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Case Report

Proximal Bronchial Tears & Perioperative Challenges Faced by Anesthesia Team - A Case Report

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Abstract

Tears in the trachea & main bronchi are relatively uncommon & fatal in nature. They are usually due to trauma. We present a case where the Left main bronchus had a erosion & tear on the 12th postoperative day after surgical repair of distal Carcinoma esophagus & the Peri-operative challenges faced by the Surgical & Anesthesia team during the emergency repair of this tear with huge (40%) air leak. Challenges include a preliminary multidisciplinary team discussion of the medical problem- a safe solution to the problem & a plan for maintenance of oxygen saturation, adequate ventilation, optimal surgical exposure & getting the proper equipment ready for the surgery

Introduction

After the bifurcation of the trachea into 2 branches at the level of the T4 - the **Left Main Bronchus** (*bronchus sinister*) smaller in caliber but longer than the right, being nearly 5 cm. long enters the root of the left lung opposite the sixth thoracic vertebra. It passes beneath the aortic arch, crosses in front of the esophagus, the thoracic duct, and the descending aorta, and has the left pulmonary artery lying at first above, and then in front of it.(figures 1 & 2) Due to its complex course & vital structures around it repairs of this nature require one lung ventilation(OLV) to maintain optimal surgical exposure & require proper multi disciplinary discussion and a plan in place before proceeding for surgery.

