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The "Simulation Roulette" Game

Heather J. Frederick, M.D.[1], **Marcia A Corvetto, M.D.**[2], **Gene W. Hobbs, CHT**[1], and **Jeffrey Taekman, M.D.**[1]

[1]Human Simulation and Patient Safety Center and Department of Anesthesiology, Duke University Medical Center, Durham, NC.DUMC. Human Simulation and Patient Safety Center. 4th floor purple zone, Rm 4057, Durham, NC, 27710. Telephone 919-6843661 Fax: 919-6846251

[2]Department of Anesthesiology. Pontificia Universidad Catolica de Chile, Human Simulation and Patient Safety Center and Department of Anesthesiology, Duke University Medical Center, Durham, NC, DUMC. Human Simulation and Patient Safety Center. 4th floor purple zone, Rm 4057, Durham, NC, 27710. Telephone 919-6843661 Fax: 919-6846251

Abstract

Introduction—"Simulation Roulette" is a new method of "on-the-fly" simulation scenario creation that incorporates a game-like approach to critical scenarios and emphasizes pre-scenario preparation. We designed it to complement our traditional anesthesia simulation curriculum, in which residents are exposed to pre-defined "critical" scenarios. During typical scenarios trainees are often given minimum preparatory information; they then start the scenario knowing only that "something bad" is going to happen. As a result, trainees often report anxiety, which can be a barrier to learning. To overcome this barrier and to augment traditional critical incident training, we developed the "Simulation Roulette" game.

Materials and methods—"Simulation Roulette" consists of pre-made cards that are randomly selected to create a patient, another set of pre-made cards to assist in selecting "complications", worksheets to guide a thorough "prebrief" discussion prior to the scenario, and scoresheets to facilitate the "debrief" discussion at the end. Similar to traditional scenarios, it requires coordination by a facilitator to ensure plausible scenarios and evaluation of trainee performance.

Results—Although we have not conducted formal testing, we believe that 1) incorporating an element of random chance to scenario selection, 2) using a game-like framework, and 3) emphasizing the "prebrief" portion of simulation all have the potential to decrease trainee anxiety.

Conclusions—We present the rationale for designing such a game; examples of instructions, cards, and scoresheets; and our initial experience with implementing this game within our simulation curriculum.

Keywords

Patient Simulation; Education; Simulation Game

Corresponding Author: Marcia A Corvetto, mcorvett@med.puc.cl.

Introduction

Simulation has become an integral part of United States physician licensing (USMLE); anesthesia resident and nurse anesthetist training[1]; and more recently, anesthesiology board certification maintenance[2, 3]. Throughout anesthesia education, medical simulation is commonly used to teach the management of infrequently encountered critical incidents. Typical scenarios that anesthesia trainees are exposed to – such as malignant hyperthermia, anaphylaxis, and inability to ventilate or intubate – all have in common an adverse event from which the simulator is at high risk of physiologic decompensation or death. Due to the critical nature of these scenarios and the high-fidelity of the simulator setting, trainees often experience anxiety[4, 5]. While some anxiety augments learning, an excess may be detrimental[6, 7].

In an attempt to decrease trainee anxiety regarding traditional "critical incident" simulation, we developed the "Simulation Roulette" game, built on the techniques of traditional role-playing games. This game provides a framework for the creation of an entire simulation scenario – including the patient, surgical setting, and critical incidents – that is intended to be both light-hearted and educational. After creating the scenario with the aid of structured worksheets, gaming dice (or random number generator), and cards, *the trainees are guided through a thorough "prebrief" discussion to help immerse them in the patient and the surgical setting. Following the prebrief*, the simulation scenario itself is carried out in a traditional manner, *except the "critical incidents" have been randomly (and blindly) selected from a bag. The combination of the game-like atmosphere and the prebrief discussion are both likely to help alleviate anxiety; the careful selection of critical incidents and complications ensures that educational goals are met.*

The educational potential of games in education and simulation has been thoroughly discussed in the literature[8–10], and used in an appropriate manner, games are an effective learning tool[11]. While a traditional medical simulation scenario fulfills almost all of the criteria required for "games" (e.g. there are fantasy, rules, goals, sensory stimuli, challenge, mystery, and control[12]) "Simulation Roulette" takes the resemblance a step further by including informal scoresheets as well as an element of "fun and play" [12].

