

**Rotation: VGH Chest Radiography**  
**VGH**  
**899 West 12th Ave., Vancouver, BC V5Z 1M9**

**Level:** PGY 2-5

**Rotation Supervisor:** Dr. Ana-Maria Bilawich

During the course of the four years, residents will receive one month of chest radiography training as a junior resident and one month of chest radiography training as a senior resident. Residents are expected to develop graded responsibility as they rise from junior to senior resident level. Each resident will be given guidance at the beginning of a rotation, an interim evaluation will occur mid rotation, and a final evaluation will be given at the end of each rotation. Each final evaluation will be submitted to the residency training program director.

All residents are expected to arrive in the department by 0800 hours and stay until the conclusion of the working day. Ongoing teaching and interaction with the staff occurs throughout the day.

If a resident is absent from his/her chest plain radiography rotation for any reason, he/she should give ample warning to Dr. Mayo (Radiology Department Head) and Dr. Bilawich (Cardiothoracic Section Head and rotation supervisor).

Vacation and conference requests must be booked with Dr. Mayo and Dr. Bilawich in advance, at least two weeks prior to any planned absence from the rotation.

**Medical Expert:**

**1. Basic Science:**

a) Knowledge of anatomy (PA and lateral chest radiographs)

At the end of first Chest radiography rotation, the junior resident (PGY2/3) will demonstrate learning all of the following anatomy on PA and lateral chest radiographs.

At the end of the second Chest radiography rotation, the senior resident (PGY4/5) will demonstrate learning all of the following anatomy on PA and lateral chest radiographs.

1. *Identify the following structures on the posteroanterior (PA) chest radiograph:*
  - a. *Lung – right, left, right upper, middle and lower lobes, left upper (including lingual) and lower lobes*
  - b. *Fissures – major, minor, azygos, superior and inferior accessory*
  - c. *Airways – trachea, carina, main bronchi*
  - d. *Heart – right atrium, left atrial appendage, left ventricle, location of the four cardiac valves*
  - e. *Pulmonary arteries – main, right, left, interlobar*

- f. *Aorta – ascending, arch, descending*
  - g. *Veins – superior vena cava, azygous, left superior intercostals ('aortic nipple')*
  - h. *Bones – spine, ribs, clavicles, scapulae, humeri*
  - i. *Right paratracheal stripe*
  - j. *Junction lines – anterior, posterior*
  - k. *Aortopulmonary window*
  - l. *Azygoesophageal recess*
  - m. *Paraspinal lines*
2. *Identify the following structures on the lateral chest radiograph:*
- a. *Lungs – right, left, right upper, middle and lower lobes, left upper (including lingual) and lower lobes*
  - b. *Fissures – major, minor, superior accessory*
  - c. *Airway – trachea, upper lobe bronchi, posterior wall of bronchus intermedius*
  - d. *Heart – right ventricle, right ventricular outflow tract, left atrium, left ventricle, the location of the four cardiac valves*
  - e. *Pulmonary arteries – right, left*
  - f. *Aorta – ascending, arch, descending*
  - g. *Veins – inferior vena cava, pulmonary vein confluence*
  - h. *Bones – spine, ribs, scapulae, humeri, sternum*
  - i. *Retrosternal line*
  - j. *Posterior tracheal stripe*
  - k. *Right and left hemidiaphragm*
  - l. *Raider's triangle*

b) At the end of the second Chest radiography rotation, the senior resident (PGY4/5) will demonstrate knowledge of X-ray physics, technical parameters of image acquisition, artifacts.