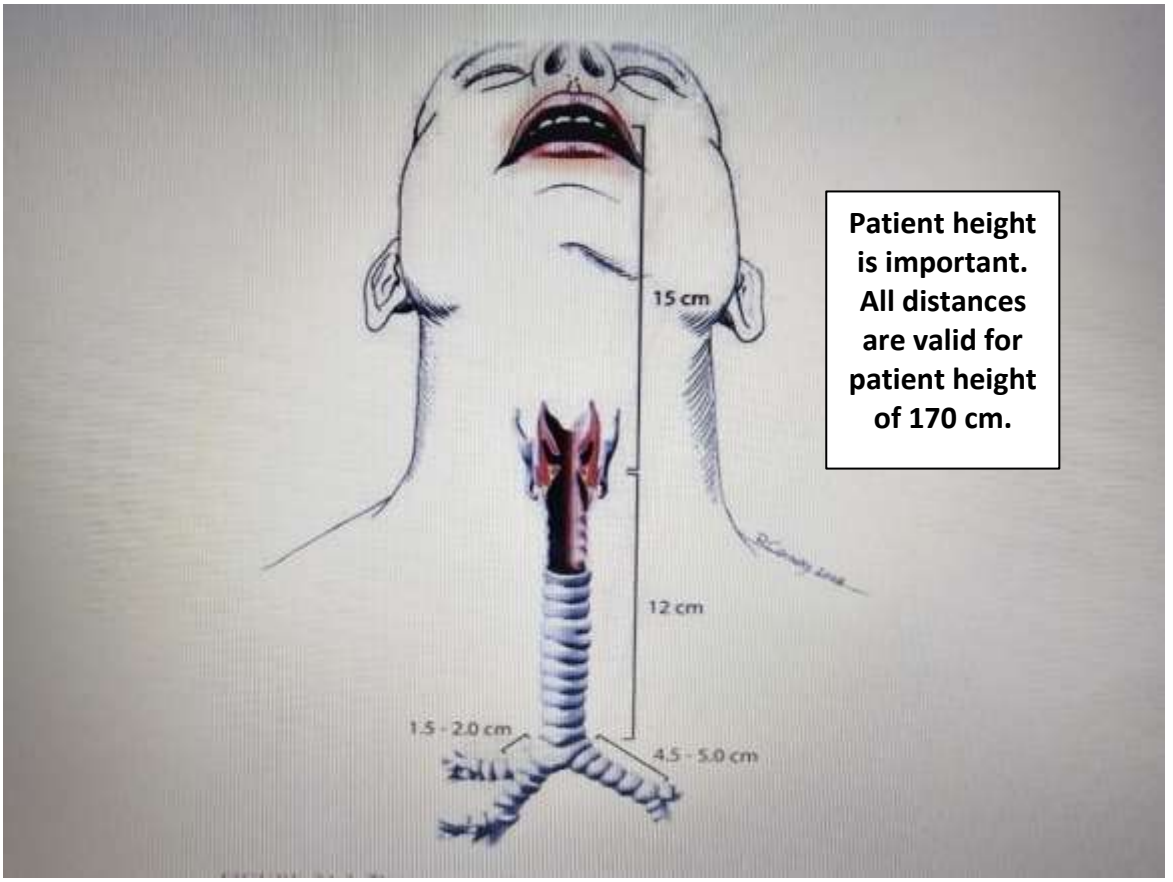


Figure 1: Approximate distance & caliber of tracheo-bronchial tree

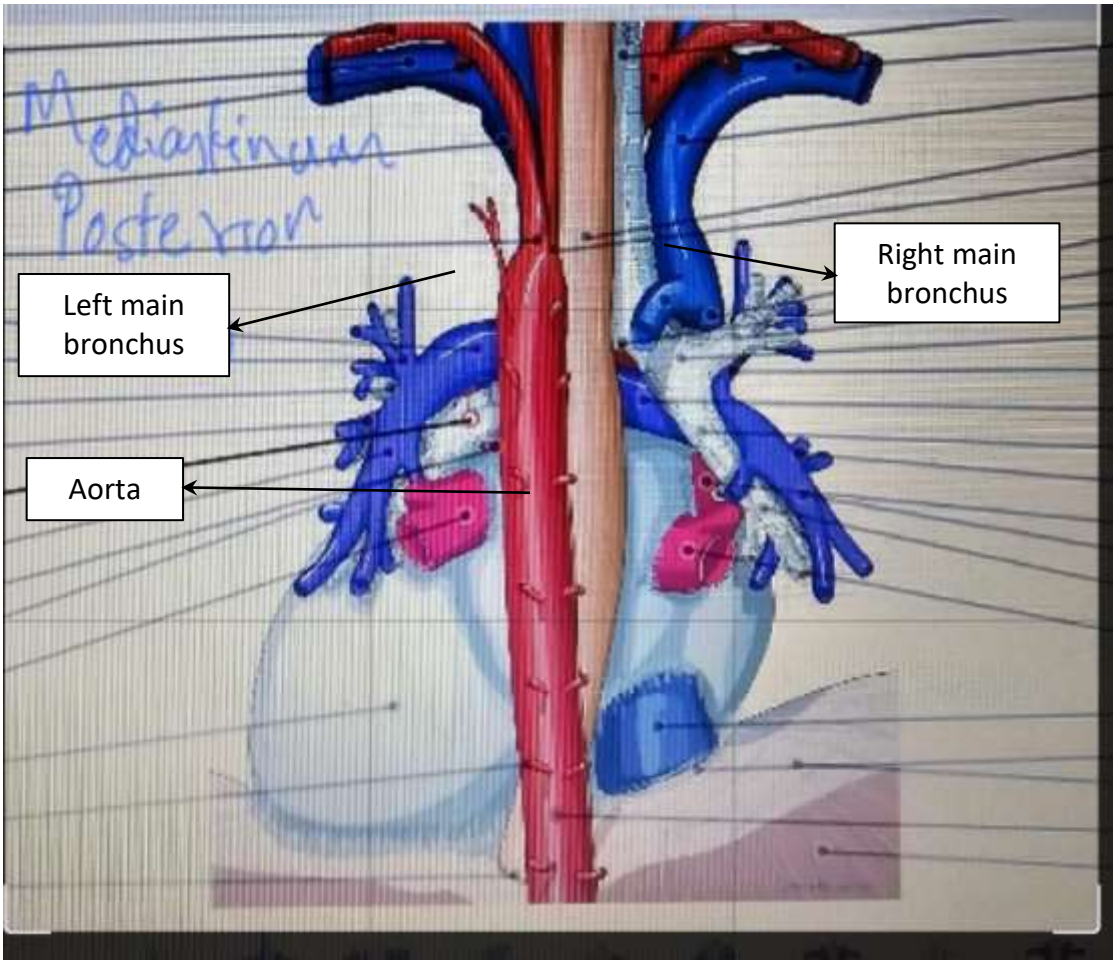


Figure 2: Posterior view of the mediastinum showing the complex relationship of vital structures.

