

PEER-TO-PEER GUIDE

Transition to Radiology Residency

Authors:

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Table of Contents

AUTHORS & AFFILIATIONS.....	2
RESIDENCY TIPS & TRICKS.....	3
COMMON ON-CALL CASES.....	3
INTRODUCTION TO RADIOLOGY REPORTS.....	4
APPROACH TO TAKING CASES DURING ROUNDS.....	5
LEARNING TO PROTOCOL STUDIES.....	5
Radiographs.....	5
Ultrasound.....	5
Computed Tomography (CT).....	6
Magnetic Resonance Imaging (MRI).....	7
CONTRAST MEDIA.....	7
Adverse Reactions to Contrast Media.....	7
Pre-medication.....	8
Contrast-Induced Nephropathy (CIN).....	8
RADIATION SAFETY.....	9
Background & Definitions.....	9
Effects of Radiation Exposure.....	9
Radiation Risk Associated with Common Imaging Examinations.....	10
RESOURCES.....	11
Free Resources.....	11
Subscriptions.....	11
APPENDICES.....	12

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Residency Tips & Tricks

Transitioning from your PGY-1 off-service rotations into the realm of medical imaging can be quite challenging and may feel different. Here are some tips and tricks from your colleagues that will hopefully help make this process easier!

In General

- Get enough sleep, bring healthy snacks, and stay hydrated!
- Prioritize and make time for the important things (hobbies, sports, etc.) and people in your life.
- Ask questions and seek help from your senior residents and/or mentors.
- If you are feeling overwhelmed or stressed, your program administrators, program directors, fellow residents, and staff are here to help. Resources are available through your university, hospital, and provincial resident organization to help you navigate this transition. Remember, you are NOT alone.

At Work

- Take breaks to go for a quick walk during the day, weather-permitting.
- Take time to adjust your chair, arm rests, and workstation before starting work every day.
- If there are adjustable workstations, try standing up to dictate.
- Do not be afraid to say, "I am not sure." You are not expected to know everything on day one of a new rotation.
- Reach out to supervising staff whenever you are uncertain about findings that may immediately affect patient safety or care.

Common On-Call Cases

Before starting radiology call, take time to focus your reading and preparation around the following pathologies. As you move through your shifts, you can add to this list and read around the cases accordingly. (*) Varies between institutions.

Body CT

- Appendicitis
- Bowel Obstruction
- Colitis
- Diverticulitis
- GI Bleed
- Mesenteric Ischemia
- Pancreatitis
- Renal Colic
- Trauma

Chest CT

- Acute Aortic Syndrome
- Pulmonary Embolism
- Trauma

Neuro CT

- Acute Stroke
- Intracranial Hemorrhage (ICH)
- Post-Op (NeuroSx)
- Vascular Dissection
- Trauma

MRI

- Acute Spine/Spinal Cord Injuries
- Acute Stroke
- Encephalitis
- Cauda Equina
- Appendicitis (Pregnancy)

Ultrasound

- Appendicitis
- Cholecystitis
- Ectopic Pregnancy
- First-Trimester Bleeding*
- Orchitis/Epididymitis
- Ovarian Torsion
- Retained Products of Conception (RPOC)*
- Testicular Torsion

Fluoroscopy

- Upper GI Series
- NG/NJ Tube Insertion
- Lumbar Puncture

COMMON STRUCTURE

CLINICAL HISTORY	TECHNIQUE	COMPARISON	FINDINGS	IMPRESSION
Pertinent provided history and lab values (check EMR if not provided)	Anatomy, modality, slice thickness, imaging phase, and reformats	Any studies used for comparison	Free form or structured reporting (some institutions use standard templates)	Summary, pertinent conclusions and recommendations, often without medical jargon

Introduction to Radiology Reports

Recommended Reading

- “The Radiology Report: A Guide to Thoughtful Communication for Radiologists and other Medical Professionals” by Curtis Langlotz
- “Style Guidelines for Radiology Reporting: A Manner of Speaking” by Coakley et al.

NOTE: These two pieces of literature differ in opinions in some areas - use what you like.

