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patients. Nearly all patients with secondary pneumothorax should be treated with tube drainage. Many will need thoracoscopy or thora cotomy with stapling of blebs and surgical pleurodesis. If the patient is not a good operative candidate or refuses surgery, chemical pleurodesis should be considered. Traumatic Pneumothorax Traumatic pneumothoraces can result from both penetrating and nonpenetrating chest trauma. Traumatic pneumothoraces are usually treated with tube drainage unless they are very small. If a hemopneumothorax is present, one chest tube might be placed in the superior part of the hemithorax to evacuate the air and another in the inferior part of the hemithorax to remove the blood. Iatrogenic pneumothorax is a type of traumatic pneumothorax that is becoming more common. The leading causes are transthoracic needle aspiration, thoracentesis, and complications of the insertion of central intravenous catheters. Most can be managed with supplemental oxygen or aspiration, but if these measures are unsuccessful, tube drainage should be performed. Tension Pneumothorax This condition usually occurs during mechanical ventilation or resuscitative efforts. The positive pleu ral pressure is life-threatening both because ventilation is severely compromised and because the positive pressure is transmitted to the mediastinum, resulting in decreased venous return to the heart and reduced cardiac output. Difficulty in ventilation during resuscitation or high peak inspiratory pressures during mechanical ventilation strongly suggest the diagnosis. The diagnosis is made by physical examination showing an enlarged hemithorax with no breath sounds, hyperreso nance to percussion, shift of the mediastinum to the contralateral side, and hypotension. Tension pneumothorax must be treated as a medical emergency. If the tension in the pleural space is not relieved, the patient is likely to die from inadequate cardiac output or marked hypoxemia. A large-bore needle should be inserted into the pleural space through the second anterior intercostal space. If large amounts of gas escape from the needle after insertion, the diagnosis is confirmed. The needle should be left in place until a chest tube can be inserted. Acknowledgment Richard W. Light contributed to this chapter in the 21st edition and some material from that chapter has been retained here. ■ ■FURTHER READING Feller-Koppman D, Light R: Pleural disease. N Engl J Med 378:740, 2018. Light RW: Pleural Diseases, 6th ed. Lippincott, Williams and Wilkins, Baltimore, 2013. Rahman NM et al: Intrapleural use of tissue plasminogen activator and DNase in pleural infection. N Engl J Med 365:518, 2011. Roberts ME et al: British Thoracic Society Guideline for pleural dis ease. Thorax 78:1143, 2023. Stefi F. Lee, Rebecca M. Baron,

Hilary J. Goldberg

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Mediastinum The mediastinum is the region between the pleural sacs bound by the thoracic inlet superiorly and the diaphragm inferiorly. It is separated into three compartments, and diseases can arise from the anatomical structures residing in each respective compartment (Fig. 306-1). The anterior mediastinum comprises the retrosternal space anterior to the pericardium and brachiocephalic vasculature; it contains the thymus

