Radiology Life Support Practical Applications

A new approach to improve radiologist and technologist response to emergencies in radiology

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Background

In the past, approaches to improve radiologist and technologist preparation for responding to emergencies have included American Red Cross CPR training, American Heart Association's Pediatric Advanced Life Support (PALS) course, and annual radiology "life support" (RLS) lectures. Despite these interventions, a training simulation/mock code conducted in the radiology department revealed suboptimal performance by both the radiologists and technologists.

Problem

In conventional emergency training programs, much of the training is irrelevant to actual emergencies experienced in the radiology department. In PALS, the focus is typically on relatively advanced concepts such as emergency medication doses, and cardiac rhythm assessment—skills which are less relevant to the first few moments of an emergency situation. Participants in our simulated emergency lacked confidence in handling more basic aspects of care, such as connecting oxygen tubing, calling for assistance, and locating and using basic equipment such suction catheters and oxygen delivery devices.

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Purpose

A radiology life support “practical applications” program was devised to improve the confidence of the radiologists and technologists to handle the first few moments of a patient emergency.

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Methods

A multidisciplinary planning team was formed consisting of two nurses, a technologist and a radiologist. Initial planning focused on keeping training concise, nonthreatening and salient to the individual's position. A "back-to-basics", hands-on format was agreed upon. Needed skills were identified based on the fact that, in most instances, the code team is just minutes away. Four skill stations were chosen: 1) O_2 and suction [Fig. 1], 2) crash cart/emergency equipment [Fig. 2], 3) airway management/bag-valve-mask [Fig. 3], and 4) "directing the first 5 minutes of a code" [Fig. 4]. Key teaching points for each station were developed.

Fig. 1 O2 and suction

Fig. 2 Crash cart /emergency equipment

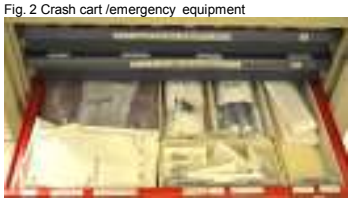

Fig. 3 Bag-valve-mask ventilation

Fig. 4 First 5 minutes of a code

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Methods

Separate "RLS practical applications" exercises for radiologists and technologists were scheduled over the noon hour. Attendance was highly encouraged but not mandatory. The sessions began with a 10 minute orientation [Fig. 5] followed by small group rotation to a new station [Figs. 6 & 7] every 10 minutes. Each station involved an interactive, hands-on teaching experience taught by a nurse or technologist. Participants checked themselves off on each key teaching point.

Fig. 5 Noon conference lecture

Fig. 6 "directing first 5 minutes of a code"

Fig. 7 Crash cart/emergency equipment

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Methods

Key teaching points: O_2 and suction [Fig. 8]

- ❑ Locate personal protective equipment: gloves, goggles, gown, mask
- ❑ Find O_2 and suction
- ❑ Make sure canister is firmly in well and red connector is securely attached
- ❑ Attach suction tubing to suction canister
- ❑ Determine appropriate size of suction catheter*
- ❑ Attach suction catheter to suction tubing
- ❑ Turn suction on to appropriate level*
- ❑ Suction the airway with suction catheter
- ❑ Suction the airway with a Yankauer suction tip
- ❑ Attach green oxygen tubing to wall O_2
- ❑ Determine appropriate O_2 mask size
- ❑ Attach green tubing to O_2 mask
- ❑ Determine appropriate O_2 flow rate*
- ❑ Turn on O_2 to appropriate flow rate and make sure O_2 is flowing

Fig. 8 O2 and suction

* = information found on badge cards [Fig. 11 & 12]

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Key teaching points: Bag-valve-mask Ventilation [Fig. 9]

- ❑ Locate O_2 and suction
- ❑ Open small airway box, find the stethoscope
- ❑ When would you use an oral airway?
- ❑ Find appropriate size oral airway - insert oral airway – remove oral airway
- ❑ Locate appropriate size face mask for patient
- ❑ Inflate mask cuff
- ❑ Describe when to use Ambu bag vs. Mapleson
- ❑ Locate appropriate size bag for patient*
- ❑ Connect mask and bag
- ❑ Connect O_2 to bag – turn O_2 to appropriate flow rate*
- ❑ Mask bag patient at appropriate ventilation rate*

Fig. 9 Bag-valve-mask ventilation

* = information found on badge cards [Fig. 11 & 12]

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Methods

Key teaching points: Crash cart/emergency equipment [Fig. 10]

