From Classroom to Practice: Dynamic Patient Safety Curriculum for Radiology Trainees

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• None
Purpose

Rendering high quality and safe patient care should be a top priority of every practicing radiologist, and is increasingly the focus of the national healthcare agenda.
Acknowledging the need for formal structured teaching on patient safety, the American Board of Radiology (ABR) and Accreditation Council for Graduate Medical Education (ACGME) have established Patient Safety as an important milestone of core competency. However, curricula to meet these milestone levels in Radiology are not widely published. To this end, the Diagnostic Radiology program at the University of North Carolina constructed a dynamic curriculum to assess and improve residents’ knowledge of patient safety.
Methods

Faculty and a senior resident developed a Patient Safety curriculum covering ACGME Milestone criteria to include radiology specific areas of interest. All residents participated in the following: radiation safety formal didactics, contrast reaction simulation laboratory, MR safety self study module with pre- and post-surveys. Interactivity was a key component. The simulation lab was modeled after the “mega-code” scenarios, proven tools used in ACLS/BLS training.
Results

We achieved compliance with ABR and ACGME requirements using a multifaceted approach: a resident formal didactic curriculum over a two year cycle, a contrast reaction simulation laboratory with scenarios and training to include take home pocket cards, and an MR safety education self-study module. 32 residents participated
Results continued

There were statistically significant increases in knowledge of patient safety and high satisfaction regarding the course. MR safety education module pre- and post-tests scores of 32% and 74% (\(p < 0.001\)). Residents’ personal gauge of knowledge before and after participation in the MRI safety module yielded improved sentiment of being extensively trained and educated in MRI safety (\(p<0.001\)). Survey responses were unanimously favorable towards the contrast reaction simulation lab and pocket contrast reaction card.
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<tr>
<th>REACTION</th>
<th>TREATMENT</th>
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<td>ANY SEVERE REACTION</td>
<td>Activation of a rapid response or code can be performed at any stage of the below algorithms depending on the patient's condition and clinical judgement.</td>
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| URTICARIA                       | 1. Discontinue injection if not completed  
                                   2. No treatment needed in the majority of cases  
                                   3. H1-receptor blocker: diphenhydramine (Benadryl) PO/IV 25-50 mg |
| SEVERE DISSEMINATED URTICARIA    | Alpha-Agonist: Epinephrine SC (1:1,000) 0.1-0.3 ml (0.1-0.3 mg) |
| FACIAL or LARYNGEAL EDEMA       | 1. Administer epinephrine based on BP status. ***May repeat q15m up to 1.0 mg  
                                   * Norepinephrine: Alpha-Agonist: Epinephrine SC (1:1,000) 0.1-0.3 ml (0.1-0.3 mg)  
                                   * Hypotensive: Alpha-Agonist: Epinephrine IV (1:10,000) 1.0 ml (0.1 mg)  
                                   2. Administer O2 6-10 L/min (via mask)  
                                   3. If not responsive to therapy, then call for assistance |
| BRONCHOSPASM                    | 1. Administer O2 6-10 L/min (via mask)  
                                   2. Beta-agonist inhaler: Albuterol, terbutaline, or metaproteranol 2-3 puffs  
                                   3. Administer epinephrine based on BP status. **May repeat q15m up to 1.0 mg  
                                   * Norepinephrine: Alpha-Agonist: Epinephrine SC (1:1,000) 0.1-0.3 ml (0.1-0.3 mg)  
                                   * Hypotensive: Alpha-Agonist: Epinephrine IV (1:10,000) 1.0 ml (0.1 mg)  
                                   4. If not responsive to therapy, then call for assistance |
| HYPOTENSION WITH TACHYCARDIA    | 1. Elevate legs to 60° or more. If unable to elevate legs, then place in Trendelenburg positioning  
                                   2. Administer O2 6-10 L/min (via mask)  
                                   3. Administer large volume of lactated ringsers or normal saline  
                                   4. If not responsive to above, then administer epinephrine based on BP status. ***May repeat q15m up to 1.0 mg  
                                   * Norepinephrine: Alpha-Agonist: Epinephrine SC (1:1,000) 0.1-0.3 ml (0.1-0.3 mg)  
                                   * Hypotensive: Alpha-Agonist: Epinephrine IV (1:10,000) 1.0 ml (0.1 mg)  
                                   5. If not responsive to all of the above therapy, then call for assistance |
| HYPOTENSION WITH BRADYCARDIA    | 1. Elevate legs to 60° or more. If unable to elevate legs, then place in Trendelenburg positioning  
                                   2. Administer O2 6-10 L/min (via mask)  
                                   3. Administer large volume of lactated ringsers or normal saline  
                                   4. If not responsive to above, then administer atropine 0.6-1.0 mg IV slowly. May repeat atropine up to total of 0.04 mg/kg (~2.3 mg) (150 lb = 2.7 mg, 200 lb = 3.6 mg)  
                                   5. If not responsive to all of the above therapy, then call for assistance |
| VASO-VAGAL REACTION             | 1. Nitroglycerin 0.4 mg tablet, sublingual (may repeat x 3); topical 2% ointment apply one inch strip  
                                   2. If no response, labetalol 20 mg IV, then 20 - 80 mg IV q10 min up to 300 mg  
                                   3. If a pheochromocytoma is suspected, phentolamine 5.0 mg (1.0 mg in children) IV  
                                   4. If not responsive to therapy, then call for assistance. Will need ICU or ED transfer. |
| HYPERTENSION, SEVERE            | 1. Administer O2 6-10 L/min (via mask)  
                                   2. Administer diazepam (Valium) 5 0mg or midazolam (Versed) 2.5 mg IV  
                                   3. If extended coverage is needed, then consider phenytoin (Dilantin) infusion 15-18 mg/kg at 50 mg/min  
                                   4. Call for assistance. Neurology vs. ED transfer. |
| SEIZURES/ CONVULSIONS           | 1. Elevate torso  
                                   2. Administer O2 6-10 L/min (via mask)  
                                   3. Administer tirosomide (Lacox) 40 mg IV, slow push  
                                   4. Consider morphine 1-3 mg IV  
                                   5. Call for assistance. Will need ICU or ED transfer. |
| PULMONARY EDEMA                 | 1. Elevate torso  
                                   2. Administer O2 6-10 L/min (via mask)  
                                   3. Administer tirosomide (Lacox) 40 mg IV, slow push  
                                   4. Consider morphine 1-3 mg IV  
                                   5. Call for assistance. Will need ICU or ED transfer. |
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<th>TIMEFRAME</th>
<th>PREMEDICATION REGIMEN</th>
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| ELECTIVE  | 1. Prednisone 50 mg PO at 13, 7, and 1 hour prior to contrast + 50 mg PO/IV Benadryl 1 hour prior to contrast (standard outpatient regimen)  
   2. Methylprednisolone (Medrol) 32 mg PO 12 and 2 hours prior to contrast + 50 mg PO/IV/IM Benadryl 1 hour prior to contrast  
   3. Hydrocortisone 200 mg IV 12 and 2 hours prior to contrast + 50 mg IV Benadryl 1 hour prior to contrast (IV only option) |
| EMERGENT  | **The below options are listed in order of decreasing desirability**  
   1. Methylprednisolone sodium succinate (Solu-Medrol) 40 mg or hydrocortisone sodium succinate (Solu-Cortef) 200 mg IV q4h until contrast study required plus Benadryl 50 mg IV 1 hour prior to contrast  
   2. Dexamethasone sodium sulfate (Decadron) 7.5 mg or betamethasone 6.0 mg IV q4h until contrast study must be done in patient with known allergy to methylprednisolone, aspirin, or non-steroidal anti-inflammatory drugs, especially if asthmatic. Also diphenhydramine (Benadryl) 50 mg IV 1 hour prior to contrast injection  
   3. Omit steroids entirely and give diphenhydramine (Benadryl) 50 mg IV. |

