

Question VI.1 A left main bronchial stent was placed four months ago to palliate central airways obstruction from unresectable squamous cell carcinoma. The patient has had good response to external beam radiation therapy as demonstrated by tumor shrinkage on computed tomography scans. Last night the patient called to report acute onset of shortness of breath after a violent coughing episode. Emergent bronchoscopy reveals the finding shown. The most appropriate next step is to

- A. Immediately transfer the patient to an interventional bronchoscopist for rigid bronchoscopy, stent removal and evaluation for possible stent replacement.
- B. Introduce a large arterial embolectomy balloon catheter through the working channel of the flexible bronchoscope. After passing it through the stent, you inflate the balloon and pull the stent proximally into the trachea, and up past the vocal cords to remove the stent from the airways.
- C. Grasp the proximal edge of the stent with the largest alligator forceps available and pull the stent proximally into the trachea, and up past the vocal cords to remove the stent from the airways.
- D. Introduce a balloon catheter alongside the flexible bronchoscope using the suture and catheter technique. After passing the catheter through the stent, you inflate the balloon and pull the stent proximally into the trachea, and up past the vocal cords to remove the stent from the airways.



Answer VI.1 A

The most conservative approach is to transfer the patient to an interventional bronchoscopist. It is likely that tumor shrinkage resulted in stent migration. It is also likely that another stent will not be necessary at this time. It is safest to remove large silicone stents using a rigid bronchoscope because the stent can be pulled up into the rigid tube and removed from the airway without risk of damaging the vocal cords. If necessary, however, each of the other techniques described is possible. If repositioning with forceps is attempted, one must avoid tearing or cutting the stent. Alligator forceps, rat tooth with alligator jaws, rubber tip forceps, and shark tooth forceps might be used with varying

levels of success. Of course, techniques will vary depending on the bronchoscopist's experience and resources available.

In order to introduce a balloon catheter using the suture-catheter technique, one can introduce a balloon catheter that does not fit through the working channel of the flexible bronchoscope. The loop of a 100 cm O silk suture is placed through the working channel of the bronchoscope using forceps. In an emergency, waxed dental floss can also be used. The catheter is then placed through the loop, which is tightened around the catheter (see Figure below). An assistant holds the tightened suture while the bronchoscope-catheter ensemble is inserted into the airways via the oral route. The catheter can be advanced into position when the assistant releases the suture. Another method is to insert a bronchial blocker balloon (See Figure below). It is always risky to remove a silicone stent using flexible bronchoscopy because the stent may become lodged in the subglottis, or the stent may damage the vocal cords.



Question VI.2 A patient had a stent placed for benign postintubation tracheal stenosis two months ago. Abrupt onset of hoarseness and dyspnea prompts emergency consultation. Which of the following has most likely occurred.

- A. Granulation tissue has obstructed the stent
- B. The stent has migrated proximally
- C. The stent and lower trachea have become obstructed with thick secretions
- D. The stent has migrated distally
- E. The stricture has become more severe and has compressed the stent

Answer VI.2: B

Proximal migration of an airway stent can cause hoarseness, cough, throat pain, difficulty swallowing, and dyspnea. Sometimes the proximal extremity of the stent touches the caudal surface of the vocal cords. Other times, the stent might be coughed out and become caught between the vocal cords. In this case there is usually complete loss of voice. Stents that have migrated can be removed using rigid bronchoscopy under general anesthesia, or using flexible bronchoscopy, balloon catheters, or a # 5 cuffed endotracheal tube. Sometimes, a stent can be removed using the flexible bronchoscope and forceps, or by flexing the tip of the bronchoscope while pulling the bronchoscope-stent ensemble upwards.

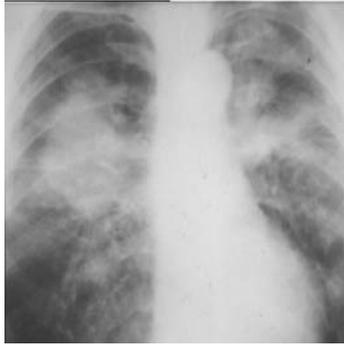
If intubation is necessary, a # 6 cuffless endotracheal tube should be used because it will usually pass beyond the stent. Depending on the site and severity of the airway stricture, however, the endotracheal tube may not pass beyond the stricture. Distal migration obviously prompts symptom recurrence but does not cause hoarseness. Thick secretions cause cough and dyspnea, but do not cause hoarseness or loss of voice. Granulation tissue can obstruct any and all airway stents. This complication occurs more frequently in patients with indwelling metal stents than in those with silicone stents. An increase in the severity of the airway stricture usually causes increasing dyspnea or cough, but should not result in hoarseness.

Cuffless # 6
endotracheal tube



Question VI.3: A 58-year-old coal miner complains repeatedly of coughing up dark phlegm. He has rheumatoid arthritis and chronic bronchitis. He coughed up a teaspoon of blood three months ago. He continues to smoke cigarettes. Chest radiograph reveals bilateral slightly cavitating lung nodules in the upper lung fields with associated volume loss and retraction of the hila upwards. The most likely diagnosis that **best** explains all these symptoms is

- A. Malignant melanoma metastatic to the large airways
- B. Bronchogenic carcinoma with occasional bleeding and presence of old blood clot
- C. Active, necrotizing tuberculosis with lymphadenopathy eroding through bronchial wall
- D. Caplan's syndrome
- E. Broncholithiasis from prior infection with *Coccidioides immitis*



Answer VI.3: D

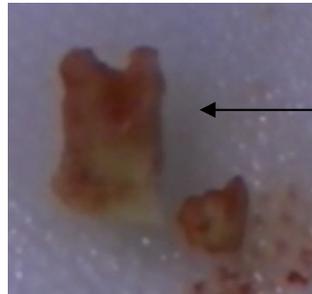
This patient probably has Caplan's syndrome, which includes multiple pulmonary nodules, rheumatoid arthritis, a cigarette smoking history and employment as a coal miner. The expectoration of black sputum, also known as melanoptysis, occurs in patients with complicated coal workers pneumoconiosis (CWP). Disease presents as bilateral large or confluent nodules in the upper lung fields. Often there is a background of simple coal worker's pneumoconiosis. The prognosis for patients with complicated CWP is poor.

For the patient described in this case, flexible bronchoscopy was performed to exclude other diseases that might be responsible for symptoms. Malignant melanoma can metastasize to the large airways, resulting in a blackish nodular obstruction that bleeds easily and might require bronchoscopic laser resection. Parenchymal melanoma nodules, however, are usually small and do not cavitate. If there were airway obstruction, one would expect to see radiographic signs of atelectasis. In addition, patients with bronchial metastases from melanoma, usually have a known history of malignant melanoma.

Patients with necrotizing tuberculosis may have erosion of caseous material and mediastinal lymphadenopathy through the medial walls of the left or right main bronchi. This might warrant stent insertion. Material is usually yellowish and thick, which does not fit the description given above. Old blood clot from a previously or actively bleeding

endobronchial tumor can appear black on bronchoscopic examination. In fact, such clots may be erroneously believed to be endobronchial tumors. Removal is often difficult because clots tear easily when grasped with biopsy forceps. It may be necessary to use rigid bronchoscopy, specially designed foreign body removal instruments or balloon catheters to remove tenacious clots from the airway.

Broncholiths are usually whitish, firm, calcified nodules that have eroded through an airway wall or otherwise entered the distal lobar or segmental bronchial lumen. They are often surrounded by granulation tissue that can bleed easily. Often asymptomatic, they may also cause hemoptysis, cough, localized wheezing, postobstructive pneumonia, and radiographic or bronchoscopic signs of endobronchial obstruction. Etiologies for broncholithiasis include *Coccidioidomycosis*, *Histoplasmosis*, and *Mycobacterium tuberculosis*. Sometimes it is necessary to use Nd:YAG laser to break up these benign broncholiths, and to remove them piecemeal using foreign-body removal techniques.



Broncholiths

Question VI.4: A 35-year-old male reports increasing shortness of breath during the past 5 years. He recently quit his job as a sand blaster because chest pain, cough, and increasing fatigue prevented him from working. On physical examination, decreased breath sounds with ronchi at the lung bases are noted. The patient has digital clubbing. There is no peripheral lymphadenopathy. He denies fever or weight loss. He denies risk factors for HIV. Arterial blood gases reveal a PaO₂ of 54 mm Hg. Diffusion capacity and Total Lung Capacity are also decreased. Chest radiograph reveals bilateral alveolar infiltrates. Patchy bilateral consolidation is noted on chest computed tomography scan. Flexible bronchoscopy with bronchoscopic lung biopsy reveals nonrepresentative tissue. Bronchoalveolar lavage shows dense eosinophilic material, which stains positive for PAS and fat. Silver stain is negative. The next step in the diagnostic evaluation is

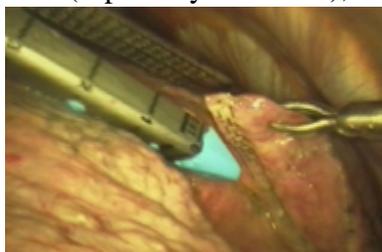
- A. High resolution computed tomography
- B. Thoracoscopic lung biopsy
- C. Repeat bronchoscopic lung biopsy
- D. Repeat BAL with repeat shell vial viral cultures
- E. Echocardiogram

Answer VI.4: B

Thoracoscopic lung biopsy rather than repeat bronchoscopic lung biopsy and bronchoalveolar lavage is most likely warranted in this case. It is noteworthy that the bronchoscopy was not “nondiagnostic”, but “nonrepresentative”. One could argue to repeat the biopsy. Satisfactory material, however, was obtained from the bronchoalveolar lavage, suggesting a diagnosis. The differential diagnosis includes Idiopathic alveolar proteinosis, Acute silicotic alveolar proteinosis, Hematologic malignancy, AIDS with cytomegalovirus infection, and new onset right heart failure in a patient with silicosis.

