

Fire Prevention and Safety During Surgical Procedures



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Program Content

Components of the fire triangle

- Ignition sources
- Fuel sources
- Oxidizers

Strategies for preventing and managing fires



Examples of Fires Reported to ECRI

Head and Neck

- Endotracheal tube
- Flash fire of eyelid
- Throat
- Facial hair

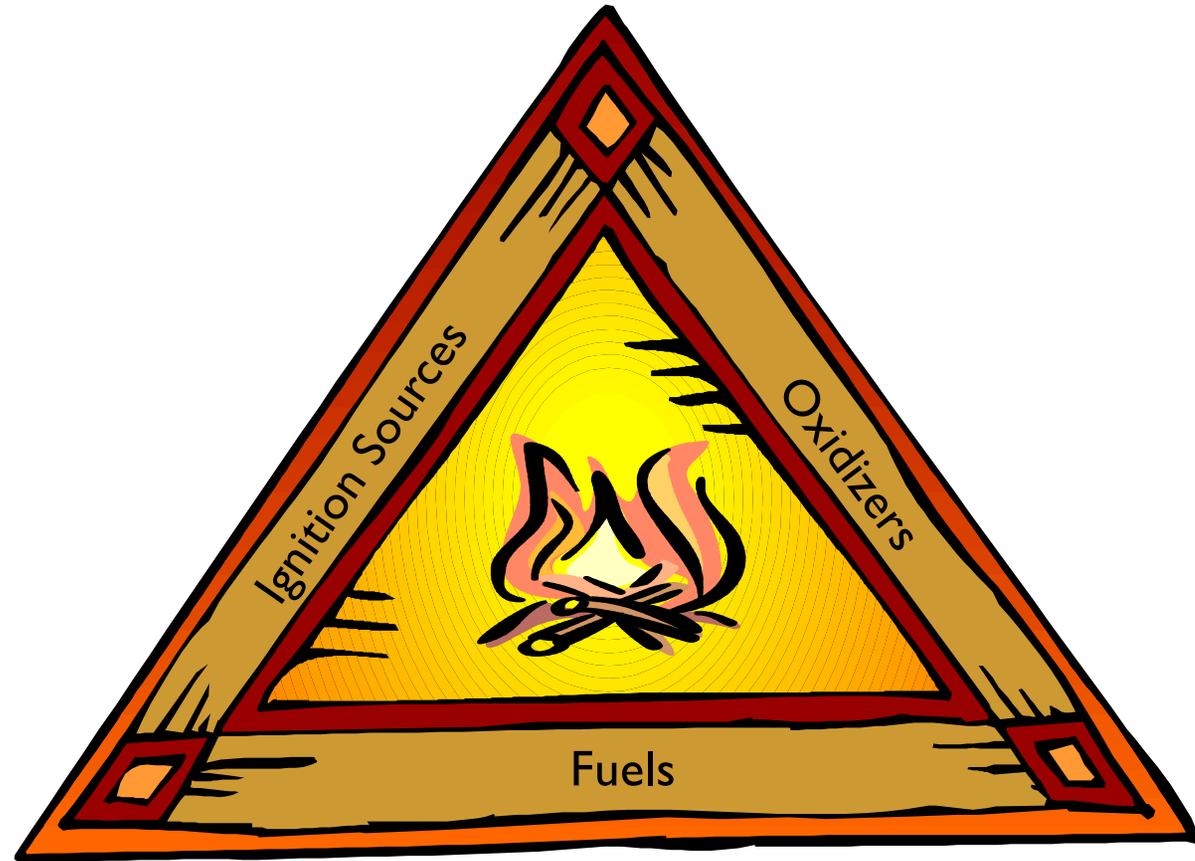
Drapes and sponges

Bowel explosion

Incision site

**Flammable prep
solution**

The Fire Triangle

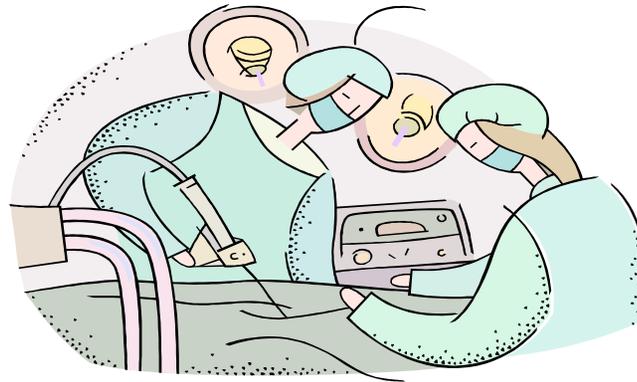


Fuel Combustion

Heat increases the oxidation rate of a fuel-oxygen mixture until combustion occurs