Disorders of the Mediastinum CHAPTER 306 FIGURE 306-1 Sagittal chest CT of the mediastinum and its three separate compartments. gland, the anterior mediastinal lymph nodes, and the internal mam mary arteries and veins, and can give rise to several neoplasms. The middle mediastinum lies between the anterior and posterior medias tina and contains the heart; the ascending and transverse arches of the aorta; the venae cavae; the brachiocephalic arteries and veins; the phrenic nerves; the trachea, the main bronchi, and their contiguous lymph nodes; and the pulmonary arteries and veins. The posterior mediastinum extends from the posterior border of the heart and trachea to the vertebral column posteriorly. It contains the descend ing thoracic aorta, the esophagus, the thoracic duct, the azygos and hemiazygos veins, and the posterior group of mediastinal lymph nodes. Disorders of the mediastinum encompass a broad range of diseases including but not exclusive to neoplastic and nonneoplastic masses, congenital or acquired malformations of anatomical structures, infec tions, and chronic fibrosing mediastinitis, which will be addressed in this chapter. ■ ■MEDIASTINAL MASSES The first step in evaluating a mediastinal mass is to place it in one of the three mediastinal compartments, since each has different characteris tic lesions (Table 306-1). The anterior mediastinum can give rise to neoplasms including thymomas, germ cell tumors, teratomas, lympho mas, and thyroid goiter. Thymomas are the most common neoplasm in the anterior mediastinum and are closely tied to paraneoplastic syndromes, most notably, myasthenia gravis, the diagnosis of which is supported by the presence of serum anti-acetylcholine receptor antibodies. Teratomas, the most common type of germ cell tumor, are multilobulated cystic lesions that contain fat, soft tissue, and calcium. Elevated tumor markers, α fetoprotein and β-human chorionic gonad otropin, distinguish between seminomatous and nonseminomatous germ cell tumors, which can guide treatment. Seminomas are generally responsive to radiation therapy, whereas nonseminomatous germ cell tumors are treated with standard chemotherapy. Computed tomogra phy (CT) scanning is an important imaging technique for evaluating mediastinal masses as it can attenuate fat, water, calcifications, and air in most instances. Diffusion-weighted magnetic resonance imaging aids in improved tumor characterization and differentiation between cystic and solid structures. Lymphomas appear as homogeneous soft

TABLE 306-1 The Three Compartments of the Mediastinum ANTERIOR COMPARTMENT MIDDLE COMPARTMENT POSTERIOR COMPARTMENT Anatomical boundaries Manubrium and sternum anteriorly; pericardium, aorta, and brachiocephalic vessels posteriorly Anterior mediastinum anteriorly; posterior mediastinum posteriorly Contents Thymus gland, anterior mediastinal lymph nodes, internal mammary arteries, and veins Pericardium, heart, ascending and transverse arch of aorta, superior and inferior vena cavae, brachiocephalic arteries and veins, phrenic nerves, trachea, and mainstem bronchi and their contiguous lymph nodes, pulmonary arteries, and veins Common abnormalities Thymoma, lymphomas, teratomatous neoplasms, thyroid masses, parathyroid masses, mesenchymal tumors, giant lymph node hyperplasia, hernia through foramen of Morgagni Metastatic lymph node enlargement, granulomatous lymph node enlargement,

pleuropericardial cysts, bronchogenic cysts, masses of vascular origin PART 7 Disorders of the Respiratory System tissue structures and can present at various stages. At more advanced stages, lymphomas can present with anterior and middle mediastinal lymphadenopathy. Mediastinoscopy is often performed for sampling of paratracheal and subcarinal lymph nodes. Biopsy can also be achieved via percutaneous fine-needle aspiration or endoscopic transesophageal or endobronchial ultrasound. Scintigraphy with radioactive iodine scan can efficiently establish the diagnosis of an intrathoracic goiter that can also lie in the anterior mediastinum. Surgical resection is the mainstay of treatment for most anterior mediastinal masses like in localized early stages of thymic carcinomas, symptomatic teratomas, and mediastinal goiters. Lymphoma is treated with multimodal therapy with a combination of radiation and chemo therapy; surgery is rarely indicated. Ultimately, the involvement of a multidisciplinary interprofessional team of oncologists, pulmonolo gists, radiologists, and cardiothoracic surgeons is necessary to guide best treatment practices and provide personalized care for each patient. The middle mediastinum consists of central vascular and broncho genic structures. Most middle mediastinal masses are benign and result from abnormalities in embryonic development, such as bronchogenic cysts (that arise from abnormal ventral foregut budding), duplication cysts (that arise from persistent diverticulum of the dorsal bud of the foregut), and pericardial cysts (that arise from abnormal fusion of pericardial recesses). In contrast, advanced stages of malignancy often do not remain localized within one compartment and can traverse borders through hematogenous and lymphatic spread (Fig. 306-2). It is also important to note that, due to the presence of central vasculature in the middle mediastinum, disruption of these structures can lead to acute life-threatening disease. For example, superior vena cava (SVC) syndrome is a medical emergency that presents with severe dyspnea and facial and upper extremity edema from venous distension because of compression of the SVC. SVC obstruction often occurs due to a FIGURE 306-2 Bronchoscopic view of main carina with a malignant mass encroaching on the right mainstem airway. (Courtesy of Dr. Majid Shafiq.)