This particular patient had secondary alveolar proteinosis. This entity has been noted in up to 5 percent of patients with hematologic malignancies and pulmonary symptoms, and in up to 10 percent of patients with myloid disorders. Patients who are immunosuppressed, including patients with AIDS or immunoglobulin deficiencies may also have an alveolar proteinosis-type reaction, although infections are often present as well. These include *Pneumocystis carini*, cryptococcosis, tuberculosis, and viral infections. Right heart failure and associated pulmonary edema may simulate the radiographic pattern of alveolar proteinosis, but edema fluid lacks eosinophilic material.

Patients with acute silicosis may also develop silicotic alveolar proteinosis. Acute silicosis can present after several years of steady exposure, usually in sand blasters, tunnelers or silica flour workers. BAL fluid might also reveal birefringent material with polarization. Idiopathic alveolar proteinosis has a variable prognosis. Although infiltrates occasionally clear spontaneously, it is more often necessary to proceed with bilateral whole lung lavage. Abundant milky fluid removed during lavage is diagnostic. About 30 percent of individuals will eventually succumb to the disease, which can progress to intractable hypoxemia, infection (especially *Nocardia*), and respiratory failure.



Question VI.5: The appearance of the endobronchial abnormality shown in the figure below is most consistent with

- A. Carcinoid Tumor
- B. Adenoid cystic carcinoma
- C. Squamous papillomatosis
- D. Sarcoma
- E. Lipoma



Answer VI.5: B

Approximately 80 percent of tracheal cancers are either squamous cell carcinomas or adenoid cystic carcinomas. Most squamous cell cancers occur in male smokers over the age of sixty, whereas adenoid cystic carcinomas occur without gender predilection over a wide age range. For adenoid cystic carcinoma, open surgical resection is the treatment of choice, although positive surgical margins occur in about 40 percent of patients. Patients with acute symptoms of central airway obstruction can be considered for bronchoscopic resection.

Patients who are not surgical candidates may require bronchoscopic resection and airway stent insertion. The tumor shown in the figure below is deep and infiltrating. Multiple endoscopic treatments, including insertion of an airway stent may be warranted. Surgical resection is difficult, and margins are likely to be positive. Local recurrence with or without synchronous distal metastases occurs in up to 25 percent of patients despite local open surgical resection with or without external beam radiation therapy, and even very late recurrences may occur.



Question VI.6: Two weeks ago, you referred a 58 year old woman with inoperable squamous cell carcinoma and right main bronchial obstruction to a colleague who performed Nd: YAG laser resection followed by silicone stent insertion. During a consultation to discuss external beam radiation therapy, she asks you about potential stent-related complications. You tell her all of the following **except**

- A. Potential complications include stent migration and stent obstruction from secretions, granulation tissue or tumor.
- B. Complications are rarely life-threatening, but some experts recommend surveillance flexible bronchoscopy.
- C. If airway patency has been satisfactorily restored, she may resume a normal life, including travel, exercise and nutrition.
- D. She should contact you or the nearest emergency room in case of new or increased cough, shortness of breath, hoarseness, chest pain, or fever.
- E. She should postpone external beam radiation therapy for at least two more weeks because it may facilitate stent migration.

Answer VI.6

E

Neither external beam radiation therapy nor brachytherapy have adverse effects on indwelling airway stents. Therefore radiation therapy and other systemic therapies should not be postponed because of airway stenting. Stent-related complications do occur, however, but are less frequent in patients with malignant central airway obstruction than in patients with benign causes of central airway obstruction. This is presumed to be because growing neoplastic tissues keep stents in position with the airway lumen. Shrinkage of these tissues from radiation therapy or response to chemotherapy will predispose to stent migration.

Should a patient develop symptoms suggestive of stent-related complications, emergent consultation is warranted. Physical examination might reveal decreased breath sounds, wheezing, or stridor. Chest radiographs may reveal stent migration, atelectasis, or pulmonary infiltrates. Flow-volume curves might reveal decreased ventilatory flow. Bronchoscopy might reveal stent migration or obstruction from granulation tissue, tumor, or secretions.

Question VI.7: A 62-year-old male with carcinoma in-situ underwent photodynamic therapy one week ago in an institution 1000 miles away from his home. He telephones your office asking whether he can watch television. You tell him that

- A. Light from the television, as well as any form of artificial light is dangerous
- B. The effects of photosensitivity last up to 6 weeks, but exposure to television and artificial light is safe.
- C. Protective clothing and eyewear should be worn while watching television
- D. He must telephone the physician who performed PDT for that information.

Answer VI.7: B

Photosensitivity precautions are essential to avoid side effects, especially skin hypersensitivity, in all patients undergoing PDT. All patients from the time of drug injection to approximately 6 weeks after treatment must wear protective clothing and special eyewear. Exposure to any bright light is dangerous. Artificial light and light from television, however, are safe.



Question VI.8: While performing transbronchial needle aspiration of ATS nodal station 4R (right paratracheal), you insert the needle 2 cm above the carina, and laterally at the 3 o'clock position (imagining the interior of the airway as a clock face and using the carina as the central reference point). Which of the following is a major anatomic danger

- A. The aorta
- B. The right pulmonary artery
- C. The mediastinal reflection of the pleura and the azygos vein
- D. The esophagus

Answer VI.8: C

Anterior and to the right of the distal third of the trachea lie the superior vena cava and the Azygos vein. Needle insertion at this site risks causing pneumothorax or bleeding. The right pulmonary artery is anterior to the right main bronchus and origin from the right upper lobe bronchus. Needle insertion through the anterior wall of the right main bronchus at the level of the origin of the right upper lobe bronchus should be avoided.

The esophagus lies closely (within 2-3 mm) behind the posterior wall of the trachea and left main bronchus. The innominate artery and the aortic arch lie directly anterior to the trachea, just above the main carina and coursing slightly to the left of the distal trachea where one can see a slight indent and faint pulsations. Obviously, it would be unwise to insert a needle into this area!

Question VI.9: During transbronchial needle aspiration of mediastinal lymphadenopathy, Which of the following is most likely to help increase diagnostic yield?

- A. Performing needle aspiration before airway examination or acquisition of other samples.
- B. Maintaining suction during needle withdrawal from the lymph node.
- C. Rinsing the working channel of the bronchoscope before needle insertion.
- D. Using a histology needle rather than the smaller gauge cytology needle only.
- E. Asking the cytopathologist to be present to immediately examine the specimens.

Answer VI.9: E

Several studies have shown that onsite examination of TBNA specimens by a trained cytopathologist results in greater diagnostic yield. In addition, this might allow the bronchoscopist to perform fewer needle passes, and might make additional specimens such as biopsies or brushing less necessary. Most experts recommend rinsing the working channel prior to performing needle aspiration. In addition, in order to avoid false positive results, needle aspiration should be performed prior to airway inspection or biopsies of endobronchial abnormalities. Once the needle is inserted through the airway wall and into the tumor or lymph node, suction is applied to obtain the sample. Suction should be released prior to removing the needle from the tumor or lymph node in order to avoid avoid contamination from bronchial wall tissue. The bronchoscope should not be connected to wall suction until all needle aspiration samples have been obtained. In many cases of mediastinal node aspiration, using the larger histology needle might result in greater yield, especially for diagnosis of lymphoma.

Question VI.10: Symptoms of cough, low-grade temperature, and shortness of breath prompt flexible bronchoscopy in a 44-year-old man two months after autologous stem cell transplantation for B cell lymphoma. His lymphocyte and neutrophil counts are normal but he remains thrombocytopenic and receives periodic platelet transfusion. Chest radiographs and computed tomography scans show unilateral right mid and lower lung zone alveolar infiltrates without lobar consolidation. On inspection, tracheobronchial mucosa is diffusely inflamed and erythematous. There are no purulent secretions. Bronchoalveolar lavage is grossly bloody and rich in hemosiderin-laden macrophages. Which of the following most likely accounts for the bronchoscopic findings?