Ignition Sources



Electrosurgery and
Electrocautery Devices



Lasers

Fiberoptic Cables

Deactivated Ignition Sources

Sparks and Glowing Tissue Embers

Fuel Sources



In or On the Patient

- Hair
- Gastrointestinal gases
- Gases present in surgical smoke

Prepping Agents

- Alcohol
- Alcohol/iodophor solution
- Tinctures
- Degreasers



Barrier Materials

- Should resist combustion
- May burn or melt when subjected to sources of intense heat

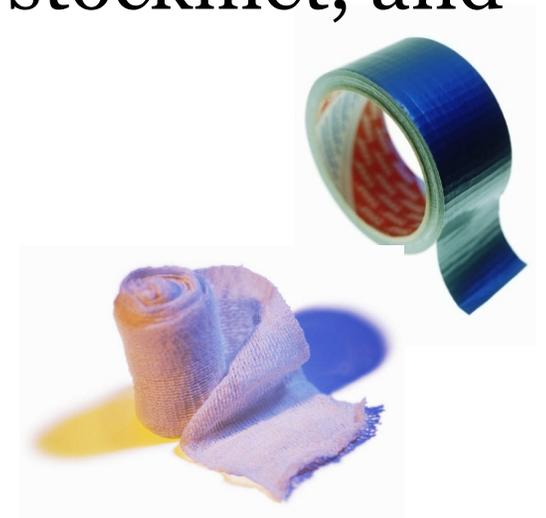


Scrubs, gowns, masks, hair and shoe covers



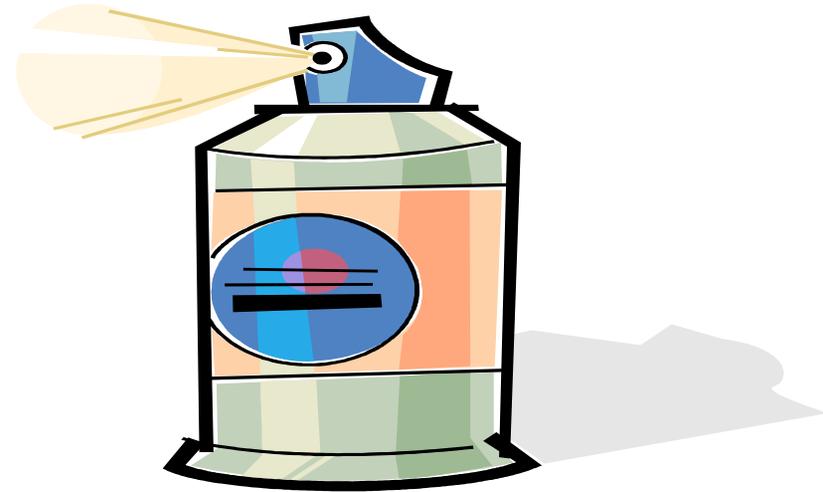
Supplies

- Mattresses and pillows
- Blankets, sheets and towels
- Sponges, tape, ace bandages, stockinet, and steridrapes
- Red rubber catheters and other materials used as electrode insulators



Other Combustible Agents

- Oil based ointments
- Tincture of Benzoin
- Aerosols
- Wax
- Collodion



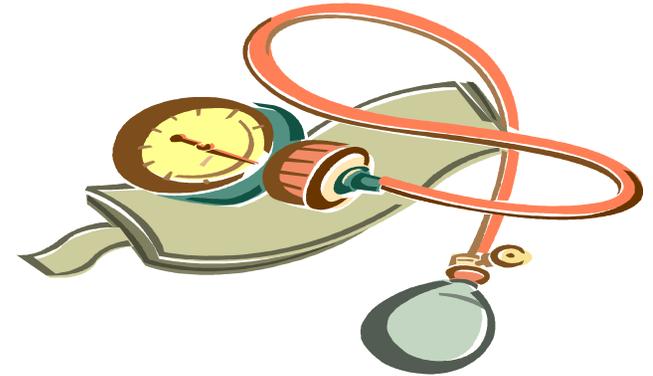
Anesthesia Components

- Breathing circuits
- Masks and airways
- Laryngeal Mask Airway
- Endotracheal tubes



Other Flammable Products

- Packaging materials
- Gloves
- Blood pressure and tourniquet cuffs
- Stethoscope tubing





