OPERATING ROOM SAFETY AT NAVICENT HEALTH

Navicent Health's purpose for this education is to increase safety culture awareness and knowledge of best safety practices within the operating room to mitigate the risk of harm to our patients and our healthcare teammates.

Navicent Health

COURSE OBJECTIVES

Treat safety as a priority

Recognize and prevent common hazards in the operating room

Safely work with radiation in the Operating Room

Properly handle lasers in the Operating Room

Apply fire safety measures in the Operating Room

WHO'S SAFETY ARE WE TALKING ABOUT?

Surgical team

- Surgeon
- Nursing staff
- Anesthetist
- Attendants

Patient's safety

AMERICAN COLLEGE OF SURGEONS - OR SAFETY AND CREW RESOURCE MANAGEMENT (CRM) APPLYING THE AVIATION MODEL TO THE OPERATING ROOM

SEVEN PRINCIPLES (CRM)

1. **Command** – One final decision maker who is willing to foster the team and accept responsibility and accountability for their team's actions.
2. **Leadership** – Defined by commander's willingness to let team members exercise their rights and responsibilities to ensure a safe and positive outcome. Although there is only one commander, any member of a team can show leadership. Surgeons who encourage teamwork are MORE respected.
3. **Communication** – Teams that fail to communicate are doomed to negative results and errors. Adverse O.R. events are often related to poor communication due to factors such as steep hierarchies, stress, and cultural differences.
4. **Situational awareness** – An effective leader relies on the team to promote situational awareness through effective communication about what is occurring. "Why didn't you tell me?!"
5. **Workload management** – Organizing tasks so there is equitable distribution amongst team members. "Plan the work and work the plan."
6. **Resource management** – Optimal use of all information, data, and assistance available to the team. Ensuring the presence of needed resources.
7. **Decision making** ☐Collaborative – discouraged in high performance teams. ☐Unilateral – fast but is a problem if leader is not aware of all information or makes incorrect decision. ☐Consultative – most effective in high performance teams. Leader must know when to stop gathering data.

HAZARDS IN OPERATING ROOM

- Blood/body fluid exposures from sharps
- Exposure to released particulates
- Exposures to waste anesthetic gases
- Possible exposures to chemical cleaning agents Slips/trips/fall hazards
- Exposures to lasers/ X-ray Radiations
- Hitting heads on O.R. lights
- Electrical shock hazards
- Steam and Fires

BLOOD/BODY FLUID EXPOSURES

- ☐50% of our sharps injuries occur during use.
- ☐Procedures with the most sharps injuries:
  - ☐Suturing
  - ☐Blood sampling
  - ☐Intradermal injections
  - ☐Cutting (Scalpel injuries)
  - ☐Inserting IV Lines

BLOOD/BODY FLUID EXPOSURES

- ☐50% of our sharps injuries occur after use.
- ☐Procedures with the most sharps injuries:
  - ☐Withdrawing needle from patient
  - ☐During clean up and disassembly
  - ☐During disposal
    - ☐Overfilled sharps container
    - ☐ Protruding needles
  - ☐Needles left in dustbin, laundry, O.R. Table, or on the floor

BLOOD/BODY FLUID EXPOSURES

What can we do to prevent these exposure injuries?

☐Utilize a safe zone during each surgical procedure.

☐Account for all sharps used.

☐Dispose of sharp in sharps container immediately after use.

☐When emptying suction canisters, always pour carefully and wear eye/face protection.

☐Use personal protective equipment (PPE).

