

## Clinical Correlations

### “The spread of cancer” p.46

- Three ways for metastasis to occur: direct seeding, lymphogenous spread, hematogenous spread
- Lymphogenous is the most common method of metastasis for carcinomas (epithelial tumors) and follows the pattern of lymph drainage
- Hematogenous spread is the most common method of metastasis for sarcomas (connective tissue cancers); venous routes are favored because they offer less resistance
- Lymphangitis (lymph vessels) and lymphadenitis (lymph nodes) are secondary inflammations and can be dangerous
- Lymphedema is when lymph does not drain from an area of the body

### “Nerves” p. 58

- Rhizotomy is the relief of spastic paralysis by cutting either the anterior or posterior root of a spinal segment
- Paresthesia is the pins and needles sensation that occurs when a nerve is compressed for too long
- A crushing nerve injury damages or kills axons distal to the injury site; however the neuronal cell bodies usually survive and nerve's connective tissue coverings remain intact so no surgical intervention is necessary (axon can follow tissue)
- A cutting nerve injury requires surgical intervention to suture the two cut ends together
- If a nerve is subjected to prolonged ischemia (inadequate blood supply) the result is often as serious as a crush or cut nerve

### “Thoracic outlet syndrome” p. 85

- Clinicians referring to the “thoracic outlet” mean the superior thoracic aperture because the arteries and T1 spinal nerves emerge from the thorax here to enter the lower neck and upper limbs

### “Dislocation of ribs” p. 90

- A dislocated rib is the displacement of a costal cartilage from the sternum
- Fairly common in contact sports and can lead to complications from underlying nerves, vessels, and muscles
- Displacement of interchondral joints usually occurs unilaterally and involves ribs 8, 9, 10; trauma that is drastic enough to displace these joints usually injures underlying structures like the diaphragm and liver; severe pain is usually felt upon deep inspiration
- Rib separation is the dislocation of a costochondral junction between the rib and its costal cartilage

“Paralysis of the Diaphragm” p. 90

- Paralysis of one half of the diaphragm (due to injury to the phrenic nerve on one side) does not affect the other half of the diaphragm
- This can be detected radiographically by noting that the paralyzed side will ascend during inspiration instead of descend like the functioning side

“Dyspnea” p. 98

- People with respiratory problems or heart failure use their accessory respiratory muscles to assist expansion of the thoracic cavity

“Absence of the Pectoral Muscles” p. 750

- Very uncommon, but no disability usually results
- The anterior axillary fold formed by the skin and fascia overlying the inferior border of the pectoralis major is absent, and the nipple is more inferior than usual
- Poland syndrome – both the pectoralis major and minor are absent; breast hypoplasia and absence of two to four rib segments are seen

“Paralysis of Serratus anterior” p. 751

- Injury to the long thoracic nerve (course along the superior surface of the serratus anterior) can paralyze the serratus anterior
- Medial border of the scapula moves laterally and posteriorly away from the thoracic wall (winged scapula)
- Upper limb cannot be abducted above the horizontal position

“Herpes Zoster” p. 101

- Herpes zoster infection causes shingles
- Primarily a viral disease of spinal ganglia, usually a reactivation of varicella-zoster virus
- Virus produces a sharp pain in the dermatome supplied by the involved nerve and manifests itself as red vesicular eruptions on dermatome
- Muscular weakness usually occurs in the same myotomal distribution

“Intercostal nerve block” p. 102

- Involves infiltration of the anesthetic around the intercostal nerve trunk and its collateral branches
- Usually must anesthetize two or more intercostal nerves because of dermatomal overlap

“Changes in the breasts” p. 106

- Colostrum (creamy white to yellowish premilk fluid) may secrete from the nipples during last trimester; but milk production does not usually start until after child is born

- Breasts in elderly women are usually small because of the decrease in fat and the atrophy of glandular tissue

“Breast Quadrants” p. 106

- Divided into superior lateral/medial, inferior lateral/medial, and axillary tail

“Carcinoma of the breast” p. 109

- Usually arise from the epithelial cells of the lactiferous ducts in the mammary gland lobules
- Lymphedema can result and cause deviation of the nipple and a thickened, leather-like appearance of the skin; prominent, puffy skin between dimpled pores gives it an orange peel appearance (peau d’orange sign)
- Invasion of the glandular tissue produces fingertip size dimples
- Subareolar cancer may cause inversion of the nipple
- If cancer invades the retromammary space the breast elevates when the pectoral muscles contract

“Breast cancer in men” p. 111

- Tends to infiltrate the pectoral fascia, pectoralis major, and apical lymph nodes of the axilla
- Consequences are serious because usually not detected until a late stage

“Gynecomastia” p. 111

- Breast hypertrophy in males after puberty
- Can indicate a hormonal imbalance pointing to suprarenal and testicular cancers, and cirrhosis

“injuries to cervical pleura and apex of lung”

- Lungs and pleural sacs may be injured during wounds to the base of the neck resulting in pneumothorax
- Because children have shorter necks, the pleura reaches higher and makes them especially vulnerable to this type of injury

