

# Call for help! Creating an efficient emergency response protocol in an outpatient imaging center

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## The Problem

In 2015, a patient at our Outpatient Imaging Center (OPIC) experienced an anaphylactic reaction to intravenous contrast. The CT technologist yelled for help. Multiple staff responded, though many were uncertain of their role in the response (Fig 1). Medication and supplemental oxygen administration was delayed, and IV fluids were difficult to locate. Multiple staff simultaneously called 911 (Fig 2), and the paramedics had difficulty distinguishing OPIC from the surrounding office buildings.



Fig 1. Distressed patient and staff confusion

Several **problem points** identified:

1. Staff role delineation
2. Medication and supply locations
3. Medication dosing
4. Facility location identification



Fig 2. Who calls 911?

## PLAN

1. Design an Emergency Response Poster to outline the steps of our new protocol  
Benefits of this poster:
  - Standardized response protocol, per ACR Manual on Contrast Media<sup>2</sup>
  - Staff **role delineation** – color coded for specific staff positions
  - Explicit medication dosing
  - Facility address to assist 911 callers
2. Designate location for the emergency response kit (medications, supplemental oxygen)
3. Install intercom system to facilitate rapid contact from CT/MRI to nursing
4. Initiate regular mock drills to reinforce understanding of the protocol
5. Use a survey to **measure success** of the new protocol. Employ Likert scores (range 1-5; 1=not comfortable/unknown, 5 = very comfortable/well known). We aimed to achieve scores of 4-5 to demonstrate high competence with the protocol. The survey consisted of three questions:
  - i. How comfortable do you feel if you had to respond to an emergency in the imaging center?
  - ii. Do you know your role during an emergency response?
  - iii. Do you know your resources if you have questions about the emergency response procedure at the imaging center?

## Banner Outpatient Imaging Center (OPIC)

### Emergency Response Procedure

Staff and Patient Safety is the Top Priority	
CT Technologist:	Keep CT Door to Hallway Open
MRI Technologist:	BEFORE ENTRY EVERYONE: Pat down and Remove all metal on their person Immediately MOVE patient safely to "Safe Zone" and <u>secure door to MRI Room</u> "Safe Zone" is between CT and MRI Keep door to Hallway Open
Only approved equipment allowed in MRI Room, any other requires Entech approval. NO OXYGEN TANKS in MRI ROOM	

