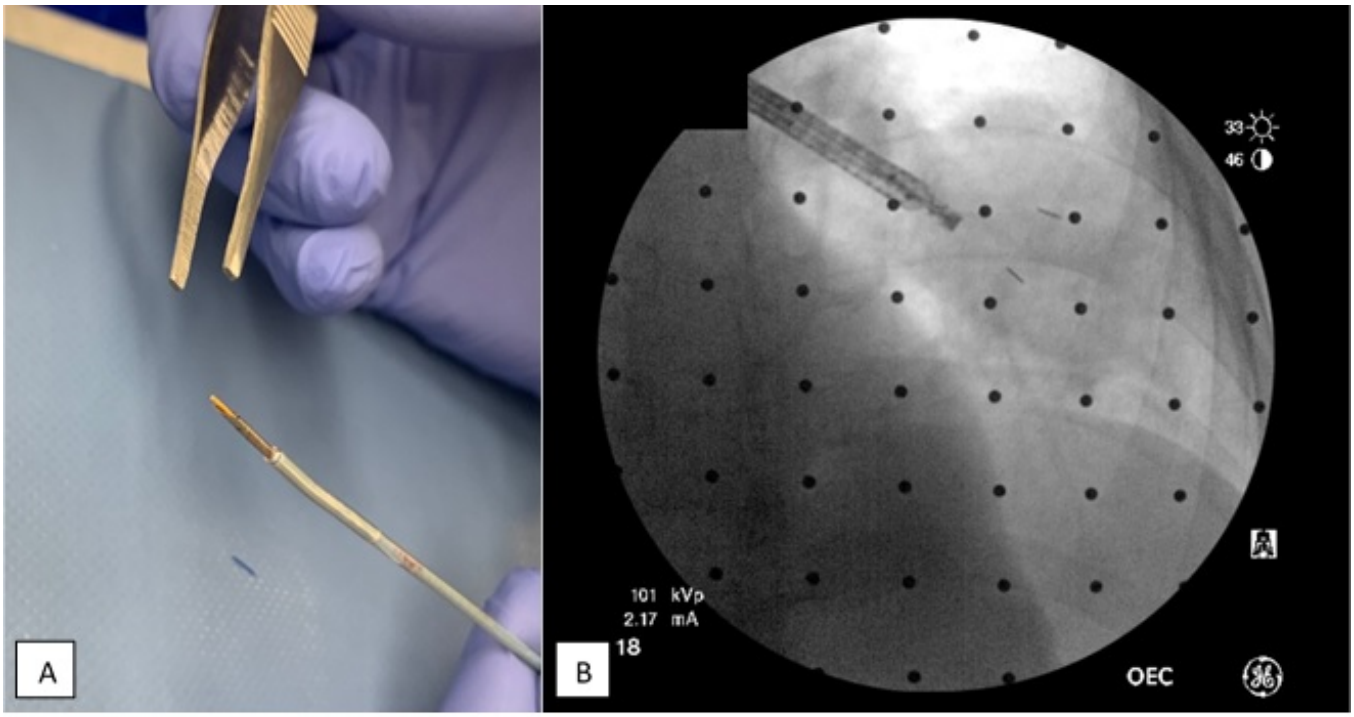


Figure 1. (A) Loading of fiducial marker into 21-gauge EBUS needle. (B) Fluoroscopic image revealing both fiducial markers after deployment.

Never Give Up on a Downed Lung

Asad Khan, M.D.[1], Majid Shafiq, M.D., MPH[2]

[1]Division of Pulmonary, Critical Care, and Sleep Medicine, Department of Medicine, University of Massachusetts Medical School-Baystate Medical Center; and [2]Division of Pulmonary and Critical Care Medicine, Brigham and Women's Hospital, Harvard Medical School, Boston, MA

Introduction: Conventional wisdom emphasizes the futility of treating long-standing obstructive lung collapse. We present a case where rigid bronchoscopic debulking of an endobronchial lipomaled to complete reversal of chronic lobar collapse.

Case Summary: A 46-year-old gentleman with a history of chronic obstructive pulmonary disease and aortic stenosis presented with recurrent right lower lobe pneumonias. Computed tomographic (CT) imaging from six months prior showed an obstructing mass in the bronchus intermedius alongwith complete collapse of the right lower lobe (Fig. 1A). Bronchoscopy revealed a tan, smooth- appearing polypoid lesion in the proximal bronchus intermedius, causing near-complete airway obstruction (Fig. 2A). The tumor was excised using an electrosurgical snare and retrieved using cryo-adhesion, leaving a completely patent bronchus intermedius along with patent distal airways. Pathology was consistent with endobronchial lipoma. Follow up CT showed a completely aerated right lower lobe and no discernable extra-bronchial extension of the lipoma (Fig. 1B).

Conclusion: Prolonged obstructive atelectasis of the lung spanning up to six months does not indicate impossibility of lung re-expansion following relief of airway obstruction. This finding hasimplications for patients with both malignant and non-malignant central airway obstruction, since treatment decisions are conventionally based on duration of obstructive atelectasis. Prospective studies are needed for further investigation.

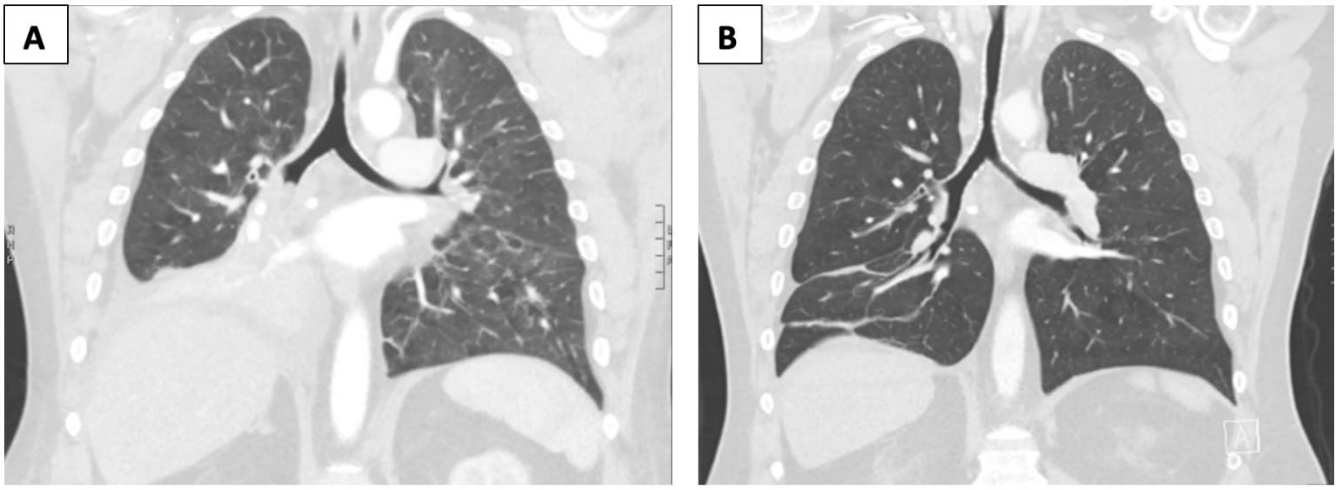


Figure 1. (A) Computed tomographic (CT) imaging demonstrating an obstructing mass in the bronchus intermedius along with complete collapse of the right lower lobe **(B).** Post procedural CT image demonstrating a completely patent bronchus intermedius and re-expanded right lower lobe.

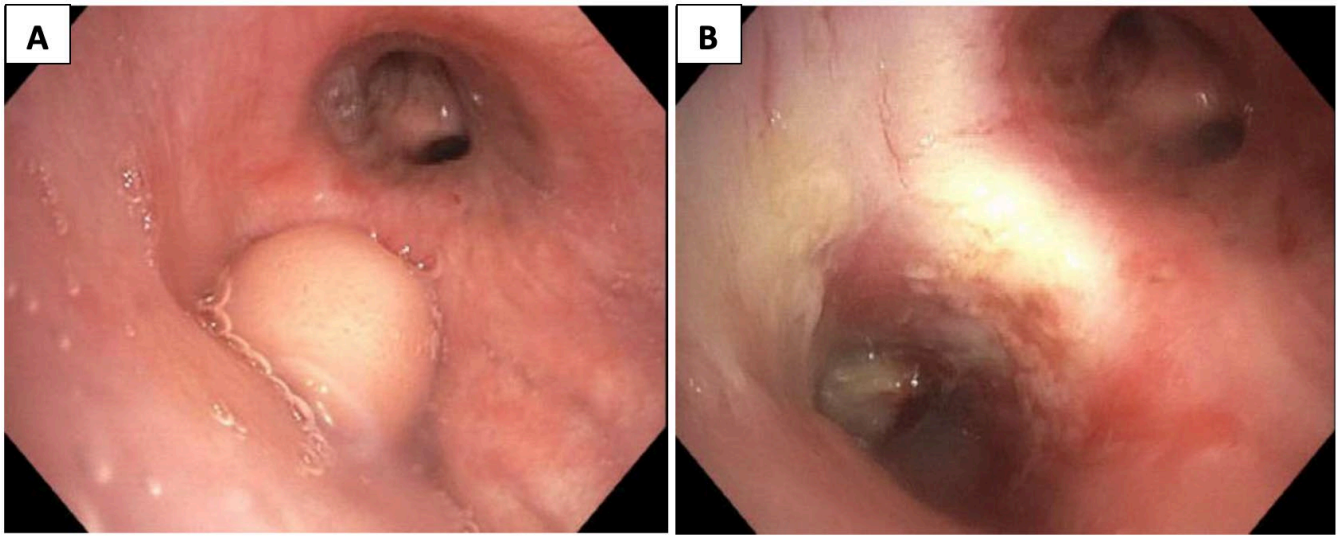


Figure 2. (A) Bronchoscopy demonstrating a tan, smooth-appearing polypoid lesion in the proximal bronchus intermedius, immediately distal to the right upper lobe bronchial orifice. **(B)** Patent bronchus intermedius following successful tumor excision.

