

## DIAGNOSTIC IMAGING:

The diagnostic imaging vertical theme content is integrated into both dedicated imaging focused sessions as well as within clinically oriented sessions and experiences throughout the program. Dr. Burbridge ([brent.burbridge@usask.ca](mailto:brent.burbridge@usask.ca)) has developed a University of Saskatchewan resource which supports this theme.

This **Undergraduate Diagnostic Imaging Fundamentals eBook** can be located at: <https://openpress.usask.ca/undergradimaging/>

Overarching concepts and objectives which would be beneficial for students to acquaint themselves with early in their program as well as to refresh their learnings around throughout the program are included in **Table 1** below.

Clinical Systems related content and learning goals are outlined in **Table 2** below. Concepts are linked to individual chapters as indicated within the Undergraduate Diagnostic Imaging Fundamentals eBook.

**Table 1: Principles of Diagnostic Imaging**

Chapter 1 – <ul style="list-style-type: none"><li>• Apply the CanMEDS roles that pertain to imaging.</li><li>• Use recognized imaging guidelines to engage in the appropriate, and optimal, utilization of imaging (Canadian Association of Radiology, and the American College of Radiology)..</li></ul>	<ul style="list-style-type: none"><li>• Describe CanMEDS roles that pertain to imaging.</li><li>• Be aware of imaging guidelines, and appropriateness criteria, for the optimal imaging of patients.</li></ul>
Chapter 2 – <ul style="list-style-type: none"><li>• Describe types of Radiation, Radiation Biology and basic Imaging Physics.</li><li>• Discuss the types and magnitudes of radiation exposure in medicine compared to radiation exposure from natural sources.</li><li>• Recognize the increased vulnerability of the fetus, and children, to ionizing radiation.</li></ul>	<ul style="list-style-type: none"><li>• Apply your knowledge of radiation biology and physics and take this into consideration when using imaging modalities.</li><li>• Communicate the potential risks and benefits of radiation related to the planned imaging procedure.</li><li>• Use radiation judiciously, especially for children.</li><li>• Choose guidelines that minimize patient radiation exposure and curtails using imaging when it is of less clinical value, such as, “Image Gently” and “Choosing Wisely”.</li></ul>
Chapter 3 – <ul style="list-style-type: none"><li>• Correlate anatomy with imaging findings.</li><li>• For the following modalities, x-ray, mammography, fluoroscopy, ultrasound,</li></ul>	<ul style="list-style-type: none"><li>• Identify normal anatomy on diagnostic images, particularly x-rays.</li><li>• Recognize optimal and suboptimal image quality in radiography.</li></ul>

<p>digital subtraction angiography (DSA), CT, and MRI the student will be able to:</p> <ul style="list-style-type: none"> <li>○ Explain the basic physical principles of image formation</li> <li>○ Discuss the relative and absolute contraindications for imaging</li> <li>○ Describe the main types of ultrasound probes</li> <li>○ Describe the Hounsfield unit scale for CT</li> </ul>	<ul style="list-style-type: none"> <li>• Recognize the technological elements displayed when encountering an image (PA chest x-ray, lung level/window CT, etc.).</li> <li>• Relate the strengths and weaknesses of different imaging modalities and be able to determine the optimal imaging modality for your patient.</li> </ul>
<p>Chapter 4 –</p> <ul style="list-style-type: none"> <li>• Evaluate the indications for contrast media for imaging examinations.</li> <li>• Describe the risks and side effects of contrast media.</li> </ul>	<ul style="list-style-type: none"> <li>• Identify if a Fluoroscopy or CT study is contrast-enhanced.</li> <li>• Communicate the risks and benefits of contrast media for common examinations..</li> </ul>
<p>Chapter 5 –</p> <ul style="list-style-type: none"> <li>• Recognize normal anatomy seen on x-rays.</li> <li>• Develop a personal strategy for reviewing common imaging examinations to ensure that pertinent anatomy is not overlooked.</li> </ul>	<ul style="list-style-type: none"> <li>• Identify specific normal anatomy on imaging.</li> <li>• Demonstrate an approach to reviewing x-ray examinations.</li> <li>• Begin to use appropriate terminology to describe abnormalities on x-rays i.e. opacity, nodule, etc.</li> <li>• Begin to use recognized terminology to describe bone fractures.</li> </ul>