Helpful Tips

- ALWAYS answer the clinical question in the impression. If not possible, briefly explain why (suboptimal study, artifact, incorrect protocol, etc.).
- Avoid dictating large paragraphs and try spacing out your text. Keep reports simple and easy to read, both for the clinician and for your colleague who will refer to it when comparing studies in the future.
- Describe the anatomical location of the abnormality as best as you can. Remember, your reports should be detailed enough so that a person not looking at the image directly can visually re-create it based on your description.
- Try not to hedge. If you need clinical correlation, try to find that clinical information or speak with the ordering physician. Remember that statements like, “this suggests...”, “this likely represents...”, “this is consistent with...”, “this could represent...”, all describe different levels of uncertainty. Be careful which you use. Our words can have lasting impressions, quite literally! ‘Normal’ is a powerful word.
- Structure your differential diagnoses in order of most to least likely.
- Provide recommendations in your reports if appropriate (i.e. consultations, further imaging). It is safer to suggest a consulting service and let them decide next steps.
- Be concise. Remember, no one wants to read a long report if they do not have to.
- Check your report to make sure there are no spelling mistakes. Your reports are your identity. Concise, accurate, and well-formatted reports will help you stand out.

Approach to Taking Cases During Rounds

DETECT	State patient demography and study indication	Scan provided images for abnormality	Organize your thoughts
DESCRIBE	Clear, concise description	Pertinent positives	Pertinent negatives
DIFFERENTIAL DIAGNOSIS	Summarize findings	Give differential diagnosis	Answer clinical question
DECISION	Correlation with prior imaging and clinical tests	Recommendations (i.e., consultations, lab tests, imaging)	Communication of findings

Learning to Protocol Studies

Learning to protocol studies is a continual process throughout residency. Over time, you will gain experience and feel comfortable with various inpatient, emergency, and outpatient study indications and their respective imaging modalities and protocols. This section will focus on learning to protocol on-call cases.

Radiographs

When in doubt, suggest starting with radiographs (x-rays) to the referring clinician! In fact, radiographs are the first-line imaging modality for osseous pathologies. Even for non-MSK conditions like chest or abdominal pain, you may want to order radiographs to rule out any life-threatening reversible causes. For instance, chest pain in a patient with 85% O₂ sats on room air could be due to a tension pneumothorax for which a chest tube can be inserted right away. Instead of waiting a few hours to get the CT (depending on the list), it is prudent to suggest a plain film assessment as first-line. You can always get additional imaging later, if needed.

Ultrasound

There are few overnight on-call indications for ultrasound imaging. Of note, this list is not exhaustive. Be sure to check with your home institution for any modifications to this list, as this may differ from one institution to another.

Adult Overnight Ultrasound Indications

- Ectopic Pregnancy
- Torsion: Ovarian, Testicular
- *Retained Products of Conception
- *First Trimester Bleeding
- *Organ Transplant-Related
- **Cholecystitis/Choledocholithiasis
- **Appendicitis

* Depending on your institution, this may or may not qualify as an overnight indication.

** May or may not qualify as an overnight indication, depending on the patient demographic. Could offer to do CT overnight if no in-house sonographer or schedule as a callback for next morning.

Computed Tomography (CT)

As radiology residents, we are the gatekeepers when it comes to performing CT scans overnight. It is imperative that we triage the urgency of each scan and determine the best imaging modality and protocol for the provided clinical indication. This often involves a discussion with the referring clinician to clarify symptoms and differential diagnosis prior to performing an imaging study.

CT protocolling can be divided into non-contrast vs. contrast studies. Contrast studies can be timed in different phases: early arterial, late arterial, portal venous, and delayed—each phase has its importance and can be critical in answering the clinical question. Contrast administration includes oral (PO), rectal (PR), intravenous (IV - peripheral or central venous access required) and miscellaneous (e.g., through an ostomy, foley, or suprapubic catheter).

Oral contrast can take approximately 2 hours to pass through the stomach and into the mid-distal small bowel. This is extended to 3-4 hours to reach the large bowel. In certain clinical scenarios, with a compliant patient, rectal contrast may be a fair alternative.