Medical history - A 68 year male with a history of dysphagia for 2 months was investigated by the gastro-enterologist. Visual gastrointestinal endoscopy & endoscopic ultrasound showed a gastric ulcer at 32 cm of the esophagus & biopsy showed carcinoma in situ & full thickness dysplasia. CT scan staged the lesion as T3N0M0. Tumor board decision was to proceed with radio chemotherapy followed by surgery (Esophagectomy with gastric interposition/ pull through)

The patient showed excellent response to chemo-radiotherapy. PET scan after therapy showed shrinkage of the lesion with no distant lesions. The tumor was again staged as T3N0M0. Since elective surgery was planned the patient was worked up in the Preoperative assessment clinic a detailed medical history & investigations were done for thoracic surgery.

Preoperative anesthesia clinic assessed the patient for general well being, smoking history, comorbidity & conducted the following:

1. Routine blood tests, EKG & CXR which revealed **Atrial Fibrillation with rapid ventricular response**.

2. Pulmonary function tests which revealed **spirometry mildly restrictive FVC 77%, normally FEV1 and ratio, severely impaired DLCO of 38% .**

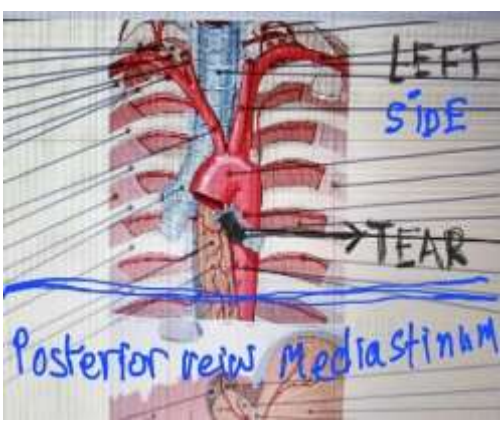
3. Cardiac stress testing which reported no inducible ischemia including 2D ECHO **with EF >55%**

Airway was assessed as Grade 2 - ZERO allergy to food/medicines were noted. Informed surgical consent was obtained for " **ESOPHAGECTOMY & GASTRIC PULL THROUGH**" surgery.

All surgical & anesthesia complications were explained & the patient was operated uneventfully & extubated in the Surgical ICU a day later. On the 10th postoperative day in the ward the patient started to become dyspneic, had a couple of bouts of vomitus & the vitals / pulse oximeter values deteriorated. Chest was auscultated & showed decreased breath sounds on the right side & chest X ray showed a right sided pneumothorax. Quick actions included oxygen mask & placement of right sided intercostal drain under local anesthesia .An urgent CT scan of the chest was requested & the report showed a 7 mm tear/erosion of the LEFT MAIN BRONCHUS 2 cm from the carina. Since the patient was deteriorating, urgent tracheal intubation with size 8 oral cuffed endotracheal tube was done. VCV mode showed alarms & leak up to 40 % of ventilation (Drager-V300 series) After intubation upper g.i endoscopy was done to check the suture line of the esophagus & the gastric pull through which confirmed an erosion with localized collection into the mediastinum. Surgical intervention with repair of the tear/erosion was the only solution & the anesthesiologist was requested for urgent consultation for a LEVEL 1 "repair of left main bronchus tear with closure by right Latissimus dorsi flap".

Assessment in the surgical ICU showed the following vitals HR 132bpm, BP 92/60 mm Hg SpO2 89%. Chest auscultation revealed decreased breath sounds on the right hemithorax.. Multidisciplinary team discussion along with family members followed the urgent assessment of the patient. Surgical goals & complications & postoperative outcomes including life support if necessary were discussed briefly along with Peri-operative anesthesia risks

Figure 3: showing the preoperative chest x ray & CT scan (erosive tear/leak) from Left main bronchus.