- A. Idiopathic interstitial pneumonia
- B. CMV pneumonia
- C. Invasive pulmonary aspergillosis
- D. Acute pulmonary edema secondary to sepsis
- E. Alveolar hemorrhage

Answer VI.10: E

Blood in airway means the patient is bleeding. It is difficult to determine the precise etiology of the bleed itself. However, Hemosiderin-laden macrophages, although nonspecific as to underlying etiology, are indicative of blood in the alveoli, suggesting alveolar hemorrhage when found in a well performed bronchoalveolar lavage

Alveolar hemorrhage is frequently a complication of any inflammatory pulmonary process in thrombocytopenic patients or those with coagulopathies.. When seen as part of the Diffuse Alveolar Hemorrhage syndrome within weeks after transplantation, the process is usually fatal. Diffuse Alveolar Hemorrhage is reported in up to 20 percent of patients following autologous transplantation, and may occur in patients with normal coagulation activity. Its cause is unknown.

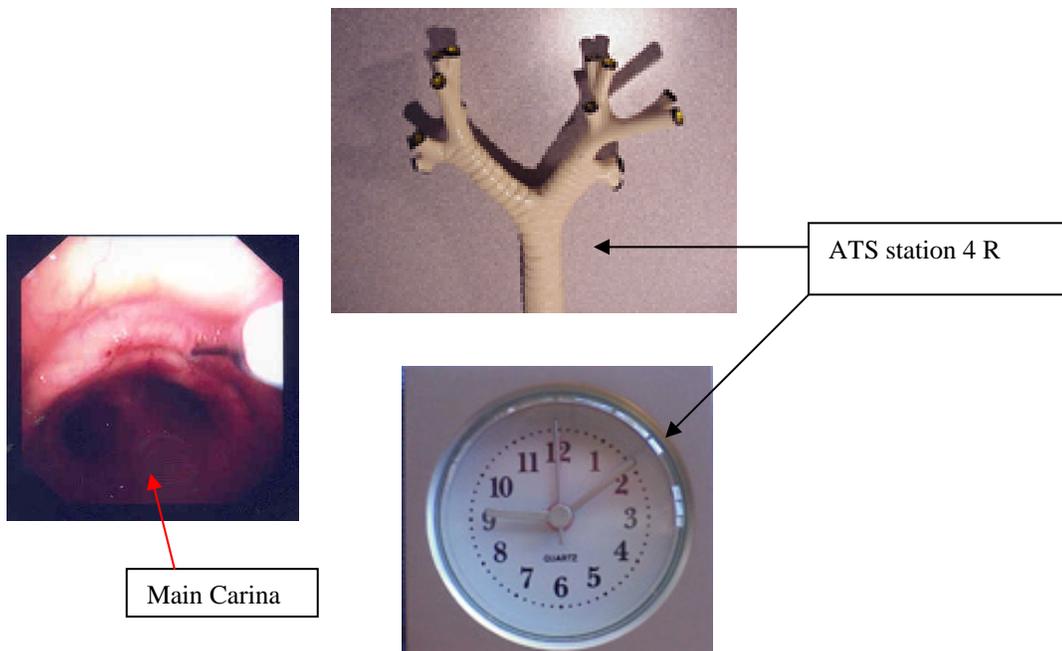
CMV pneumonia, pulmonary edema and idiopathic interstitial pneumonia usually present with diffuse radiographic findings, but could each cause alveolar hemorrhage also. Invasive pulmonary aspergillosis could be unilateral and cause alveolar hemorrhage, but would not be expected in the absence of neutropenia or corticosteroids (corticosteroids are frequently used to treat graft-versus-host disease among allogeneic transplant recipients. Because this patient had autologous transplant, it is unlikely that corticosteroids would have been administered, making invasive aspergillosis less likely).

Question VI.11: Where are the right paratracheal lymph nodes (ATS stations 4R, Wang bronchoscopic nodal station 3) in relation to the trachea

- A. Posterior-lateral
- B. Anterior-lateral
- C. Lateral
- D. Posterior

Answer VI.11: B

ATS nodal station 4 R is anterolateral to the trachea, and can be accessed by needle aspiration at a site that is two-four intercartilaginous spaces above the carina, aiming the needle anterolaterally towards the 1 or 2 o'clock position (imagining the interior of the airway as a clock face and using the carina as the central reference point). Aiming the needle more laterally risks puncturing the azygos vein. The paratracheal lymph nodes are generally located slightly lateral to the trachea. They are difficult to access because of the very lateral position required of the needle and of the tip of the flexible bronchoscope, especially on the left (ATS station 4L or aortopulmonary window node).



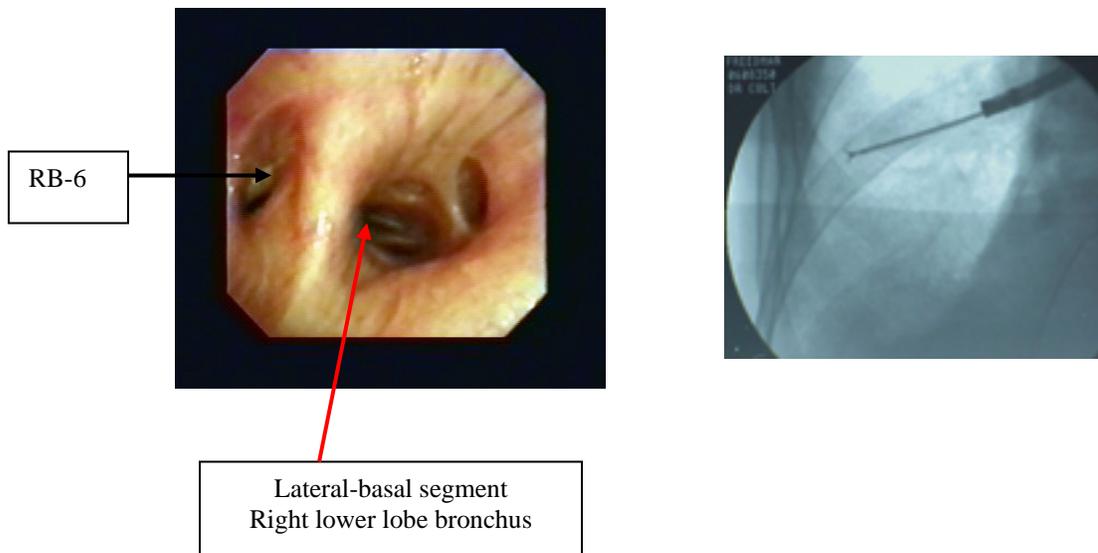
Question VI.12: Bronchoscopic lung biopsy through which bronchial segment is most likely to present fluoroscopically an exact position of the forceps in relation to the pleura:

- A. The lateral basal segment of either lower lobe.
- B. The medial basal segment of the right lower lobe.
- C. The posterior basal segment of either lower lobe.
- D. The apical segment of either lobe upper lobe.
- E. The superior segment of either lower lobe

Answer VI.12: A

The lateral-basal segment of either lower lobe extends into the costophrenic sulcus, and thus provides an accurate picture of the exact location of the forceps in relation to the rib cage and pleura. In addition, should biopsy-related bleeding occur, tamponade is readily possible in this gravity dependent basal segment. The flow of blood downwards will also enhance clot formation and prevent contamination of the contra lateral airways.

Knowing the exact location of the forceps in relation to the pleura is difficult in the posterior basal and medial basal segments of the lower lobes, partially obscured by the heart borders, and in the apical segments of the upper lobes, where the pleural reflection actually extends above the clavicles. Biopsy through the superior segmental bronchus (RB-6) might increase the risk for pneumothorax because the superior segment of the lower lobe is directly adjacent to the major fissure.

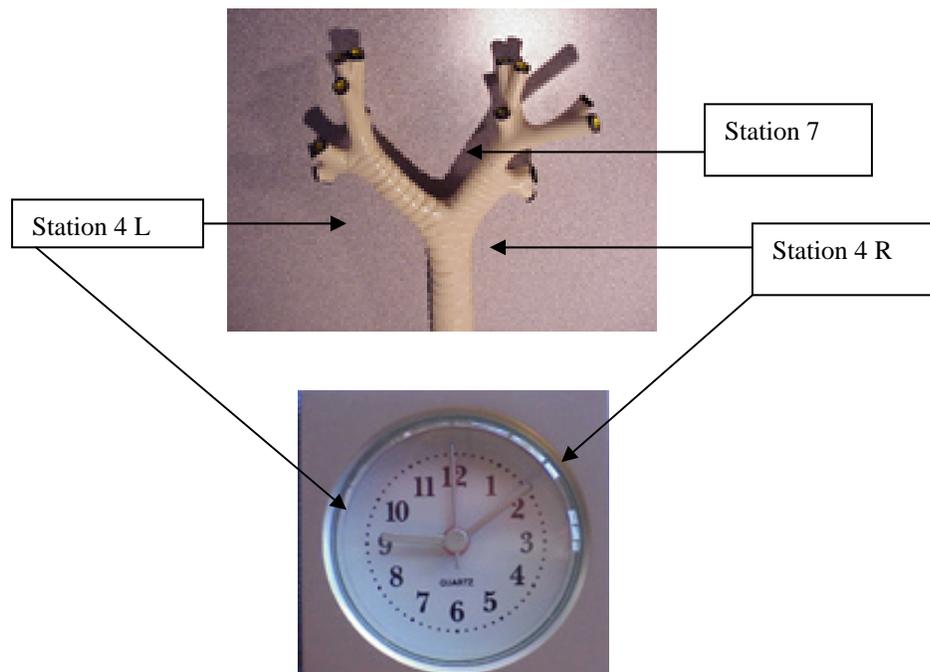


Question VI.13: The Wang bronchoscopic nomenclature (proposed for mediastinal lymph node transbronchial needle aspiration) for the anterior carina (Wang station 1), posterior carina (Wang station 2), subcarinal (Wang station 8), left paratracheal (Wang station 4), and right paratracheal (Wang station 3) lymph nodes correspond to which of the following nodal combinations using the modified Naruke/ATS-LCSG map.