Note that different institutions have subtle differences about how CT studies are performed (e.g., volume of contrast, timing of study), but the general concept remains the same and is as follows:

Non-Contrast Study

- High creatinine clearance or low glomerular filtration rate (generally, this means $eGFR < 30$ but check home institution for respective cut-off values)
- Well documented anaphylactic reaction to the iodinated contrast medium available at your institution
- Assess for renal stones (KUB)
- Assess for acute blood products (hematoma)

IV Contrast-Enhanced Study

- The timing of image acquisition post IV contrast administration is determined by what structures are in question. The study can be tailored to scan the region of interest in the following phases.
- **TIP:** Take time to read about contrast-enhanced CT phases and the [respective timing](#) of each phase. Also, practice protocolling studies while on early rotations to get used to the indications and benefits of each phase.

Common PO and PR-contrast Indications:

- Trauma-related imaging to exclude bowel perforation/anastomotic leak/fistula
- Patients who cannot receive IV contrast due to clearance-related issues can still get PO/PR contrast.

Miscellaneous:

- Via an ostomy
- Via a foley or suprapubic catheter, especially in trauma cases, to assess for bladder injury (minimum 250 cc contrast required to adequately distend bladder)

Magnetic Resonance Imaging (MRI)

- Gadolinium is the contrast of choice for MR imaging.
- Ensure the patient does not have an allergy and meets renal clearance requirements.
- At many institutions, MRI requests are approved by the fellow or staff physician on call. They will help with protocolling and interpreting these studies while you are at a junior resident level. This also varies between institutions as residents are only exposed to MRI starting PGY-3 at some centers. However, basic MRI sequences to become familiar with include:
 - T1 (w/ + w/o fat saturation)
 - T2 (w/ + w/o fat saturation)
 - Diffusion Weighted Imaging (DWI)
 - Apparent Diffusion Coefficient (ADC)
 - Post-Contrast T1 Fat Saturated (T1FS)
 - T2*/Susceptibility Weighted Imaging (SWI)
- Broadly, on-call MRI indications are as follows (again, check with your home institution to verify the details of these indications):
 - Acute Stroke
 - This is particularly useful when there is a high clinical suspicion for acute posterior fossa stroke; the findings of which are not often seen on CT imaging.
 - Spinal Cord Compression/Cauda Equina Syndrome:
 - Multiple causes such as epidural collection (blood, abscess), neoplasm, metastases, and degenerative disc disease.
 - If clinical suspicion arises in the context of known primary malignancy, whole spine imaging may be considered in addition to scanning at the level of neurologic dysfunction.
 - Cord Injury
 - Often in the setting of trauma or immediate post-operative period.
 - Make sure to include a T2*/SWI sequence to look for intra-medullary blood product and epidural hematoma.
 - Acute Appendicitis (Pregnancy)
 - Equivocal ultrasound or appendix not seen on ultrasound.

Contrast Media

Adverse Reactions to Contrast Media

*From the CAR/CSACI Practice Guidance for Contrast Media Hypersensitivity (2025).

Adverse reactions to contrast media range from mild self-limited symptoms to severe life-threatening reactions. These reactions are generally classified as: hypersensitivity reactions, or physiologic reactions. In general, contrast medium administration for all patients should always be taken in the appropriate clinical context, weighing risks, benefits and imaging alternatives.

Modern low-osmolality iodinated contrast medium (LOCM) has significantly lower likelihood of adverse events compared to older high-osmolality agents, estimated at 0.2-0.7%.

Multiple risk factors for increased risk of reactions to ICM (iodinated contrast media) have been reported. However, it is important to note that most patients with these risk factors will not develop allergic reaction after administration of ICM.

For patients with history of hypersensitivity to ICM, switching to a different ICM agent is the BEST protective measure (appendix A). For this reason, in context of acute hypersensitivity reaction, it is important to document the exact agent administered in the radiology report.

In patients with history of hypersensitivity to an **unknown** ICM. If the reaction is reported before 2000, it can be reasonably assumed that the reaction was triggered by a high-osmolality contrast media, and it is therefore safe to give LOCM. If the reaction is reported after 2000, premedication with a second-generation antihistamine could be considered for mild and moderate reactions. (appendix B).

Pre-medication

Second-generation antihistamines could be considered for mild and moderate reactions. Premedication is not recommended for severe reactions.

Premedication with steroids is **NOT** recommended.

Treatment for Anaphylaxis

Intramuscular epinephrine 0.3-0.5 mL of 1mg/mL (1:1000) into the mid-anterolateral thigh, repeated every 5-15 min as needed, is the single most critical intervention.