The foundation for "Simulation Roulette" was inspired by the set of scenarios described by Murray et al[13], who described simple simulation scenarios that can be used for assessing the performance of residents and anesthesiologists. *To their published list of 12 incidents*[13], *we added* 14 scenarios from our simulation curriculum to comprise the complete set of complications for the game*. Many of these are typical critical incidents, such as pulmonary embolus and malignant hyperthermia, but the game also includes a variety of incidents of lower complexity.*

The set of available comorbidities and complications provides a framework for easily simulating a diverse combination of patients and adverse incidents *within a specified curriculum. Twenty-two comorbidity cards include maladies from the mundane to the severe in every major organ system. The 14 complication cards created for this game include the projected complexity, appropriate patients, instructions for implementation, and even an*

occasional suggestion to improve plausibility. Indeed, improvisation is often required to make the resulting scenarios plausible; *however, any simulation experience requires an inherent "suspension of disbelief", which may be facilitated by the structure of the game*.

"Simulation Roulette" is designed to allow up to three trainees to each perform a scenario within a two-hour session. *It* is intended to be facilitated by an instructor – for example, an attending anesthesiologist – and requires the assistance of an experienced simulation coordinator to control the mannequin and implement the selected "complications". This approach could be modified for pediatric or obstetric anesthesia scenarios, as well as for other medical specialties that incorporate critical incident training, such as emergency medicine or critical care.

Methods

This report describes the details of the "Simulation Roulette" game. For simulation centers with similar resources, these instructions should provide enough information to allow the creation of their own versions of the game.

Overview

The "Simulation Roulette" game consists of four distinct parts: "Scenario Selection", "Prebrief", "Simulation", and "Debrief". We provide an overview of each part, required equipment, instructions, and worksheets ("Scenario Selection Worksheet" [Appendix 1], "Anesthesia Plan Worksheet" [Appendix 2] and "Scoresheet" [Appendix 3]).

The most important components of "The Simulation Roulette" game are the "Co-morbidity" bag and the "Bag O'Badness". The "Co-morbidity" bag provides a comprehensive set of medical problems organized by organ system and stratified by American Society of Anesthesiology (ASA) physical status (Table 1); each card has an ASA 1, 2, 3, and 4 item (Table 1). Comorbidity cards span each organ system and important sub-categories, for example "Cardiac – ischemic", "Cardiac – Arrhythmia", and "Cardiac – Congestive Heart Failure". The "Bag O'Badness" includes complication cards, each with instructions for setting up the scenario and implementing the critical incident, along with recommended simple scoring criteria as used by Murray (Table 2)[13]. Complication cards were created to cover the most important critical incidents *or complications* that can happen during an anesthetic case. A full description of the *co-morbidity and complication* cards is available electronically.

(http://simcenter.duke.edu/roulette/Comorbidity-Cards-for-Bag-OBadness.pdf and http://simcenter.duke.edu/roulette/Complication-Cards-For-Simulation-Roulette.pdf).

As the "complication" cards provide only an outline of each event, essential to the success of this game at our institution has been the assistance of a full-time, dedicated simulation coordinator with extensive biomedical experience who is very adept at manipulating the mannequin (Laerdal SimMan) to provide realistic scenarios.

The structure of the game

1. Scenario Selection (5–10 minutes): The first step is the scenario selection, in which the patient is characterized through using the simple rules shown on the "Scenario Selection worksheet" (Appendix 1). This part could be accomplished using 20-sided (D20), 6-sided (D6), and 4-sided (D4) dice; a dice application available on smart phones or the Internet; or a random number generator on a spreadsheet program such as Microsoft Excel. We used a "dice bag" smart phone application in order to provide a more "game-like" approach. Patient co-morbidities are drawn from the "Co-Morbidity" bag; three complication cards that could occur during the simulation are drawn blindly from the "Bag O'Badness". The facilitator and trainee will finalize the patient and intended surgical setting, but only the facilitator and coordinator will look at the complication cards ahead of time.

2. Prebrief:

   A. Pre-operative preparation (5 minutes): Following scenario selection, the trainees will go to another room to prepare their anesthetic plans. During this time, the facilitator and the coordinator review the complication cards for each scenario and plan the best implementation – some or all of the complications may be included depending on time or plausibility.

   B. Pre-simulation discussion (10 minutes): Before running each scenario, the facilitator will spend about 5 minutes asking the trainee to describe and justify the anesthetic plan, choice of monitors, choice of induction drugs, plan for post-operative pain, and any other issues that arise. This pre-operative discussion allows the trainees to become thoroughly familiar with the patient prior to the actual simulation *(and prior to discovering the nature of the selected complications)*.

3. Simulation (10 minutes): As a trainee is performing the case, the facilitator or another trainee will fill in the "Scoresheet". The learning outcomes of the intraoperative "complications" are clearly stated on each card, allowing for easy scoring of each trainee's performance and providing a framework to guide feedback. *To facilitate scoring, trainees should be instructed during the introduction to the game* to provide the following information for each encountered complication:

   a. IDENTIFY the problem

   b. DISCUSS the differential diagnosis

   c. TREAT the problem

d. PLAN the next steps

4. Debrief (10 minutes): The debriefing session allows the trainees to discuss their performance and explore alternative ways of diagnosing or treating their scenario.