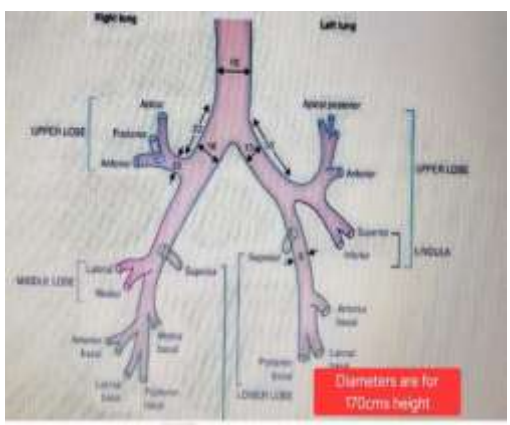


Figure 4: Schematic diagram showing the tear in the Left main bronchus and diameter of bronchi

Surgical goals were clear

1-Left lateral decubitus position for the surgery

2-Right thoracotomy & surgical repair of the left main bronchus tear by posterior mediastinal approach using the right Latissimus dorsi flap.

3-One lung ventilation of the right lung – with gentle surgical retraction of the right upper lobe for optimal surgical view

4-Occasional apneic ventilation of the right lung coupled with jet ventilation of the left lung during mediastinal dissection to facilitate bronchial repair.

Anesthetic challenges during the surgery included but not limited to:

1-Maintenance of vitals & usage of inotropes if necessary.

2-Prevent hypoxia & maintain Spo2 at least above 92 %

3-Permissive hypercarbia limited to Pco2< 60 mm based on ABG values.

4-Maintain arterial pH above 7.25 with usage of Sodium bicarbonate & hyper-ventilation (rate based-because of massive bronchial leak) when necessary.

5-Arrange necessary equipment in the operating room for Jet ventilation & ECMO.

Peri-operative Management - This patient was sedated & intubated in the Surgical ICU with a VCV mode of ventilation & a peri-bronchial leak of 40 %(Drager-V300 Series) A right internal jugular central line & radial arterial line were placed in the ICU & right intercostal drain output was noted before shifting the patient to the operating room. In the operating room weight based opioid & sedatives (i.v remifentanil & midazolam) and relaxant - rocuronium 50 mg iv was given & the existing ET tube was replaced with a

37 FG Right sided Double lumen tube (DLT). The chest was noisy from the leak & bronchoscopy confirmation of the alignment of the opening slot of the DLT & right upper lobe lumen was confirmed at 26 cm from the Carina and the DLT was fixed . Left main bronchus tear was confirmed < 2 cm from the Carina.

Figure:5 Bronchoscopy view showing the tracheal Carina & the left bronchus tear <2cms distal to the Carina.

The patient was then positioned in the left decubitus & the position of the R-DLT was checked again. All monitors (arterial & central line) were re-calibrated and the patient was re bolused with adequate doses of remifentanil/ midazolam & rocuronium for the surgery.

Surgery proceeded by right thoracotomy at the T6 (tip of scapula) level & a post mediastinal approach to the tear was possible with hypo-ventilation of the right upper lobe with gentle surgical retraction. Jet ventilation was supplemented to the left lung whenever the oxygen saturation's dropped below 90 %. Arterial blood gas was done every 30 minutes to check PH , Pco2 & electrolytes .. Respiratory rates were adjusted accordingly & weight based Sodium bicarbonate was used when the PH values dropped to 7.22. Total surgical time was calculated as 270 minutes in which the actual bronchus tear repair by the Latissimus dorsi flap was 70 minutes. Peak airway pressure was limited to < 30 cm H20 to prevent barotrauma to the lungs & limit further dissection of the tear. PEEP was limited to less than 5 cm H20. At the end of uneventful surgery the R-DLT was changed to regular 7.5 OCETT & patient was taken back to ICU for post op ventilation. After satisfying the extubation criteria the patient was extubated uneventfully on the following day.