Contrast-Associated Acute Kidney Injury (CA-AKI)

*From the Canadian Association of Radiologists Guidance on Contrast Associated Acute Kidney Injury (2022) and ACR manual on contrast media (2024).

➡ Definition & Prevalence

Contrast-associated acute kidney injury (CA-AKI) refers to sudden deterioration in renal function after contrast administration without proving causality. Note that CA-AKI does not occur with gadolinium administration. Recent studies suggest that CA-AKI is much less common than previously believed. For example, in patients with a stable baseline eGFR ≥ 45 mL/min/1.73 m², IV iodinated contrast is not an independent nephrotoxic risk factor. Similarly, in patients with a stable baseline eGFR 30-44 mL/min/1.73 m², IV iodinated contrast media carry a very low or negligible risk of AKI.

➡ Risk Factors

The strongest risk factor for CA-AKI is **pre-existing severe chronic kidney disease (eGFR <30)**. Multiple other risk factors have been proposed including recent AKI, hypovolemia or dehydration, hemodynamic instability, those receiving a high volume of contrast especially through the arterial route, and concurrent nephrotoxic medications. Evidence for additional risk factors (e.g., diabetes mellitus, multiple myeloma, hypertension) is weak when renal function is otherwise normal.

➡ Risk Thresholds

There is no agreed-upon serum creatinine or eGFR threshold at which the risk of CA-AKI is so great that intravascular iodinated contrast medium should not be administered. **However, if a threshold for CA-AKI risk must be used, eGFR <30 has the greatest level of evidence.** In any patient, the risk of contrast administration must be weighed against the benefits, as failure to diagnose an important clinical entity can have serious consequences on patient morbidity and mortality.

➔ CA-AKI in Renal Disease

It is important to note that no serum creatinine or eGFR threshold is adequate to risk stratify patients with AKI because serum creatinine is unreliable in this setting. As a rule, administration of iodinated contrast medium in patients with AKI should only be performed if the benefit to the patient outweighs the risk, as these patients are particularly susceptible to nephrotoxin exposure. Patients with anuric end-stage renal disease (ESRD) without a functioning transplant kidney are not at risk for CA-AKI because their kidneys are nonfunctional. These patients may receive iodinated contrast when clinically necessary. Routine urgent dialysis following contrast administration is not required, and dialysis schedules generally do not need to be altered.

➔ Prevention

- Avoid contrast administration, when possible, in patients with AKI or severe chronic kidney disease, unless the benefits outweigh the risks.
- Use low-osmolar or iso-osmolar iodinated contrast media.
- Avoid multiple contrast exposures within a short time interval when possible.
- Sodium bicarbonate and N-acetylcysteine (NAC) are not routinely recommended due to limited and contradicting evidence.

Radiation Safety

Radiologists are responsible for ensuring patient safety during imaging studies that utilize ionizing radiation. Ultimately, the benefits of the examination should outweigh the potential hazards. The acronym **ALARA** – “As Low As Reasonably Achievable” – is often used when discussing radiation safety as a reminder that radiation exposure should be minimized while still obtaining necessary diagnostic information. In addition to protecting patients, radiologists also have a key role in protecting themselves and other healthcare professionals.

The purpose of this document is to serve as an overview of basic radiation safety concepts for residents. More detailed information on minimizing radiation risk can be found at [Image Wisely website](#), or [Image Gently \(for Pediatrics\)](#).

Background & Definitions

- **Absorbed dose:** The amount of radiation absorbed per unit mass of tissue. Measured in Grays (Gy).
- **Equivalent dose:** The absorbed dose multiplied by a radiation weighting factor (w_R) that considers the differing biological effects of various types of radiation on tissues. Measured in Sieverts (Sv).
- **Effective dose:** Estimates overall biological risk by incorporating both the equivalent dose and tissue weighting factors (w_T) that reflect the differing radiosensitivity of organs and tissues. Measured in millisieverts (mSv).

While the type of radiation used and overall dose is important, the **radiosensitivity** of the tissue also plays a key role in determining the possible side effects. For example, bones and soft tissues are much more resistant to radiation exposure than glandular breast or thyroid tissues, so special care should be taken to minimize radiation to these areas.