Fulfillment of ACGME learning objectives

The set of complications was constructed to allow opportunities to evaluate the Accreditation Council for Graduate Medical Education General (ACGME) competencies. The "critical incident" scenarios incorporate "Medical knowledge" (through the prebrief and the discussion of complications), "Patient care" (through management of the simulation), and "Practice-based learning and improvement" (through the debrief). We developed additional complications such as "belligerent patient" and "disclosing an error made by another" to allow opportunities to evaluate "Interpersonal and communication skills", "Professionalism", and "Systems-based practice".

Instructions provided to facilitators

The following is an example of instructions provided to facilitators. *To introduce the game to trainees, facilitators should describe the basic steps (Scenario selection, Prebrief, Running the Simulation, and Debrief). This is a good time to e*mphasize the four requirements for *successfully managing* each complication, *which are included on the scoresheet, and that the trainee should keep in mind during each scenario*: 1) Identifying the problem, 2) Discussing the differential diagnosis, 3) Treating the problem, and 4) Planning the next steps.

1. Scenario selection – use "Scenario Selection" worksheet (Appendix 1): With all the trainees, let each one in turn roll the dice to pick their scenario. After identifying the patient, comorbidities, and surgical specialty for a scenario, you have some leeway to make the scenario work best, e.g. if it's "General" is it a ruptured aortic aneurysm or an appendectomy? Is the patient coming from home or the intensive care unit? Is it an elective or emergency case?

Have each trainee pick three complications from the "Anything Can Happen" bag and hand these to the coordinator without looking at them. (*Each complication card is hidden inside an envelope to prevent trainees from seeing them.)* Have each trainee transcribe their scenario onto their "Scoresheet" (which you will keep) and "Anesthesia Plan worksheet".

2. Prebrief A. Pre-operative preparation – use "Anesthesia Plan worksheet" (Appendix 2): Ask the trainees to go to another room and take about five minutes to prepare their anesthetic plans. In this time, consult with the coordinator to come up with appropriate ways to fit the complications (all or some) into the scenarios. For each trainee's scenario, the coordinator can finish setting up the scenario while you go over the anesthesia plan with the resident.

Repeat in order for each scenario:

Prebrief B. Pre-simulation discussion: Either in the simulator or a separate room, prompt the trainee to describe their anesthetic plan, e.g. choice of monitors, choice of induction drugs, etc. This could be as relaxed as the conversation you'd have the night before a case, or it could as formal as the oral boards.

3. Run the simulation – use "Scoresheet" to take notes (Appendix 3):

   Set the scene for the trainee: tell him where the case will be at when he walks in the room, e.g. is he inducing, extubating, taking over from a break?

   Run the scenario: To facilitate scoring, you can pause and ask the trainees to provide their thought-process. If there are three trainees for the session, you could have two of them run the scenario and let the third fill in the Scoresheet.

4. Debrief: A debriefing session is standard for all of our scenarios. For facilitators, the emphasis of our debriefing sessions is guiding the discussion while letting the trainees evaluate their performance, discuss important concepts, and ask questions. After a period of open-ended discussion, you can provide feedback on the specific scenarios according to the checklist (Identify, Discuss, Treat, Plan).

Results

In the six months since the development of the "Simulation Roulette" game, it has been used primarily for anesthesia resident sessions, although it could easily be used for nurse anesthesia students or medical students on an anesthesiology rotation. It has been used twice by facilitators who had not pre-selected scenarios and who had no prior experience with the game, with a satisfactory experience for the facilitators and the residents. An integral part to the success of this game at our institution is a full-time simulation coordinator who is present for all of the resident simulation sessions (scheduled one afternoon a week, with three residents per session).

Adequacy of scenarios

The scenarios encountered through the "Simulation Roulette" game are intended to be comparable to traditional scenarios in terms of acuity and medical complexity. On preliminary surveys, trainees have agreed that the sessions are both educational and fun, and that they assess important skills.

After running multiple sessions with the original "Simulation Roulette" game, we noticed that the age distribution was skewed toward a younger population with a mean age of 35; the average age of a surgical patient receiving general orotracheal anesthesia at our institution is 52. To allow for this, the current algorithm is slightly more complicated ("add 30 if < 50 and 15 if ≥ 50") but results in a more realistic distribution of patient ages, while still allowing for the use of gaming dice.