Contrast Media Reactions	Contrast Extravasation	Vaso-Vagal Reactions
<b>Step 1</b> MRI or CT push "Call Button" <b>Step 2</b> Scheduler Vocera state (Broadcast Women's Imaging) "Nurse Now" 3 times to CT/MRI <b>Step 3</b> Nurse/RN Assess patient and execute physician's order set <b>Step 4</b> Tech Aide Vocera Supervisor or Designee <b>Step 5</b> Supervisor or Designee contact Radiologist <b>Step 6</b> Tech Aide bring Oxygen and Emergency Respiratory Supplies <b>Step 7</b> Nurse/RN <ul style="list-style-type: none"><li>- Maintain airway</li><li>- Support Breathing with supplemental oxygen apply O2 @ 2L/nasal prongs</li><li>- Apply Vital Signs Monitor and Pulse Oximetry (SPO2 &gt;90%)</li><li>- Initiate IV fluid bolus of 0.9% normal saline 250cc over 15minutes</li><li>- <b>Per order of Radiologist</b> give Benadryl (diphenhydramine) 50mg IVP</li><li>- <b>Per order of Radiologist</b> give Epinephrine dilution 1:1000 (1mg/ml) 0.3mg-1.0mg (max) subq or IM.</li><li>- Draw medication up in 1cc syringe give epinephrine in 0.1ml (100mcg/0.1ml) increments as ordered.</li><li>- (Have epinephrine abbo-jet available 1:10,000 dilution/10ml. Give IV 1ml of 1:10,000 dilution (0.1mg); administer slowly into running IV infusion of saline flush; can repeat every few minutes as needed up to 10ml (1mg)</li><li>- <b>Per order of Radiologist</b> give sola-cort (hydrocortisone) 100mg IVP</li></ul> <b>Step 8</b> Supervisor or Designee will call 911 if condition deteriorates per discretion of RN/Radiologist <ul style="list-style-type: none"><li>- Patients name and age</li><li>- Patient condition</li><li>- Location address, phone number, and where on BGMC campus</li><li>- Scheduler to wait for ambulance to guide ER rescue staff to patient location</li></ul>	<b>Step 1</b> Report to Imaging Radiologist: <ul style="list-style-type: none"><li>- Type / Amount of contrast</li><li>- Age of patient</li><li>- General condition of affected extremity</li><li>- Patient symptoms: pain, burning, swelling, numbness, discoloration</li></ul> <b>Step 2</b> Mark boundaries of extravasation on skin <b>Step 3</b> Measure circumference of the extravasation <b>Step 4</b> Elevate extremity <b>Step 5</b> Apply cold compresses for 15 min on and 15 min off, for 2 hours. *** Insulate patient's skin from cold compresses, with towel first	<b>Step 1</b> MRI or CT push "Call Button" <b>Step 2</b> Scheduler Vocera state (Broadcast Women's Imaging) "Nurse Now" 3 times to CT/MRI <b>Step 3</b> Nurse/RN Assess patient and execute physician's order set <b>Step 4</b> Tech Aide Vocera Supervisor or Designee <b>Step 5</b> Supervisor or Designee contact Radiologist <b>Step 6</b> Tech Aide bring Oxygen and Emergency Respiratory Supplies <b>Step 7</b> Nurse/RN <ul style="list-style-type: none"><li>- Trendelenburg position elevate legs</li><li>- Assess airway and breathing</li><li>- Cold compress</li><li>- Apply Vital Signs monitor and pulse oximetry</li><li>- Ammonia Inhalant</li><li>- If signs and symptoms resolve, continue with procedure.</li></ul> <b>Step 8</b> Tech Aide Vocera Supervisor or Designee <b>Step 9</b> Tech Aide bring Oxygen and Emergency Respiratory Supplies <b>Step 10</b> Nurse/RN If signs and symptoms are not resolving <ul style="list-style-type: none"><li>- Initiate IV fluid bolus of normal saline 0.9% normal saline 250cc over 15 minutes.</li><li>- If patient develops symptomatic bradycardia or hypotension RN to give Atropine 0.5 – 1.0mg max IVP <b>Per order of Radiologist</b></li></ul> <b>Step 11</b> Supervisor or Designee call 911 if patient condition deteriorates per discretion of RN/Radiologist <ul style="list-style-type: none"><li>- Patients name and age</li><li>- Patient condition</li><li>- Location address, phone number, and where on BGMC campus</li><li>- Scheduler to wait for ambulance to guide ER rescue staff to patient location</li></ul>

Medical Imaging Radiologist	Nurse/RN	Supervisor or designee	MRI and CT Technologist	Scheduler	Tech Aide	Mammo or US Technologist

MDA Imaging Center  
Canyon Springs Medical Plaza  
2940 E Banner Gateway Dr. Suite #150  
480-543-6900 press 1

Fig 3. OPIC emergency response poster

## DO

1. Created the emergency response poster (Fig 3)
2. Secure poster in critical locations in department (Fig 4)
3. Location chosen for the emergency response kit in the nursing area (Fig 5)
4. Intercom system purchased and deployed (Fig 6)
5. Scheduled an OPIC team meeting to review the new protocol. Distribute the QI survey before and immediately after the meeting.
6. Performed a mock drill three months after the initial meeting to assess for continued understanding. Distributed the QI survey after this mock drill.