- A. ATS station 7, ATS station 4L, and ATS station 4 R.
- B. ATS station 6, ATS station 4L, and ATS station 4 R.
- C. ATS station 7, ATS station 8, ATS station 4L, and ATS station 4 R.

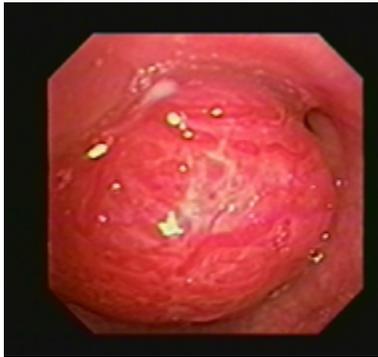
Answer VI.13: A

The ATS station 7 corresponds to the anterior, posterior, and subcarinal nodes. Stations 4L and 4R correspond to the lower paratracheal nodes (station 5 being the aortopulmonary window node). The right paratracheal nodes are best sampled by inserting the needle about 2 cm above or from the second or third intercartilaginous space above the carina at the 1 o'clock or 2 o'clock position (imagining the interior of the airway as a clock face and using the carina as the central reference point). The left paratracheal (aortopulmonary) nodes should be sampled from the lateral wall of the left main bronchus at the level of the carina by inserting the needle at the 9 o'clock position.



Question VI.14: The appearance of the endobronchial abnormality shown in the figure below is most consistent with

- A. Carcinoid Tumor
- B. Adenoid cystic carcinoma
- C. Squamous papillomatosis
- D. Sarcoma
- E. Lipoma



Answer VI.14: A

Carcinoid tumors are usually round, smooth-walled, fleshy appearing, and glistening. They may be partially or completely obstructive. At least one study has convincingly shown that cherry red, atypical carcinoid tumors bleed most easily. Carcinoid tumors are classified as either typical or atypical tumors. Typical carcinoids are defined as a group of neuroendocrine cells with an alveolar or glandular appearance. 5-10 year survival is greater than 90 percent, and only 10 % of deaths that occur are due to local recurrence. Atypical carcinoids have increased mitotic activity, necrosis, or disorganized architecture. 5-10 year survival is about 60 percent, and more patients have lymph node involvement.

Carcinoid tumors can be resected and treated endoscopically (Nd:YAG laser resection appears to be most beneficial long-term). Current conventional wisdom suggests, however, that definitive treatment is surgical (pneumonectomy, lobectomy or parenchymal-sparing such as segmentectomy and sleeve resections). Surgical management decisions depend on extent of tracheobronchial disease, invasion within and through the airway wall, existence of nodal disease, available interventional bronchoscopist and thoracic surgical expertise, underlying patient health, and type of disease.

Question VI.15 A patient with renal cell carcinoma and malignant melanoma presents with persistent cough, decreased exercise tolerance, and severe shortness of breath. Bronchoscopy reveals the abnormality shown in the Figure below. Which of the following steps is most appropriate now.

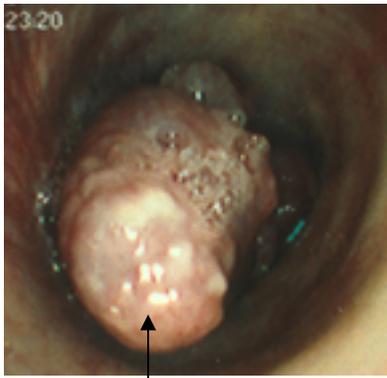
- A. The abnormality should be biopsied using forceps through the flexible bronchoscope
- B. The abnormality is most consistent with metastatic melanoma. The patient should be referred to an interventional bronchoscopist for biopsy and removal.
- C. The abnormality is most consistent with metastatic renal cell carcinoma. The patient should be referred to an interventional bronchoscopist for biopsy and removal.
- D. The patient should be referred for external beam radiation therapy
- E. The patient should be referred to hospice. No aggressive bronchoscopic therapies are warranted.



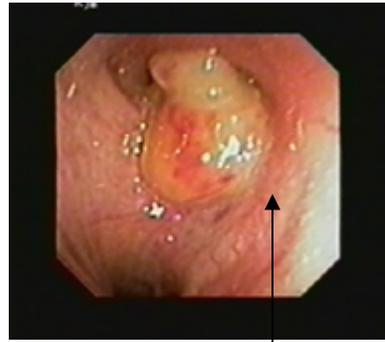
Answer VI.15. B

The large and darkly pigmented intraluminal tracheal mass is most suggestive of metastatic melanoma. It appears to be growing up and out of the left main bronchus, and does not appear to be adherent to the anterior wall of the trachea. This patient should be immediately referred to an interventional bronchoscopist for laser resection. The lesion appears very amenable to rigid bronchoscopic resection. It is unlikely that a stent will be needed. External beam radiation will not immediately improve symptoms.

Hospice care and end-of-life issues should be discussed because the patient has a potentially terminal illness, however, aggressive bronchoscopic therapies and further systemic therapy should be offered. Interventional bronchoscopic therapies improve quality of life, improve lung function and exercise tolerance, provide symptomatic relief, and give patients “time” and energy to undergo additional systemic therapy. The abnormality does not look like metastatic renal cell carcinoma, which is usually red, relatively smooth-walled, and bleeds easily.

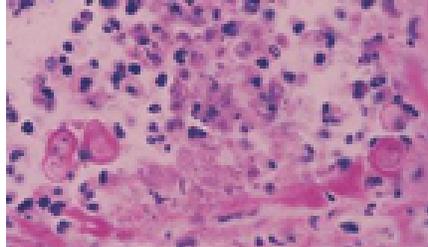


Malignant melanoma



Renal cell carcinoma

Question VI.16: A 53-year-old woman has been homeless for two years. She lives along a small riverbank in Southwestern Mexico. She sleeps under aluminum siding, and smokes abundantly. She has been hospitalized with weight loss, productive cough of unclear duration, and a chest radiograph showing a large perihilar mass. Flexible bronchoscopy with BAL and bronchoscopic lung biopsy is performed. Histopathology is shown in the Figure below. Which of the following bronchoscopic abnormalities helps increase your certainty that perhaps Blastomycosis, and not cancer, is the cause for her symptoms and radiographic findings?

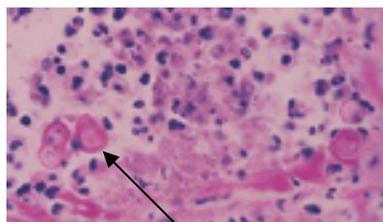


- A. Circumferential narrowing of the right upper lobe bronchus associated with mucosal granularity and thrush-like whitish plaques.
- B. Right main bronchial compression with near total closure of the right upper lobe bronchus from extrinsic compression.
- C. Abundant, white mucosal plaques in the lower trachea with small nodules and vesicular lesions surrounding an area of focal bronchial narrowing within the right main bronchus and right upper lobe bronchus.

Answer VI.16: C

Blastomyces dermatitidis is another dimorphic soil-dwelling fungus. In the United States, most cases occur in states surrounding the Mississippi and Ohio rivers. Cases have also been noted in Canada, Venezuela, Mexico, Africa, and the Middle East. Infection is signaled by a febrile influenza-like illness. Incubation periods are unclear. Patients can present with productive cough of mucopurulent sputum and a chest radiograph showing lobar consolidation or multiple small pleural-based round opacities. When abnormalities coalesce to form large masses, the appearance is suggestive of bronchogenic neoplasm. Pneumothorax, pleural effusions, or pleural thickening are frequently associated findings.

Disease also affects the skin, the central nervous system, the genitourinary tract, and articulations. Diagnosis is made by identification of dark, large-based, round single budding yeast forms with thick refractile walls on tissue sections. Staining with 10% KOH of BAL fluid may also be positive. Skin testing and complement fixation tests are insensitive and unreliable.