Novel use of indwelling tunneled pleural catheters for non-malignant effusions to facilitate radiation therapy for early-stage primary lung cancer

Christopher H Chang, Lakshmi Mudambi

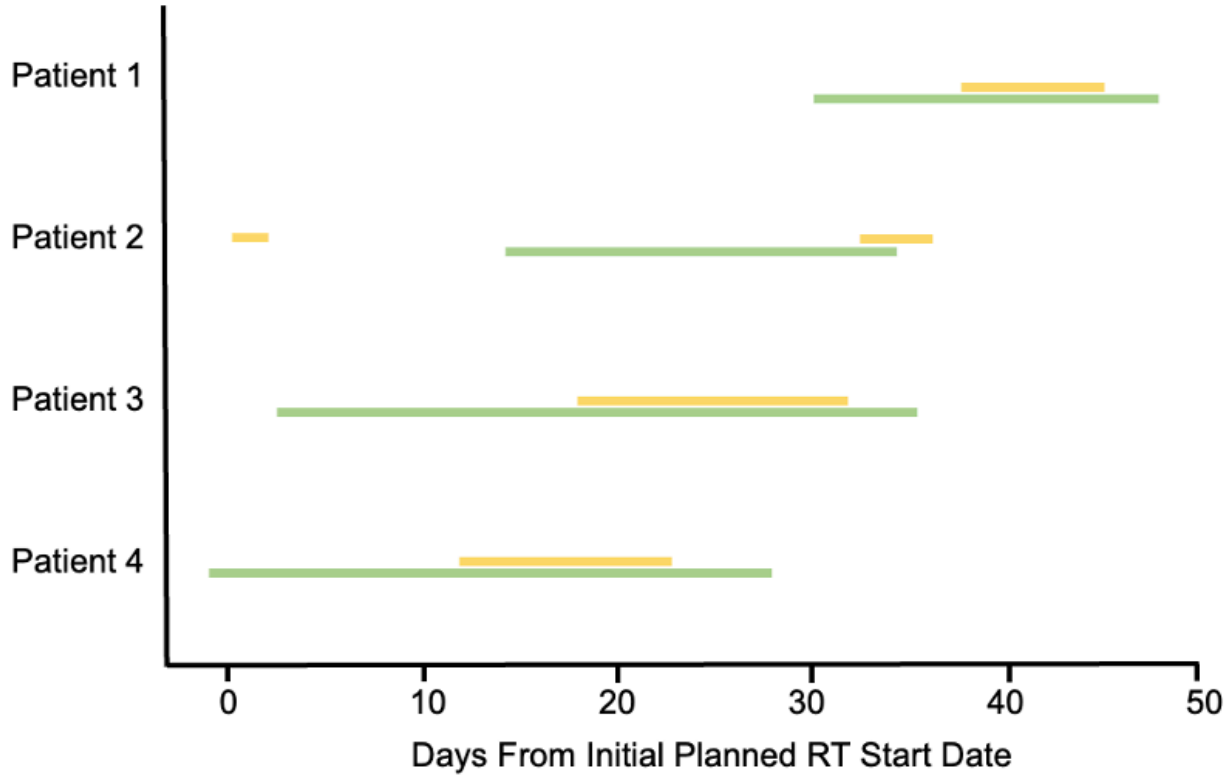
Introduction: Radiation therapy (RT) has become a fundamental component in treating early lung cancers.[7] The planning and delivery of RT requires precision, which can be significantly affected by the presence of a fluctuating pleural effusion. The placement of an indwelling pleural catheter (IPC) to drain an effusion prior to each treatment can eliminate this variable. We describe a single-center experience using IPCs to facilitate RT for early-stage non-small cell lung cancers (NSCLC) in the setting of a dynamic non-malignant pleural effusion.

Methods: A single-center, retrospective review was conducted on patients who had an IPC (PleurX) placed at the Portland Veteran Affairs Medical Center in Portland, Oregon between January 1, 2017 and December 31, 2020. Patients were identified using pharmacy records for those who had drainage kits dispensed during the selected time frame. All patients had a pathology- confirmed diagnosis of stage I or II NSCLC and a prior thoracentesis with pleural cytology negative for malignant cells.

Results: Of the 82 patients who had an IPC placed, five were placed to facilitate RT for stage I or II NSCLC. One patient was excluded due to an unrelated death prior to RT. The etiologies of effusions included para-malignant effusions (2), heart failure, and a hepatic hydrothorax. Three patients had IPCs placed prior to treatment while one was placed during the RT course. The mean duration from initial RT start date and IPC placement to treatment completion were 33.8 days and 22.3 days, respectively. IPCs were removed within 1 week of treatment completion. One patient developed a pneumothorax following IPC placement that required an overnight admission. In the same patient, the catheter was unintentionally pulled out prior to the completion of RT and required an additional thoracentesis. There were no other apparent complications on follow-up.

Discussion: Pleural effusions can lead to anatomic distortion of the lung, which ultimately affects RT planning for NSCLC. We describe four cases of successfully using IPCs with non-malignant effusions to facilitate RT. Two complications were noted in one patient including a pneumothorax and accidental IPC dislodgement. There were no incidences of infection, hemorrhage, prolonged pain, or catheter fracture related to the IPCs. IPCs appear to be a relatively safe intervention that maybe more practical and comfortable for patients over serial thoracenteses, pleurodesis, or surgical interventions.

Figure 1. Timeline of clinical course. Day 0 represents the initial planned radiation therapy start date. Yellow bars represent duration of radiation therapy. Green bars represent duration of IPC placement.



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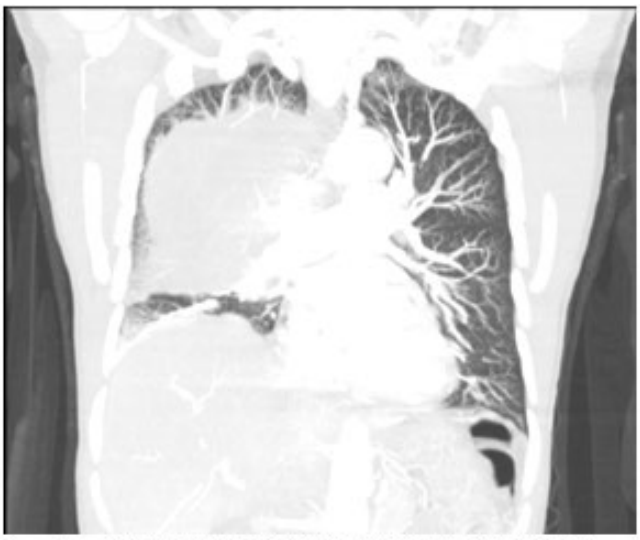
Pulmonary Carcinosarcoma Diagnosed on CryoProbe® Biopsy

Fatima Ali DO; Steffi Lena DO; Jay Kirkham DO

Pulmonary sarcomatoid carcinomas (PSC) are an uncommon form of non-small cell lung cancerand are found in 0.4% of all lung malignancies. The five histologic variants include) pleomorphic carcinoma, spindle cell carcinoma, giant cell carcinoma, carcinosarcoma and pulmonary blastoma. Because of the heterogeneity of pulmonary carcinosarcomas, they are difficult to diagnose preoperatively and usually require surgical lung biopsy. Following report discusses a case of pulmonary carcinosarcoma diagnosed preoperatively with bronchoscopy using CryoProbe®.

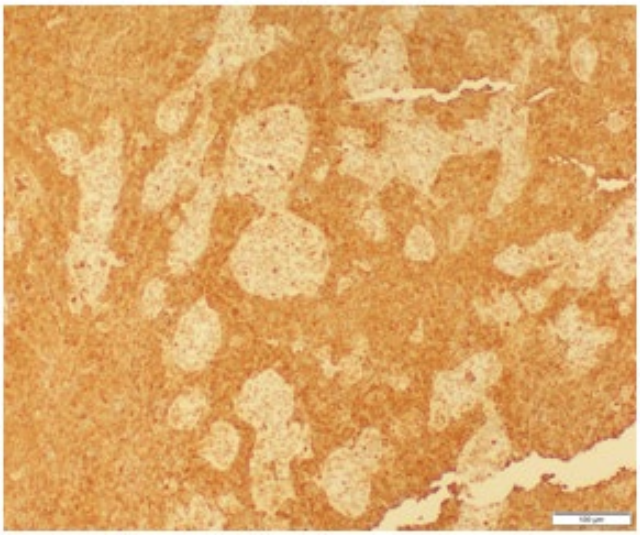
A 57-year-old female with a 43 pack year smoking history presented to the hospital with hemoptysis, cough and unexplained 20 lb. weight loss. On admission, CT Chest demonstrated an11cm right upper lobe (RUL) mass. Bronchoscopy revealed a polypoid heterogeneous mass emanating out of the RUL orifice. Using a 2.4 mm CryoProbe®, multiple biopsies were taken of the mass. Pathology was significant for a poorly differentiated malignant tumor with components of epithelial carcinoma and sarcoma consistent with carcinosarcoma of the lung. The epithelioid component was poorly differentiated and showed no morphologically squamous or adenocarcinoma features. Immunohistochemical stains were focally positive for p40, which would indicate squamous cell differentiation. The sarcoma component was focally positive for S100, indicating pleomorphic liposarcoma or fibrosarcoma. Patient had a PET CT which was significant for FDG avid focus in the sternum and multiple vertebral bodies. The final diagnosis was Stage IV Pulmonary Carcinosarcoma. The patient iscurrently following up with Hematology/Oncology and receiving chemotherapy as weekly external beam radiation treatment.

In this patient, CryoProbe® biopsies yielded a sufficient sample to provide an accurate diagnosisusing a minimally invasive procedure. We were able to provide large enough tissue samples for clinical morphological evaluation and immunohistochemical staining for accurate identification of this rare and difficult-to-diagnose lung cancer. CryoProbe® should be considered as a non- surgical option for obtaining an ample biopsy via bronchoscopy.