## **2. Diagnostic Chest Radiography**

a) Knowledge of clinical radiology and pathology

At the end of first Chest radiography rotation, the junior resident (PGY2/3) will demonstrate learning the following knowledge-based objectives written in italics:

At the end of the second Chest radiography rotation, the senior resident (PGY4/5) will demonstrate learning all of the following knowledge-based objectives (written in italics and normal typeface):

- *Signs in Thoracic Radiology: Definite, identify and state the significance of the following on a radiograph*
  - *Air bronchogram – indicates a parenchymal process, including nonobstructive atelectasis as distinguished from pleural or mediastinal process*
  - *Air crescent sign – indicates a lung cavity, often resulting from fungal infection or saprophytic colonization*
  - *Deep sulcus sign on a supine radiograph – indicates pneumothorax*
  - *Continuous diaphragm sign – indicates pneumomediastinum*
  - *Ring around the artery sign (air around pulmonary artery, particularly on lateral chest radiograph) – indicates pneumomediastinum*
  - *Fallen lung sign – indicates a fractured bronchus*
  - *Flat waist sign – indicates left lower lobe collapse*
  - *Gloved finger sign – indicates bronchial impaction, which can be seen in allergic bronchopulmonary aspergillosis*
  - *Golden S sign – indicates lobar collapse caused by a central mass, suggesting an obstructing bronchogenic carcinoma in an adult*
  - *Luftsichel sign – indicates upper lobe collapse, suggesting an obstructive bronchogenic carcinoma in an adult*
  - *Hampton’s hump – pleural based, wedge-shaped opacity indicating a pulmonary infarct*
  - *Silhouette sign – loss of contour of the heart, aorta or diaphragm allowing localization of a parenchymal process (e.g. A process involving the medial segment of the right middle lobe obscures the right heart border, a lingular process obscures the left heart border, a basal segmental lower lobe process obscures the diaphragm)*
  - *Cervicothoracic sign – a mediastinal opacity that projects above the clavicles is retrotracheal and posteriorly situated, whereas an opacity effaced along its superior aspect and projecting at or below the clavicles is situated anteriorly*
  - *Tapered margins sign – a lesion in the chest wall, mediastinum or pleura may have smooth tapered borders and obtuse angles with the chest wall or mediastinum while parenchymal lesions usually form acute angles*
  - *Figure 3 sign – abnormal contour of the descending thoracic aorta, indicating coarctation of the aorta*
  - *Fat pad sign or sandwich sign – indicates pericardial effusion on lateral chest radiograph*
  - *Double density sign – opacity projecting over the right side of the heart, indicating enlargement of the left atrium*
  - *Hilum overlay sign and hilum convergence sign – used to distinguish a hilar mass from a non-hilar mass*
  - *Interstitial lung disease*
1. List and identify on a chest radiograph four patterns (nodular, reticular, reticulonodular and linear) of interstitial lung disease (ILD).
  2. Identify Kerley A and B lines on a chest radiograph and explain their etiology.

3. *Recognize the changes of congestive heart failure on a chest radiograph – enlarged cardiac silhouette, pleural effusions, vascular redistribution, interstitial or alveolar edema, Kerley lines, enlarged azygous vein, and increased ratio of artery to bronchus diameter.*

4. *Define the terms ‘asbestos-related pleural disease’ and ‘asbestosis’ and identify each on a chest radiograph.*

5. *Identify honeycombing on a radiograph, state the significance of this finding (end-stage lung disease), and list the common causes of honeycomb lung.*

6. *Describe the radiographic classification of sarcoidosis.*

7. *Recognized progressive massive fibrosis/conglomerate masses secondary to silicosis or coal worker’s pneumoconiosis on radiography.*

8. *List causes of lower lobe predominant ILD.*

9. *List causes of upper lobe predominant ILD.*

- *Alveolar Lung Disease*

1. *List four broad categories of acute alveolar lung disease (ALD).*

2. *List five broad categories of chronic ALD.*

3. *Recognize a pattern of peripheral ALD on radiography and give an appropriate differential diagnosis, including a single most likely diagnosis when supported by associated radiologic findings or clinical information.*

- *Atelectasis, Airways and Obstructive Lung Disease*

1. *Recognize partial or complete atelectasis of the following on a chest radiograph: right upper lobe, right middle lobe, right lower lobe, right upper and middle lobe, right middle and lower lobe, left upper lobe, left lower lobe.*

2. *Recognize complete collapse of the right or left lung on a chest radiograph list an appropriate differential diagnosis for the etiology of the collapse.*

3. *Distinguish lung collapse from massive pleural effusion on a frontal chest radiograph.*