BLOOD/BODY FLUID EXPOSURES

Should an exposure occur:

- ☐For face/eye exposure: Rinse with water for about 15 minutes.
- ☐For needle-stick injuries:
  - ☐Express blood from stick
  - ☐Wash with soap and water or betadine
  - ☐Spirit/sterillium NOT to be used

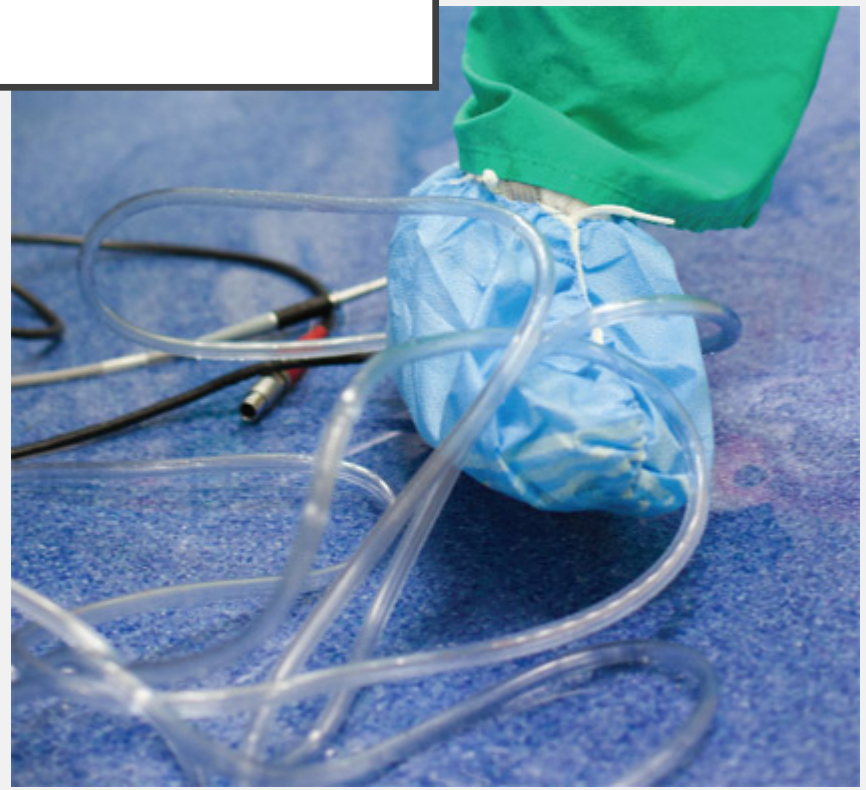
PARTICULATE RELEASES

- Some procedures in the O.R. generate particulates into the air (i.e., from cauterizing blood vessels, using lasers).
- These particulates can have viable organisms present that can cause infections.
- Preventive actions:
  - Use suction close to point of generation
  - Wear tight fitting safety goggles
  - Wear N95 respirator

WASTE ANESTHETIC GASES

- Releases of anesthetic gases into an O.R. can result in loss of small motor skills, slowing of reflexes, metal confusion, and tiredness.
- Action by the anesthesiologist can minimize these exposures:
  - Check all connections before use for leaks.
  - Pack endotracheal tube to prevent leaks.
  - Have equipment serviced/checked periodically.

SLIPS/TRIPS/FALLS



- ☐The walking surface of O.R. locations can be slippery, causing an injury.
- ☐Take the appropriate precautions:
  - ☐Wear slip resistant foot wear.
  - ☐Report water/fluids on floor for clean up.
  - ☐Use a "CAUTION – WET FLOOR" sign on floor until cleaned.

X-RAYS, LASERS

We must prepare the O.R. for use of X-Rays/ Lasers.

☐ Place Lead aprons / lead thyroid shield at the entry of O.R. to be used by everyone inside the O.R.

☐ Place the eye protection equipment at the entry of O.R. if Laser is to be used.

☐ Verify that personnel entering the O.R. don adequate protection.

☐ Keep the use of C-arm to the minimum.