Adequacy of simulation experience

The initial feedback from facilitators and trainees about the simulator experience generated with “Simulation Roulette” has been positive. While extensive creativity may be required by the facilitator and coordinator to make the scenario plausible, this has not been reported as a source of anxiety. Trainees have reported enjoying all parts of the session as “most useful” although most have specifically mentioned the prebrief or the debrief. Facilitators have noted that it is difficult to fit all the complications in for each trainee during a two hour session; we have found that allowing for the use of “one or all” of the selected complications has easily yielded enough material for a single simulation session.

Effect on anxiety

The approach of this game differs from traditional scenarios in that it emphasizes pre-operative preparation, allowing trainees to become thoroughly immersed in their patient and thus potentially decreasing anxiety about the scenario. This report does not formally test the hypothesis that the “Simulation Roulette” game decreases anxiety compared to traditional scenarios, or that a decrease in anxiety would improve the learning experience.

Scoring

Consistent with our goal of decreasing trainee anxiety, we have not emphasized the “scoring” aspect of the game. The Scoresheet seems to best be used as a framework for taking notes on specific trainee actions, and being used informally to guide feedback.

Case example

We provide an example of a session recently “played” on our simulator that illustrates the process of scenario selection and flexibility by the facilitator in order to maintain a realistic scenario. This scenario created a 27 year old, 84 kg, female patient who was 8 weeks pregnant, ASA 4, undergoing a surgery to-be-determined. Sequential rolls were:

- Age: D20:**4**, D4:**3**. 4 × 3 = 12 + 15 = 27 years old
- Weight: D20:**8**. 8 × 3 = 24 + 60 = 84 kg
- Gender: D6:**6** = Female pregnant, D20:**8** = 8 weeks pregnant
- ASA comorbidities: D4:**4** = ASA 4
- Surgery: D6:**6** = Dealer’s Choice

The first co-morbidity card selected was “Cardiac – Congestive Heart Failure” and the ASA 4 item revealed that the patient had an EF of 15%. Due to the complexity of the case thus far, no further co-morbidities were selected from the bag. The facilitator created a scenario of a young woman with severe post-partum cardiomyopathy and early pregnancy presenting for elective dilatation and curettage. After a pre-operative discussion of the patient’s cardiac status (including a recommendation from the requested cardiology consult that the patient receive an epidural or spinal) and careful placement of an epidural catheter and test dose, the facilitator induced a “total spinal” scenario, requiring intubation and resuscitation. While this scenario yielded an expected complication, the facilitator could have also chosen to

implement “Aspiration” or “Fire in the Operating Room”. This one scenario yielded many teaching points and items for discussion during the debriefing.

Discussion

We have found the “Simulation Roulette” game to be a useful supplement to traditional simulation scenarios at our institution. Our curriculum provides opportunities for residents to participate in simulation sessions three times per year; each resident experiences approximately nine sessions over their three-year clinical anesthesia residency. Currently we are trying to expose each resident to this format at least once. While the game can be adapted for trainees with a wide variety of experience, we have found it particularly helpful for introducing less experienced residents to the simulator experience. Decreasing anxiety is especially important for newer trainees, and this is facilitated by this game’s emphasis on pre-operative preparation and its specific instructions for successfully navigating a complication (i.e. identification, discussion, treatment, and planning next steps). We have found that residents especially appreciate the prebrief discussion.

This game-like format for simulation has advantages to facilitators as well as trainees. Our resident simulation curriculum relies on a group of regular facilitators who have created formal scenarios based on specific critical incidents; however, occasionally facilitators show up to run a session without a preconceived plan, or new facilitators need assistance running a simulation for the first time. This game has been used to provide a structured method for “on-the-fly” scenario creation that also provides an easy way for new facilitators to get used to running simulations.

The “random” element of scenario selection has both benefits and detriments. On the one hand, it provides a light-hearted element to scenario selection and allows for improvisation. However, it does not allow the facilitator to test the performance of more experienced residents on specific scenarios. When using this format with experienced trainees, we have found it useful to modify the “random” choice of complications and sometimes have implemented specific scenarios that the trainees have not been exposed to before.

As described, the “Simulation Roulette” game is most useful for simulating adult patients undergoing general anesthesia. Future revisions of this game will likely include a separate “Bag O’Badness” specific to regional techniques (e.g. the “Total Spinal” scenario is inappropriate unless a neuraxial technique is plausible), as well as pediatric and obstetric versions.