Pericardium and trachea anteriorly; vertebral column posteriorly Descending thoracic aorta, esophagus, thoracic duct, azygos and hemiazygos veins, sympathetic chains, and the posterior group of mediastinal lymph nodes Neurogenic tumors, meningocele, meningomyelocele, gastroenteric cysts, esophageal diverticula, hernia through foramen of Bochdalek, extramedullary hematopoiesis malignant process; lung cancer, particularly small-cell lung carcinoma, accounts for up to 50% of cases. Endovenous recanalization, usually performed via an interventional radiology approach, restores venous return and reduces the risk of respiratory failure and death. Neurogenic tumors are the most common cause of posterior mediastinal tumors. They may arise from peripheral, autonomic or paraganglionic nervous systems and are often benign. Other causes include diaphragmatic hernia, meningoceles, esophageal diverticula, or extramedullary hematopoiesis. Barium studies of the gastrointestinal tract are indicated in many patients with posterior mediastinal lesions because hernias, diverticula, and achalasia are readily diagnosed in this manner. Finally, mediastinal masses have a wide spectrum of disease severity, for which reason it may be difficult to determine the best course of action. When presented with a mediastinal mass, considering factors such as clinical symptoms, age of the patient, and location of the mediastinal tumor helps to determine the likelihood of malignancy and need for intervention. ■ ■ACUTE MEDIASTINITIS Mediastinitis refers to an acute inflammatory and/or infectious condi tion involving the mediastinum. Cases of acute mediastinitis are usually due to esophageal perforation, occur after median sternotomy for cardiac surgery, or are seen related to infections descending from the neck, oral cavity, or facial area. Patients with esophageal rupture are acutely ill with chest

pain and dyspnea due to the mediastinal infection. The esophageal rupture can occur spontaneously or as a complication of esophagoscopy or the insertion of a Blakemore tube. Appropriate treatment consists of exploration of the mediastinum with primary repair of the esophageal tear and drainage of the pleural space and the mediastinum. The incidence of mediastinitis after median sternotomy is 0.4–5.0%. Patients most commonly present with wound drainage. Other pre sentations include sepsis and a widened mediastinum. The diagnosis usually is established with mediastinal needle aspiration. Treatment includes immediate drainage, debridement, and parenteral antibiotic therapy, but the mortality rate still exceeds 20%. ■ ■CHRONIC MEDIASTINITIS AND

FIBROSING MEDIASTINITIS The spectrum of chronic mediastinitis ranges from granulomatous inflammation of the lymph nodes in the mediastinum to fibrosing mediastinitis. Most cases of fibrosing mediastinitis follow a history of granulomatous infections, commonly due to histoplasmosis or tubercu losis, but sarcoidosis, silicosis, and fungal diseases are at times causative. Patients with granulomatous mediastinitis are usually asymptomatic. Those with fibrosing mediastinitis usually have variable symptoms depending on the extent and location of invasion of mediastinal struc tures such as the SVC or large airways, phrenic or recurrent laryngeal nerve paralysis, or obstruction of the pulmonary artery or proximal pulmonary veins. Fibrosing mediastinitis can be devastating in severe cases. Common clinical manifestations include dyspnea, chest pain, SVC syndrome, hemoptysis, dysphagia, and Horner’s syndrome. Diagnosis involves a combination of clinical, radiologic, and histopathologic find ings. Imaging modalities such as CT and magnetic resonance imaging

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