HEAD INJURIES

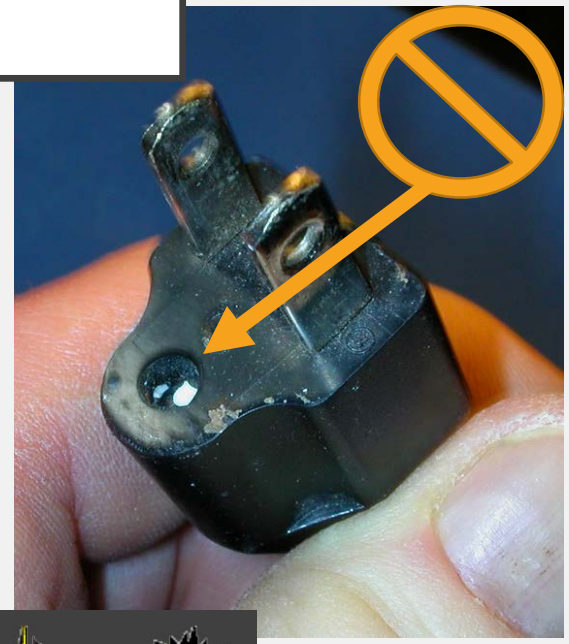
☐ O.R. lights are adjustable. Sometimes they may be in a position that can cause a head injury.

☐Use these simple rules:

- ☐Keep light up, out of the way until needed.
- ☐Once done using, move the light up, out of the way.

ELECTRICAL SHOCKS

- ☐Shocks are usually the result of faulty equipment.
- ☐Take the following actions:
  - ☐Unplug power cords by holding the plug, never pull the cord.
  - ☐Never operate equipment if the ground plug is missing. Take the unit out of service for repairs.
  - ☐Prevent exposure of electrical equipment from body fluids/ Other electrolytes inside the O.R.



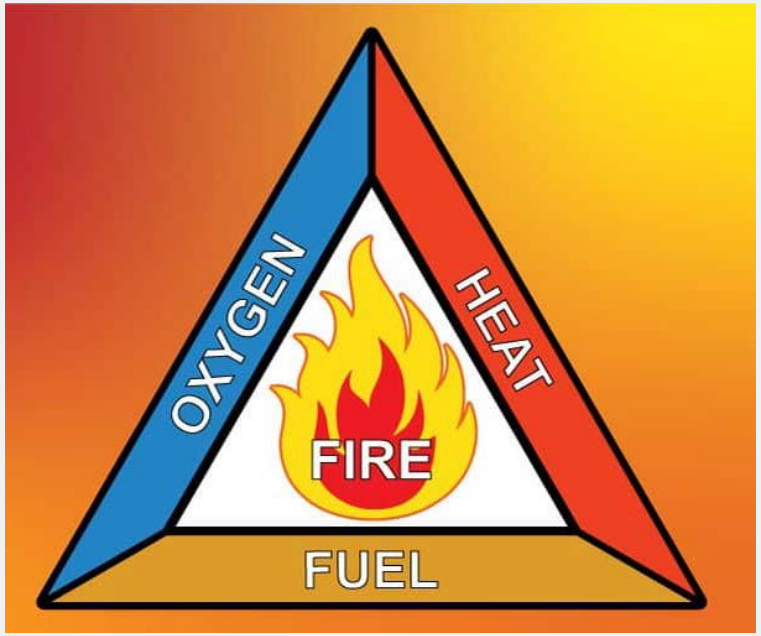
STEAM (IUSS)

- When performed correctly and when deemed appropriate, Immediate-Use Steam Sterilization (IUSS) is an effective and safe way to sterilize critical medical devices for a surgical procedure (CDC, 2008).
- Some unfavorable events have been associated with IUSS sterilization, including postoperative infections and clinical burns. Therefore, IUSS should not be used for convenience or to save time in the O.R.
- IUSS users must follow all critical steps for sterilization including cleaning, decontamination, rinsing, and aseptic transfer from the sterilizer to the point of use regardless of which sterilization cycle types are being used.
- IUSS should only be used in emergency clinical situations and with management approval. Those situations include the following:
    - When a one-of-a-kind instrument has been contaminated and needs to be replaced to the sterile field immediately.
    - When an item has dropped on the floor and is needed to continue a surgical procedure.
- Logs of IUSS should be audited weekly for compliance.