“Injuries to other parts of the pleurae”

- Three areas are vulnerable to injury: right part of the infrasternal angle, and the right and left costovertebral angles

“Pulmonary collapse”

- Secondary atelectasis is the collapse of a previously inflated lung; primary atelectasis is the failure of the lung to inflate at birth

- Normal lungs remain distended even when the airway is open because the visceral pleura adheres to the internal thoracic wall due to surface tension of the liquid separating the pleurae
- A penetrating wound to the pleura will cause air to be sucked in due to negative pressure; surface tension destroyed and lung collapses
- A mediastinal shift results where the mediastinum shifts towards the affected side

“Thoracentesis” p. 118

- When patient is sitting upright fluid accumulates in the costodiaphragmatic recess
- Inserting needle through 9<sup>th</sup> intercostal space on the midaxillary line during expiration will avoid the inferior border of the lung (angle needle upward to avoid penetrating deep side of recess)

“Chest tube” p. 119

- Short incision made in the 5<sup>th</sup>/6<sup>th</sup> intercostal space along midaxillary line and tube is directed either superiorly (for air removal) or inferiorly (for fluid removal)

“Pleuritis (Pleurisy)” p. 119

- Inflammation of the pleura makes the lung surfaces rough and makes a sounds like a clump of hair being rolled between the fingers upon auscultation

“Pleurectomy and Pleurodesis” p. 120

- Pleurectomy is the removal of part of the pleura; pleurodesis is the application of an irritating powder to promote the adherence of the two layers of pleurae

“Variations in the lobes of the lungs” p. 123

- Sometimes the left lung has three lobes and the right only has two
- Most common accessory lobe is the azygos lobe where the azygos vein arches over the apex of the right lung instead of the hilum

“Appearance of lungs” p. 123

- Lymph from the lungs carries special “dust cells” that remove carbon from gas-exchanging surfaces and deposits it in the inactive connective tissue
- So the lungs can absorb a lot of carbon before being adversely affected

“Auscultation/Percussion of thorax” p. 123

- To auscultate the base of the lung apply the stethoscope to the posterior thoracic wall at the level of the 10<sup>th</sup> thoracic vertebra
- The lungs should have a resonant sound when percussed

“Lung cancer and mediastinal nerves” p. 124

- Lung cancer involving the phrenic nerve may result in hemiparalysis of the diaphragm
- Cancer of the apex of the lung may result in damage to the recurrent laryngeal nerve that will result in hoarseness

“Pulmonary embolism” p. 131

- Results from an embolus traveling through venous circulation to the heart and getting lodged in one of the pulmonary arteries or its branches
- Patient suffers acute respiratory distress because of a major decrease in blood oxygenation
- A medium sized embolus may block a BP segment and result in pulmonary infarct (dead tissue)
- In physically active people collateral circulation may develop through the extensive anastomoses of the bronchial arteries

“Lymphatic drainage and pleura adhesion”

- If the parietal and visceral pleurae of the lung adhere the lymphatic vessels in the lung and visceral pleura may drain to axillary lymph nodes
- Presence of carbon particles in these lymph nodes is evidence of a pleural adhesion

“Bronchogenic Carcinoma”

- Refers to any lung cancer
- Metastasizes early to the bronchopulmonary lymph nodes and then to other thoracic lymph nodes
- The brain, bones, lungs, and adrenal glands are common metastatic sites
- Lymph nodes superior to the clavicle are usually enlarged in this condition and tip off the physician to the presence of thoracic malignancy (sentinel lymph nodes)

“Pleural Pain”

- Visceral pleura is insensitive to pain because it has no nerves for general sensation
- Parietal pleura (especially the costal part) is extremely sensitive to pain through its extensive supply from branches of the intercostal and phrenic nerves
- Irritation of the parietal pleura may result in local pain or referred pain projected to the dermatomes supplied by the same spinal ganglia (irritation of mediastinal and diaphragmatic areas of the p. pleura result in referred pain to the root of the neck and over the shoulder – C3-C5)

“Widening of the mediastinum”

- Any structure in the mediastinum is capable of contributing to pathological widening
- Hemorrhage of a great vessel can produce widening as well as malignant lymphoma

“Surgical significance of the transverse pericardial sinus” p. 140

- A surgical clamp can be passed through this to assist in a coronary bypass

“Exposure of the IVC and SVC” p. 140

- The entire IVC after the diaphragm is inside the pericardial sac and the inferior portion of the SVS is inside the sac as well

“Pericarditis, Pericardial rub, Pericardial effusion” p. 140

- Pericarditis is the inflammation of the pericardium and results in friction when auscultated over the left sternal border (rub)
- Some inflammatory diseases result in pericardial effusion (passage of fluid from pericardial capillaries into the pericardial cavity); heart becomes compressed and ineffective

“Positional abnormalities of the heart” p. 145

- Dextrocardia is where the apex of the heart is directed towards the right; this can be part of situs inversus where it would not have many clinical implications
- In isolated dextrocardia severe cardiac anomalies develop