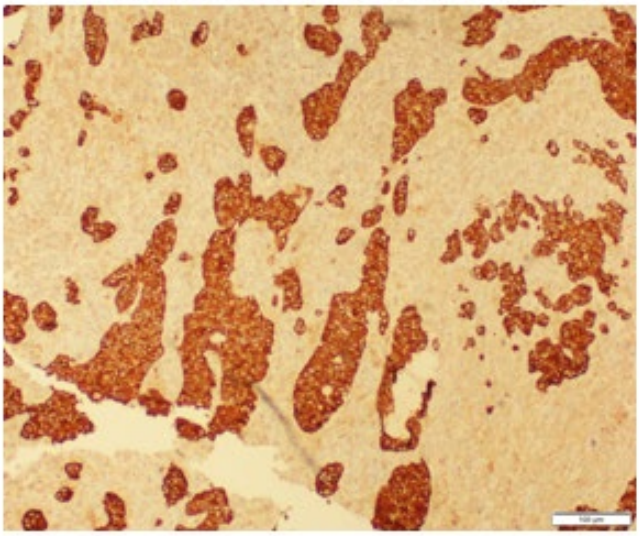


A. CT Chest on Admission with RUL opacification

B. Right Upper lobe mass with complete obliteration of the right upper lobe bronchus



C. Vimentin Stain for Sarcoma component



D. AE1-3 stain for carcinoma component

Pulmonary Function Tests Findings in Patients with Severe and Non-Severe Expiratory Central Airway Collapse

Alejandra Yu Lee-Mateus, MD[1]; Juan C. Garcia-Saucedo, MD[1]; David Abia-Trujillo, MB, MD[1]; Omran Saifi, MD[2]; Britney Hazelett, RN[1]; Sebastian Fernandez-Bussy, MD[1]

[1] Division of Pulmonary, Allergy, and Sleep Medicine, Mayo Clinic Florida, Jacksonville, FL, USA
[2] Department of Radiology, Mayo Clinic Florida, Jacksonville, FL, USA

Introduction: Expiratory Central Airway Collapse (ECAC) is the narrowing of the trachea or bronchi of more than 70% during expiration. Diagnosed by dynamic bronchoscopy, when the collapse is over 90%, patients undergo a 7-day stent trial to evaluate the need for definite surgical treatment. Pulmonary Function Tests (PFTs) are non-specific in patients with ECAC. However, previous observational studies have not compared PFTs adjusted by the severity of the airway collapse. Our study aims to compare PFTs findings between patients with severe ECAC and non-severe ECAC.

Methods: An observational cohort study using electronic medical records of 142 patients diagnosed with ECAC by dynamic bronchoscopy, from January 2019 to February 2021. We defined severe ECAC as the overall degree of airway collapse over 90% in patients that required a stent trial. Patient's demographic characteristics and PFTs findings were compared in patients with severe and non-severe ECAC.

Results: There were 39 patients with severe ECAC (median age: 64 years; 59% female; 35% former smokers), and 103 patients with non-severe ECAC (median age: 65 years; 73% female; 37% former smokers). In PFTs findings from patients with severe vs. non-severe ECAC, no statistically significant difference was observed among the median TLC% (100 vs. 88; P .21), RV% (107 vs. 95; P .4), FVC% (91 vs. 84; P .16), FEV1% (85 vs. 87;P 1), FEF 25-75% (76 vs. 88; P .71), PEF% (99 vs. 100; P .92) PIF (3.7 vs. 4.1; P .53) FEF 50-FIF 50 (63 vs. 66; P.53) and DLCO% (80 vs. 76; P .53). Only the median FEV1/FVC was lower in patients with non-severe ECAC compared to patients with severe ECAC (75.1 vs. 78; P <.01).

Conclusions: Our results support previous observational studies' outcomes on PFTs in ECAC. We found no statistically significant difference between PFTs findings in patients with severe ECAC and non-severe ECAC.

Radial endobronchoscopic ultrasound versus CT scan guided lung biopsy for peripherallung lesion, a meta-analysis of randomized controlled trials

An Thi Nhat Ho, Setu Patolia, Ramya Gorthi, Robert Lee, Mohit Chawla

Background: Bronchoscopy with radial endobronchial ultrasound (rEBUS) and Computed tomography (CT) scan guided lung biopsy are commonly used to investigate peripheral lung nodules but high quality data has been still contradicting about the diagnostic and safety profile comparison of these two modalities.

Method: We included all available randomized controlled trials (RCT) comparing rEBUS and CT guided lung biopsy in patients who have single peripheral lung nodule from 1970 to present.Two reviewers extracted data independently on diagnostic performance and complication rates. Secondary endpoints also include factors increasing diagnostic yield of rEBUS.

Results: 170 studies were screened using our search terms, in which 4 RCT with total of 325 patients were found. Radial EBUS was CT guided lung biopsy had a higher diagnostic yield thanradial EBUS (83.45% vs 68.82%, risk difference -0.15, 95% CI, [-0.24,-0.05]), especially for lesion from 1 cm to 2cm diameter (83% vs 50%, risk difference -0.33, 95% CI, [-0.51,-0.14]). For malignant disease, rEBUS had a combined diagnostic yield of 75.75% vs 87.7% of CT guided lungbiopsy (risk difference -0.12, 95% CI, [-0.22,-0.03]). However, rEBUS has a significant better safety profile with lower risk of pneumothorax (2.87% vs 21.43%, OR= 0.12, 95% CI [0.05-0.32]) and combined outcomes of hospital admission, hemorrhage and pneumothorax (8.62% vs 31.81%, OR 0.21, 95% CI, [0.11-0.40]). Factors increasing diagnostic yield of rEBUS are found to be the lesion size and localization of the probe inside the lesion but not the distance to the chest wall, hilum nor probe localizing adjacent to the lesion.

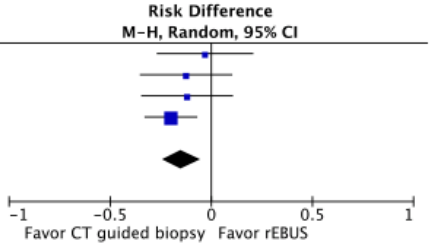
Conclusion: CT guided lung biopsy had a higher diagnostic yield than bronchoscopy with radial EBUS in diagnosing peripheral lung nodule, particularly for lesion from 1 cm to 2 cm. However, radial EBUS is significantly safer with five times to eight times less risk of pneumothorax and composite complications of hospital admission, hemorrhage and pneumothorax. Selecting radial EBUS might be a reasonable approach for larger lesions, especially with bronchus sign.

Table 1: Diagnostic comparisons

Diagnostic yield

Study or Subgroup	rEBUS Events	rEBUS Total	CT guided biopsy Events	CT guided biopsy Total	Weight	Risk Difference M-H, Random, 95% CI	Year
Steinfort 2011	25	32	13	16	15.3%	-0.03 [-0.27, 0.21]	2011
Fielding 2011	22	33	19	24	16.7%	-0.13 [-0.35, 0.10]	2011
Gupta 2018	18	25	21	25	16.9%	-0.12 [-0.35, 0.11]	2018
Wang 2018	52	80	68	80	51.2%	-0.20 [-0.33, -0.07]	2018
Total (95% CI)		**170**		**145**	**100.0%**	**-0.15 [-0.24, -0.05]**	
Total events	117		121				

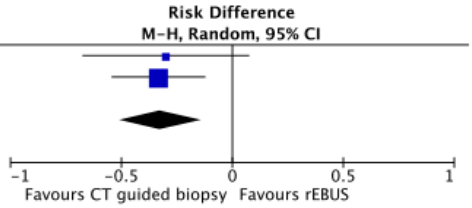
Heterogeneity: $Tau^2 = 0.00$; $Chi^2 = 1.63$, df = 3 (P = 0.65); $I^2 = 0\%$
Test for overall effect: Z = 3.11 (P = 0.002)



Diagnostic yield for lesion 1 cm to 2 cm

Study or Subgroup	rEBUS Events	rEBUS Total	CT guided biopsy Events	CT guided biopsy Total	Weight	Risk Difference M-H, Random, 95% CI
Fielding 2011	6	12	8	10	24.1%	-0.30 [-0.68, 0.08]
Wang 2018	16	32	30	36	75.9%	-0.33 [-0.55, -0.12]
Total (95% CI)		**44**		**46**	**100.0%**	**-0.33 [-0.51, -0.14]**
Total events	22		38			

Heterogeneity: $Tau^2 = 0.00$; $Chi^2 = 0.02$, df = 1 (P = 0.88); $I^2 = 0\%$
Test for overall effect: Z = 3.46 (P = 0.0005)



Diagnostic sensitivity for malignant diseases

Study or Subgroup	rEBUS Events	rEBUS Total	CT guided biopsy Events	CT guided biopsy Total	Weight	Risk Difference M-H, Random, 95% CI
Fielding 2011	17	23	23	26	18.4%	-0.15 [-0.36, 0.07]
Gupta 2018	18	24	21	24	18.3%	-0.13 [-0.34, 0.09]
Steinfort 2011	23	28	12	13	21.2%	-0.10 [-0.30, 0.10]
Wang 2018	42	57	51	59	42.1%	-0.13 [-0.27, 0.02]
Total (95% CI)		**132**		**122**	**100.0%**	**-0.12 [-0.22, -0.03]**
Total events	100		107			

Heterogeneity: $Tau^2 = 0.00$; $Chi^2 = 0.09$, df = 3 (P = 0.99); $I^2 = 0\%$
Test for overall effect: Z = 2.62 (P = 0.009)

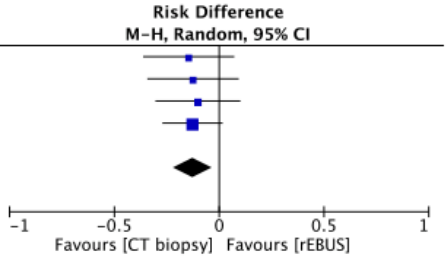
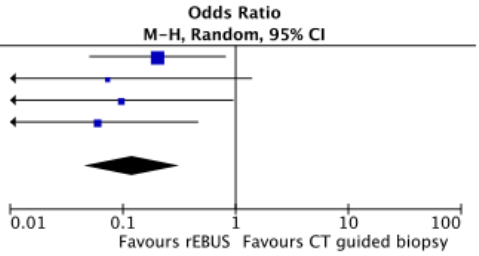