4. *Name the important things to look for on a chest radiograph when the patient history is ‘asthma’.*

5. *Recognize Kartagener syndrome on a chest radiograph and name the three components of the syndrome.*

- *Mediastinal Masses and Mediastinal/Hilar Lymph Node Enlargement*

1. *State the anatomic boundaries of the anterior, middle, posterior and superior mediastinum.*

2. *Name the four most common causes of an anterior mediastinal mass and localize a mass to the anterior mediastinum on a chest radiograph.*

3. *Name the three most common causes of a middle mediastinal mass and localize a mass in the middle mediastinum on a chest radiograph.*
4. *Name the most common cause of a posterior mediastinal mass and localize a mass in the posterior mediastinum on a chest radiograph.*
5. Name two causes of a mass that straddles the thoracic inlet and localize a mass to the thoracic inlet on a chest radiograph.
6. Name five etiologies of bilateral hilar lymph node enlargement.
7. *State the three most common locations (Garland's triad) of thoracic lymph node enlargement in sarcoidosis.*
8. *List the four most common etiologies of 'egg-shell' calcified lymph nodes in the thorax.*
  - Solitary and Multiple Pulmonary Nodules
  1. *Define the terms pulmonary nodule and pulmonary mass.*
  2. *Name the three most common causes of a solitary pulmonary nodule.*
  3. *Name six causes of cavitary pulmonary nodules*
  4. *Name four causes of multiple pulmonary nodules.*
5. Describe an appropriate imaging algorithm to evaluate a solitary pulmonary nodule.
  - Benign and Malignant Neoplasms of the Lung and Esophagus
  1. *Name the four major histologic types of bronchogenic carcinoma.*
  2. *Name the type of non-small cell lung cancer that most commonly cavitates.*
  3. *Name the types of bronchogenic carcinoma that are usually central.*
4. Describe the TNM classification for staging non-small-cell lung cancer.
5. Describe the staging of small-cell lung cancer.
6. Name the most common extrathoracic sites of metastases for non-small-cell and small-cell lung cancer.
7. Name the stages of non-small-cell lung cancer that are potentially resectable.
8. Recognize abnormal contralateral mediastinal shift on a postpneumonectomy chest radiograph and state etiologies for the abnormal shift.
9. Name the most common thoracic locations for adenoid cystic carcinoma and carcinoid tumors to occur.
10. Describe the TNM classification for staging esophageal carcinoma, the role of imaging in staging esophageal carcinoma and the stages of esophageal carcinoma that are potentially resectable.

11. Describe the classification of lymphoma, the role of imaging in staging of lymphoma and the typical and atypical imaging findings of thoracic lymphoma.

12. Define primary pulmonary lymphoma.

13. Describe the typical chest radiograph appearances of Kaposi sarcoma.

- Chest Wall, Pleura and Diaphragm

1. *Recognize and name causes of a large unilateral pleural effusion on a chest radiograph.*

2. *Recognize a pneumothorax on an upright and supine chest radiograph.*

3. *Recognize a pleural based mass with bone destruction or infiltration of the chest wall on a chest radiograph and name likely causes.*

4. *Recognize pleural calcification on a chest radiograph and suggest the diagnosis of asbestos exposure (bilateral involvement) or old tuberculosis or trauma (unilateral involvement).*

5. *Recognize the typical chest radiographic appearances of pleural effusion, given differences in patient positioning, and describe the role of the lateral decubitus view to evaluate pleural effusion.*

6. *Recognize apparent unilateral elevation of the diaphragm on a chest radiograph and suggest a specific etiology with supporting history and associated chest radiographic findings.*

7. *Recognize imaging findings suggesting a tension pneumothorax and understand the acute clinical implications.*

8. Recognize diffuse pleural thickening, as seen in fibrothorax, malignant mesothelioma and pleural metastases.

- Infection and Immunity

1. *Name the radiographic manifestations of postprimary pulmonary tuberculosis.*

2. *Name the most common segmental sites of involvement of postprimary tuberculosis in the lung.*

3. *Define a Ghon lesion (calcified pulmonary parenchymal granuloma) and Ranke complex (calcified node and Ghon lesion); recognize both on a chest radiograph and describe their significance.*

4. Name and describe the types of pulmonary aspergillus disease.

5. Identify an intracavitary fungus ball on chest radiography.

6. Describe the radiographic appearances of PCP pneumonia.

7. Other than bacterial infection, name two important infections and two important neoplasms to consider in patients with AIDS and chest radiograph abnormalities.