While our department uses this game as a tool to supplement traditional goal-driven anesthesia simulation scenarios, a simulation “game” provides many possibilities for augmenting the simulation experience. Such a game could be used for introducing simulation to new learners, identifying skills deficiencies in more experienced trainees, or even training new simulation facilitators. Though there is a significant amount of effort required to create a cohesive set of co-morbidities and complications, this basic format could easily be modified for other acute healthcare settings.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1

Comorbidity Cards for “Bag O’Badness” in Simulation Roulette

Neurological - Cerebrovascular	
ASA 1	Headaches
ASA 2	Seizure disorder, controlled on meds
ASA 3	History of CVA
ASA 4	Subarachnoid hemorrhage and vasospasm
Neurological – Central Nervous System	
ASA 1	History of migraines
ASA 2	s/p Ventriculo-peritoneal shunt
ASA 3	Brain tumor
ASA 4	Increased intracranial pressure, altered mental status
Neurological – Peripheral Nervous System	
ASA 1	Carpal tunnel syndrome
ASA 2	Neurofibromatosis Type 1
ASA 3	Multiple sclerosis
ASA 4	Acute Guillan-Barre syndrome
Cardiac - Valves	
ASA 1	Mitral valve prolapse (has murmur, but asymptomatic)
ASA 2	Bicuspid aortic valve with mild aortic stenosis
ASA 3	Moderate mitral stenosis
ASA 4	Critical aortic stenosis
Cardiac – Ischemic	
ASA 1	Emergency room visit for “chest pain”; turned out to be heartburn
ASA 2	On medications for hypertension and hyperlipidemia
ASA 3	History of 4-vessel CABG; Q waves on ECG
ASA 4	s/p non-ST elevation MI one week ago
Cardiac – Congestive heart failure	
ASA 1	Couch potato – “shortness of breath” with exertion but no known cardiac history
ASA 2	EF 50%, “adequate” exercise tolerance
ASA 3	EF 40%, on diuretics, compensated heart failure with symptoms only with moderate exertion
ASA 4	EF 15%, symptoms at rest. Roll 20-sided die: 20 = LVAD
Cardiac - Arrhythmias	
ASA 1	PVCs that disappear with exercise
ASA 2	Pacemaker for isolated sinus node dysfunction
ASA 3	Atrial fibrillation, on coumadin
ASA 4	AICD in place for EF<30% and history of VT
Pulmonary - Miscellaneous	
ASA 1	Snores loudly
ASA 2	Smokes something illegal. Roll 6-sided die: 1 = bananas; 2 = crack; 3= marijuana; 4–6= acutely high on cocaine

Neurological - Cerebrovascular	
ASA 3	Obstructive sleep apnea, supposed to use CPAP
ASA 4	Pulmonary hypertension on continuous prostaglandin infusion
Pulmonary - Tobacco	
ASA 1	Only smokes when drinking
ASA 2	< 20 pack-years
ASA 3	> 30 pack-years and/or has had multiple episodes of bronchitis
ASA 4	Severe COPD on continuous O_2
Pulmonary Asthma	
ASA 1	Seasonal allergies
ASA 2	Mild intermittent asthma
ASA 3	Moderate/Persistent asthma
ASA 4	Status asthmaticus
Gastrointestinal - intestines	
ASA 1	Irritable bowel syndrome
ASA 2	Constipation from chronic methadone treatment; takes Colace
ASA 3	History of small bowel resection from gunshot wound; on TPN
ASA 4	Acute small bowel obstruction – actively vomiting, +/− hypotension
Gastrointestinal - stomach	
ASA 1	History of motion sickness
ASA 2	GERD, controlled on over-the-counter medications
ASA 3	Active GERD despite maximal medical therapy, occasionally wakes up vomiting
ASA 4	s/p esophagectomy for Stage 4 esophageal cancer
Hepatic	
ASA 1	1–2 drinks/day
ASA 2	Gallstones
ASA 3	s/p liver transplant 6 months ago
ASA 4	On liver transplant list for Hepatitis C cirrhosis
Renal	
ASA 1	Normal creatinine
ASA 2	Mild renal insufficiency, creatinine 1.4
ASA 3	Chronic renal insufficiency, creatinine 2.5
ASA 4	End-stage renal disease
Genitourinary	
ASA 1	Male: Benign prostatic hypertrophy; Female: Frequent urinary tract infections
ASA 2	Recurrent nephrolithiasis
ASA 3	Recurrent bladder cancer, s/p chemotherapy and radiation
ASA 4	Acute ureteral obstruction from abdominal or pelvic tumor, with rising creatinine
Endocrine - Diabetes	
ASA 1	Eats a lot of sugar; has bad dental caries