**Table 2: Clinical Module and Experience Related Diagnostic Imaging Curriculum**

<p>Chapter 8 –</p> <ul style="list-style-type: none"> <li>• Recognize normal cardiac anatomy seen on chest radiography</li> <li>• Discuss the key imaging findings for aortic aneurysm and the classification of aortic dissection.</li> <li>• Correlate the pathophysiology of heart failure with common x-ray findings.</li> </ul>	<ul style="list-style-type: none"> <li>• Identify cardiac chambers forming the cardiac silhouette on chest radiography.</li> <li>• Recognize cardiac enlargement on a chest x-ray.</li> <li>• Recognize aortic enlargement that may be due to aneurysm or dissection.</li> <li>• Recognize radiographic findings of congestive heart failure.</li> </ul>
<p>Chapter 9 –</p> <ul style="list-style-type: none"> <li>• Describe key anatomic structures and common abnormal signs that suggest abnormalities on the chest x-ray.</li> </ul>	<ul style="list-style-type: none"> <li>• Identify the following structures on postero-anterior (PA) and lateral chest radiographs: lobes and fissures of the lung, trachea, main bronchi, cardiac atria and</li> </ul>

	<ul style="list-style-type: none"> <li>• Discuss the terminology used to describe imaging patterns on chest x-rays.</li> <li>• Describe the imaging appearances of various monitoring and support devices.</li> <li>• Recognize common diseases of the chest that may require imaging for diagnosis and management.</li> </ul>	<p>ventricles, pulmonary arteries, aorta, diaphragm.</p> <ul style="list-style-type: none"> <li>• Identify common signs on the chest x-ray: silhouette, air bronchogram, deep sulcus.</li> <li>• Identify common abnormalities seen on chest x-rays : consolidation, atelectasis, nodules, masses, lucencies, and opacities.</li> <li>• Identify proper positioning of the following monitoring and support devices: endotracheal tube, central venous catheter, and nasogastric tube.</li> <li>• Recognize and understand basic elements of imaging reports and imaging examinations depicting: <ul style="list-style-type: none"> <li>○ Atelectasis</li> <li>○ Lobar and lung collapse</li> <li>○ Pleural effusion</li> <li>○ Pneumonia</li> <li>○ Pneumothorax/Tension Pneumothorax</li> <li>○ Emphysema</li> <li>○ Solitary lung nodule/mass</li> <li>○ Multiple lung nodules</li> <li>○ <u>Pulmonary thromboembolism</u></li> </ul> </li> </ul>
	<p>Chapter 10 –</p> <ul style="list-style-type: none"> <li>• Recognize common diseases of the gastrointestinal and abdominal system that may require imaging for diagnosis and management.</li> </ul>	<ul style="list-style-type: none"> <li>• Recognize and understand basic elements of imaging reports and imaging examinations depicting: <ul style="list-style-type: none"> <li>○ Cholecystitis</li> <li>○ Intestinal perforation/pneumoperitoneum</li> <li>○ Ileus</li> <li>○ Intestinal obstruction</li> <li>○ Appendicitis</li> <li>○ Diverticulitis</li> <li>○ Toxic Megacolon</li> <li>○ Liver tumors (primary vs. secondary)</li> <li>○ Jaundice</li> </ul> </li> </ul>
	<p>Chapter 6 –</p> <ul style="list-style-type: none"> <li>• Recognize common diseases of the nervous system that may require imaging for diagnosis and management.</li> </ul>	<ul style="list-style-type: none"> <li>• Recognize and understand basic elements of imaging reports and imaging examinations depicting: <ul style="list-style-type: none"> <li>○ Intracranial hemorrhage</li> <li>○ Ischemic stroke</li> </ul> </li> </ul>

		<ul style="list-style-type: none"> <li>○ Tumors of the brain</li> <li>○ Hydrocephalus</li> <li>○ Low back pain</li> <li>○ Spine fractures</li> </ul>
	<p>Chapter 11–</p> <ul style="list-style-type: none"> <li>• Recognize how the female reproductive organs change with age and during pregnancy.</li> </ul>	<ul style="list-style-type: none"> <li>• Recognize and understand basic elements of imaging reports and imaging examinations depicting: <ul style="list-style-type: none"> <li>○ Normal Pregnancy</li> <li>○ Benign and Malignant tumors of the female reproductive organs</li> <li>○ Ectopic Pregnancy</li> <li>○ Placenta Previa</li> </ul> </li> </ul>
	<p>Chapter 14 –</p> <ul style="list-style-type: none"> <li>• Describe imaging findings related to trauma and common arthritides.</li> </ul>	<ul style="list-style-type: none"> <li>• Recognize and understand basic elements of imaging reports and imaging examinations depicting: <ul style="list-style-type: none"> <li>○ Clavicle fractures and acromioclavicular dislocation</li> <li>○ Acromioclavicular dislocation</li> <li>○ Rotator cuff injuries</li> <li>○ Glenohumeral dislocation with associated fractures (anterior and posterior)</li> <li>○ Elbow fractures (radial head)</li> <li>○ Hand and Wrist fractures (thumb, fifth metacarpal, scaphoid bone, distal radius)</li> <li>○ Pelvic fractures</li> <li>○ Hip fractures (femoral neck, intertrochanteric)</li> <li>○ Knee fractures (tibial plateau)</li> <li>○ Ankle fractures</li> <li>○ Degenerative joint disease (osteoarthritis)</li> <li>○ Other arthritic conditions</li> </ul> </li> </ul>
	<p>Chapter 15 –</p> <ul style="list-style-type: none"> <li>• Discuss the pediatric anatomic and physiologic changes with age.</li> <li>• Discuss when to refer a child for imaging.</li> <li>• Recognize the typical imaging manifestations of accidental and non-accidental trauma.</li> </ul>	<ul style="list-style-type: none"> <li>• Recognize that pediatric anatomy has unique appearances on imaging i.e. organ size, bone epiphyses, etc.</li> <li>• Recognize and understand basic elements of imaging reports and imaging examinations depicting: <ul style="list-style-type: none"> <li>○ Accidental and non-accidental skeletal trauma – including growth plate injuries</li> </ul> </li> </ul>