Effects of Radiation Exposure

*From the ACR-SPR Practice Parameter and Radioisotope Safety Content (RISC) Study Guide 2025.

The effects of radiation exposure can be divided into 2 categories: non-stochastic (or deterministic) and stochastic. The differences are outlined in Table 1 below.

Table 1. Non-stochastic and stochastic effects of radiation exposure

Non-stochastic (deterministic) effects	Stochastic effects
<ul style="list-style-type: none">• Only occur once specific threshold of exposure has been exceeded• Severity increases with dose• E.g., skin erythema, cataracts, sterility, radiation sickness	<ul style="list-style-type: none">• No specific threshold (i.e. any amount can cause harm)• Severity independent of dose• Cumulative effect over time• E.g., cancer, genetic damage

The primary risk associated with exposure to ionizing radiation is **cancer induction**. It is estimated that approximately 1 in 1,000 individuals will develop cancer from an exposure of 10 mSv which is relatively small compared to the risk of developing cancer from all other causes. Radiation-induced cancer has a **latency period of 10-20 years** or more, so those with a higher life-expectancy (i.e., children) are at greater risk.

Radiation Risk Associated with Common Imaging Examinations

The **ACR Appropriateness Criteria** is a useful reference designed to guide physicians in selecting the most appropriate imaging test for a specific clinical question. The **relative radiation levels**, which is based on the effective dose, can be used to compare the relative risk of different imaging examinations.¹

Special populations

Children

Radiation-induced cancer mortality risk in children is 3-5 times higher than adults due to their increased tissue radiosensitivity and longer life expectancy. The latency period for radiation-induced malignancy varies but is approximately 10 years for leukemia and longer for solid tumors. Care should be taken to select the study with the lowest possible radiation dose and to utilize pediatric-specific imaging protocols whenever possible.

Pregnancy

Establishing the pregnancy status of female patients is imperative prior to exposing the patient and embryo/fetus to ionizing radiation. Potential radiation-induced effects on the fetus include prenatal death, fetal growth restriction (FGR), neurodevelopmental effects (e.g., reduced IQ), congenital malformations, and an increased risk of childhood cancer, depending largely on gestational age and radiation dose. The probability of these effects occurring is largely related to the fetal age at the time of the exam and the radiation dose.

Whenever possible, imaging alternatives that do not use ionizing radiation (e.g., ultrasound or MRI) should be considered. Some imaging examinations can be safely performed with minimal fetal radiation exposure, such as chest or extremity radiographs, as well as head or chest CT, because the fetus is outside the primary beam. For studies that directly irradiate the abdomen or pelvis, efforts should be made to minimize dose, including optimization of scan parameters and avoidance of multiphase or repeat acquisitions.

Protecting yourself

Appropriate measures should be taken to protect yourself and other members of the healthcare team involved in imaging acquisition. Time, distance, and shielding are the primary methods used to reduce occupational radiation exposure. Maintaining a safe distance from the radiation source and wearing appropriate protective equipment (i.e., lead aprons) can help reduce your exposure.

¹ <https://edge.sitecorecloud.io/americancoldf5f-acrorgf92a-productioncb02-3650/media/ACR/Files/Clinical/Appropriateness-Criteria/ACR-Appropriateness-Criteria-Radiation-Dose-Assessment-Introduction.pdf>

Resources

Free Resources

Radiology Assistant

- High-yield radiology topics that are easy to understand and read
- Great diagrams and tables to explain concepts

Head-Neck-Brain-Spine

- Interactive multi-planar CT/MRI neuroanatomy with a quiz mode to test your anatomy
- Cases with detailed explanations and answers

Radiopaedia

- Great for quick synopses of pathologies
- Images to demonstrate findings (some of which you can scroll through)

Radiology Masterclass

- Good general primer for starting radiology
- Interactive images including annotations

Radiology Resident Core Lecture Series

- Didactic lectures classified by body system
- Easy to browse by topic

Subscriptions

IMAIOS e-Anatomy

- Annual subscription, **generally covered by your program**
- Very detailed interactive multi-planar anatomy with various options to display or hide certain systems. Imaging modalities include plain films, CT, and MRI.
- Very helpful when trying to identify the structure that is abnormal

