Surgical Safety Education Review

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Instructions
After reviewing the enclosed material, please print, sign, and return the last page of this packet

Table of Contents

Laser physics & Safety ........................................3
Fire Safety..........................................................20
Malignant Hyperthermia.................................49
Signature Page..................................................79
A laser safety program should include:

- Delegation of authority and responsibility for supervising laser safety to a laser safety officer (*Mary Wetzel*)
- Identification of hazards and appropriate control measures
- Establishment of use criteria & authorized procedures for all HCP’s working in NHZ
- Education of personnel
A “Nominal Hazard Zone” should be identified to prevent unintentional exposure to a direct, reflected, or scattered beam.

NHZ’s are different for different wavelengths.

NHZ for 532 nm laser is considered to be the room (approx. 14 feet).

NHZ for HoYAG is 12”.
Laser Safety Precautions

- O. R. Doors should be closed
- Windows should be covered with non-laser transparent material
Warning signs should be posted on all access doors when the laser is in service.
Keep Laser Key in a Designated Area

- Never leave key in the ignition of an un-attended laser
- Never leave laser keys in a non-secure, un-attended area
Laser Log and Checklist

- All Hospitals Should Create a Laser Log and Checklist
Proper Cystoscope Care

• Laser fibers should be extended a minimum of 1cm beyond the end of a cystoscope before lasing.
Awake patients should be given Laser Glasses
Laser Eye Protection

- Patients under general anesthesia should have their eye taped shut, and either laser glasses, a wet towel, or a laser eye shield placed over their eyes.
Potential Laser Eye Hazard

KTP, LBO, 980 Diode

Holmium, Thulium, Excimer, CO$_2$
Proper Laser Eyewear

- Only Specific Laser Eyewear should be used.
- O.D. $\geq 4$
- Proper Wavelength
- Side shields
Proper Laser Eyewear

- Laser eyewear is not interchangeable!
- Laser eyewear is wavelength & density specific
- Eyewear must be labeled with OD and wavelength
- Patients eyes must also be protected!
- Post eyewear at all access doors
Hazard Electrical Shock

- Broken or frayed electrical cords could pose a shock hazard. Especially where liquids are present.
Potential Fire Hazards

• The majority of medical lasers are Photo-Thermal devices. Improper use or a fiber break could lead to a fire hazard
Flammability Hazards

• All people in the laser treatment area should be aware of fire hazards associated with laser use
• The intense heat of the laser beams can ignite combustible solids, liquids, or gases
• Laser appropriate fire extinguishers and water should be immediately available.
Communication is the Key

Good communication between the doctor and laser operator is the key to a safe and successful procedure.
Fire Prevention
in the Perioperative Practice Setting

2013 AORN Fire Safety Tool Kit
Overview and Goal

- Recent statistics indicate the numbers of surgical fires reported have increased from approximately 100-200 fires per year to over 550 surgical fires per year.

- The goal of this learning activity is to educate the perioperative team about fire safety in the perioperative practice setting. Proactive tools to promote fire prevention, plan effective responses, and develop perioperative evidence-based policies to protect perioperative patients and personnel will be discussed.
Objectives

After completion of this continuing education activity, the participant will be able to:

1. Identify the three components of the fire triangle.
2. Identify fire prevention interventions.
3. Describe the Fire Risk Assessment.
4. Explain the “PASS” technique.
5. Review the “RACE” technique.
Fire Facts

Estimated Frequency

- 550-650 per year in the U.S.
- 44% on head, neck or upper chest
- 26% elsewhere on the patient
- 21% in the airway
- 8% elsewhere in the patient
Patient Injuries

- Of the 550-650 fires per year in the U.S.
  - 20 to 30 are serious and result in disfiguring or disabling injuries
  - 1 to 2 are fatal
Surgical Fires