8. Name most important etiologies of hilar and mediastinal lymphadenopathy in patients with AIDS.

9. Describe the time course and chest radiographic appearance of a blood transfusion reaction.

10. Describe the chest radiographic appearance of a military pattern and provide a differential diagnosis.

11. Describe the chest radiographic findings of posttransplant lymphoproliferative disorder.

- Unilateral Hyperlucent Hemithorax

1. Recognize a unilateral hyperlucent hemithorax on a chest radiograph.

2. Identify the common causes for unilateral hyperlucent hemithorax on a chest radiograph, and suggest a specific diagnosis when certain associated findings are seen.

- Pulmonary Vasculature

1. Recognize enlarged pulmonary arteries on a chest radiograph and distinguish them from enlarged hilar lymph nodes.

2. Recognize enlargement of the central pulmonary arteries with diminution of the peripheral pulmonary arteries on a chest radiograph and suggest the diagnosis of pulmonary artery hypertension.

3. Name the common causes of pulmonary arterial hypertension.

- Thoracic Aorta and Great Vessels

1. Describe the classification of aortic dissection (DeBakey and Stanford) and implications for classification on medical vs. surgical management.

2. Recognize a right aortic arch and double aortic arch on a chest radiograph.

3. State the significance of right aortic arch with mirror image branching vs. with an aberrant subclavian artery.

4. Recognize a cervical aortic arch on a chest radiograph.

5. Define the term aneurysm and pseudoaneurysm.

- Cardiac Valvular Disease

1. Identify and describe the findings of each on a chest radiograph: enlarged right atrium, enlarged left atrium, enlarged right ventricle, and enlarged left ventricle.

2. Describe and recognize the chest radiograph findings associated with each of the following valvular diseases: mitral regurgitation, mitral stenosis, aortic regurgitation, aortic stenosis, tricuspid regurgitation.

3. Recognize an enlarged ascending aorta and aortic valve calcification on a chest radiograph and suggest the diagnosis of aortic stenosis when these findings are present.

4. Recognize an enlarged left atrium, vascular redistribution, and mitral valve calcification on a chest radiograph and suggest the diagnosis of mitral stenosis when these findings are present.

5. State the most common etiologies of aortic stenosis, aortic regurgitation, mitral stenosis, mitral regurgitation, tricuspid regurgitation, pulmonary stenosis.

- Pericardial Disease

1. *Recognize pericardial calcification on a chest radiograph and name the most common causes.*
2. *Describe and identify two chest radiograph signs of a pericardial effusion.*
3. *Name common causes of a pericardial effusion.*
4. *Describe findings of each of the following on a chest radiograph: pericardial cyst, constrictive pericarditis, absence of the pericardium, pneumopericardium.*

- *Monitoring and support devices 'lines and tubes'*

1. *Describe and identify on a chest radiograph the normal appearance and complications associated with each of the following:*

- a. *Endotracheal tube*
- b. *Central venous catheter*
- c. *Peripherally inserted central venous catheter*
- d. *Pulmonary artery catheter*
- e. *Feeding tube*
- f. *Nasogastric tube*
- g. *Chest tube*
- h. *Intra-aortic balloon pump*
- i. *Pacemaker generator and leads*
- j. *Automatic implantable cardiac defibrillator*
- k. *Left ventricular assist device*
- l. *Atrial septal defect closure device*
- m. *Pericardial drain*
- n. *Extracorporeal life support cannulae*
- o. *Intraesophageal manometer, temperature probe and pH probe*
- p. *Trachea, bronchial and esophageal stent.*