Table 2: Adverse event risks

Pneumothorax

Study or Subgroup	rEBUS Events	rEBUS Total	CT guided biopsy Events	CT guided biopsy Total	Weight	Odds Ratio M-H, Random, 95% CI
Fielding 2011	3	37	10	33	48.7%	0.20 [0.05, 0.82]
Gupta 2018	0	25	5	25	10.9%	0.07 [0.00, 1.40]
Steinfort 2011	1	32	4	16	18.0%	0.10 [0.01, 0.96]
Wang 2018	1	80	14	80	22.4%	0.06 [0.01, 0.47]
Total (95% CI)		**174**		**154**	**100.0%**	**0.12 [0.05, 0.32]**
Total events	5		33			

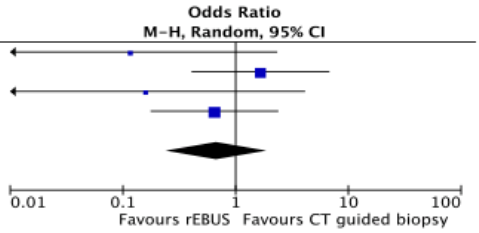
Heterogeneity: $Tau^2 = 0.00$; $Chi^2 = 1.18$, df = 3 (P = 0.76); $I^2 = 0\%$
Test for overall effect: Z = 4.26 (P < 0.0001)



Bleeding

Study or Subgroup	rEBUS Events	rEBUS Total	CT guided biopsy Events	CT guided biopsy Total	Weight	Odds Ratio M-H, Random, 95% CI
Fielding 2011	0	37	3	33	10.8%	0.12 [0.01, 2.34]
Gupta 2018	6	25	4	25	37.9%	1.66 [0.41, 6.78]
Steinfort 2011	0	32	1	16	9.3%	0.16 [0.01, 4.13]
Wang 2018	4	80	6	80	42.1%	0.65 [0.18, 2.39]
Total (95% CI)		**174**		**154**	**100.0%**	**0.68 [0.24, 1.89]**
Total events	10		14			

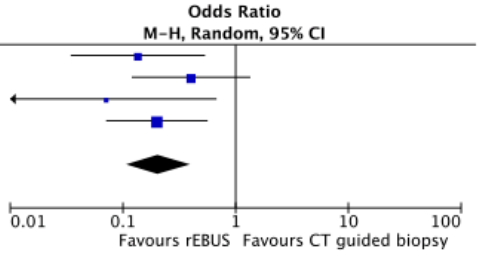
Heterogeneity: $Tau^2 = 0.21$; $Chi^2 = 3.66$, df = 3 (P = 0.30); $I^2 = 18\%$
Test for overall effect: Z = 0.75 (P = 0.45)



All complications

Study or Subgroup	rEBUS Events	rEBUS Total	CT guided biopsy Events	CT guided biopsy Total	Weight	Odds Ratio M-H, Random, 95% CI
Fielding 2011	3	37	13	33	22.7%	0.14 [0.03, 0.54]
Gupta 2018	6	25	11	25	29.1%	0.40 [0.12, 1.35]
Steinfort 2011	1	32	5	16	8.4%	0.07 [0.01, 0.68]
Wang 2018	5	80	20	80	39.7%	0.20 [0.07, 0.56]
Total (95% CI)		**174**		**154**	**100.0%**	**0.21 [0.11, 0.40]**
Total events	15		49			

Heterogeneity: $Tau^2 = 0.00$; $Chi^2 = 2.39$, df = 3 (P = 0.50); $I^2 = 0\%$
Test for overall effect: Z = 4.74 (P < 0.00001)



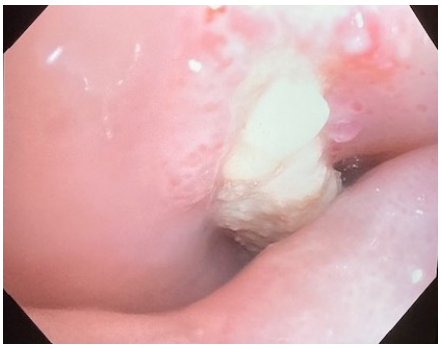
Role of comprehensive bronchoscopy and oxygen insufflation in an unusual case of hemoptysis

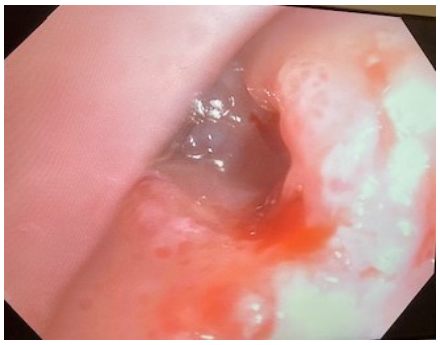
Michael Post DO[1], Osheen Abramian MD[1], Michelle Chai PA-C[1] Wissam AbouzgheibMD[1]

[1]Department of Medicine, Division of Pulmonary Medicine, Cooper University Hospital, Camden, NJ.

Introduction: The role of bronchoscopy is not well-defined during the workup of non- massive hemoptysis. Several studies have addressed its safety and utility compared to non-invasive methods such as computed tomography angiography (1). We present a case of unexplained hemoptysis, diagnosed with bronchoscopy, evaluating upper and lower airways, with intermittent channel oxygen insufflation.

Case Presentation: A 65 y.o male, nonsmoker with a history of oropharyngeal squamous cell carcinoma presented with non-massive hemoptysis for 4 days. His history includes osteonecrosis of the hyoid bone status post tracheostomy. The night prior, he expectorated a foreign body, believed to be a remnant of necrosed hyoid bone. CT chest was non-revealing for the cause of hemoptysis. Nasopharyngolaryngoscopy performed by ENT revealed no nasal, laryngeal or tracheal bleeding, no reflux of blood from lower airways and no peristomalgranulation tissue. Bronchoscopy through the tracheostomy was unremarkable. Bronchoscopythrough the mouth showed swelling of the epiglottis and a crowded upper airway. Intermittent oxygen insufflation at 8 liters/min, through the bronchoscope channel, was used for pneumaticdilation and better visualization of the supraglottic space. A foreign body was noted behind the epiglottis with surrounding granulation tissue that was suspected to be the source of hemoptysis. It was removed with rat tooth forceps and measured 1cm x 0.5cm x 0.2cm. The patient was discharged the next day and hemoptysis has not recurred.





Discussion: The role of bronchoscopy during hemoptysis evaluation is to identify the site ofbleeding, assess the nature of the source, attempt a therapeutic intervention and collect samples that impact management (2). Our case highlights the importance of investigating thesupraglottic space during bronchoscopy even in the setting of an unrevealing nasopharyngolaryngoscopy. This case also highlights the utility of oxygen insufflation through the bronchoscope channel with pneumatic dilation of crowded spaces promoting improved diagnostic evaluation, which better allows for therapeutic intervention.

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Single center rate of COPD exacerbations in BLVR patients who receive peri and post procedural systemic glucocorticoid therapy.

Rebecca Priebe MSN, ACNP-BC[1], Daniel Kapadia MD[1], Michael J. Simoff MD[1,2], Javier Diaz-Mendoza MD[1,2], Labib Debiane MD[1], A.Rolando Peralta MD[1], Avi Cohen MD[1]

Interventional Pulmonology, Pulmonary and Critical Care Medicine, Henry Ford Health System[1],Wayne State University[2], Detroit, MI

Background: COPD is the fourth overall leading cause of death, with a higher mortality rate for those age 65 and above (1). Treatment for those with emphysema include medication therapy, pulmonary rehabilitation, and surgical LVRS and transplant pending candidacy. Since June 2018, the use of bronchoscopic lung volume reduction (BLVR) has provided a less invasive treatment option for patients with emphysema. The goal of BLVR is improvement in dyspnea, quality of life and exercise tolerance. As seen in previous trials, BLVR has associated risks including COPD exacerbation of 7.8% (3) within 45-days of procedure. We hypothesized that the use of peri and post procedural systemic glucocorticoid therapy will decrease the incidence of COPD exacerbations.

Methods: After encountering multiple patients who had an acute exacerbation of COPD after BLVR, we implemented a protocol to administer peri and post procedural systemic glucocorticoid therapy. The patients who received steroids started prednisone 40mg once daily for 5 days starting 1 day pre-procedure. All patients with severe emphysema, who met inclusion criteria, underwent BLVR with general anesthesia and oral intubation. Patients were followed 45-days to evaluate exacerbation rate post-procedure. A COPD exacerbation was defined as worsening dyspnea from baseline, new productive cough, change in secretions, and/or wheezing requiring oral steroid and/or antibiotic treatment for a minimum of 5 days.

Results: Prior to empirical systemic glucocorticoid therapy implementation 17 (24%) out of 72 patients had an exacerbation within 45 days of the procedure. After the implementation of empirical systemic glucocorticoid therapy 3 (10%) out of 30 patients were treated for an acute exacerbationwithin 45 days of the procedure.

Conclusion: We performed a single center retrospective review of 102 patients who underwent BLVR at ourinstitution. After the initiation of our steroid protocol, we observed a decrease in the rate of COPD exacerbation with a relative risk reduction of 58%. The empirical use of systemic glucocorticoid therapy for BLVR reduced the rates of acute exacerbations of COPD within 45days.

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Sliding Away From Using Ultrasound to Diagnose Pneumothorax Following Endobronchial Valve Placement

Asad Khan, MD[1], Victoria Elizabeth Forth, PA-C[2], Majid Shafiq, MD, MPH[2]

[1]Division of Pulmonary, Critical Care, and Sleep Medicine, Department of Medicine, University of Massachusetts Medical School-Baystate Medical Center; and [2]Division of Pulmonary and Critical Care Medicine, Brigham and Women's Hospital, Harvard Medical School, Boston, MA

Introduction: Bronchoscopic lung volume reduction (BLVR) using one-way endobronchial valves(EBV) has ahigh incidence of postprocedural pneumothorax, which may warrant urgent chest tube placement at the bedside. Although not pathognomonic, a new loss of lung sliding on ultrasound is frequently used by clinicians to diagnose the development of iatrogenic pneumothorax following various procedures. We present a case that demonstrates the limitation of this approach in BLVR cases.