- On your way to this station, locate the *real* crash cart in Nuclear Medicine
- Now go to the Nuclear Medicine room and find practice crash cart
- Open all drawers and check what is inside. FIND:
  - Venipuncture supplies
  - Normal saline fluids
  - Intubation supplies
- Locate backboard
- Check chart on top of crash cart to find average weight for 6 year old patient
- Find medication drawer/tray
- Locate 1:10,000 Epinephrine – open and assemble
- Determine dose for 20 kg. patient (use your card)
- Locate 1:1,000 Epinephrine
- On your way to the next station – go by MRI
  - Show where you would resuscitate a patient in MR
  - Find the *real* crash cart

Fig. 10 Crash cart drawer

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Methods

Key teaching points: "directing the first five minutes of a code" [Fig. 4]

- Turn on lights as you enter room
- Have the tech assemble O2 as you do a quick assessment of the patient *(patient is unresponsive – remember your ABC's)*

Airway

- Check the airway – is it open?
- Open it using the head tilt/chin lift or jaw thrust
- Look, listen, and feel for breathing. Find a stethoscope. Re-tilt and check again. Is the patient breathing? *(patient is not breathing)*

Call for help

- Show how to call a nurse using the Hil Rom box
  - What hours is the nurse available?
- Show how to call a code blue on the Hil Rom box
- Show how to call a code blue on the telephone
  - How do you cancel a code if it is accidentally tripped?
- Who else could you call in case of an emergency?

Fig. 4 First five minutes of a code

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Methods

Key teaching points: "directing first five minutes of a code" [Fig. 6]

Breathing

- ❑ Have someone start bag-valve-mask ventilation

Circulation

- ❑ Check for a pulse
- ❑ Say where to find monitors
- ❑ Put on the monitors. Find the O_2 saturation of a volunteer in your group
- ❑ Find out history from technologist
- ❑ Tell the nurse the appropriate medication and dose for a severe contrast reaction
- ❑ Give a brief summary to the code team when they arrive
- ❑ Show how to fill out an incident report

Fig. 6 "directing first 5 minutes of a code"

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Methods

In order to maintain an environment conducive to learning, participants were given badge cards with pediatric resuscitation information. The badge cards contain the following information: normal vital signs, epinephrine routes/doses, suction catheter size by age, suction strength, O_2 flow rates by device, and CPR breathing and compression rates [Fig. 11 & 12].

Fig.11 Badge card side 1

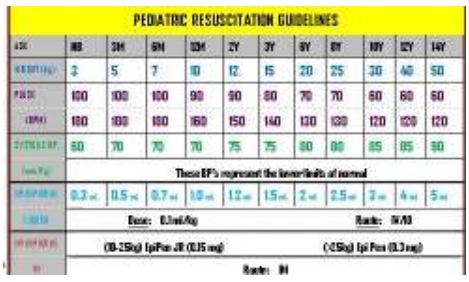

Fig.12 Badge card side 2

Measures

Success of the program was measured in two ways: 1) using a "before and after" participant survey based on perceived level of confidence in performing each skill and 2) a rating of the effectiveness of the training format and content. A similar survey was used for both radiologists and technologists [Fig. 13]. The radiologist's training was repeated again in six months to accommodate new staff and others who were unable to attend the prior session. The skill confidence survey was based on a 9-point Likert rating scale with 1 being the least confident and 9 being most confident. Statistical significance was tested using a Wilcoxon sign-rank test.

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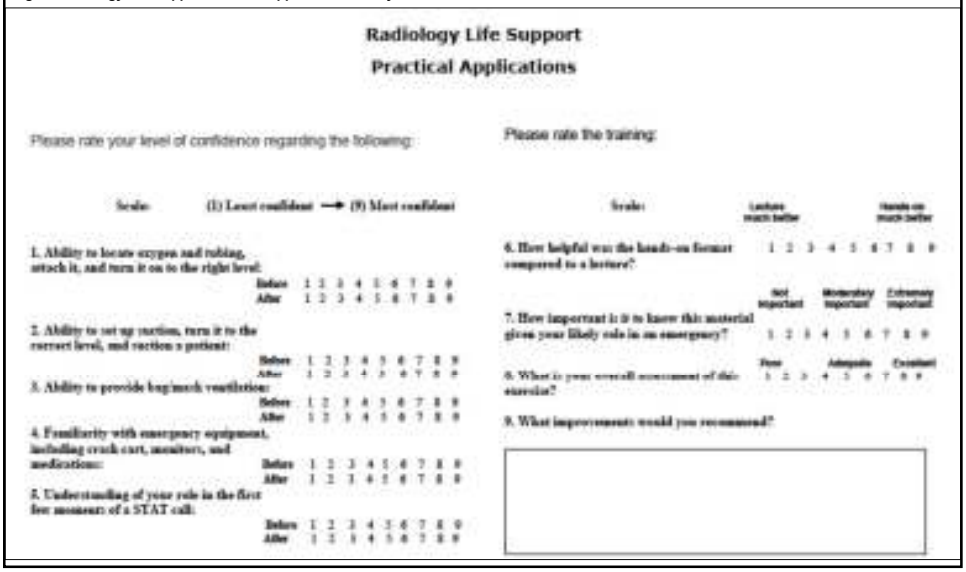
Fig. 13 Radiology Life Support Practical Applications survey