Reported by Procedure

- Tracheotomy
- Oral surgery
- Tonsillectomy
- Facial surgery
- Infant surgeries
- Pneumonectomy
- Cervical conization
- Cesarean section
Surgical procedures above the xiphoid process and in the oropharynx carry the greatest risk:
- Lesions removal on the head, neck, or face
- Tonsillectomy
- Tracheostomy
- Burr hole surgery
- Removal of laryngeal papillomas
## Contributing Factors

<table>
<thead>
<tr>
<th>Ignition Sources</th>
<th>Oxidizers</th>
<th>Fuel</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ 70% Electrosurgical units,</td>
<td>□ 75% Oxygen-enriched atmospheres.</td>
<td>• 4% Alcohol-based surgical prepping agents.</td>
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<tr>
<td>□ 20% Other heat sources</td>
<td></td>
<td></td>
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<tr>
<td>■ Hand-held battery operated devices</td>
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<tr>
<td>■ Fiberoptic light sources</td>
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<td></td>
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<tr>
<td>■ High-speed burrs</td>
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<tr>
<td>■ Defibrillators</td>
<td></td>
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<tr>
<td>□ 10% Lasers</td>
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</tbody>
</table>
Fire Triangle
Ignition Sources

- Electrosurgical unit
- Argon beam coagulator
- Power tools (e.g. drills, burrs)
- Laser
- Fiber optic light
- Defibrillator
- Electrical equipment
Controlling Ignition Sources: Interventions

- Do not use an ignition source to enter the bowel when distended with gas.

- Keep ESU active electrode away from oxygen or nitrous oxide.

- Use active electrodes or return electrodes that are manufacturer approved for the ESU being used.

- Use approved protective covers as insulators on the active electrode tip. NOT red rubber catheter or packing material.
Controlling Ignition Sources: Interventions

- Use a laser-resistant endotracheal tube when using laser during upper airway procedures
- Place wet sponges around the tube cuff if operating in close proximity to the endotracheal tube
- Use wet sponges or towels around the surgical site
- Only the person controlling the laser beam activates the laser
- Have water and the appropriate type fire extinguisher available
Controlling Ignition Sources: Interventions

- Place the light source in standby mode or turn off when not in use
- Inspect light cables before use and remove from service if broken light bundles are visible
- Select defibrillator paddles that are correct size
- Use only manufacturer recommended defibrillator paddle lubricant
- Position defibrillator paddle appropriately
Oxidizers

- Oxygen
- Oxygen enriched environment
- Nitrous oxide
Controlling the Oxidizer Interventions

- Tent drapes to allow for free air flow
- Keep oxygen percentage as low as possible
- Deliver 5 L to 10 L/min of air under drapes
- If >30% concentration required, intubate or use laryngeal mask airway
- Stop supplemental $O_2$ or nitrous oxide 1 min. before using ignition source
- Use an adhesive incise drape
Fuels

- Patient
- Personnel
- Drapes
- Gowns
- Towels
- Sponges
- Dressings
- Tapes
- Linens
- Head Coverings
- Shoe covers
- Collodion
- Alcohol-based skin preparations
- Human hair
- Endotracheal Tubes
Controlling Fuels: Interventions

- Use moist towels around the surgical site when using a laser
- During throat surgery, use moist sponges as packing in the throat
- Use water based ointment and not oil based ointment in facial hair and other hair near the surgical site
Controlling Fuels: Interventions

- Prevent pooling of skin prep solutions
- Remove prep-soaked linen and disposable prepping drapes
- Allow skin-prep agents to dry and fumes to dissipate before draping
- Allow chemicals (e.g., alcohol, collodion, tinctures) to dry
- Conduct a skin prep “time out”
ECRI Revised Recommendation

**Fire prevention is a team effort!**

- Perform a Fire Risk Assessment
- Surgeon must be made aware of open O$_2$ use
- Stop supplemental O$_2$ before & during use of ignition source

ECRI Recommendations

- Oxygen delivery during head, face, neck, and upper chest surgery:
  - Do **not** use open delivery of 100% oxygen
  - Intubate or use laryngeal mask airway if supplemental oxygen needed
  - If $O_2$ is greater than 30% via open delivery, use 5-10 L of air/min under the drapes