Case Summary: A 77-year-old gentleman with a history of severe emphysema and hyperinflation along with resultant dyspnea on exertion was brought in for BLVR. Based on chest computed tomography (CT) analysis and endobronchial balloon occlusion assessment, his right upper lobe (RUL) and right middle lobe (RML) were identified as suitable BLVR targets. Prior to EBV placement, ultrasonography of the right anterior chest (zone 1) showed normal lung sliding (2- dimensional mode) along with a “seashore sign” (M-mode; Fig. 1A). Approximately 5-10 minutes after EBV placement in the RUL and RML, ultrasonography showed the absence of lung sliding(2- dimensional mode) along with a “bar code” or “stratosphere” sign (M-mode; Fig. 1B). A post- procedure chest x-ray showed new right-sided lung volume loss without pneumothorax (Fig. 2A). An unrelated CT scan performed on postoperative day 1 as part of workup for an incidentally discovered vocal cord lesion during bronchoscopy also showed the absence of pneumothorax alongwith partial collapse of the RUL and RML and a rightward mediastinal shift (Fig. 2B).

Conclusion: Lobar atelectasis following BLVR can mimic a pneumothorax by causing a decreasein normal pleural excursion, manifesting as a loss of lung sliding on ultrasound. Therefore, in the absence of radiographic confirmation, a new loss of lung sliding in the postoperative setting shouldnot be used as grounds for urgent chest tube placement in order to avoid injury to the lung parenchyma.

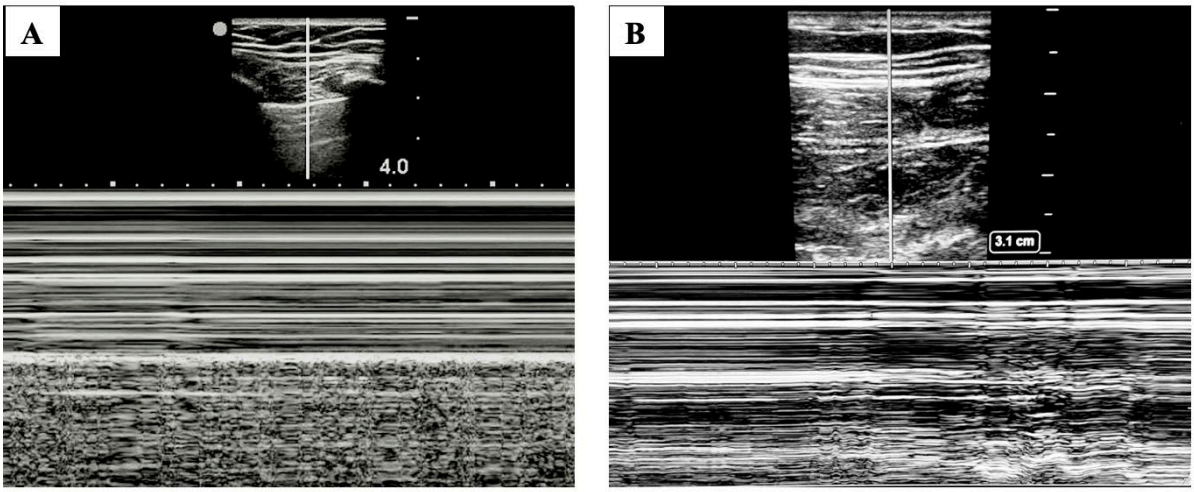

Figure 1. (A) M-mode image demonstrating the "seashore sign" seen with normal lung sliding (Image obtained from the available ultrasound literature[1]) **(B)** Ultrasound image of our patient from the anterior right chest demonstrating the "bar code" or "stratosphere" sign on M-mode, which indicates the absence of lung sliding after EBV placement. A lung point was not appreciated due to the presence of the right middle lobe EBV.

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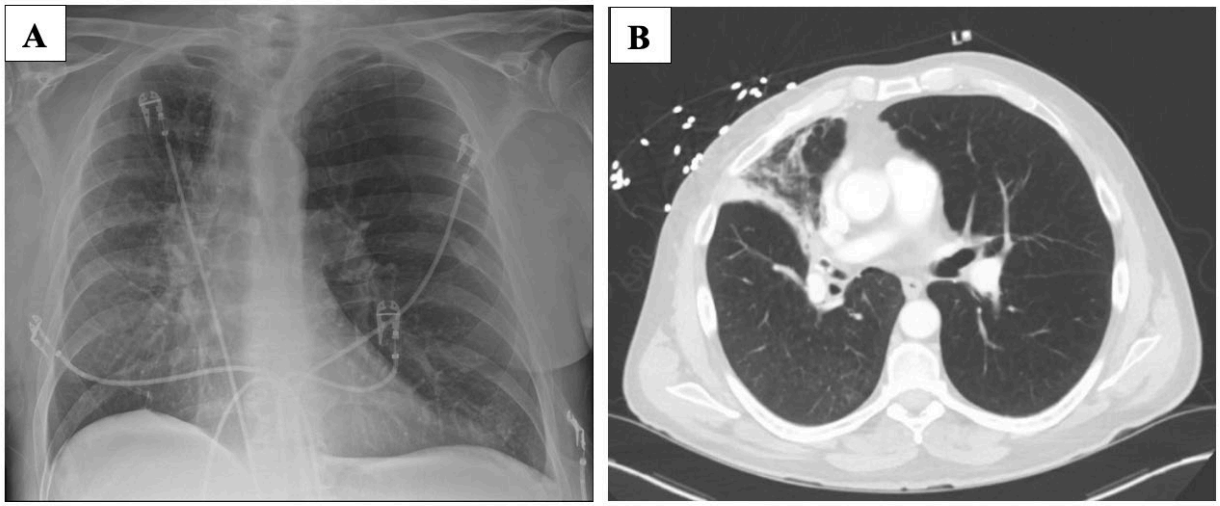


Figure 2. (A) Post-procedure chest x-ray demonstrating new right-sided lung volume loss due to EBV placement. No pneumothorax is seen. **(B)** An unrelated CT scan of the chest performed on postoperative day 1 shows partial collapse of the right upper lobe along with a rightward mediastinal shift. Once again, no pneumothorax is appreciated.

Study of Diffusing Alpha-Emitter Radiation Therapy (DaRT) in Treatment of Lung Cancer- Preclinical Phase One, Development of Seed Deployment Methods via Bronchoscopy

Ali Sadoughi MD, Christine Chan MD, Abhishek Sarkar MD, Samuel Green, Ofer Magen, Elad Flaischer, Yadin Cohen, Or Zellner, Ilay Malinyak, Amnon Gat, Robert Den MD

Background: Diffusing Alpha-emitter Radiation Therapy (DaRT) utilizes implantable seeds to deliver alpha emitting atoms to treat solid malignancies. Significant tumor responses have been reported in preclinical and clinical studies of DaRT. It provides highly destructive alpha radiationand has been shown to induce a systemic antitumor immune response following tumor ablation. Future lung cancer treatments with this method require special tools and techniques to assure safe delivery and implantation of DaRT seeds in different parts of the lung. Current achievements in advanced bronchoscopy methods enable precise localization of small size targets in human lungs and can be modified for DaRT seeds insertion.

Methods: In this preclinical study, we investigated different methods for implanting inert seeds into lungs of healthy swine using guided bronchoscopy techniques currently used at Montefiore medical center. Other objectives included assessments of animal health and viability post seeds implantation. We used advanced bronchoscopy tools to detect the areas of interest in live swine lung and mediastinum and used novel deployment devices designed by Alpha-Tau Medical Ltd.for insertion of seeds. Seed placement and the status of lung were surveyed by fluoroscopy and serial CT scans. The seeds placement was performed under general anesthesia in two sessions. The vital signs, oxygen saturation, adequacy of pulmonary ventilation and response to care were monitored throughout the procedure. The temperature, pulse, respiration, behaviors and appetiteof the animals were observed for 38 days.

Results: A total of three porcine animals were used. Five inert seeds were implanted in each cranial, middle/accessory and caudal lobes of the right lung, and three inert seeds were implantedin mediastinum in first session. About one month later fifteen additional inert seeds were placed in the cranial and caudal left lobes of the animals. Computed tomography of the chest was obtained on three different days to confirm device placement and the status of the lung. In total ninety-nine seeds were inserted in three swine using two different deployment mechanisms. No significant adverse events including pneumothorax, pulmonary hemorrhage or infection occurred.

Conclusion: In this study, we established the technical feasibility of inert DaRT seed placement in bilateral lung fields and the mediastinum of the porcine animals via two different deployment mechanisms, using advanced guided bronchoscopy methods. Additionally, radiographic imaging confirmed device placement with no significant complication. This clinical methodology is viable for future studies for delivery of local radiotherapy within lung tumors in animal models.

The Role of Interventional Pulmonology during the Era of COVID-19 Pandemic

Nancy Guirguis, Spencer Deleveaux, Priyanka Shastri, Essam Mekhaiel

Introduction: Coronavirus disease 2019 (COVID-19) is an infection caused by a novel SARS- CoV-2 pathogen. Interventional pulmonology procedures such as bronchoscopy, tend to carry an inherently high risk of transmitting respiratory droplets. Recommendations aim to reduce exposure by avoiding interventional procedures. Here we present a case in which urgent advanced bronchoscopy resulted in immediate stabilization and improvement in patient condition.