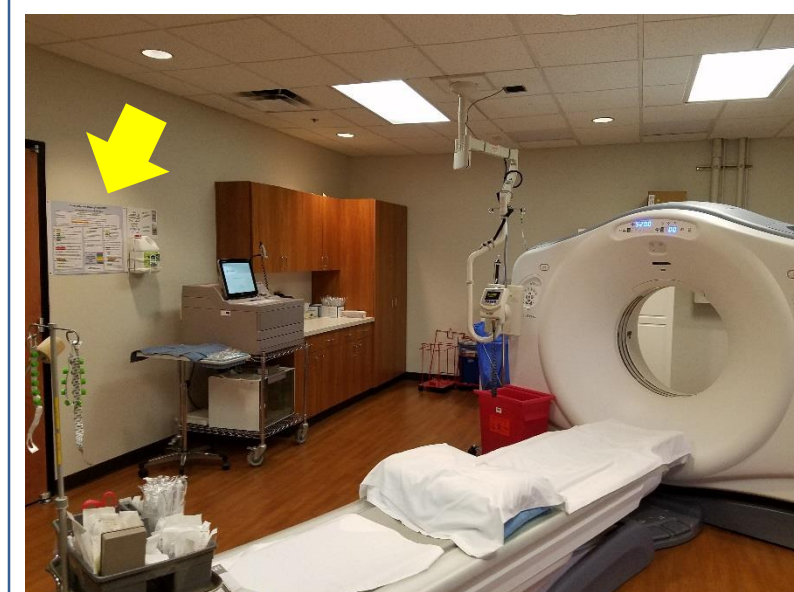


Fig 4. Poster (arrow) placed in CT room



Fig 5. Response kit and oxygen stay in nursing area

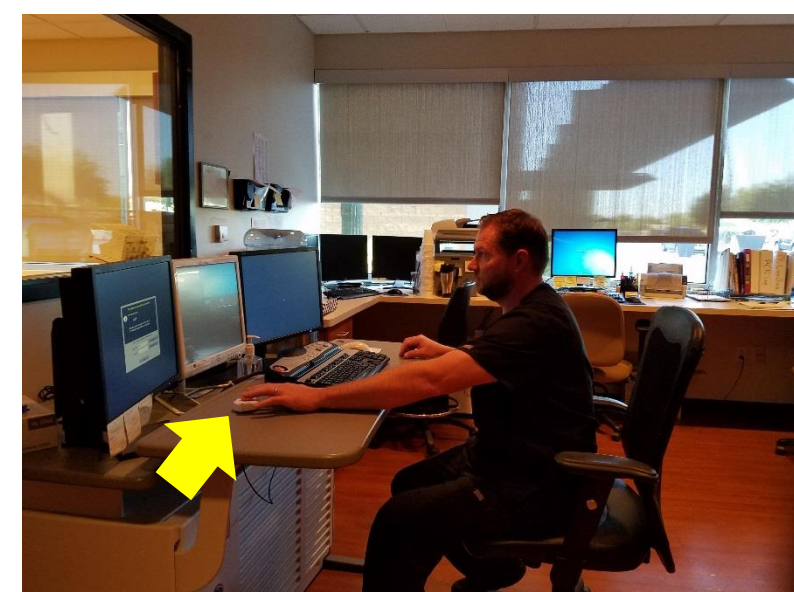


Fig 6. Intercom (arrow) readily accessible for CT technologists

## STUDY

Pre- and post-intervention survey scores are as follows:

	Pre-Intervention (n=18)			Post-intervention immediately after first meeting (n=18)			After mock drill (n=15)		
	Question 1	Question 2	Question 3	Question 1	Question 2	Question 3	Question 1	Question 2	Question 3
Mean	2.9	3.1	3.7	4.6	4.9	5.0	4.8	4.9	4.9
SD	1.0	1.2	1.1	0.5	0.2	0.0	0.4	0.3	0.3

Mean Likert scores **increased significantly** after the initial protocol review meeting ( $p < 0.0001$  for all three survey questions). After the mock drill, mean Likert scores did not significantly change relative to the initial post-review meeting survey ( $p = 0.4, 0.49, 0.3$ , respectively).

In the *study* phase of the mock drill, the QI team discussed areas for improvement. We discovered that the intercom system had a nonfunctional battery.

## ACT

The emergency protocol implementation was deemed **successful** based on the persistent high comfort/understanding reflected on the QI survey (Fig 7). In fact, several weeks after the mock drill, the OPIC staff further proved their competence by using the protocol to efficiently and safely respond to a true contrast reaction. During the *Act* phase, the QI team initiated next steps:

1. Distributed copies of the poster throughout the remainder of OPIC
2. Designated a technologist to replace the intercom battery quarterly
3. Scheduled semi-annual mock drills to reinforce understanding of the protocol and educate newly hired staff



Fig 7. Confident staff = safe, consistent, high quality care

Due to the success of our small scale project, our healthcare organization, Banner Health, plans to **widely disseminate** similar emergency response protocols within other departments. For example, inpatient and cancer center radiology areas, infusion, and inpatient nursing floors plan to adapt our protocol to emergency scenarios that are specific to their clinical areas.

## Conclusions

Our emergency response QI project highlights several take home points for other institutions:

1. A successful PDSA cycle requires **team engagement**, measurable data, and continuous improvement.
2. In an emergency situation, **role delineation** is critical to minimize confusion and errors.
3. A **standardized and simple** protocol decreases variability in emergency response, improves safety and team efficiency, and promotes adherence to professional organization guidelines.

## Contact

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## References

1. Taylor MJ, McNicholas C, Nicolay C, et al. Systematic review of the application of the plan-do-study-act method to improve quality in healthcare. *BMJ Qual Saf* 2014; 23: 290-298.
2. ACR Committee on Drugs and Contrast Media. ACR Manual on Contrast Media version 10.3. 2017.