Neurological - Cerebrovascular	
ASA 2	DM2, oral agents only, well-controlled
ASA 3	DM1 or 2: Insulin therapy, somewhat erratic control
ASA 4	DM1: “Brittle diabetic” with history of diabetic ketoacidosis and hypoglycemic episodes
Endocrine	
ASA 1	Hydrocortisone cream for eczema
ASA 2	Hypothyroid, on synthroid
ASA 3	Chronic steroid use for ulcerative colitis
ASA 4	Thyrotoxicosis
Musculoskeletal	
ASA 1	Broken foot from extreme skateboarding
ASA 2	Osteoarthritis
ASA 3	Scoliosis with restrictive lung disease
ASA 4	Severe rheumatoid arthritis
Hematologic	
ASA 1	HbSS trait (heterozygote)
ASA 2	Mild anemia, Hct = 30
ASA 3	Sickle cell disease (HbSS homozygote)
ASA 4	s/p bone marrow transplant for recurrent AML, platelets < 10,000 K
Infectious diseases	
ASA 1	History of positive PPD
ASA 2	History of MRSA skin infections
ASA 3	Pneumonia last week, still on antibiotics
ASA 4	Sepsis
Wild Card	
ASA 1	Only speaks Russian
ASA 2	Jehovah’s Witness
ASA 3	Family history suspicious for pseudocholinesterase deficiency
ASA 4	Pheochromocytoma
Lab abnormalities	
ASA 1	Hypomagnesemia
ASA 2	Hypokalemia
ASA 3	Hypercalcemia
ASA 4	Hyponatremia

Table 2

Complication cards for "Simulation Roulette"

Acute hemorrhage *Complexity*: Moderate *Appropriate patients*: Anyone undergoing invasive surgery *Setting*: Intraoperative *Instructions*: Several minutes after beginning the simulation, blood pressure begins to decrease to 85/50 mmHg and heart rate increases to 115 bpm. Report that suddenly one liter of blood is in the suction canister and the surgeons say the patient is "oozy."	**Scoring items** • State the most likely differential diagnosis depending on the circumstances. • Consider coagulopathy or platelet dysfunction. • Communicate with surgical team. • Administer adequate fluid resuscitation (e.g. 3xEBL in crystalloid or 1xEBL in colloid or blood products). • Determine whether pharmacologic therapy or transfusion is indicated (discuss any patient factors that would alter the transfusion threshold).
Seizure *Complexity*: Moderate *Appropriate patients*: Any *Setting*: • If GA: Prior to induction or after extubation depending on most likely context • If Regional/MAC: Anytime (could be presentation of local anesthetic toxicity as well) *Instructions*: Suddenly, the patient develops twitching in arm that proceeds to grand mal seizure and loss of consciousness. HR increases to 150 bpm, BP increases to 200/110, and SpO_2 decreases to 93%. For advanced trainees: SpO_2 stays at 93% for one minute then starts dropping over next minute to 50%. STAT Plausibility Consult: Oops – it turns out the patient had a few seizures several years ago, but didn't keep taking the medications because they meant he couldn't drive.	**Scoring items** • State diagnosis. • Discuss possible causes (e.g. neurological, pharmacological, metabolic). • Administer oxygen, support airway as needed with mask (or bag-valve-mask). • Administer pharmacologic treatment of choice (e.g. benzodiazepine if SpO_2 stable, succinylcholine if SpO_2 dropping). • Order chemistry profile if metabolic disruption is a likely cause. • State appropriate next steps depending on context (e.g. head CT). Indications for proceeding with intubation: history of full stomach, elevated ICP, emergency surgery, falling SpO_2.
Acute elevation in ICP *Complexity*: Moderate *Appropriate patients*: Could be any, with a little creativity *Setting*: After extubation *Instructions*: One minute after extubation the patient has altered mental status, RR slows to 5 breaths per minute, BP rises to 180/98, HR decreases to 45. STAT Plausibility Consult: Did your patient just have a ruptured aneurysm? They can happen in otherwise healthy patients with very little warning.	**Scoring items** • State problem. • State differential diagnosis (e.g. Bleeding? Obstruction? Elevated cerebral blood flow?). • Intubate, state CO_2 goal of mild hypocapnia, consider mannitol. • State appropriate next steps depending on context (e.g. surgical exploration, head CT, or ICU)
Pulmonary Embolus *Complexity*: High *Appropriate patients*: Any *Setting*: Middle of a case (GA most plausible) *Instructions*: Suddenly there is an acute drop in CO_2 to 10 mmHg, drop in BP to 70/30 mmHg, elevation in HR to 130 bpm, and over next few minutes decrease in SpO_2 to 80%. STAT Plausibility Consult: Did your patient have an occult malignancy? Recent trans-oceanic flight? Lower extremity trauma?	**Scoring items** • State problem (especially: recognize the significance of the drop in $ETCO_2$). • State differential diagnosis (thrombolic event, fat embolus, or air embolus depending on context). • Auscultate lungs, treat with 100% O_2, epinephrine, fluid bolus.