Case presentation: A 74-year-old female with recently diagnosed squamous cell lung cancer presented to an outside hospital with complaints of fevers and left sided flank pain for three days. CT angiogram of the chest demonstrated left mainstem bronchus obstruction, due to endobronchialtumor and external compression from her existing tumor. Workup for pulmonary embolus was negative. Patient initially tested negative for COVID-19 and received the first of palliative radiotherapy sessions. The patient was then transferred to our tertiary care center for advanced bronchoscopy. Upon arrival, the patient was on high flow nasal cannula 40L/60%. The patient developed worsening respiratory failure and a repeat COVID-19 test returned with a positive result. The patient was emergently intubated and the decision was made to proceed with advanced bronchoscopy. During bronchoscopy, complete occlusion of the left mainstem bronchus, with tumor involvement of the medial wall of the left mainstem bronchus and main carina was noted (Image 1). Minimal tissue debulking was done using cryotherapy and a large forceps, followed by balloon dilatation. A 4cm x 12mm stent was deployed to the left mainstem bronchus, resulting in amelioration of the obstruction (Image 2). The following day patient was extubated and was discharged shortly thereafter.

Discussion: Cases such as this one proves that interventional pulmonology procedures are prudent for patientcare, and should not be delayed, regardless of COVID-19 infection. These procedures should be performed with airborne precautions in place to protect both patients and medical staff. Further studies analyzing the role of advanced bronchoscopy specifically in the setting of COVID-19 should focus on improvements in time to diagnosis, time to therapeutic intervention, and overallimprovement in patient mortality.

Image 1: Complete occlusion of left main bronchus

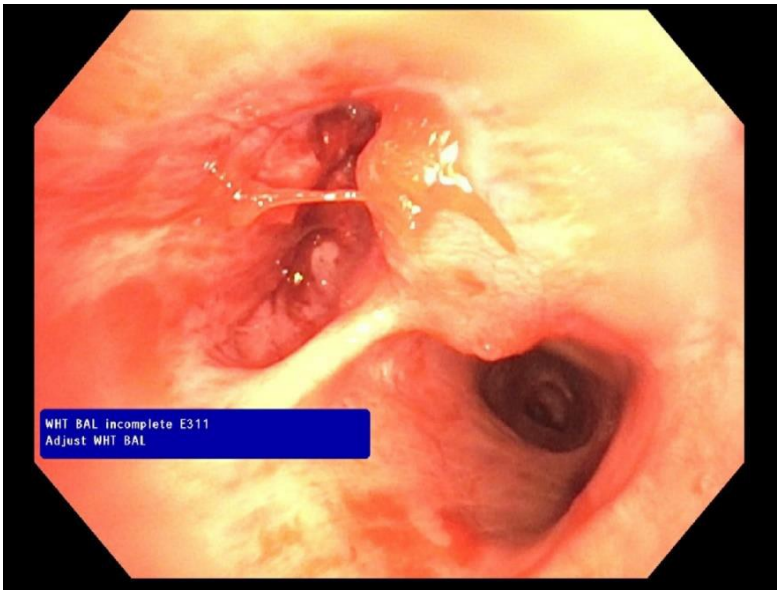
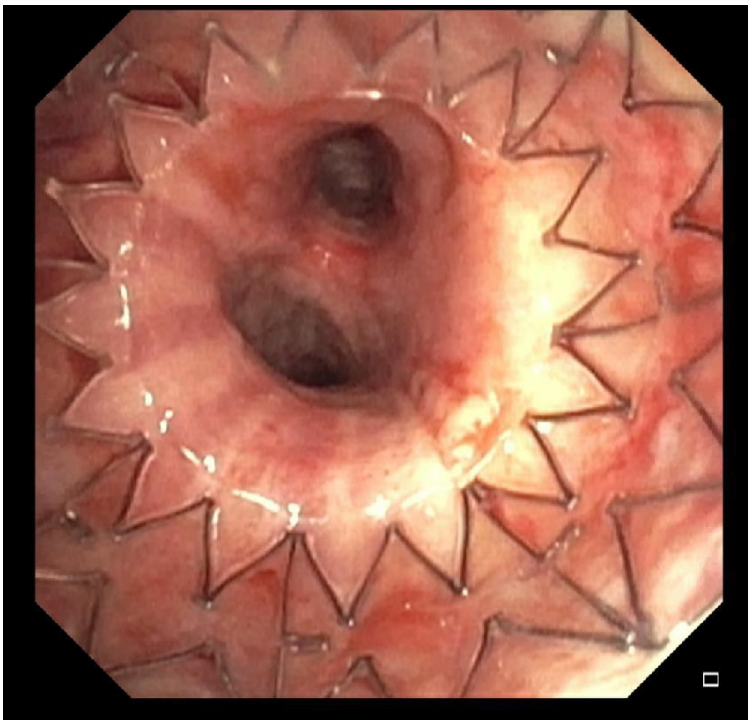


Image 2: Stent placement with amelioration of obstruction of left main bronchus.



The Yield and Complications of Endobronchial Ultrasound Guided Transbronchial Forceps Biopsies

Lankowsky, Jeffrey; Diab, Khalil; Baram, Daniel

Background: The use of endobronchial ultrasound guided transbronchial forceps biopsy (EBUS-TBFB) has become increasingly more common in the diagnosis of mediastinal related diseases.
The combined use of endobronchial ultrasound-guided transbronchial needle aspiration (EBUS- TBNA) with TBFB using a 1.0 mm micro forceps has been shown to be safe and increase yield indiagnosis of mediastinal diseases. The objective of this study was to determine the utility and safety of using a standard 2.0 biopsy forceps for TBFB when combined with TBNA using a 21- gauge needle.

Methods: This was a retrospective review of cases using both TBNA and TBFB with a standard2.0mm forceps in the diagnosis of mediastinal lymphadenopathy or lung mass.

Results: TBNA yielded a diagnosis in 15/21 cases (71.4%). The used of TBFB yielded a diagnosis in 17/21 case (81%). The combined yield of TBNA and TBFB was 18/21 (85.7%) cases revealed a diagnosis. The median size of tissue taken from TBFB was 5 mm (1-10 mm)..There were 7 cases of granulomatous inflammation. There were 12 cases of carcinoma. There were no significant adverse events.

Conclusion: The use of 2.0 biopsy forcep for TBFB combined with TBNA is safe and mayprovide increased diagnostic yield. We will be looking at its utility in lymphoma and mutational analysis of malignancy in the future.

There is a Fungus Among Us: Evaluation of the Utility of Genomic Sequencing Classifiersin the Setting of Endemic Coccidioidomycosis

Madhav Chopra MD, [1] Kawanjit Surapur MD, [1] Venkata Sai Jasty BS,[2] Billie Bixby MD[1]

[1]University Arizona College of Medicine Department of Pulmonary, Allergy, Critical Care and Sleep
[2]University Arizona College of Medicine

Background: Coccidioidomycosis, an endemic fungus, is a common cause of infection in the southwestern United States. Pulmonary nodules less than 5 cm are a recognized sequala of active or past infection. The nodules typically do not calcify like histoplasmosis and are confused for malignancy. Pulmonary nodules are difficult to diagnose using bronchoscopy with an overall tissue yield at best of 70%. Furthermore, there is no clear consensus as to whether a more invasive procedure or surveillance is the appropriate management for nodules with intermediate risk pre-testprobability.

The Percepta Genomic Sequencing Classifier (GSC) assists physicians to re-classify the probability of a nodule being malignant and can ultimately guide the decision to pursue more invasive procedures. A recent multicenter prospective study showed that Percepta testing performed during bronchoscopy, down-classified the risk of malignancy in 34.3% of cases with themajority avoiding an invasive procedure initially and at 12 months follow-up.

We hypothesize that in endemic coccidioidomycosis areas, the Percepta GSC will down-classify agreater percent of nodules.

Methods: A retrospective chart review was conducted analyzing subjects with indeterminate lungnodules undergoing bronchoscopic evaluation including Percepta testing at an academic medical center in Tucson, Arizona from 2018 to present. Data includes subject demographics, smoking history, nodule size, pre-test malignancy risk, post-test risk using Percepta GSC, results of coccidiomycosis serologies when available and tissue diagnosis of malignancy when available. Descriptive statistics were used to analyze the data. Patients with a concurrent malignancy orhistory of lung cancer and those with inconclusive Percepta results were excluded.

Results: A total of 55 subjects were identified with 12 high, 38 intermediate, and 6 low pretest risk. 22% of subjects were down-classified and 15% up-classified post Percepta. A total of 16 subjects had a tissue diagnosis indicating malignancy. A total of 4 of these subjects had Perceptatesting classifying them as intermediate risk and the remaining 12 being high or very high risk. Table 1 has complete results.

Conclusion: This retrospective review showed that in a coccidioidomycosis endemic region therate of post-test down-classification was 12% less than what is reported in the literature. Limitations include inadequate testing to accurately confirm a prior or current fungal infection, limited sample size and analysis at a single center. A larger, prospective, multi-center study in regions with endemic fungal disease will better elucidate the role of Percepta and other GSC testingin the management of indeterminate lung nodules in these areas.

TABLE 1:

A. BASELINE DATA

MEAN AGE	68.4
MALE	16
FEMALE	39
% FORMER/CURRENT TOBACCO USE	30
AVERAGE PACK YEAR SMOKING HISTORY (IN TOBACCO USERS ONLY)	19
NODULES <10MM (N)	2
NODULES 10MM-30MM (N)	45
NODULES >30MM (N)	8
B. RESULTS	
DOWN-CLASSIFIED POST TEST RISK (%)	22
UP-CLASSIFIED POST TEST RISK (%)	15
NO CHANGEN (%)	63
POSITIVE COCCIDIOIDOMYCOSIS SEROLOGY (%)	9
NEGATIVE COCCIDIOIDOMYCOSIS SEROLOGY (%)	53
NOT TESTED FOR COCCIDIOIDOMYCOSIS (%)	38

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Traumatic pneumatocele after bougie intubation requiring acrylate glue for bronchopleural fistula

Toribiong Uchel MD and Maria del Mar Cirino-Marcano MD

Introduction: Pneumoatoceles are pulmonary parenchymal cavities often caused by thoracictrauma. Iatrogenic pneumatoceles have been described following extrathoracic guidewire manipulation but none via endobronchus [1]. Pneumatocele rupture leads to bronchopleural fistula (BPF) requiring invasive surgical correction, pleurodesis, or bronchoscopic intervention.