Thick-walled yeast forms

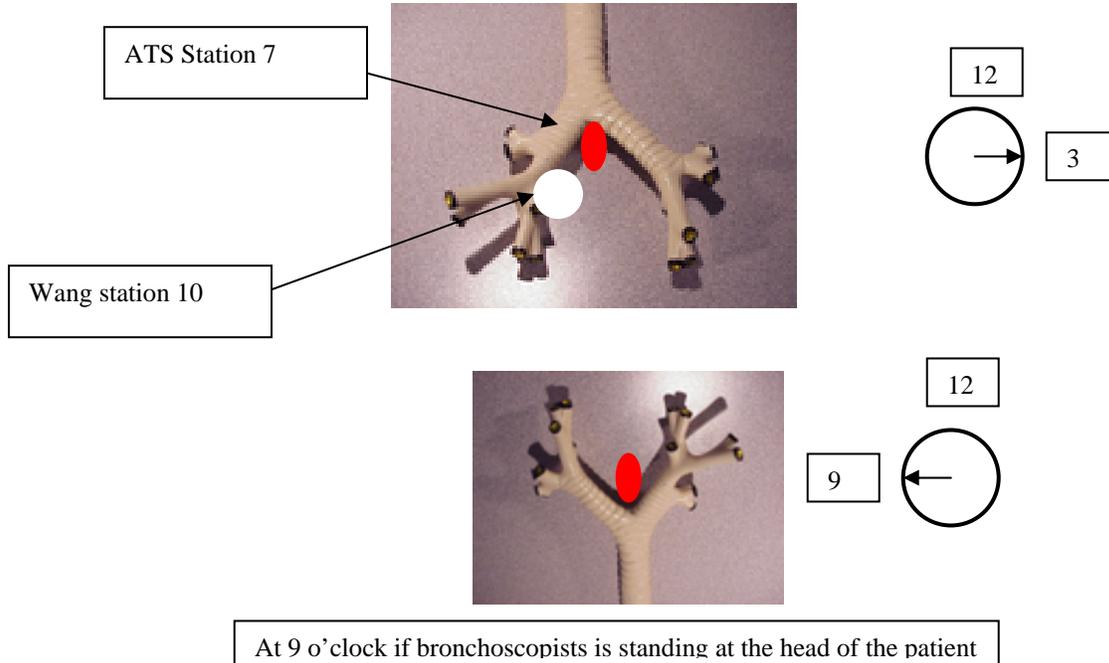
Question VI.17: Imagining the interior of the airway as a clock face and using the carina as the central reference point, transbronchial needle aspiration at the 9 o'clock position along the medial wall of the bronchus intermedius at a level just proximal to the right middle lobe bronchial orifice will sample

- A. The right lower hilar lymph node
- B. The sub-subcarina lymph node
- C. The right main bronchus lymph node
- D. The sub carina lymph node

Answer VI.17: B

The sub-subcarina lymph node (Wang nodal station 10) is often seen on computed tomography scan. It is located between the bronchus intermedius and the left main bronchus, at or near the level of the right middle lobe bronchus. The subcarina lymph nodes on the other hand (ATS station 7, Wang station 8), are between the right and left main bronchus, at or near the level of the right upper lobe bronchus on computed tomography scanning.

In order to sample the subcarina lymph node, the needle should be inserted at the 3 o'clock position along the medial wall of the right main bronchus, just proximal to the level of the right upper lobe bronchial orifice (if the bronchoscopist is standing in front of or to the side of the patient). The Wang nodal classification scheme is not commonly used in bronchoscopic practice (yet).



Question VI.18: Imagining the interior of the airway as a clock face and using the carina as the central reference point, transbronchial needle aspiration at the 12 o'clock position along the anterior wall of the trachea at a level between the first and second intercartilaginous interspace from the lower trachea will sample

- A. The right lower hilar lymph node
- B. The sub carina lymph node
- C. The posterior carina lymph node
- D. The anterior carina lymph node

Answer VI.18: D

The anterior carina lymph node is in front and between the proximal portion of the right and left main bronchus on computed tomography scanning. It may be helpful to first lodge the needle tip into the mucosa, then to advance the needle catheter so that the entire length of the needle protrudes beyond the tip of the bronchoscope. For example, using the free hand, the bronchoscopist fixes the proximal end of the catheter to the bronchoscope, preventing the needle from recoiling into the bronchoscope when resistance is encountered.

The scope and the needle catheter can then be pushed simultaneously and as a single unit into the lesion. As the ensemble is advanced, the bronchoscope and catheter will curve slightly in a cephalad direction, moving the needle tip into a more perpendicular orientation at the puncture site. This helps avoid cartilaginous rings and also prompts a deeper insertion depth of the needle. In order to sample the posterior carina lymph node, the needle should be inserted at the posterior portion of the carina at about the 6 o'clock position.



Question VI.19: Bronchoscopic lung biopsy is performed in the patient seen in the Figure below. Severe bleeding has begun. Which of the following is most correct

- A. Wedging the bronchoscope in an upper lobe segment can be difficult, if not impossible
- B. A bolus of straight epinephrine; 1:10,000 will cause vasoconstriction and stop the bleeding
- C. It would have been safer to biopsy the anterior segment of the left upper lobe
- D. The patient's abnormal bleeding time predicted the likelihood of bleeding, so ancillary instruments should be opened and ready to use.



Answer VI: 19

A

Wedging the bronchoscope while applying suction is often effective to tamponade the bleeding bronchus, enhance clot formation, and maintain airway patency in the rest of the tracheobronchial tree. The patient should also be placed into the safety position (lateral decubitus, left side down). A bolus of epinephrine will probably be pushed back by blood or during a cough. Regardless, epinephrine should be diluted in normal saline before administration (1:1,000 use 1 ml of epinephrine diluted in 10-20 ml of solution).

In patients potentially at risk for bleeding, it is wisest to biopsy gravity dependent areas such as the lower lobe bronchi and the posterior segmental bronchus of the upper lobes. This way the contralateral lung and other segments are more easily protected from blood spillage. The anterior segment is not a gravity-dependent segment when patients are supine. An abnormal bleeding time (normal is 2-9 minutes) does not predict likelihood of bleeding, nor does it predict safety of the procedure.

Question VI.20: A patient has a smooth-walled, fleshy appearing tumor that looks like a carcinoid. Which of the following statements about the amount, consistency, and quality of the literature is most correct.

- A. Evidence is high demonstrating that biopsy will make a diagnosis in 80 percent of cases, and that the risk of bleeding from biopsy is about 1 percent.
- B. Evidence is low demonstrating that biopsy will make a diagnosis in 80 percent of cases, and that the risk of bleeding from biopsy is about 1 percent.
- C. It is impossible to analyze risk of bleeding or chance for making a diagnosis.

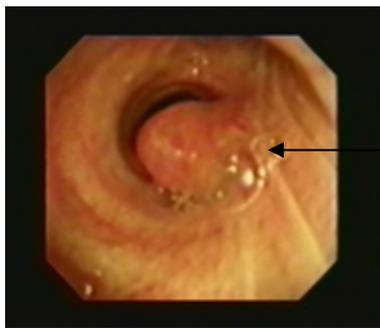


Answer VI.20:

A

Historically, it has been taught that carcinoid tumors bleed easily and that great caution is warranted when bronchoscopic biopsies are obtained. Although this may be true, this “fact” has not been addressed in prospective studies. Many experts recommend applying topical epinephrine to the lesion immediately before biopsy to reduce the risk of bleeding. Although potentially effective, this practice has not been validated in prospective studies. It is well recognized that when biopsies are done, the chance of making a diagnosis of carcinoid by endobronchial biopsy is about 80 percent.

From historical studies it is also recognized that major bleeding risk is about 1 percent. Differentiating between typical and atypical carcinoids preoperatively, including by frozen section, is difficult. In addition, washings, needle aspiration, and brushings are rarely useful in establishing a diagnosis of carcinoid tumor. Many experts believe that endobronchial biopsies should be deep because some tumors are covered superficially by normal bronchial mucosa as in the figure below. In many instances, the diagnosis on biopsy may be falsely reported as small cell or squamous cell carcinoma.



Typical carcinoid at entrance of right upper lobe bronchus

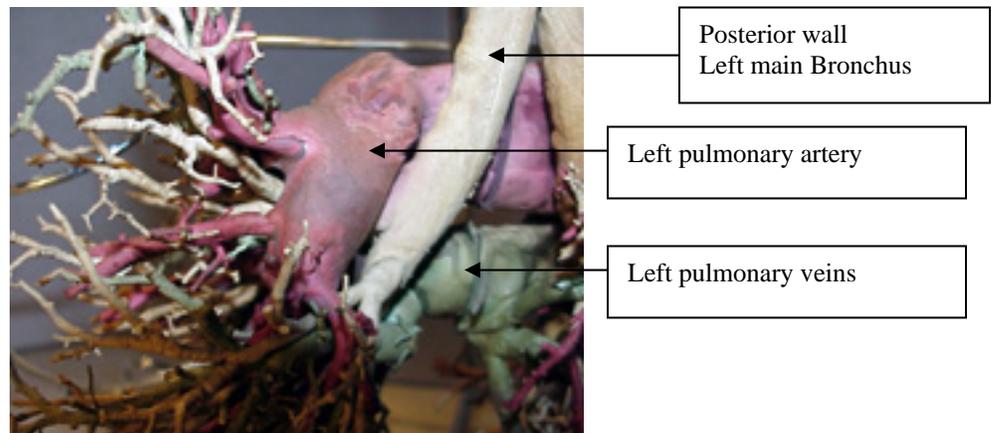
Question VI.21: Transbronchial needle insertion through the anterior wall of the proximal left upper lobe bronchus, just above the carina dividing the lingual from the upper division bronchus risks entering

- A. The left pulmonary vein
- B. The left pulmonary artery
- C. The aorta
- D. The esophagus

Answer VI.21: A

The left pulmonary veins lie immediately anterior to the left main bronchus and left upper lobe bronchus. The left pulmonary artery is a major vascular danger for interventional bronchoscopists because it forms a long “S” around the left main bronchus and around the left upper lobe bronchus.