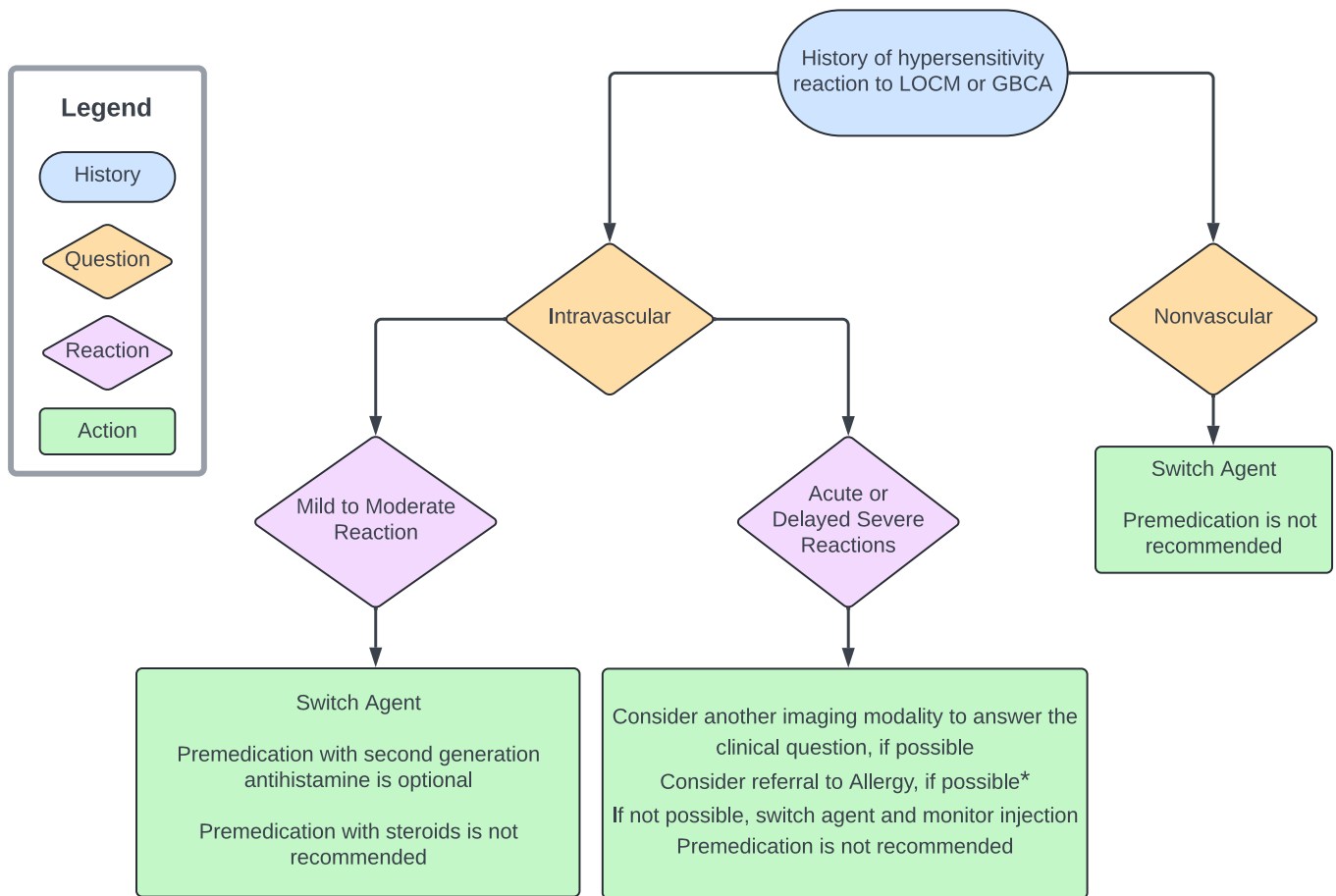
StatDx

- Annual subscription, **generally covered by your program** (trainee STATdx+ RADPrimer Bundle 12-month subscription available)
- Detailed synopses of pathologies with images demonstrating the findings, generally more detailed than Radiopaedia (especially the radiology findings)
- Very helpful for call and for considering/ruling out differential diagnoses

Medality

- Annual subscription, covered by a few programs
- Extensive course libraries including content on anatomy, physiology, common and uncommon pathologies, through all modalities; DICOM cases available for review