Oxidizers

Oxygen

- An oxygen-enriched atmosphere exists when O_2 is above 21%

NITROUS OXIDE

- Thermal decomposition of N_2O can supply oxygen for a fire

Preparing for Fires

- Assess the flammability characteristics of all products used in the OR
- Assess patient preparation protocols
- Observe cases in progress for potentially hazardous behaviors



- Locate and test gas shutoff valves and circuit breaker
- Evaluate traffic patterns
- Note location and accessibility of fire extinguishers and alarms
- Keep wet sponge or towel in basin on back field



Fire Extinguishers

- CO₂ best choice for putting out fires typically encountered in ORs
- Class ABC-rated extinguishers are not appropriate for use in the OR



Fire blankets not recommended

- Less effective at extinguishing fires on the patient than other methods
- Use can lead to additional complications
 - Spreading the fire
 - Wound contamination

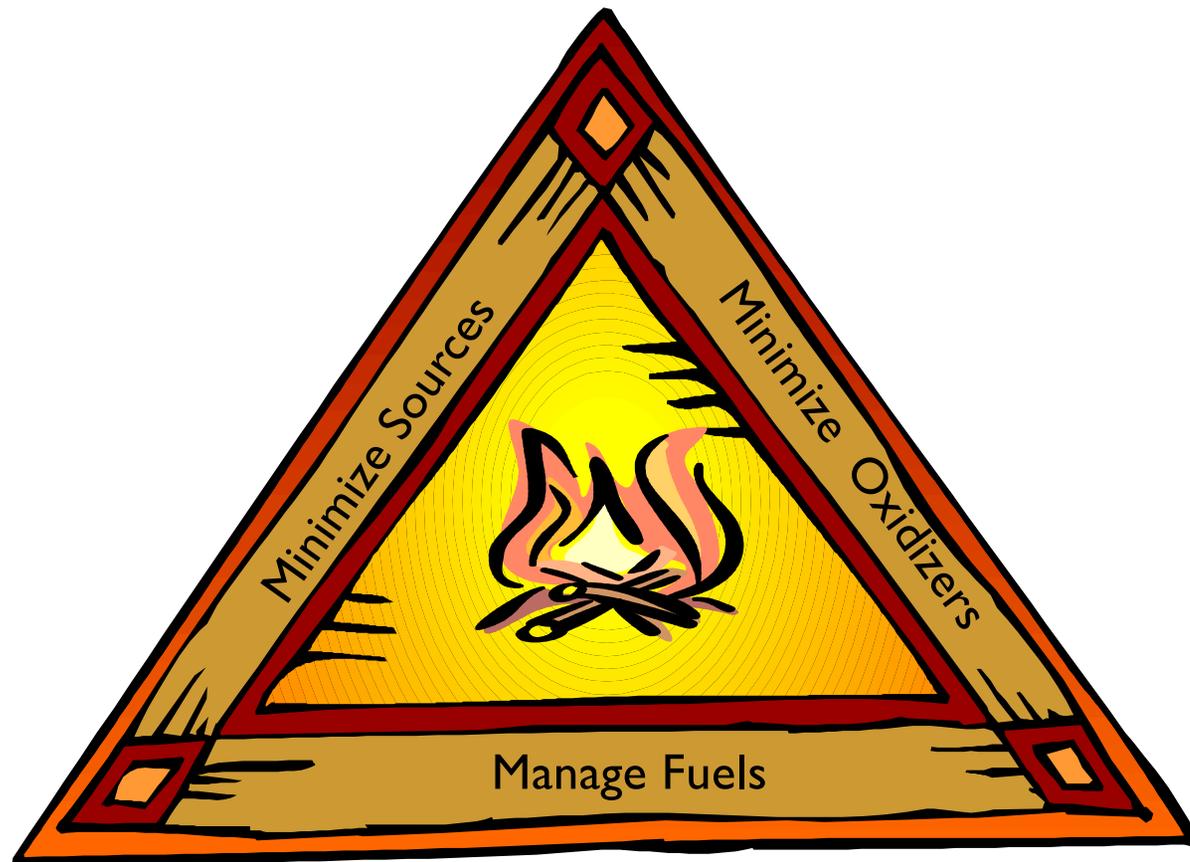


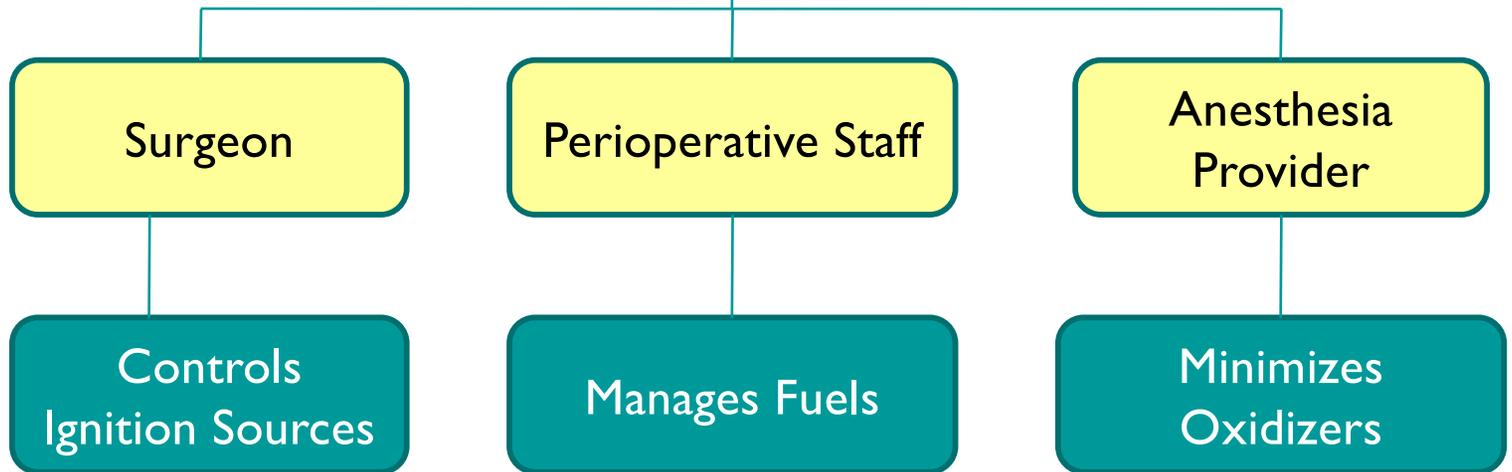
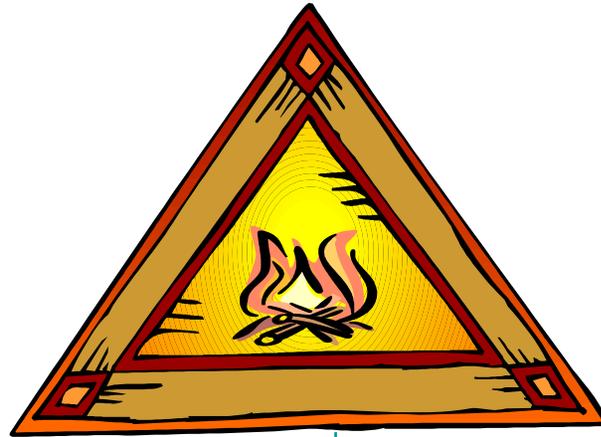


Fire Drills

- Familiarize staff with policy and procedures
- Conduct frequently

Preventing Fires







Control Ignition Sources

- Use a non-conductive safety holster
- Use electrosurgery with caution where gastrointestinal gases or oxidizers can accumulate
- Avoid metal-to-metal arcing



Eschar

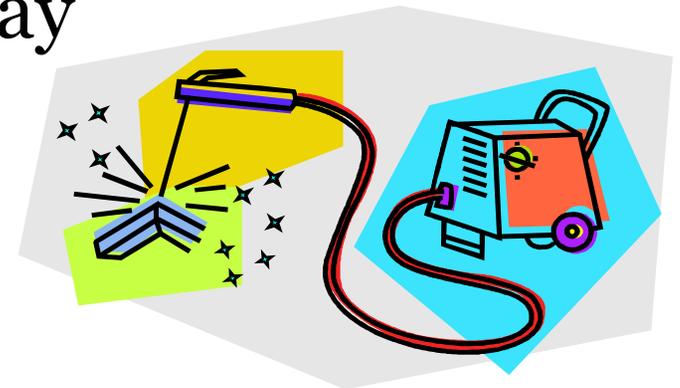
- Prevent build-up on electrodes
- Use coated electrodes to facilitate removal



ESU, ECU, and Laser

- Activate only when the tip is in view
- Deactivate before the tip leaves the surgical site
- Avoid activating close to sponges or surgical drapes