The aortic arch is in contact with superior and posterior portion of the left main bronchus. In order to access aortopulmonary lymph nodes (station 5, Wang bronchoscopic station 4) by needle aspiration, the needle should be inserted posterolaterally at about the 9 o’clock position (imagining the interior of the airway as a clock face and using the carina as the central reference point) at the level of the carina or one intercartilaginous space below along the lateral wall of the left main bronchus.



Question VI.22: Which of the following actions is widely accepted and without controversy in regards to bronchoscopy-induced bleeding

- A. Moving the patient into the “safety” position; lateral decubitus with bleeding side down.
- B. Wedging the flexible bronchoscope into the bleeding bronchial segment while applying continuous suction.
- C. Keeping the bronchoscope mobile (without wedging) in order to suction, wash with abundant saline, and protect the contralateral lung
- D. Administering a bolus of epinephrine before biopsy
- E. Administering boluses of cold saline when bleeding occurs

Answer VI.22: A

Moving the patient into a gravity dependent position is widely accepted and considered routine preventive practice when bronchoscopy-related bleeding occurs. This position promotes clot formation and protects the contralateral airway. Each of the other actions is appropriate, but each is controversial. Some experts advocate wedging, others advocate keeping the scope mobile. Some advocate cold saline wash, others advocate epinephrine administration before biopsy. Of course one does not exclude the other. The important thing when bleeding occurs is to keep the patient calm, to give clear orders to one’s assistants, maintain adequate oxygenation, protect the contra lateral lung, and attempt tamponade using suction, the bronchoscope, and ancillary instruments.



Question VI.23: When performing transbronchial or transcarinal needle aspiration, which of the following appears to be most important for increasing diagnostic yield.

- A. Performing at least 3-4 passes blindly.
- B. Having a cytopathologist present “in the procedure suite” to examine each specimen immediately.
- C. Using the largest and stiffest needle possible
- D. Obtaining the needle specimen after bronchoalveolar washings or biopsies

Answer VI.23:

B

Needle aspiration has been shown to have an increased yield when cytopathologists are present at the bedside to determine whether samples are representative. This has become standard of practice and should be encouraged in institutions where bronchoscopic needle aspiration is performed. Needle aspiration should be performed before any other bronchoscopic specimens are collected in order to avoid contamination and false positives. The stiffer, larger-bore, two part histology needle appears to be very helpful for transcarinal sampling, but is more difficult and sometimes impossible to use in more distal airways. Most investigators have found that at least 3-4 needle passes are necessary to make a diagnosis.

Question VI.24: Which of the following statements about bronchoscopy-induced bleeding is correct

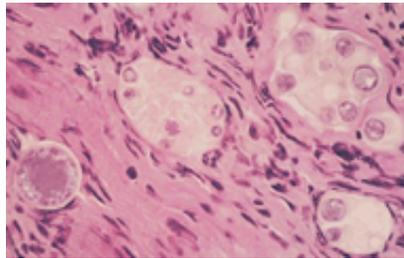
- A. Usually, the overall risk of bleeding more than 50 ml after bronchoscopic lung biopsy is about 1-2 % but is reportedly as high as 45% in patients with uremia (serum creatinine > 2, blood urea nitrogen > 25 mg/dl)
- B. Once bleeding has stopped, the clot should be removed in order to be certain that there is no active bleeding distally.
- C. All patients undergoing bronchoscopy should have platelet counts and coagulation profile measured before the procedure
- D. Most experts agree that patients with a platelet count below 50,000/mm³; blood urea nitrogen of 45 mg/dl, and a serum creatinine of 3 can safely undergo endobronchial biopsy.

Answer VI.24: A

The risk of bleeding is real, and most definitely increased in patients with uremia, dysfunctional platelets, liver failure (Bilirubin > 1.5 mg/dl, alkaline phosphatase > 110, SGOT > 25) and known coagulopathy. Routine measurement of platelets and coagulation profile is unwarranted except in patients in whom the history and physical has documented a potential bleeding risk. Findings include a history of anticoagulation, known diseases associated with platelet dysfunction, hereditary disorders such as Von Willebrand's disease or hemophilia, drugs such as sulfa, thiazides, disorders associated with decreased platelet production such as leukemia, myeloma, lymphoma, and secondary cancers involving the bone marrow, and diseases associated with platelet destruction such as immune (ITP, drugs, systemic lupus) and nonimmune (disseminated intravascular coagulation, burns, trauma, TTP) disorders.

Although precise "numbers" pertaining to bleeding risk have not been studied, it is reasonable to avoid biopsy in patients with elevated BUN (>45) or creatinine (>3), and to perform biopsies only if absolutely necessary if platelets are less than 50,000 mm³. Inspection and bronchoalveolar lavage in such patients, however, is safe. Should bleeding occur, it is usually easily controlled. Fresh clots should not be removed even when they obstruct lobar or segmental bronchi. One well known expression is "leave the clot". A bronchoscopy can readily be performed the next day in order to remove clot if there is symptomatic deterioration or radiographic evidence of atelectasis.

Question VI.25: A 45 year old woman with a history of breast cancer 15 years ago frequently goes hiking and camping in the desert valley east of San Diego, California. Her dog is with her constantly during her camping trips. He was recently very ill, but improved after a course of antibiotics and itraconazol. Now, the woman is febrile and has a fine erythematous rash on her forearms and legs. Skin test for tuberculosis is nonreactive and she is anergic to Mumps and Candida. Fine crackles are noted on auscultation over the lung bases bilaterally. Chest radiograph reveals bilateral pulmonary infiltrates greatest in the right lower and mid lung fields. Because of persistent fever and pulmonary symptoms despite three days of bed rest and intravenous antibiotics, she is referred for flexible bronchoscopy with lavage and bronchoscopic lung biopsy. Histopathology results are shown in the Figure below. Which of the following bronchoscopic findings increases your certainty regarding a diagnosis of acute Coccidiomycosis infection?



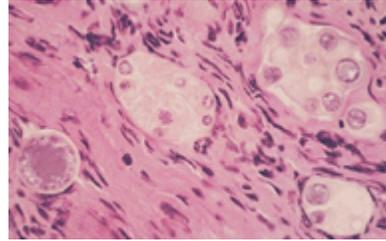
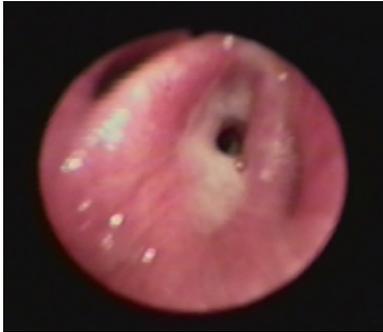
- A. Circumferential narrowing of the right lower lobe bronchus associated with mucosal granularity and a firm, raised polypoid endobronchial abnormality
- B. Substantial focal narrowing of the right middle lobe bronchus with complete bronchial obstruction by a glistening smooth walled mass and surrounding erythema.
- C. Soft whitish secretions with surrounding bronchial mucosal edema and erythema within the right lower lobe bronchus.

Answer VI.25: C

Coccidiomycosis immitis is a dimorphic fungus easily airborne and aspirated when groundwork or construction occurs in semiarid regions with a short but intense rainy season followed by dry weather. These conditions occur in areas of California, Mexico, and Central and South America. Although most infections are asymptomatic, signs of lung disease may occur 1-3 weeks after inhalation. Patients present with cough, fever, pleuritic chest pain, myalgias, and occasionally a fine erythematous rash, erythema nodosum or erythema multiform. Reactivation can occur even many years after travelers have left an endemic area. Skin tests become positive within 4 weeks of exposure, and usually remain positive for life. Rising IgG complement fixation (which remains positive for up to 8 months after exposure) may signal progressive or reactivation disease.

Bronchoscopic appearances are nonspecific, and can mimic those of neoplasm, although endobronchial polyps and nodules are usually not seen. Large and deep biopsies of abnormal appearing mucosa are often necessary for diagnosis. Fungi are large

spherules with doubly refractile walls and numerous endospores. Yield of BAL and BLB is greater in patients with pulmonary infiltrates than in those with pulmonary nodules.



Whitish secretions with mucosal erythema and edema

Question VI.26: Tracheal enlargement is commonly associated with all of the following except

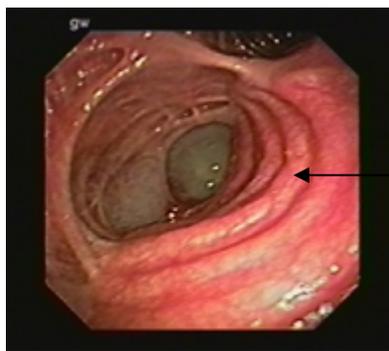
- A. Ehlers-Danlos syndrome
- B. Mounier-Kuhn syndrome
- C. Ataxia-teleangiectasia
- D. Chronic obstructive airway disease
- E. Tuberculosis

Answer VI.26 E

Focal segmental strictures are commonly found in patients with a history of tuberculosis. Some patients, however, can also have tracheobronchomegaly, probably due to traction and scarring between the lung, trachea, mediastinum, and parietal pleura. This finding, apparently, is relatively infrequent. Diffuse tracheobronchomegaly is found in each of the other entities named above. Malacia may or may not accompany tracheal dilatation.