Note: IV steroids have not been shown to be effective when administered less than 4 to 6 hours prior to contrast injection.

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<th>SEVERITY</th>
<th>CONTRAST EXTRAVASATION MANAGEMENT</th>
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| ALL      | 1. Evaluate the patient specifically for diminished pulses, swelling, decreased range of sensation, decreased muscle strength, decreased capillary refill, and skin changes  
   2. Ask about pain  
   3. Manage as per below depending on severity  
   4. Document event, discussion with patient, and return precautions. Use the extravasation macro. If an outpatient, relay an EPIC inbox message to the ordering physician. If an inpatient, call the ordering physician to relay information |
| NO SIGNS OR SYMPTOMS | 1. Explain signs and symptoms to patient to be aware of and document in dictation  
   2. Recommend elevation and warm or cold compresses |
| MILD SIGNS OR SYMPTOMS | 1. Closely observe patient over the next 2 hours for worsening signs and symptoms  
   2. If worsening symptoms, then have a low threshold for surgery consultation  
   3. If improving symptoms at end of 2 hours, then follow the “No Signs of Symptoms” algorithm |
| SEVERE SIGNS OR SYMPTOMS | 1. Stat plastic surgery consult for possible compartment syndrome, local tissue damage, or skin necrosis |

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<th>DRUG(S)</th>
<th>WEIGHT BASED DOSING</th>
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<td>IV EPINEPHRINE</td>
<td>Epinephrine (IV)* IV 0.1 mL / kg of 1:10,000 dilution (0.01 mg / kg); administer slowly into a running IV infusion of fluids; can repeat every 5 – 15 min, as needed, max = 1 mL (1 mg) total.</td>
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<tr>
<td>IM EPINEPHRINE</td>
<td>Epinephrine (IM)* IM 0.01 mL / kg of 1:1,000 dilution (0.01 mg / kg); max 0.30 mL (0.30 mg); can repeat every 5-15 minutes, max = 1 mL (1 mg) total.</td>
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<tr>
<td>IM/IV/PO DIPHENHYDRAMINE</td>
<td>Diphenhydramine (Benadryl) IV/PO 1 mg/kg; max = 50 mg; administer IV dose slowly over 1 - 2 minutes</td>
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<tr>
<td>CONTRAST PREMEDICATION REGIMEN</td>
<td>Prednisone 0.7 mg/kg (not to exceed 50 mg) PO at 13, 7, and 1 hour prior to contrast + 1 mg/kg (not to exceed 50 mg) PO/IV Benadryl 1 hour prior to contrast (standard outpatient regimen)</td>
</tr>
</tbody>
</table>
Conclusions

The Diagnostic Radiology program at the University of North Carolina constructed a successful curriculum that improved residents’ knowledge of patient safety and fulfilled regulatory agency requirements.