“Percussion of the heart” p. 145

- Percussion performed at the 3<sup>rd</sup>, 4<sup>th</sup>, and 5<sup>th</sup> intercostal spaces from the left anterior axillary line to the right anterior axillary line
- Dullness should present around 6cm lateral from the left border of the sternum

“Stroke or cerebrovascular incident” p. 151

- Thrombi develop on the walls of the left atrium in certain types of heart disease
- If they detach they can occlude arteries throughout the body
- Occlusion of the brain can result in a stroke or CVA and affect vision, cognition, motor function

“Valvular heart disease” p. 154

- Stenosis is the failure of a valve to open fully, slowing blood flow from one chamber to another
- Insufficiency or regurgitation is failure of the valve to close completely
- Both of these produce turbulence called eddies that are audible as murmurs and can sometimes be felt over an area of turbulence as thrills
- Mitral valve insufficiency – extends back into left atrium during systole sending blood back; causes chest pain and fatigue in those affected
- Pulmonary valve stenosis – prevent right ventricular outflow and cause hypertrophy of RV
- Pulmonary valve incompetence – valve does not close completely and sends blood back into RV during diastole

- Aortic valve stenosis – LV hypertrophy
- Aortic valve insufficiency – aortic regurgitation producing heart murmur and collapsing pulse

“Coronary artery disease” p. 159

- Coronary atherosclerosis – lipid accumulations in the coronary arteries
- Slowly progressive CAD – many times collateral circulation has time to develop in this case so that a blockage of an artery may not be as devastating

“Angina Pectoris” p. 160

- Pain that originates in the heart
- Pain is the result of ischemia of the myocardium that falls short of causing an MI
- The buildup of lactic acid stimulates pain receptors in muscle
- Relieved by a 1 – 2 min period of rest, sublingual nitroglycerin (dilates coronary arteries)

“Coronary bypass graft” p. 161

- A segment of an artery or vein is connected to the ascending aorta or to the proximal part of a coronary artery and then to the coronary artery distal to the stenosis
- The great saphenous vein is used fairly often because it is the right diameter, can be easily dissected from lower limb, and offers lengthy portions with minimum occurrence of valves or branching
- An internal thoracic artery may also be used

“Coronary angioplasty” p. 161

- A catheter with a small inflatable balloon is fed towards the obstruction
- When it reaches the obstruction it is inflated, flattening the plaque against the vessel’s wall

“Collateral circulation via smallest cardiac veins” p. 162

- Reversal of flow in the anterior and smallest cardiac veins may bring luminal blood (from heart chambers) to capillary beds of myocardium
- Likely not enough to make up for MI

“Coronary occlusion and conduction system” p. 165

- Heart block occurs if vasculature supplying the nodes are obstructed
- The ventricles will begin to contract at their own rate (25 – 30 times per minute)
- If one of the bundles is obstructed then the signal will only travel to one ventricle and pass to the other via myogenic conduction resulting in a late contraction

“Artificial Cardiac Pacemaker” p. 166

- Consists of a pulse generator and a battery pack

- Pacemakers produce electrical impulses that stimulate contraction of the heart
- Electrode is fixed to trabeculae carneae in the RV

“Cardiac Referred pain” p. 167

- Heart is insensitive to touch, cutting, cold, and heat; ischemia and the accumulation of metabolic products stimulate pain endings in the myocardium
- The afferent pain fibers enter spinal cord segments T1 through T4/T5
- Cardiac pain is often referred to the upper limb because the spinal cord segments of these cutaneous nerves are also common to the visceral afferent terminations for the coronary arteries

“Aneurysm of the Ascending Aorta”

- Distal part of the ascending aorta receives a strong thrust of blood upon contraction of LV
- An aneurysm can develop that will look like a large silhouette on the ascending aorta
- Individuals usually complain of chest pain that radiates to the back

“Variations in the great arteries” p. 174

- In 65% of people the usual pattern of branching occurs
- In 27% of people the left common carotid arises from the brachiocephalic trunk
- In 2.5% of people there is no brachiocephalic trunk and all 4 vessels arise from the arch
- In 1.2% of people a left and right brachiocephalic trunk exists
- A retroesophageal right subclavian artery sometimes arises as the left-most branch and crosses posterior to the esophagus to reach the right upper limb (causing dysphagea)
- Sometimes a right arch of the aorta exists (passes over the root of the right lung)
- Rarely, a double arch of the aorta occurs where the esophagus and trachea go through the arch of the aorta and cause dysphagea and dyspnea

“Coarctation of the aorta” p. 175

- The arch of the aorta or descending aorta experiences a stenosis
- A good collateral circulation usually develops between the proximal and distal parts of the aorta through the intercostal and internal thoracic arteries
- The collateral vessels may become so large that they noticeably pulse in the intercostal spaces

“Laceration of the thoracic duct” p. 181

- Duct is vulnerable to inadvertent injuries during surgery because it is thin walled and colorless
- Lymph will escape into the thoracic cavity at rates ranging from 75 to 200ml per hour
- Lymph or chyle from the lacteals may also enter the pleural cavity and result in chylothorax; the fluid may be removed by needle tap for thoracentesis