2. *Explain how an intra-aortic balloon pump works.*
3. *Describe the venous anatomy and expected course of the veins from the axillary vein to the right atrium relative to anatomic landmarks.*
4. *Recognize the difference between skin fold and pneumothorax on a portable chest radiograph.*

- Postoperative thorax



1. Identify the normal postoperative findings and complications of the following procedures on chest radiographs:

- a. Wedge resection, lobectomy, pneumonectomy
- b. Coronary artery bypass graft surgery
- c. Cardiac valve replacement
- d. Aortic graft
- e. Aortic stent
- f. Transhiatal esophagectomy
- g. Lung transplantation
- h. Lung volume reduction surgery.

b) Understands imaging techniques

c) Detects findings

d) Interprets findings into an appropriate differential diagnosis

e) Ability to summarize case, offer recommendations, understands treatment and clinical implications

There may be the opportunity for the resident to participate in the review of chest radiographs at the TB Clinic with the staff chest radiologist.

**Communicator:**

a) Communicates effectively with patients, families and other health professionals

b) Appropriate and timely communication of findings to referring physicians, including when results are urgent

c) Obtains appropriate informed consent

d) Accurate, concise, complete reports

**Collaborator**

a) Respects, recognizes the roles of, and effectively interacts with the health care team, including nurses and technologists

b) Fulfills consultant role (for level of training)

**LEADER ROLE:**

Implement processes to ensure personal practice improvement

Set priorities and manage time to integrate practice and personal life

Apply the science of quality improvement (ie discussion of potential audit) to contribute to improving systems of patient care

Contribute to a culture that promotes patient safety, including recognition of patient safety issues, and utilization of health informatics to improve patient safety

Demonstrate leadership skills to enhance health care

*The resident (PGY2) in the First Chest Radiography rotation will be responsible for reviewing a minimum of 20 chest radiographs per day (ICU, CCU, other inpatient and outpatient chest radiographs) with the staff chest radiologist. 15 of the 20 chest radiographs will have to be reviewed by noon.*

*The resident (PGY4/5) in the Second Chest Radiography rotation will be responsible for reviewing a minimum of 30 chest radiographs per day (ICU, CCU, other inpatient and outpatient chest radiographs) with the staff chest radiologist. 20 of the 30 chest radiographs will have to be reviewed by noon.*

c) Reports are dictated and signed in a timely manner

*All dictated reports have to be signed by the end of the working day.*

### **Health Advocate**

a) Understands benefits and risks related to imaging studies

b) Understands the appropriate use of imaging studies and rationalization of use of imaging resources

### **Scholar**

a) Effectively teaches others, including residents, medical students and patients

b) Demonstrates continuous self-directed learning (reads around cases and topics)

c) Demonstrates evidence based medical approach and critical appraisal with regards to radiology literature

d) Attends weekly Thoracic Surgery Rounds (7-8 am every Tuesday) and Radiologic-Clinical-Pathologic Rounds (1-2 pm every Friday from September to June)

e) The resident is responsible for submitting two teaching files to the MIRC server per rotation, and will present the two submitted teaching files to the chest radiology staff during the last week of the rotation.

### **Professional**

a) Exhibits professional behaviour, displaying honesty, integrity and respect

b) Exhibits ethical behaviour, sensitivity to gender/culture diversity

c) Demonstrates punctuality

- d) Demonstrates good work ethic, enthusiasm and motivation
- e) Demonstrates reliability, responsibility and conscientiousness
- f) Demonstrates insight with regards to own limitations, strength and weaknesses, asks for help when appropriate
- g) Accepts constructive criticism

**Reading List:**

Recommended Textbooks:

1. Chest Radiology The Essentials. By Jannette Collins and Eric J. Stern.
2. Thoracic Imaging Pulmonary and Cardiovascular Radiology. By W. Richard Webb and Charles B. Higgins.

Radiologic Diagnosis of Diseases of the Chest. By NL Muller, R Fraser, N Colman and PD Pare is available as a reference in the reading room.

Reading around cases that the resident encounters during his/her rotation is mandatory. This can be done with StatDX and internet can provide many review articles (ie. Radiographics).