	• Consider interventional radiology, TEE.
Pulmonary Edema *Complexity*: Moderate *Appropriate patients*: Any long case *Setting*: Intraoperative or Postoperative. Could be towards end of long case with lots of fluid (or inadvertent fluid overload by break relief). *Instructions*: Gradually the SpO_2 decreases to 92% (but returns to 97% with 100% O_2), lung sounds have crackles, lung compliance gets worse at same time.	**Scoring items** • State problem • State differential diagnosis (cardiogenic or non-cardiogenic) • Auscultate lungs, recognize significance of crackles • Attempt ETT suction, recruiting maneuvers, consider diuretic
Low urine output *Complexity*: Low *Appropriate patients*: Any case where it is plausible to have a urinary catheter *Setting*: End of long case where provider is taking over from another provider; or PACU *Instructions*: Report that there is no urine in the foley bag. Charted UOP is 20 ml over the past 2 hours. Pick the most likely option depending on the patient: • Option 1: Hypovolemia (HR 95, BP 90/55, low CVP) • Option 2: Low Cardiac Output (HR 50, BP 90/55, high CVP, +/− lungs with crackles) • Option 3: Post-renal obstruction	**Scoring items** • State problem. • Identify differential diagnosis (e.g. pre-renal, intra-renal, post-renal), state most likely diagnosis in this patient. • Perform physical exam (quality of heart sounds, quality of pulse); troubleshoot urinary catheter. • Pick appropriate treatment (e.g. fluid vs. diuretic vs. wait-and-see). • Plan follow-up (e.g. check urine in next hour vs send to ICU).
Unexpected difficult airway *Complexity*: Moderate to High *Appropriate patients*: Any *Setting*: Beginning of case *Instructions*: Create a can ventilate/cannot intubate scenario in a case that mandates an ETT (or make sure the LMA doesn't work properly). Advanced: Let the scenario progress to cannot ventilate/cannot intubate.	**Scoring items** • State problem. • Prior to induction, take appropriate precautions if patient is likely to be difficult ventilation (e.g. positioning, airway adjuncts immediately available, avoiding long-acting muscle relxants). • Follow difficult airway algorithm and demonstrate rapid progression to surgical airway in case of cannot ventilate/cannot intubate. Extra credit: Draw the ASA Difficult Airway algorithm
Aspiration *Complexity*: Low *Appropriate patients*: Any *Setting*: • If GA: Immediately after intubation • If Regional/MAC: After administration of sedative drugs *Instructions*: SpO_2 drops to 90%, HR 95, BP increase by 10%, increased airway pressure, report that there was a lot of yellow fluid suctioned from back of mouth (and ETT/LMA, if in place). STAT Plausibility Consult: Your outpatient stopped at a fast food restaurant and ate a turkey biscuit on the way into the hospital. Or your inpatient, it turns out, had an unrecognized ileus from days of being on narcotics.	**Scoring items** • State problem • Discuss differential diagnosis of wheezing and decreased SpO_2 after intubation; discuss risk factors for aspiration. • Auscultate lungs, suction ETT. • Decide on appropriate post-operative care (PACU or ICU, need for antibiotics, duration of monitoring, whether a CXR is indicated).
Local anesthetic toxicity *Complexity*: Low to High *Appropriate patients*: Regional technique *Setting*: During block placement (epidural or regional), following negative test dose of local anesthetic with epinephrine (could create peaked T wakes on monitor as only initial sign). *Instructions*: Patient reports feeling funny, lips tingling, HR 100, BP 80/50.	**Scoring** • State problem. • Ensure appropriate monitoring and airway support, place patient on 100% oxygen.