- Use the lowest possible power setting
- Avoid long activations of the electrosurgical generator
- Do not use ESUs to cut tracheal rings and enter the airway



Fiberoptic Cables

- Connect to scope or headlight prior to activation
- Deactivate before disconnecting
- Never lay illuminated or hot light cable end on drapes





Lasers

- Place in standby mode when not being used
- Use anodized, dull, nonreflective instruments near the target tissue to decrease reflectivity of laser beams

Manage Fuels

Do not activate ignition sources in the presence of flammable agents





Flammable Agents

- Avoid pooling of prepping solutions
- Drape patient after vapors from flammable agents have dissipated

- Evacuate surgical smoke to reduce the potential for combustion
- Use water-based lubricants to make hair and other flammable parts of the body fire resistant



- 
- Use wet gauze sponges during procedures identified as high risk for fire
 - Use active electrodes insulated by the manufacturer



Minimize Oxidizers

- Prevent accumulation of O_2 and N_2O under surgical drapes
- Verify all breathing circuits are leak-free
- Use pulse oximeter to determine O_2 saturation and need for supplemental O_2

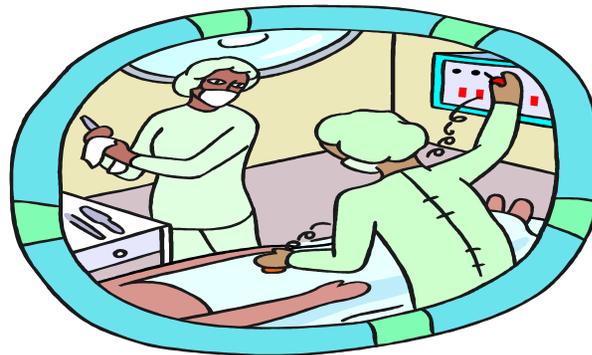


Endotracheal Tubes

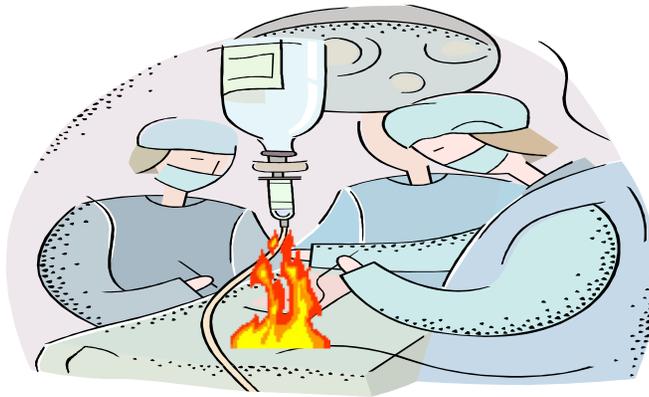
- Use water-based lubricants
- Use laser safe tubes for airway procedures
- Inflate cuff with methylene blue-tinted water or saline during airway procedures

Managing Fires

- Most fires will be on or in the patient
- Flash of heat or flame, smell of smoke or fire should prompt a fast response



A small fire can progress to a life-threatening large fire in about 30 seconds





In the event of a small fire on the patient, immediately:

- Smother fire with a wet sponge or towel, or remove burning material from the patient



In the event of a large fire on the patient, immediately:

- Stop the flow of breathing gases to the patient
- Remove burning material from patient
- Care for the patient



If measures to contain the fire are not effective:

- Toxic smoke will form a hot, dense layer near the ceiling, obliterating overhead lights
- Smoke can migrate through the room ventilation system and from room-to-room



Evacuating the Patient

- Transport the patient on OR table if possible
- Shut off O₂ and N₂O valves
- Shut off electrical equipment, especially if water is used to douse fire
- If fire progresses past one minute, the entire OR suite should be evacuated



At the first sign of an endotracheal tube fire, immediately and rapidly:

- Disconnect breathing circuit from the endotracheal tube
- Remove endotracheal tube
- Care for patient



Conclusion

- Virtually all operating room fires ignite on or in the patient.
- The basic elements of a fire are always present during surgery.
- Vigilance of the surgical team in controlling the fire triangle is the best defense against an ignition incident.
- Fire prevention is the responsibility of the entire team.



Program Summary

Components of the fire triangle

- Ignition sources
- Fuel sources
- Oxidizers and how they feed the fire triangle



Strategies for preventing and managing fires

Prior to use, clinicians should review the Instructions for Use product inserts and/or User's Guide provided by the Manufacturer, to ensure safe and appropriate utilization of electrosurgical devices.