		<ul style="list-style-type: none"> <li>○ Foreign body ingestion/aspiration</li> <li>○ Urinary tract infection with vesico-ureteral reflux</li> <li>○ Pyloric Stenosis</li> </ul>
	<p>Chapter 16 –</p> <ul style="list-style-type: none"> <li>• Recognize common diseases of the kidneys, ureters, bladder, prostate, seminal vesicles and testes.</li> </ul>	<ul style="list-style-type: none"> <li>• Recognize and understand basic elements of imaging reports and imaging examinations depicting: <ul style="list-style-type: none"> <li>○ Urinary tract obstruction</li> <li>○ Renal tumors – Indeterminate renal mass</li> <li>○ Lower urinary tract symptoms</li> <li>○ Testicular tumors</li> <li>○ Testicular torsion</li> </ul> </li> </ul>
	<p>Chapter 7 –</p> <ul style="list-style-type: none"> <li>• Discuss the main breast imaging techniques.</li> <li>• Recognize the difference between breast screening and a diagnostic work-up.</li> <li>• Recognize when to refer a patient for mammography and breast ultrasound, for assessment of a palpable breast abnormality.</li> <li>• Describe the ACR-BiRads Classification and how it affects management of a patient.</li> </ul>	<ul style="list-style-type: none"> <li>• Communicate the benefits and risks associated with mammography and breast ultrasound.</li> <li>• Recognize and understand basic elements of imaging reports and imaging examinations depicting breast abnormalities.</li> </ul>
	<p>Chapter 12 –</p> <ul style="list-style-type: none"> <li>• Recognize common diseases of the head and neck that may require imaging for diagnosis and management.</li> </ul>	<ul style="list-style-type: none"> <li>• Recognize and understand basic elements of imaging reports and imaging examinations depicting: <ul style="list-style-type: none"> <li>○ Thyroid Nodule</li> <li>○ Facial Fractures</li> <li>○ Sinusitis/Mastoiditis</li> <li>○ Retropharyngeal Abscess</li> <li>○ Epiglottitis - Child</li> </ul> </li> </ul>
	<p>Chapter 13 –</p> <ul style="list-style-type: none"> <li>• Recognize that Vascular and Interventional Radiology plays an important role in patient diagnosis and treatment.</li> </ul>	<ul style="list-style-type: none"> <li>• Discuss the indications, contraindications, and limitations for the following vascular and interventional imaging procedures: <ul style="list-style-type: none"> <li>○ Angiography</li> <li>○ Percutaneous needle biopsy</li> <li>○ Percutaneous fluid drainage (thoracentesis, paracentesis, abscess drainage)</li> </ul> </li> </ul>

		<ul style="list-style-type: none"> <li>○ Venous access (peripherally inserted central catheter (PICC, Tunneled Line)</li> <li>○ IVC filter</li> </ul>
	Demonstrate the appropriate utilization of imaging in clinical situations.	<ul style="list-style-type: none"> <li>• Assess the role of Diagnostic Imaging during clinical encounters.</li> <li>• Use imaging resources appropriately based on strategies, guidelines, and clinical supervision.</li> <li>• Explain to a patient what to expect when having imaging examinations that you request.</li> <li>• Explain the results of the imaging examinations that you have requested to your patients, and their families, in terms that they will understand.</li> </ul>

**Additional Resources:**

\*WEBSITE – Choosing Wisely: <http://www.choosingwisely.org/>