Advanced: Proceed to full cardiovascular collapse: BP drops to 60/20, HR increases to 130 then progresses to PVCs, VTach, Vfib.	• If cardiovascular collapse: call for help, administer IntraLipid, support with ACLS, prepare for cardiac bypass/ ECMO.
Power failure *Complexity*: Moderate *Appropriate patients*: Any *Setting*: Any time *Instructions*: Power to whole OR goes out	**Scoring items** • Continue to appropriately monitor the patient. • Find flashlight. • Ensure important equipment is plugged into “emergency” outlets.
Fire in the operating room *Complexity*: Moderate *Appropriate patients*: Any *Setting*: Any time *Instructions*: If plausible, have the ETT catch on fire. If not, have the drapes catch on fire with cautery (e.g. could be MAC case with face mask O_2).	**Scoring items** • If ETT fire: Remove tube, reintubate, examine airway for damage • If drapes: remove O_2, remove drapes, use fire extinguisher (drapes are water-resistant) • Discuss factors increasing risk of fire (fuel such as alcohol prep solution, ignition source such as cautery, oxygen) • Plan for next steps, e.g. intubation? ABG? ICU?
Failure to emerge from general anesthesia or sedation *Complexity*: Low *Appropriate patients*: Any case with “emergence” *Instructions*: Provider takes over near the end, right after taking a break (during which it is possible that the break relief gave–but did not chart–additional sedative drug/relaxant). If GA case: Patient does not move at end of case, but HR goes up to 120 and BP goes up to 145/90 (residual neuromuscular blockade scenario). If sedation case: Patient does not regain appropriate level of alertness. Advanced: Patient is actively agitated and delirious.	**Scoring items** • State problem. • State differential (neurological, metabolic, pharmacologic causes). • Search for causes: check for level of neuromuscular blockade, check patient temperature, consider checking electrolytes. • As appropriate: identify and treat residual neuromuscular blockade/ sedation/agitation.
Laryngospasm/Negative pressure pulmonary edema *Complexity*: Moderate *Appropriate patients*: Any *Setting*: After extubation, or anytime during mask case *Instructions*: Induce complete laryngospasm that does not respond to positive pressure. Advanced: After successfully treating the laryngospasm, the patient has persistent requirement for O_2 in the recovery room, RR 30, SpO_2 100% on O_2 but 89% on room air.	**Scoring items** • State problem • Discuss possible causes (e.g. concurrent aspiration, secretions in oropharynx, light anesthesia) • Treat with positive pressure ventilation and when this fails, proceed to succinylcholine/rocuronium as appropriate. • Advanced: Identify negative pressure pulmonary edema, order chest x-ray, check arterial blood gas (pH 7.48, pCO_2 30, pO_2 150 on simple face mask), identify significant A-a gradient in this setting
Rhabdomyolysis *Complexity*: Low to Moderate *Appropriate patients*: Any long GA case *Setting*: At end of case or in PACU/ICU *Instructions*: Report that the patient has brown-colored urine. Advanced: Tachycardia, hypotension, PVCs, hyperkalemia, metabolic acidosis.	**Scoring items** • State problem. • State differential diagnosis. • Check Creatine Kinase level.

STAT Plausibility Consult: Perhaps the patient had undiagnosed mitochondrial myopathy and some lower extremity weakness (an admittedly rare, but possible, confounder)? Or an unfortunately severe response to trauma?	• Rule out malignant hyperthermia (no temperature increase or increased CO_2) • Treat hyperkalemia (insulin/glucose, bicarbonate) • Institute treatment with fluids at high rate, identify risk of renal failure and need for ICU in severe cases
Medical error made by other *Complexity*: Low *Appropriate patients*: Regional or MAC case (awake patient) *Setting*: Intraoperative, after returning from a break. *Instructions*: Upon returning from break relief, the provider is told "They made incision. I gave the Ancef while you were gone." The patient, who is only mildly sedated, says "Wait, is that a cephala-something? I'm allergic to anything that has a 'cef' in it. I'm feeling kind of short of breath, actually. And itchy all over." The patient proceeds to have an allergic reaction consisting of rash and mild wheezing, easily treated with anti-histamines and inhaled albuterol. After, the patient is angry and demands to know: how could this happen? And, What could you do to prevent this from happening again?	**Scoring items** Identify and treat allergic reaction. Demonstrate appropriate rapport with patient; express regret that it happened without assigning blame; identify sources of error; identify an action plan for quality improvement.
Belligerent patient *Complexity*: Low *Appropriate patients*: Any *Setting*: Prior to induction, you are wheeling the patient into the room (you have just given a small amount of midazolam) and the surgical team is not present yet. The OR nurses are busy. *Instructions*: The patient is acting drugged, demented, or deranged – but it is not clear if she is crazy or just mad. Either way, she refuses to get on the bed and says you have no business forcing her to, and furthermore, she's calling the cops. She screams when you touch her IV and is taking back her consent for surgery and actively trying to leave. No one is coming to your help despite the obviously deteriorating situation.	**Scoring items** • State problem, and rule out medical causes for delirium/agitation. • Demonstrate effective interpersonal skills: • Must politely yet firmly enlist aid of recalcitrant team. • Address ethical issues of proceeding with case despite refusal of patient (who has been sedated).
Abbreviations: ABG – Arterial blood gas ACLS – Advanced Cardiac Life Support ASA – American Society of Anesthesiologists BP - Blood pressure BPM - Beats per minute CT - Computed tomography scan CVP – Central Venous Pressure CXR – Chest X-ray EBL - Estimated Blood Loss ECMO – Extracorporeal membrane oxygenation ETCO2 – End-tidal carbon dioxide ETT - Endotracheal tube	GA - General Anesthesia HR - Heart rate ICP - Intracranial pressure ICU – Intensive Care Unit LMA – Laryngeal mask airway MAC - Monitored anesthesia care OR – Operating room PACU – Post-anesthesia care unit PVC – Premature Ventricular Complex RR – Respiratory rate SpO2 - Oxygen saturation by pulse oximetry TEE – Transesophageal echocardiography UOP – Urine output