Pleurodesis has been successful using acrylate glue when surgery is contraindicated [2]. Bronchoscopic intervention using acrylate glue has also been used for BPF post- pneumonectomy [3]. After an extensive literature search, to our knowledge, this is the firstreported case of an iatrogenic pneumatocele after traumatic bougie intubation requiring bronchoscopic acrylate glue instillation for BPF closure.

Case: A 30-year man with history of spinal muscular atrophy, presented with hypoxic respiratory failure requiring intubation. The procedure was difficult due to severe kyphosis with multiple attempts by three physicians. Endotracheal intubation was finally achieved afterSeldinger technique utilizing the bougie. Post-procedural chest x ray (CXR) showed right- sided pneumothorax necessitating a 14-french pigtail thoracostomy tube. Due to a persistent air-leak a chest CT was done revealing a ruptured traumatic pneumatocele in right upper lobe (RUL) apex (*Figure 1*). Bronchoscopic exploration showed an anterior tracheal erythema 3rd to 4th tracheal ring proximal from the carina with friable mucosa extending to the RUL bronchus, likely from the bougie. The air-leak stopped after temporary balloon occlusion of the RUL apical segment. Latex allergy prohibited the use of *Spiration* valve [4]. This hospitalization preced the advent of non-latex based endobronchial valves. Acrylate glue instilled to the apical sub-segment of RUL resulted in air leak cessation. Repeat bronchoscopyshowed the acrylate glue in appropriate position (*Figure 2*) and CXR without pneumothorax. Thoracostomy tube was discontinued after BPF resolved.

Conclusion: This case highlights ruptured pneumatocele as a rare complication of traumatic intubation. The management of BPF predates non-latex endobronchial valves and therefore acrylate glue was used with resolution of pneumothorax.

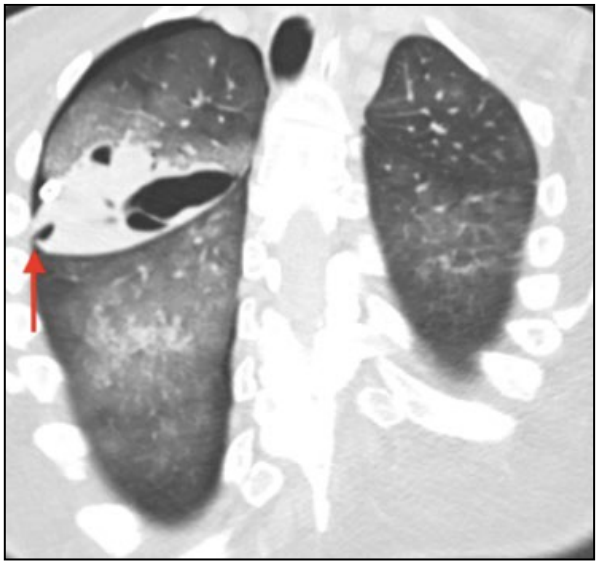

Figure 1. Severe kyphoscoliosis with ruptured RUL apex pneumatocele with fistula (red arrow)

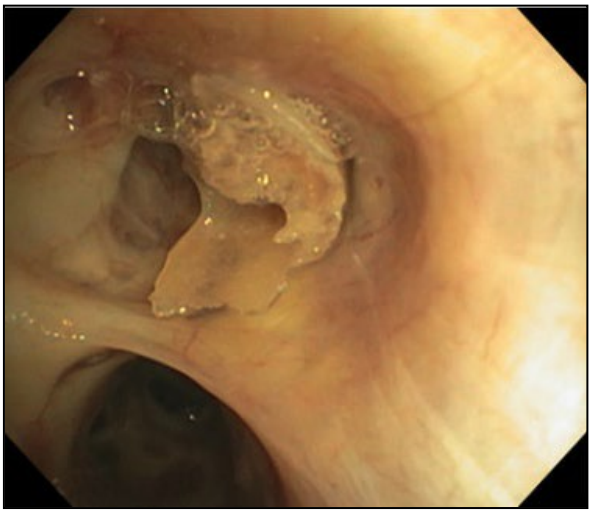

Figure 2. Acrylate glue in right upper lobe apical sub-segment.

Understanding the Role of Transbronchial Cryobiopsy in the Diagnosis of Interstitial Lung Disease at Cleveland Clinic Florida

John R. Woytanowski MD, Samantha Gillenwater MD, Sajive Aleyas MD, Ihab Alshelli MD,Nydia Martinez MD

Respiratory Institute, Cleveland Clinic Florida, Weston FL

Background: The diagnosis of interstitial lung disease (ILD) is challenging and relies on clinical history, radiographic and laboratory findings and, quite often, histology. Transbronchial cryobiopsy (TBLC) has emerged in recent years as an alternative to traditional forceps biopsy in thediagnosis of ILD; it has shown promise due to both a superior yield relative to forceps and less morbidity relative to surgical biopsy, however, the diagnostic concordance rates with surgery vary widely. Guidelines in recent years have advocated for a multidisciplinary (MDD) approach as the gold standard in the diagnosis of ILD, and many centers have adopted TBLC as part of their workup. We aimed to understand how TBLC has impacted the MDD at our institution.

Methods: Retrospective chart analysis was performed on all adults (18+) who underwent TBLC at Cleveland Clinic Florida from 1/1/2015 - 5/1/2020. A total of 23 subjects were enrolled. Each patient was presented at least once at our multidisciplinary discussion – the majority were presented after TBLC, however, some were presented both before and after biopsy. We noted whether the pathology was adequate and able to provide a differential diagnosis, whether the MDD utilizing the cryobiopsy was able to come to a consensus diagnosis, and whether the MDD led to a change in therapy.

Results: A histologic differential diagnosis was provided in 73.9% (17/23) of cases. A consensus diagnosis among MDD was able to be achieved in 78.3% (18/23) of cases, while 21.7% (5/23) werestill labeled as undifferentiated interstitial disease. The MDD resulted in a change of therapy in 54.5% of cases (12/22). None of our subjects were subsequently referred for surgical biopsy.

Conclusion: The rate at which cryobiopsy was able to provide pathologic differential diagnoses issimilar to cited studies, as is our rate of achieved consensus diagnoses among multidisciplinary discussion utilizing TBLC findings. Our study is limited but we believe that transbronchial cryobiopsy has definitively contributed to the consensus diagnoses achieved; one particularly interesting finding was that treatment was modified in more than half of cases upon review of biopsy results. Moving forward, we plan to follow the model of other centers and screen each patient in MDD prior to performing TBLC. The study is ongoing and should prompt other centers to evaluate the utility of TBLC within their MDD.

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Unintentional Use of Endobronchial Valves as a Proof of Benefit Prior to Lung VolumeReduction Surgery

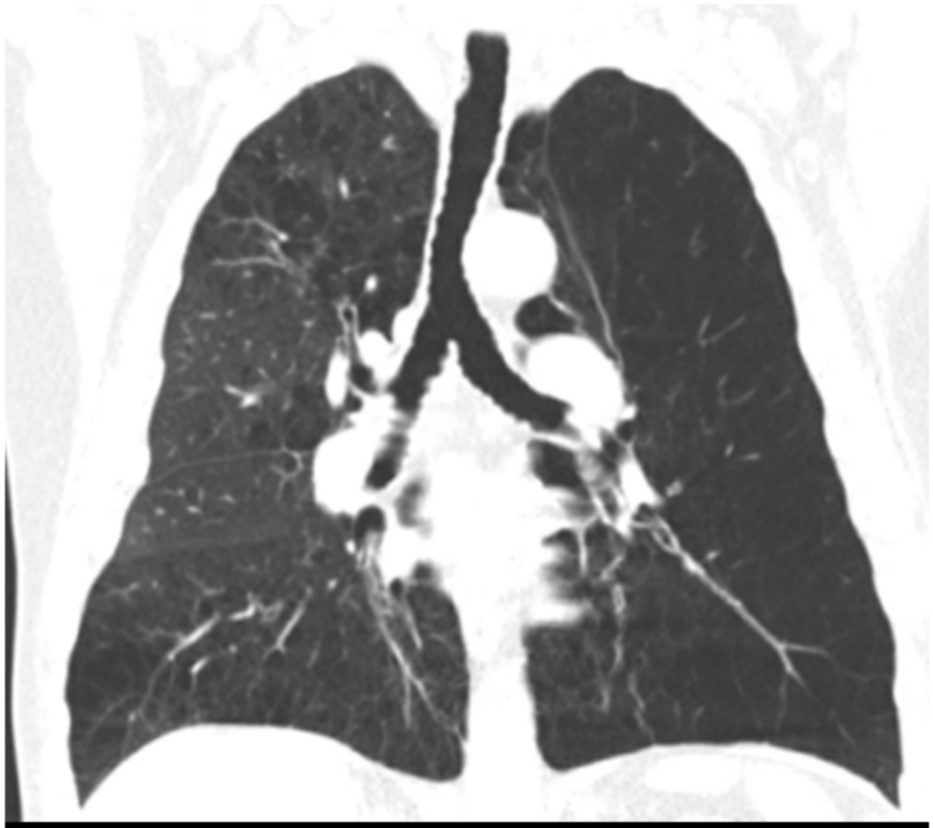
Yanglin Guo MD, George E. Abraham III MD, Michal Senitko MD

Introduction: Treatment of advanced emphysema has progressed over the years. Lung volumereduction surgery (LVRS) showed benefit in several long-term outcomes for select patients, butshort-term morbidity is high, and multiple co-morbidities may prohibit surgery. Bronchoscopic lung volume reduction (BLVR) has been shown to be a safe and effective alternative to LVRS; however, the use of BLVR as proof of benefit prior to LVRS is not well described in the literature.