Discussion

Iatrogenic injuries are not uncommon during gastric pull through operations for treatment of distal esophageal carcinomas. The known complications include immediate & delayed complications. Postoperative bleeding, sepsis & iatrogenic injuries to structures in the mediastinum include the right or left main bronchus. Bronchial injuries are rare & immediately detected when the surgeon requests the anesthesiologist to inflate both the lungs after flooding the surgical field with saline.In our case no injury was detected during positive pressure inflation of the lungs during the first surgery.. These injuries depend on the experience of the surgeon and in the range of 1-9 %[3] . In our case good hemostasis & suture integrity was confirmed during a per operative endoscopy. The patient had liquid feeds from day 3 & was mobile during his entire post operative period until day 12 when he had a bout of vomiting & his vitals started to deteriorate. Surgical findings later at the left main bronchial bronchus include chemical erosion from the gastric juice from a suture-line leak & the formation of gastro-bronchial fistula with a collection behind the heart extending to the right hemithorax.It is very rare to have a left main bronchus tear & not to have to ipsilateral pneumothorax. In our case the patient presented with right sided pneumothorax & an intercostal drain was

promptly inserted in the ward under local anesthesia to relieve the respiratory distress with slight improvement in oxygen saturation . Posterior mediastinum approach is preferred by the surgeon in esophageal cancer treatment surgery because of the ease of surgical dissection & is a challenge for the anesthesiologist to maintain acceptable oxygen saturation & adequate ventilation with permissive hypercarbia. In our case ECMO was an option & kept as a standby . Conventional L- DLT is a good choice in left main bronchus leaks due to trauma in which the cuff is sited beyond the tear/ leak which is gently pulled back during a flap closure . In our case the tear was very close to the carina <2cms and surgical repair in the area could include suturing of the DLT(figure 4) The area was very fragile due to erosion from the gastric juice & there was very possibility of increasing the tear due to manipulation of the L-DLT and so a R-DLT was the only choice in this repair[5] .Gentle surgical retraction of the right upper lobe with CPAP 5-10 cm applied to the left lung will usually maintain good oxygenation. Jet ventilation was used at regular intervals in conjunction with the arterial blood gas results done half hourly to maintain the PCO2 below 60 mm Hg[4].Based on the leak fraction of 40 % displayed on the ventilator we realized that that the patient was having a sort of OLV. With oxygen saturation of 89% on Fio2 of 0.5 & a elevated of PCo2 of 69 mm Hg we realized that every minute of delay would cause dangerous hypercarbia & serum K + shifts.

This case highlights the importance of delayed complications of esophageal cancer surgery & the challenges faced by the Anesthesia team during post operative repairs especially when the main airways such as the trachea or main bronchi are involved. Extensive leaks of the airways can pose difficulties in maintaining the PO2 and hypoxaemia can set in quite quickly especially when the leak is >25 %. Hypercarbia can be a serious problem with severe respiratory acidosis setting in as quickly as 30 minutes with PCO2>60 mm Hg. with serious arrhythmia s & serum K+ fluctuations[6]. Vigilance & urgent intervention are necessary. Proper equipment should be assembled in minutes to proceed for surgery. ECMO should be considered in right main bronchus leaks as dangerous hypoxemia may occur even during introduction of the double lumen tube for lung isolation.

References

1.Esophagectomy and Gastric Pull-through Procedures: Surgical Techniques, Imaging Features, and Potential Complications Radiographics Volume 36 Issue 1, published Jan 12, 2016 (https://doi.org/10.1148/rg.2016150126) by Jennifer C.Flanagan , Richard Batz et al

2.Adequate Management of Postoperative Complications after Esophagectomy: A Cornerstone for a Positive Outcome in Cancers 2022, 14,5556 (https://doi.org/10.3390/cancers14225556) published 12 November, 2022. by Imad Kamaleddine, Alexander Hendricks, Magdalena Popova and Clemens Schafmayer

3. 14 Years' experience of esophageal replacement surgeries Muhammad Saleem, Asif Iqbal, Uzma Ather, Naveed Haider, Nabila Talat, Imran Hashim, et al Accepted: 5 March 2020 / Published online: 31 March 2020 in the PEDIATRIC SURGERY INTERNATIONAL. © Springer-Verlag GmbH Germany, part of Springer Nature 2020, corrected publication 2020

4. Permissive hypercapnia: Is there any upper limit? by Dr Sunil Kumar Garg Indian J Crit Care Med. 2014 Sep; 18(9): 612–614. doi: 10.4103/0972-5229.140154

5. How to choose the double lumen-tube size and side by Pedoto et al : The eternal debate Anesthesiology Clinics 2012;4:671-681.

6.Medical Emergencies Steven W. Salyer PA-C, ... Chris R. McNeil, in Essential Emergency Medicine, 2007