- **Exceptions:**
  - Patient verbal response required during surgery (e.g., carotid artery surgery, neurosurgery, pacemaker insertion)
  - Open oxygen delivery required to keep the patient safe

Fighting Fires *On A Patient*

- Announce the fire
- Attempt to extinguish with water or saline
- Remove burning materials from patient
- Extinguish on floor
- Turn off oxygen source
- Obtain fire extinguisher as last response
- Save all involved materials
Fighting Fires
*Involving an Endotracheal Tube*

- Announce the fire.

- Collaborate and assist the anesthesia professional with:
  - disconnecting and removing the breathing circuit
  - turning off the flow of oxygen
  - pouring saline or water into the airway
  - removing the endotracheal tube and any segments of the burned tube
  - examining the airway
  - re-establishing the airway
NFPA Fire Classification*

Class A: wood, paper, cloth, and most plastics (eg, combustible materials)

Class B: flammable liquids or grease

Class C: energized electrical equipment

Combination: ABC, AC

* NFPA = National Fire Protection Association
Recommended Fire Extinguisher

- ECRI: Class A, B, C
- NFPA: Class A, B, C, or AC
- Check with the authority having jurisdiction (e.g., local fire marshal)
Fire Extinguisher Use
“PASS”

P  Pull the pin
A  Aim nozzle at the base of the fire
S  Squeeze the handle
S  Sweep the stream over the base of the fire
Shutting Off Gases

- Find the Valve Location outside every OR room
- Be familiar with Valve Operation
- Anesthesia will shut off gases or delegate a member of the team
Sprinklers and Smoke Detectors

- **Sprinkler**
  - activated by Heat
  - must be unobstructed

- **Smoke Detector**
  - sounds alarm
Evacuation Steps
Use “RACE”

R  Rescue
A  Alarm
C  Confine
E  Extinguish
Summary

Steps for surgical fire prevention

1. Know the components:
   a) Ignition sources
   b) Oxidizers
   c) Fuels

2. Communicate:
   a) Fire Risk Assessment
   b) Presence of a Fire
MALIGNANT HYPERTHERMIA
CHARACTERISTICS

- An inherited disorder of skeletal muscle triggered in susceptible (human or animal) in most instances by inhalation agents and/or succinylcholine, resulting in hypermetabolism, skeletal muscle damage, hyperthermia, and death if untreated. Underlying physiologic mechanism – abnormal handling of intracellular calcium levels

- Underlying physiologic mechanism – abnormal handling of intracellular calcium levels
WHEN DOES MH OCCUR?

- When triggered by inhalation agents and/or succinylcholine, malignant hyperthermia typically occurs shortly after anesthesia is first given. But it can occur at any time during anesthesia or in rare cases may occur as late as 24 hours after surgery.
SIGNS

- Increase in end-tidal CO2
- Tachycardia that is unexplained
- Generalized muscle rigidity
- Masseter (jaw) muscle rigidity
- Temperature elevation (late sign)

Be suspicious when there is:

- Unexplained tachycardia
- Cola-colored urine (Rhabdomyolysis)
- Unanticipated acidosis
TRIGGER/SAFE AGENTS

Triggering Agents
- Halothane
- Sevoflurane
- Desflurane
- Succinylcholine

Safe Agents
- Opioids
- Non-depolarizing agents
- Ketamine
- Propofol
- Anxiolytics
PREPARATION FOR AN MH SUSEPTIBLE PATIENT

- Shut/disable vaporizers
- Flow 02 @ 10L/min for 20 minutes
  (through machine and ventilator)
- OPTIONAL - Change carbon dioxide absorbent
- Use non-trigger agents or local anesthesia
- Monitor temperature and for early signs of MH
- Have Dantrolene available
- **Note:** A separate, vapor-free anesthesia machine is not necessary.
MH PROTOCOL

- Circulating nurse announce overhead MH crisis in room #.....