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Please rate your level of confidence regarding the following:

Scale: (1) Least confident → (9) Most confident

1. Ability to locate oxygen and tubing, attach it, and turn it on to the right level:
Before 1 2 3 4 5 6 7 8 9
After 1 2 3 4 5 6 7 8 9

2. Ability to set up suction, turn it to the correct level, and suction a patient:
Before 1 2 3 4 5 6 7 8 9
After 1 2 3 4 5 6 7 8 9

3. Ability to provide bag/mask ventilation:
Before 1 2 3 4 5 6 7 8 9
After 1 2 3 4 5 6 7 8 9

4. Familiarity with emergency equipment, including crash cart, monitors, and medications:
Before 1 2 3 4 5 6 7 8 9
After 1 2 3 4 5 6 7 8 9

5. Understanding of your role in the first few moments of a STAT call:
Before 1 2 3 4 5 6 7 8 9
After 1 2 3 4 5 6 7 8 9

Please rate the training:

Scale: Lecture much better ... Hands-on much better

6. How helpful was the hands-on format compared to a lecture? 1 2 3 4 5 6 7 8 9

Not important ... Moderately important ... Extremely important

7. How important is it to know this material given your likely role in an emergency? 1 2 3 4 5 6 7 8 9

Poor ... Adequate ... Excellent

8. What is your overall assessment of this exercise? 1 2 3 4 5 6 7 8 9

9. What improvements would you recommend?

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Results

A total of 31 radiologists (out of 45 staff and fellows) and 31 technologists (out of 102 technologists) attended the sessions. All attendees filled out the survey before and after the training [see table 1 for the "before and after" results on skill confidence].The participants' self-reported confidence levels increased by ≥ 42% for all skill areas. Before-after differences were statistically significant in all cases. Participants also rated the training for training format effectiveness, importance of training content and for overall assessment of the exercise [see table1 for responses & table 2 for percent of participants rating training at ≥ 8]. The majority of radiologists and technologists rated the hands-on format much better than lecture, the material as extremely important, and gave an overall assessment of excellent. Comments on the survey were overwhelmingly positive (7 positive comments, 3 neutral, 0 negative) [see table 3 for examples].

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Results

Table 1. Survey responses. All responses are on a 1-9 Likert scale.

		Radiologists				Technologists			
TOPICS		n	Median	Mean	SD	n	Median	Mean	SD
O2	Before	31	4	4.4	2.1	31	7	6.5	2.3
	After		8	7.8	1.5		9	8.8	0.5
	Diff		**4**	**3.4**	-		**2**	**2.2**	-
Ventilation	Before	28	5	5.2	1.8	22	4	3.9	1.5
	After		8	7.9	1.3		8	8.0	1.2
	Diff		**3**	**2.7**	-		**4**	**4.1**	-
Crash Cart	Before	32	3	3.8	2.1	20	6	5.4	2.7
	After		8	7.5	1.3		9	8.5	0.9
	Diff		**5**	**3.7**	-		**3**	**3.1**	-
First min of STAT	Before	30	4	4.4	2.3	20	-	-	-
	After		**8**	**7.5**	1.6		-	-	-
	Diff		4	3.1	-		-	-	-
FORMAT			Median	Mean	SD		Median	Mean	SD
Hands On			9	8.7	0.6		9	8.4	2.0
Importance			9	8.5	1.6		9	8.5	2
Overall Assessment			9	8.4	1.6		9	8.4	1.6

Note: All differences were statistically significant ($p<0.01$).

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Results

Table 2. Survey responses – taken from a 1 - 9 point Likert scale

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Table 3. Survey comments

"Great idea! Very helpful"
"Very good exercise, hands-on & small group format worked great, room coaches were informative, focused & non-threatening! Thanks"
"Outstanding! Thank you so much!"

Conclusions

Radiology Life Support practical applications exercises are an effective way to raise radiologist and technologist skill confidence and are well received by the participants. Additional research is needed to ascertain the frequency of practice needed to maintain skill confidence.

For the future, development of an objective measure, such as simulation, could be helpful to better determine the impact of the practical applications format on actual performance in emergency situations and to tailor the practical applications training.