In some patients, dynamic bronchoscopy will reveal floppy airways. Mounier-Kuhn syndrome consists of diffuse dilatation that involves the entire trachea. Inefficient cough, retained secretions, and recurrent bronchopneumonia, bronchiectasis and emphysema result from this anomaly. The lungs are usually hyperinflated. Patients with Ehler-Danlos syndrome also have recurrent joint dislocations, hypermobility, and bowel diverticulosis. Ataxia telangiectasia consists of progressive skin telangiectasias and cerebellar ataxia.

Some patients with COPD, as well as some patients with cystic fibrosis may acquire tracheomegaly as a result of chronic inflammation and degenerative changes of the elastic fibers of the pars membranosa, leading to malacia and floppy airways.



Bronchomegaly and retained purulent secretions

Question VI.27: Which of the following is most difficult to avoid despite proper and repeated education of bronchoscopists and their assistants.

- A. Improper handling of a transbronchial needle
- B. Forceful passage of a forceps through a flexed or hyperextended distal extremity of the flexible bronchoscope
- C. Forceful flexion or twisting of the bronchoscope at any point along its insertion tube
- D. Crushing by teeth, or the drawers, doors, or wheels of a procedure cart.
- E. Repeated banging of the distal tip of insertion tube onto the side of a cart or bedrails.

Answer VI.27: E

Proper education regarding the use and abuse of a flexible bronchoscope is mandatory! When damaged, most scopes are returned to the manufacturer or to a third party for repairs. Parts are readily replaced, but are very costly. Repairs to flexible fiberoptic and video bronchoscopes usually cost thousands of dollars, and can rapidly deplete endoscopy section budgets. In order to avoid damage to the working channel of a bronchoscope, all transbronchial needles should be handled properly. No needle should be inserted or withdrawn if its sharp tip is visible and protruding beyond the protective sheath.

Instruments should not be inserted forcefully through a flexed bronchoscope when the distal tip is bent at an acute angle. The insertion tube of the bronchoscope should never be forcefully twisted between the fingers, and of course, bite blocks should always be used when a scope is inserted orally. During procedures, all drawers of procedure carts should be closed, making sure that the insertion tube or the universal cord of the bronchoscope is not caught inside. Each of these “mishaps” can and should be avoided! It is difficult, however, to avoid the occasional banging of a scope on the side-rails of a bed or on the side-rails of a procedure cart. When this occurs, it might be helpful to remind persons handling the scope that the purchase price of the scope might be greater than the purchase price of the automobile they drive...and the repair cost, most definitely greater than their insurance premiums!



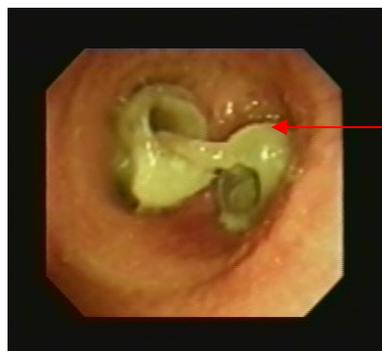
Question VI.28: All of the following statements pertaining to patients with indwelling airway stents are true **except**

- A. Stent related complications are seen less frequently in patients with cancer than in patients with benign disease
- B. Flow volume loops and spirometry are warranted to document clinical and symptomatic improvement after stent insertion
- C. Because of the risk of migration and obstruction, many experts advocate surveillance bronchoscopy during the first three months after stent insertion.
- D. Retained secretions are frequently noted within indwelling stents during follow-up bronchoscopy, but active infection is unlikely and antibiotics are usually not needed.

Answer VI.28 **B**

Symptomatic improvement after stenting occurs in most patients and is usually clinically apparent. Surveillance pulmonary function tests, therefore, are not necessary unless one is performing a research study. Surveillance bronchoscopy remains a controversial topic. It is unclear whether patients with indwelling stents should undergo flexible bronchoscopy on a regular basis, or whether bronchoscopy should be performed only in the presence of new or increased symptoms suggestive of a stent related complication.

Symptoms include cough, respiratory distress, hemoptysis, radiographic atelectasis or focal pulmonary infiltrates, hoarseness, loss of voice, and decreased exercise tolerance. Although retained secretions and potentially pathogenic organisms are frequently noted on follow-up bronchoscopies, stent-related infection is rare and antibiotics are rarely warranted.



Thick secretions partially occlude silicone stents in left and right main bronchus

Question VI.29: Which of the following known complications of bronchoscopic needle aspiration can be avoided if proper technique is used.

- A. Hemomediastinum
- B. Pneumothorax
- C. Bronchial hemorrhage
- D. Fracture of needle catheter
- E. Bacterial pericarditis

Answer VI.29: D

Proper technique, training, and practice should prevent fracture of the needle catheter by the needle during use. In addition, proper technique will also prevent harming the working channel of the bronchoscope with a protruding needle tip. The needle should never be withdrawn or inserted into the bronchoscope without first ensuring that the needle is well within the catheter. Other complications of needle aspiration such as those listed above occur rarely and are probably unavoidable. Significant bleeding after needle aspiration occurs rarely, even when vascular puncture is confirmed by bloody return in the syringe or catheter during suctioning.

Question VI.30: In regards to transbronchial needle aspiration, which of the following has the greatest risk of damaging the flexible bronchoscope

- A. Jabbing method for needle penetration
- B. Piggyback method for needle penetration
- C. Hub against wall method for needle penetration
- D. Use of a nonretractable needle
- E. Cough method for needle penetration

Answer VI.30: D

Using a nonretractable needle or a needle-catheter ensemble that has been damaged such that the needle cannot be retracted into its catheter is most likely to damage the working channel of a flexible bronchoscope. The other methods are each useful for penetrating through the airway wall. While keeping the bronchoscope as straight as possible, and with the bending tip in a neutral position, the retracted needle-catheter ensemble is advanced through the working channel of the bronchoscope. The needle is advanced and locked into place after the metal hub is visible beyond the tip of the scope. The catheter is retracted and the scope is advanced to the target area.

With the “jabbing method”, the needle is thrust through the intercartilaginous space using a quick firm jab to the catheter while the scope is held at the nose or mouth.

The “hub method” has the needle in the retracted position so that the distal end (metal hub) of the catheter is placed in direct contact with the airway wall, and held firmly while the needle is pushed out of the catheter and through the airway wall.

The “piggyback method” has the catheter fixed against the proximal end of the instrument insertion port (using either an index finger or with the help of an assistant). This is done after the needle has been advanced and locked into position at the target site. The bronchoscope and the needle-catheter ensemble are then advanced together until the entire needle penetrates the airway wall.

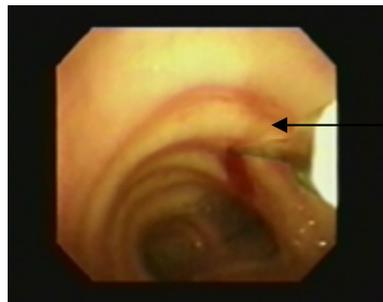
With the “cough method” the bronchoscopist first employs the piggyback or jabbing technique. The needle is placed directly against the target area and the patient is asked to cough. The cough forces the needle through the airway wall. Once the needle is inside the target, it should be moved forward and backward while suction is maintained in order to shear off cells. Suction is then released, the tip of the bronchoscope is straightened if necessary, the needle is withdrawn from the target, retracted into its catheter and the needle-catheter ensemble is withdrawn from the scope.

Question VI.31: After performing transbronchial needle aspiration, the needle cannot be withdrawn into its catheter. You should

- A. Pull the needle completely into the working channel of the scope anyway in order to remove it.
- B. Straighten the bronchoscope. Then remove the needle and the flexible bronchoscope simultaneously while keeping it in the middle of the airway but without pulling the needle back into the working channel of the scope.
- C. Straighten the bronchoscope. Pull the needle into the working channel so that only the tip of the needle is visible beyond the tip of the scope. Then remove the needle and the flexible bronchoscope simultaneously while keeping it in the middle of the airway.
- D. Straighten the bronchoscope. Then pull the needle back into the working channel in order to remove it.

Answer VI.31: C

It is safest to straighten the bronchoscope, and while keeping the needle tip in view, to pull the entire ensemble out. By keeping the scope and needle tip in the middle of the airway, there is no risk of injury the airway mucosa. The only danger is to scratch pharyngeal or nasal mucosa. This risk is minimal if the scope is “straight” and without distal flexion or extension, and if only a small portion of the needle tip is visible beyond the distal tip of the bronchoscope.