- Circulator will delegate someone to:
  - Retrieve MH cart and code cart
  - Mix Dantrolene (Assign at least 3 people)
  - Record events (code sheet)/medications
  - Retrieve ice
  - Notify pharmacy/ARC
  - Notify MH hotline
AFTER HOURS

Chambersburg

- Circulator will call “3333” to initiate MH crisis
- Notify the ARC
- The ARC will notify MH hotline and pharmacy to obtain more Dantrolene from the Surgical Center and Waynesboro hospital

Waynesboro

- Circulator will call Shift administrator to notify pharmacy to obtain more Dantrolene from the Surgical Center and Chambersburg Hospital
- The shift administrator will then send 2 additional RN’s as well as aids/ environmental techs for ice brigade
INITIAL TREATMENT

- Discontinue inhalation agents, succinlycholine
- Hyperventilate with 100% O2
- Bicarbonate 1-2 mg/kg as needed
- Get additional help
- Dantrolene 2.5 mg/kg push, repeat PRN
- Cool patient: lavage, surface, wound until patient reaches 38 degrees
- Treat arrhythmias – do not use calcium channel blockers
- Arterial or venous blood gases
- Electrolytes, coagulation studies
HOW TO MIX DANTROLENE

- Dantrolene Sodium for Intravenous Injection is labeled as requiring reconstitution with 60cc sterile water for injection.
HOW MUCH DANTROLENE DO WE NEED?

- 36 VIALS ON HAND
- 2.5 mg/kg is recommended, with a suggested upper limit of 10 mg/kg. If a patient of average weight (approximately 70 kg) were to require dantrolene at the upper dosing limit, then at least 700 mg of dantrolene would be needed.
- “Worst Case” scenario of a very large person (i.e., about 100-110 kg or 220–250 pounds) Thirty-six (36) vials of dantrolene will allow for initial stabilization and treatment while more vials are being acquired to continue treatment, as needed.
• Myoglobinuria - Mannitol
• Hyperkalemia - Bicarbonate, Insulin, and Glucose
• Cardiac Toxicity - Calcium Chloride
• Metabolic Acidosis - Sodium Bicarbonate
• DIC – ”Consider” Heparin Sodium
• Arrhythmias - Procainamide
POST ACUTE PHASE

- Patient must remain in PACU for a minimum of 4 hours
- ICU 24-48 hours
After Crisis is controlled

- Give Dantrolene 1 mg/kg every 4-6 hours for 24 – 48 hours
- Monitor for recrudescence – rate is 25%
- Follow electrolytes, blood gases, CK, core temperature, urine output and color, coagulation studies
  - Biochemical markers
  - Blood gases – pCO2, pH
  - Myoglobin levels in serum and urine
  - PT, PTT, INR, fibrin split products
- Liver enzymes, BUN
- Monitor for signs of myoglobinuria and rhabdomyolysis and institute therapy to prevent renal failure
Chambersburg Hospital
WHERE IS THE MH CART LOCATED?

Anesthesia Work Room
Location/Drawers

- Sterile Drape
- 60cc Syringes
- 18g Needles
- IV Starter Kits
- Arterial Blood Testing Kits
- Lab Kits
- Medications
- Urine Meter
- Cysto Tubing
- 3Way Foley
- Sterile Specimen Cups
- Dantrium
- Sterile Water
- CVP Monitor
- Mini Spike Pins
Drawer #4

URINE METER
CYSTO TUBING
STERILE SPECIMEN CUPS
3WAY FOLEY
Bottom of Cart
Waynesboro Hospital
WHERE IS THE MH CART LOCATED?

PACU
Malignant Hyperthermia Cart
Drawer #1
Drawer #4
I have received and read the material presented. I acknowledge understanding of the material and its importance. I will incorporate this information and knowledge into my role as a member of the medical staff.

The material included:

Laser Safety
Fire Safety
Malignant Hyperthermia

__________________________________      ___________________________
Printed Name                                                    Date

__________________________________
Signature