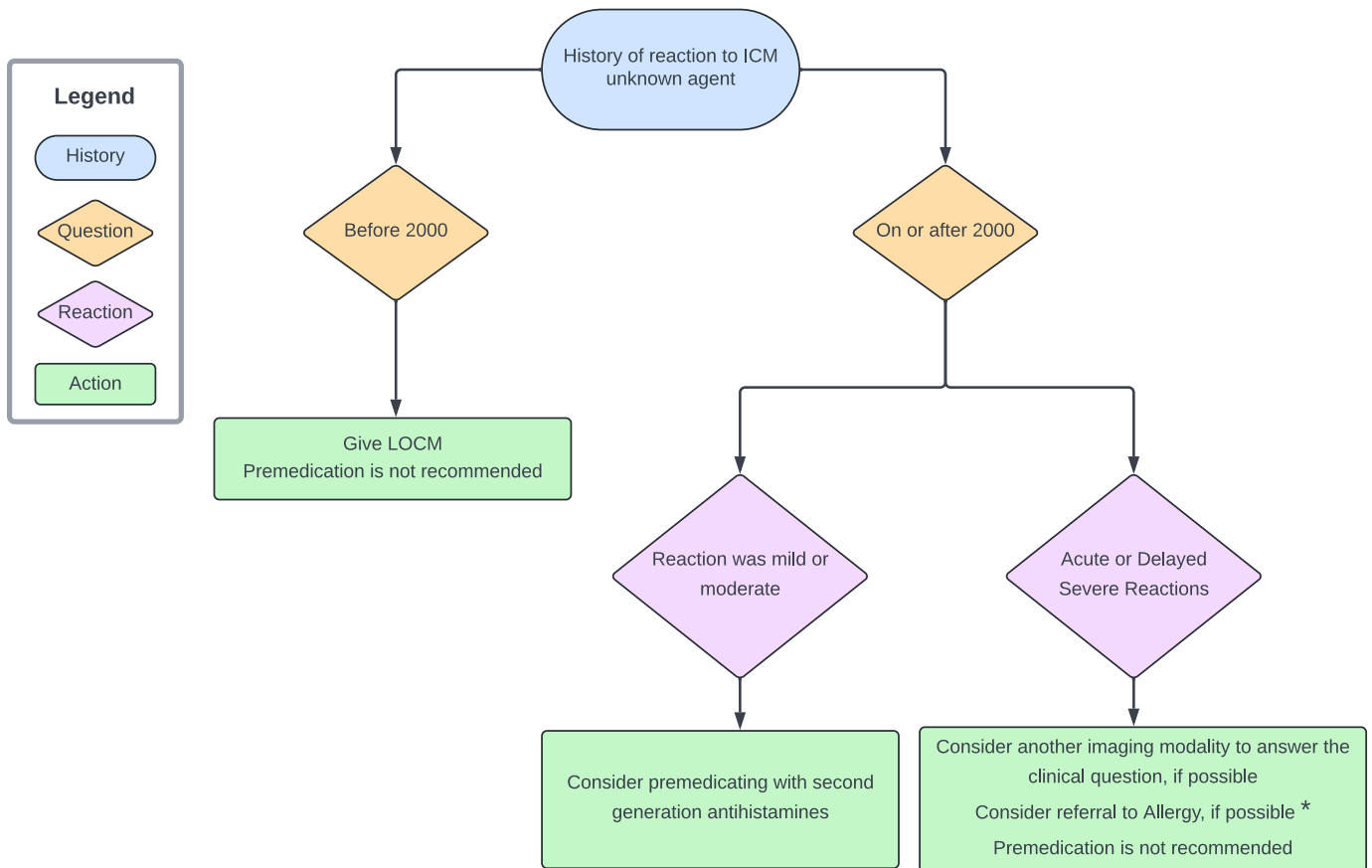
Appendix A



* If access to an allergist and urgency of medical imaging allows.

Byrne A, Macdonald DB, Kirkpatrick IDC, et al. CAR/CSACI Practice Guidance for Contrast Media Hypersensitivity. *Canadian Association of Radiologists Journal*. 2025;76(3):400-416. doi:10.1177/08465371241311253

Appendix B



* If access to an allergist and urgency of medical imaging allows.

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