



# Managing Surgical Emergencies in the Operating Room: Interdisciplinary Training Topics Focusing on Fire in the OR and Utility Failure



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## BACKGROUND

- According to the Emergency Care Research Institute (ECRI), approximately 550 to 650 surgical fires occur every year in the United States. Most non-serious fires are under-reported, vastly, understating the true magnitude of an atypical surgical emergency. Nationally, patients and staff members working in operating rooms have sustained serious, and even fatal injuries as a result of OR fires and other crises. The Penn Medicine Clinical Simulation Center, in cooperation with the Hospital of the University of Pennsylvania (HUP), Departments of Surgery and Perioperative Services, and Safety Management, developed a surgical simulation exercise to clarify staff roles and responsibilities during a surgical fire.
- This is a weekly, one-hour, multi-departmental training on crisis management procedures in the event of a fire or utility failure. Each session includes up to thirty participants from PeriOp Nursing, Support Staff and Perfusion, as well as physicians from Anesthesia, Surgery, Otorhinolaryngology, Gynecology, Oral Surgery, and Orthopedics.

## MATERIALS and METHODS

- Staff are divided into groups of five to seven and directed into one of up to five simulated operating rooms. Staff are divided into groups according to their scope of practice: one circulating nurse, one scrub nurse, two residents, one anesthesia resident, and one perioperative support staff member. They are unaware of the topic of the current simulation session. Staff are advised to "prep the patient" as if surgery were about to begin. A trained moderator in the room then releases simulated smoke from a machine. Participant responses to the simulated fire are recorded using the Sim Center's integrated AV system.
- After the initial "cold" simulation, staff members attend the didactic component of the training. Background information is provided and roles for each staff member are assigned. Various steps, such as announcing "fire", removing draping, calling security, shutting off gases, and evacuating the patient, are reinforced. Staff members review the recorded initial sessions, and share questions and comments. Once participants are comfortable with the steps and their primary roles, the exercise is then repeated.
- A second emergency (power failure) is introduced after the fire scenario is completed. Following this "warm" simulation, there is a final didactic, where some additional information is provided about power failure. At the conclusion of the session, participants evaluate the session, including their "pre" and "post" session understanding of their role. PMSC staff review the recorded sessions and annotate if/when each of the steps listed above is performed and the time required to do so is compared in the pre- and post didactic training. The participants' pre- and post- session understanding is analyzed.

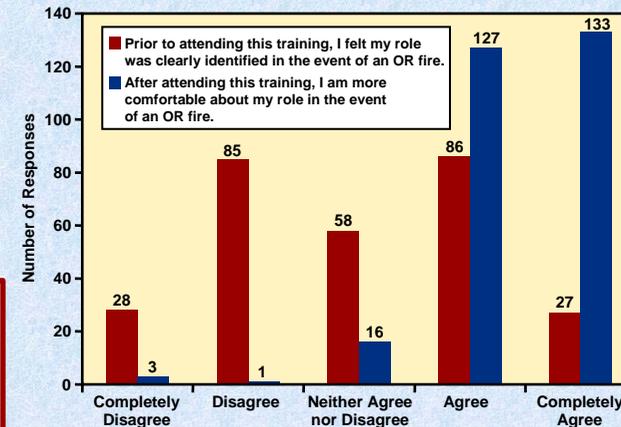


|                             | Surgery Residents | Anesthesia Residents | Perioperative Nursing |
|-----------------------------|-------------------|----------------------|-----------------------|
| Pre-Training Understanding  | 37%               | 74%                  | 65%                   |
| Post-Training Understanding | 98%               | 86%                  | 96%                   |
| Relevance to Practice       | 96%               | 96%                  | 96%                   |

**TABLE 1** - A Wilcoxon Signed Ranks Test was conducted. Surgery residents and Perioperative nursing staff had a significant ( $p < 0.05$ ) increase in understanding after the exercise. Anesthesia residents showed a trend ( $p = 0.07$ ) towards significance. The differences between the groups was significant ( $p < 0.05$ ).

## RESULTS

Participant Comprehension of Role in OR Fire Pre and Post Training



**FIGURE 1** – The improvement in understanding of role in an OR fire improves after a dedicated simulated team training exercise.

| Number of Steps Performed | % Pre-Didactic | % Post-Didactic |
|---------------------------|----------------|-----------------|
| 0 out of 5                | 0%             | 0%              |
| 1 out of 5                | 10%            | 0%              |
| 2 out of 5                | 24%            | 0%              |
| 3 out of 5                | 50%            | 14%             |
| 4 out of 5                | 12%            | 52%             |
| 5 out of 5                | 5%             | 33%             |

**TABLE 2** – Up to 5 steps are required in the fire mitigation scenario. 1) announce "fire", 2) remove draping, 3) call the OR control office or security, 4) shut off gases and 5) evacuate patient if necessary. 85% of participants performed at least 4 steps after the training, compared to 17% prior to the training.

| Step                        | Average Difference in Time to Perform Pre- and Post- Didactic Training in Seconds |
|-----------------------------|---|
| Time to call "Fire"         | -5.5  |
| Time to shut off gases      | -19.0   |
| Time to call Security       | -15.8   |
| Time to Remove Drape        | -18.4   |
| Time to Call for Evacuation | -30.3   |

**TABLE 3** – All scenarios were recorded and reviewed by PMSC staff. The time intervals necessary to perform the five steps in fire mitigation were reduced for each task after training ( $p < 0.05$ ).

## CONCLUSIONS

- As of December, 2010, we have trained 296 physicians and operating room staff on surgical fires and utility failures.
- There is a clear difference between surgery residents, anesthesia residents, and nurses in terms of pre-simulation understanding of their role.
- The videos of the scenarios reveal significant improvement between the cold and warm scenarios. Both the number of steps performed and the timeliness of the responses to fire significantly improve after the simulation training (see Table 2)