Diaphragm Paralysis

Management of 5 consecutive cases that I was referred

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• 54 year old previously healthy man
• Developed progressive shortness of breath and hypercapnea ($CO_2 > 100$ mmHg)
• Required intubation
• Chest X-ray showed marked elevation of the left hemidiaphragm
Intubated patient
Typically do not appreciate diaphragm elevation on positive pressure ventilation
Case 1

- No history of surgery or trauma
- CT of the chest did not show any evidence of malignancy
- Was unable to be weaned from the ventilator, had two attempts at extubation which failed
  - 2 hrs off vent
  - 12 hrs off vent
- Neurological evaluation
  - No focal deficits on physical examination
  - EEG normal
- Brain MRI was negative
• OR
  – Left hemidiaphragm plication
  – Tracheostomy
• Post operative course was uneventful
  – POD #2 on trach collar
  – POD #4 on trach collar for 24 hrs
  – POD # 6 right pleural effusion was drained
  – POD #11 decanulated
  – POD #13 discharged home
Chest X-ray two weeks later
Case 2

- 51 year old man with a history of a 1\textsuperscript{st} rib resection 15 years previously for thoracic outlet syndrome
- Required placement of a chest tube following the procedure for a large hemothorax
- He complained of progressive shortness of breath
- Remains fairly active, but is very dyspnic and needs to rest while climbing the slope of the Ravenel bridge
Case 2

- PMH: none
- PSH: left first rib resection
- PFTs
  - FVC 3.23 (64%)
  - FEV$_1$ 2.32 (63%)
  - DLCO 27.9 (101%)
• VATS plication of the left diaphragm
Case 2

• VATS plication of the left diaphragm
  – The initial post operative course was uncomplicated
  – POD #2 he complained of left chest pain and shortness of breath
  – A Chest X-ray showed significant elevation of the left diaphragm

• Underwent a left thoracotomy for plication of the diaphragm
• PFTs 2 months post op
  – FVC 3.88 (75%)
  – FEV\textsubscript{1} 3.00 (75%)
  – DLCO 27.4 (101%)

• PFTs 2 years post op
  – FVC 3.69 (72%)
  – FEV\textsubscript{1} 2.6 (66%)
  – DLCO 27.8 (101%)
Chest X-ray three weeks later
Case 3

- 45 yo woman presented syncope and chest pressure
- Chronic shortness of breath
  - substantially worse for the past 4 months
- Previously could walk 6 miles, but now walks < 1/2 mile
- No trauma or viral illness that preceded her dyspnea
- She becomes very dyspnic while lying down, and she is only able to lye on her left side
- A chest X-ray and a CT performed 4 months previously showed significant elevation of the left hemidiaphragm
- Brain MRI was unremarkable
- A fluoroscopic sniff test was performed that demonstrated a paralyzed left hemidiaphragm with paradoxical motion
- PFTs: FVC 2.77 (75%), FEV1 1.96 (66%) and DLCO 18.6 (75%)
• Left VATS plication of the diaphragm
• She was seen 3 weeks after her operation for a routine follow up visit
• Could sleep lying flat without dyspnea
• Dyspnea was significantly improved
• 74 year old man became acutely short of breath
• CT was negative for PE but did reveal elevated diaphragms bilaterally
• His dyspnea has persisted
• It was markedly worse when he is supine although he was still able to sleep supine or lying on either side
• Large meals make him more dyspnic
• Lost 20 pounds
• He is able to exercise
  – He has good muscle strength
  – minimal shortness of breath except when exerting himself
• Does not think that any of his peripheral muscle strength in arms or legs has noticeably changed
• Diaphragm fluoroscopy has been reported as normal
PMH:
  DM
  Prostate cancer
  CAD- stent RCA

MEDICATIONS:
  Atrovent
  Glimepiride
  Metformin
  Simvastatin
  Symbicort
PFTs

FVC 2.08 L (51%)
FEV$_1$ 1.34L (46%)
DLCO 19.8
Case 5

- 78 yo man with progressive dyspnea over the past several years
- 50% reduction in his pulmonary function in 10 months – coincides a cervical spinal fusion the anterior right neck
- Able to walk 200 feet
- Prior to his cervical operation he could walk the length of a football field
- He denies any fevers, chills cough or other respiratory symptoms
- Unable to sleep with right side down / always sleeps with left side down
- Able to breathe comfortably sitting completely upright, but severely dyspnic when reclining
PMH:
  - Obstructive sleep apnea
  - Seizures
  - Restless leg syndrome
  - Asthma
  - Diaphragm Paresis

PSH:
  - Cervical spine fusion
  - Lumbar fusion
  - Left shoulder
  - Right shoulder
  - Cataracts
  - Cholecystectomy
  - Carpal tunnel release
  - Appendectomy
  - Tonsillectomy
  - Pilonidal cyst
FVC 1.15 (33%)
FEV$_1$ 0.75 (31%)
DLCO 22.7

sO$_2$ 93% on 3 L nasal cannula
• Fluoro sniff test
• Left diaphragm: 2.5 cm of excursion
• Right diaphragm: 1.0 cm excursion
• No shift of the mediastinum
• Findings are compatible with paresis but not paralysis of the right phrenic nerve
• Enrolled in pulmonary rehabilitation
  – Able to walk 300 ft
  – Also riding stationary bicycle
• Subjective dyspnea improved butt still short of breath with minimal activity
• Remained very interested in diaphragm plication
• His referring pulmonologist also very interested in diaphragm plication
Case 5

- Underwent right thoracotomy for diaphragm plication
- Surgery was uneventful
- Discharged home on POD #5

- Enrolled in pulmonary rehabilitation (again)
- 2 months after surgery was able to walk 300 ft