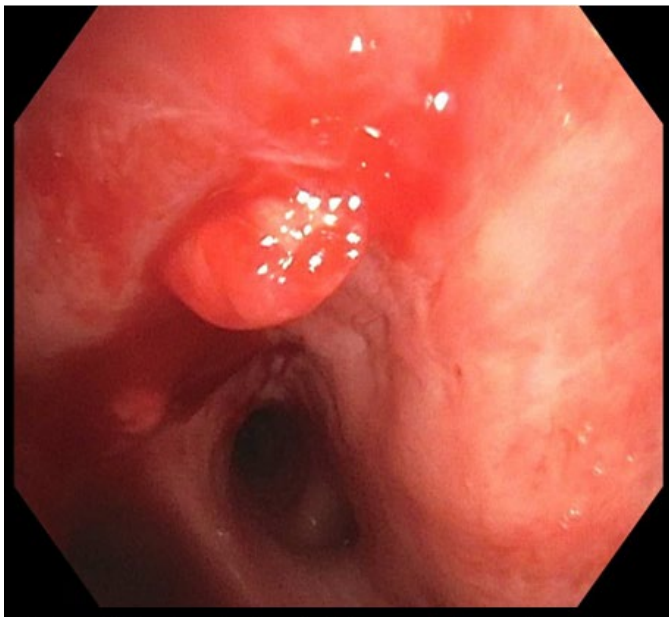
Case Description: 74-year-old man with COPD was referred for BLVR. He had rapid functional decline despite maximum medical therapy. FEV1 was 0.66 L (24% predicted), TLC 8.64 L (133% predicted), RV 6.23 L (237% predicted). 6MWD was 350m. CT chest showed a large bullae in theleft apex (<30% of the total left lung) with emphysema. StratX analysis revealed fissure completeness on the left and high destruction score in the left lower lobe (LLL).

Bronchoscopy was performed with the Chartis system, which confirmed negative collateral ventilation. Four Zephyr valves were placed in the LLL without any complications, and he had significant symptom improvement. He had gradual functional decline four weeks later. Repeat bronchoscopy showed valve migration. Polypoid lesions were seen in the LLL, which were biopsied and showed inflammation and vascular congestion. He underwent allergy testing, whichrevealed a titanium allergy. All of the valves were later removed due to loss of benefit and metal allergy. He was referred to thoracic surgery for LVRS, and successfully underwent robotic left lower lobectomy, and wedge bullectomy of the left upper lobe.

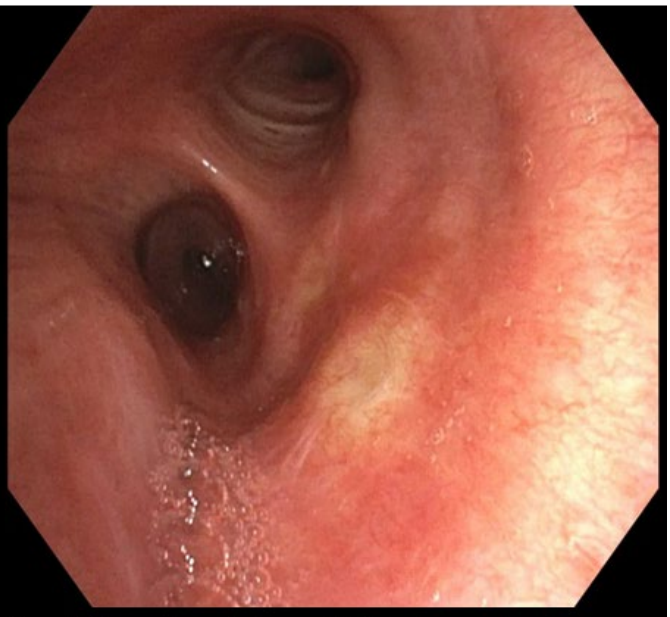
Conclusion: BLVR is safe and effective in patients with advanced pulmonary emphysema, who would otherwise not be candidates for LVRS or lung transplant. We demonstrated that BLVR can be used to establish proof of benefit prior to LVRS in an initially poor surgical candidate.



CT chest with left lower lobe emphysema.



Polypoid lesion in the left lower lobe adjacent to the endobronchial valves.



Resolution of endobronchial lesions after endobronchial valve removal.

Unique Case of BOOP/COP in COVID-19

Jasmine Caballero, Mary Cynthia Duran, Naresh Singh, Vamsi Guda.

Universidad Autonoma de Guadalajara, College of Medicine; Touro University,College of Medicine

Introduction: Bronchiolitis obliterans with organizing pneumonia (BOOP) is seen in many conditions but more commonly induced by a virus. During the SARS pandemic of 2003 physicians reported organizing pneumonia in 30-60% of ICU patients. During the 2020 SARS-CoV-2 pandemic, we are seeing a rise in organized pneumonia within persistently symptomaticpatients at greater frequency than SARS-CoV-1. Symptoms of BOOP ranging from flu-like to hemoptysis with diffuse alveolar damage are seen in 40-60-year-old individuals without gendervariability.

Case Summary: F a 51-year-old female with a past medical history of 30 pack year historyof tobacco smoke and hypothyroidism presented with a recurring dry cough and episodes ofhypoxemia for several weeks in June of 2020. Initial evaluation shows negative testing for SARS-CoV-2 PCR. F's dyspnea worsened and O2 saturations dropped to 75%. By January 2021,F continued to test negative for SARS-CoV-2 PCR but was positive for SARS-CoV-2 antibodies.A flexible bronchoscopy was performed for a bronchoalveolar lavage and left lower lobe transbronchial biopsy was performed. The lavage was significant for a neutrophilic predominance and the biopsy showed fragments of alveolar parenchyma with organizing pneumonia and fragments of bronchial mucosa with mild chronic inflammation. F was treated with prednisone 40 mg/dl for four weeks and was gradually lowered to 20 mg/dl for two weeks to be followed up in 6 weeks with a CT scan and a PFT. She continued to improve on the regimen of steroids.

Conclusion: Initiation of steroid therapy is now the mainstay of management for COVID-19. This case describes the development of BOOP in the setting of SARS-CoV-2 auto-inflammatory disease. The common theme in COVID-19 and BOOP management is suppression of the inflammatory cascade with steroids. This case provides evidence for the possibility of BOOP as an underdiagnosed condition in SARS-CoV-2 PNA.


A

Venovenous Extracorporeal Membrane Oxygenation Facilitates Bronchoscopic Interventionin Severe Central Airway Obstruction

Fahid Alghanim MD[1], Edward Pickering MD[1], Ashutosh Sachdeva MBBS[1], Ngoc-Tram HaMD[1],Faria Nasim MBBS[1], Van Holden MD[1]

[1]Division of Pulmonary, Critical Care, and Sleep Medicine, Department of Medicine, UniversityofMaryland School of Medicine, 110 S. Paca St., Baltimore MD, USA 21201

Introduction: Patients with severe central airway obstruction (CAO) have a higher risk of morbidity with traditional anesthetic practices due to decreased airway patency with supine positioning and decreased muscular tone from the induction of anesthesia and the administration ofneuromuscular blocking agents [1,2]. Venovenous extracorporeal membrane oxygenation (VV- ECMO) is an emerging strategy utilized to ensure adequate tissue oxygenation while securing a definitive airway in these patients [3-6]. We describe our experience with VV-ECMO support in two patients with malignant CAO requiring bronchoscopic intervention with stent placement.

Case Summary: Patient A is a 20-year-old woman who presented to an outside facility for respiratory distress and acute hypercapnic respiratory failure. She was found to have a right lung mass with extensive subcarinal adenopathy causing CAO. Her course was complicated by PEA arrest after induction of anesthesia for a planned mediastinoscopy. A tracheostomy was placed emergently, and she was transferred to our facility for therapeutic rigid bronchoscopy with cryodebulking and stent placement under general anesthesia and VV-ECMO support (bi-femoral approach) [Figure 1].

Patient B is a 24-year-old man who presented to an outside facility for subacute dyspnea in the setting of extrinsic tracheal compression secondary to a 15 cm anterior mediastinal germ cell tumor diagnosed via CT-guided biopsy. The patient was transferred to our facility for rigid bronchoscopy with placement of a tracheal stent under general anesthesia and VV-ECMO support (bi-femoral approach) [Figure 2].

Both procedures were completed without complications, and the patients were decannulated from VV-ECMO support within 12 hours.

Conclusion: The utilization of VV-ECMO is instrumental as a means for temporary oxygenation and ventilation while patients with severe CAO undergo lifesaving procedures for definitive management of their airway. Future studies should focus on the selection of the ideal candidate for VV-ECMO inpatients with CAO.

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Figure 1: A- Endoluminal appearance of endobronchial lesion at the level of the carina B-Endoluminal view of carina post-debulking and cautery of right and left mainstem.

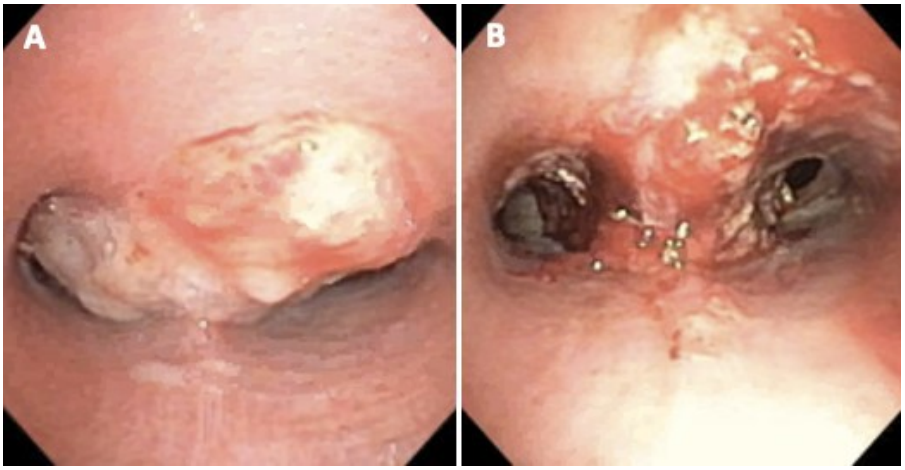

Figure 2: A- Endoluminal appearance of nearly full extrinsic compression at the level of the carina B-Endoluminal view of carina post-stent and balloon dilatation.