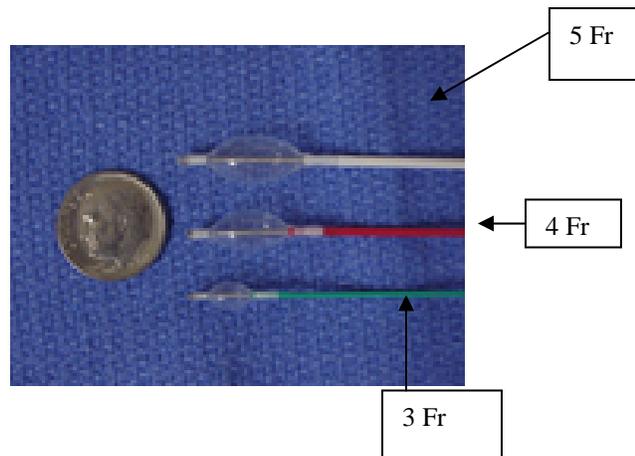
Mucosal trauma caused by scope
not kept in midline during removal

Question VI.32: Bronchoscopic lung biopsy in the right lower lobe using a diagnostic flexible fiberoptic bronchoscope prompted a moderate amount of bleeding that you are unable to control by saline washings and suction alone. The adult male patient is not in respiratory distress. He remains alert and is breathing comfortably. You request an arterial embolectomy balloon catheter. Your assistant, after two minutes of searching through the cabinets in your procedure room, returns to your side with several different catheters in hand, and asks which size catheter you want. You ask for

- A. A 3 Fr catheter.
- B. A 5 Fr catheter.
- C. A 7 Fr catheter.
- D. An 8 Fr tamponade balloon instead.
- E. An endotracheal tube instead and perform a controlled intubation of the right main bronchus.

Answer VI.32: B

A 5 F catheter is 1.5 mm wide and should fit easily through the working channel of a diagnostic flexible bronchoscope or videobronchoscope. It would have a deflated balloon measuring 6F (18 mm), and an inflated balloon size of about 10 mm. A variety of balloon catheters should be available in your procedure cart. Only those instruments you are familiar with and have practiced using should be stocked. You and your assistants should know the outer diameters and working channel diameters of all flexible bronchoscopes in your possession. Measurements should be written down on your procedure cart in case you forget or have an inexperienced assistant. Working channel may be different depending on the bronchoscope being used. As of this writing, most videobronchoscopes have outer diameters of either 4.9 mm or 6.0 mm and are 60 cm long. Flexible fiberoptic bronchoscopes have outer diameters of 4.0mm and 6.0 mm, and are 55 cm long. Working channel diameters of fiberoptic and videobronchoscopes are 2.2 mm or 2.8 mm. Remember that intubation is warranted only if bleeding cannot be controlled.



Question VI.33 A patient with subcarinal adenopathy undergoes flexible bronchoscopy and transcarinal needle aspiration. The cytopathologist is present on site to inform you that the first pass (shown in the Figure below) has no material in it. The second pass could be made

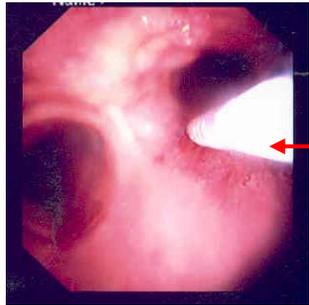
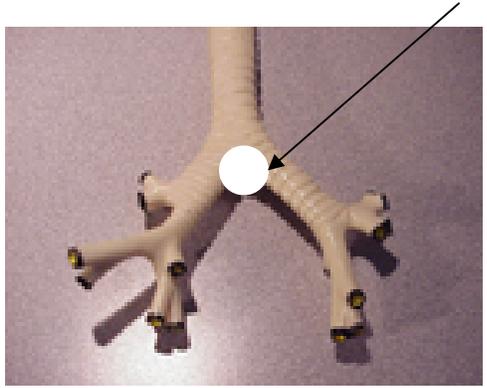
- A. 3-5 mm below on either side of the carina in an infero-medial direction.
- B. One intercartilaginous space above and directed more anterior.
- C. Two intercartilaginous spaces above and in an anterolateral direction



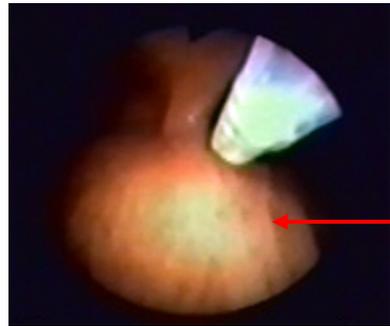
Answer VI.33 A

Subcarinal lymph nodes (ATS station 7, Wang bronchoscopic station 1 and 2) can be sampled by inserting the needle directly through the main carina in an inferior direction, or by inserting the needle 3-4 mm below on either side of the carina, directing the needle inferiorly and medially. If the needle were directed more superiorly, anteriorly and laterally (answer c) the right paratracheal node would be sampled. If the needle were directed more superiorly and anteriorly (answer b) the anterior carinal node would be sampled. If the needle were directed posterior, the posterior carinal node could be sampled (but this also risks causing pneumothorax because of proximity of the azygoesophageal recess).

ATS Station 7



Second pass



Sampling of posterior carina node (Wang station 2)

Question VI.34: Flexible bronchoscopy with transbronchial needle aspiration of a left upper lobe abnormality is performed in a 33-year-old patient with Acquired Immune Deficiency Syndrome (AIDS). After the procedure, the technician notices that the leak test is positive. An air leak is detected from the surface of the flexible bronchoscope. He asks you for instructions. You should tell him to

- A. Disinfect the scope in a Glutaraldehyde bath before packing it and sending it to the manufacturer for repair.
- B. Clean only the working channel with warm water and detergent, then pack the scope and send it to the manufacturer for repair.
- C. To not clean the bronchoscope at all. Place the bronchoscope in a biohazard bag. Pack the scope and send it to the manufacturer with a note explaining the circumstances of scope damage.
- D. Continue with manual cleaning of the bronchoscope and all internal channels using only warm water and detergent, then pack it in a biohazard bag and send it to the manufacturer for repair.

Answer VI.34: C

Bronchoscopes should not be submerged in fluid until a leak test has been performed. If the leak test is positive, water or fluid immersion risks serious and costly damage to the bronchoscope. The bronchoscope will need to be sent bronchoscope out for repair. Universal precautions should be routinely followed in order to prevent the transmission of infection. The patient's known AIDS infection is therefore irrelevant.

Question VI.35: Which of the following “expressions” is most appropriate for bronchoscopic lung biopsy

- A. Keep the middle way
- B. Gentleness is a virtue
- C. A bronchoscopist must have eyes on the tips of his fingers
- D. Never give up
- E. Feel the wall

Answer VI.35: C

This expression, originally attributed to Chevalier Jackson, the well-known otolaryngologist and teacher from Philadelphia, also suggests that one must “feel” the maximum distance forceps can be inserted into a peripheral bronchus before opening and obtaining representative lung tissue, but without causing pneumothorax. Bronchoscopic lung biopsy is easier when using fluoroscopic guidance, but the expression “eyes on the tips of the fingers” still applies.

Of course, the expression “gentleness is a virtue” would also be correct because most experts advocate that a biopsy sample should be grasped then tugged on gently, rather than briskly ripping the sample from the airway mucosa or lung parenchyma. One technique is to insert the forceps under fluoroscopic guidance into a peripheral bronchus. The forceps is watched as it is advanced to within one or two centimeters of the chest wall. Still under fluoroscopy, the forceps is withdrawn 2 to 3 cm, opened and advanced once more 1 to 2 cm. The forceps is closed and gently removed. If the patient feels pain at any time during the procedure, it usually means that the forceps has been advanced too far. It should be pulled back, and the procedure repeated taking care to not advance the forceps as far. Therefore, “Gentleness is a virtue” also allies to the relationship between the bronchoscopist and the patient.

The expression “Never give up” was the life motto of Shigeto Ikeda, the famous Japanese bronchoscopist who introduced flexible bronchoscopy to the world in the 1960s. Ikeda subsequently devoted his life to technical innovations and the science of Bronchology. He also founded the World Association for Bronchology, an organization that is still active today.

Question VI.36: All of the following descriptions of left bronchial anatomy variants are correct except.

- A. The left upper lobe upper division bronchus, normally of bipartite appearance, sometimes has a tripartite appearance, dividing into three distinct branches rather than two.
- B. The bipartite appearance of the left upper lobe upper division bronchus is caused by a displacement of the apical-posterior bronchus to a separate origin during embryonic development.
- C. The posterior, lateral and anterior basal bronchi of the left lower lobe frequently mirrors the anatomic appearance of the right lower lobe basal segmental bronchi, except that for the frequent absence of a medial basal bronchus on the left.
- D. Equally common to a tripartite division of the left lower lobe basal bronchi, is that of a bipartite division that gives off two main basal branches each of which immediately divides again.

Answer VI.36: B

The bipartite variation is actually caused by displacement of the anterior segmental bronchus to a separate origin during embryonic development. This causes the separation into apical-posterior (LB 1 and 2) and anterior (LB 3) bronchus. The left lower lobe frequently has only 4 basal bronchi (LB 6, 8, 9 and 10) because the medial basal bronchus (LB 7) is often not formed. When there is a bipartite division of the left lower lobe bronchi, however, the most anterior branch usually gives rise to a medial and anterior basal bronchus, while the more posterior segment gives rise to a posterior and lateral bronchus.