(IUSS is not approved for Children's Hospital or Ambulatory Surgery Center.)

FIRE

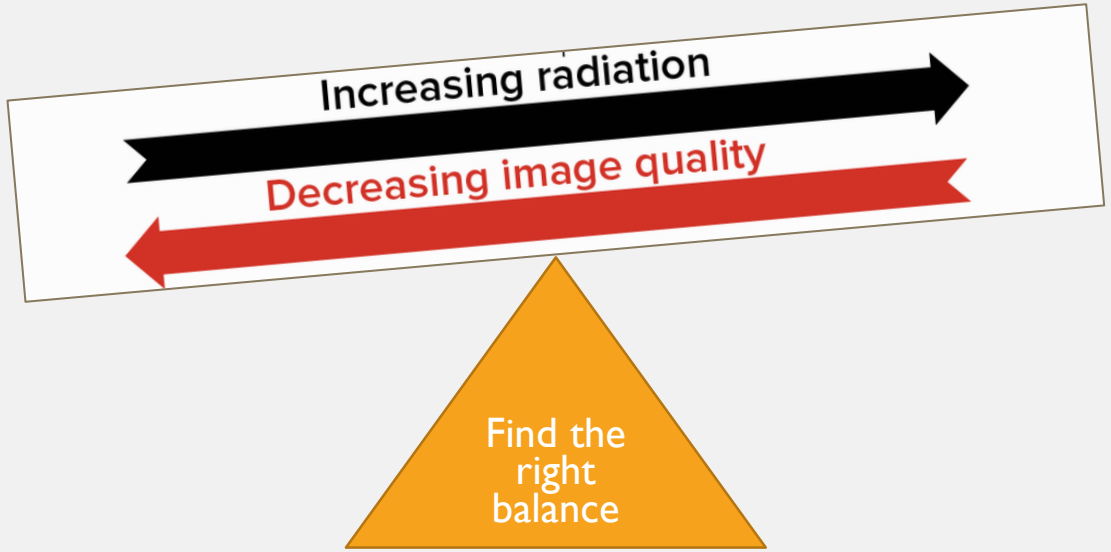
- In order to understand how fire extinguishers work, you first need to know a little bit about fire.
- Essentially, fire extinguishers put out fire by taking away one or more elements of the fire triangle.



TAKING A CLOSER LOOK AT RADIATION, FIRE, AND LASER SAFETY IN THE OPERATING ROOM

RADIATION SAFETY IN THE OPERATING ROOM: **ALARA**

- **A**s
- **L**ow
- **A**s
- **R**easonably
- **A**chievable



EXTERNAL RADIATION PROTECTION

TIME

- Try to keep Fluoroscopy time to a minimum.
- Most procedures should never take > 20 minutes (with the exception of Interventional Fluoroscopy).
- Always log and maintain a log of fluoroscopy time.
- The less time spent with the source of ionizing radiation, the lower your exposure.

DISTANCE

By doubling the distance between your body and the source of radiation, it will cut the radiation exposure by a factor of 4.

SHIELDING

- A lead apron that provides at least 0.5 mm Pb eq in the front AND 0.25 mm Pb eq in the back.
- For Pregnant staff: same as above and some special aprons can be ordered that provide1 mm Pb eq over the pelvis (wrap around skirts almost do).

INFECTION CONTROL AND THE LEAD APRON

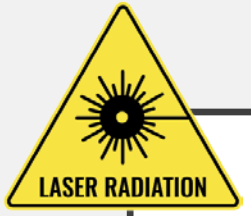
- Be sure to wipe down all aprons used clinically at the end of each procedure.
- This reduces the exposure of pathogens and bacteria to you and the next person who wears the apparel.
- Be sure to use an approved disinfectant (spray or wipes).
- Contact your apron manufacturer to attain the name(s) of safe disinfecting products to use.

INTEGRITY OF LEAD SHIELDING

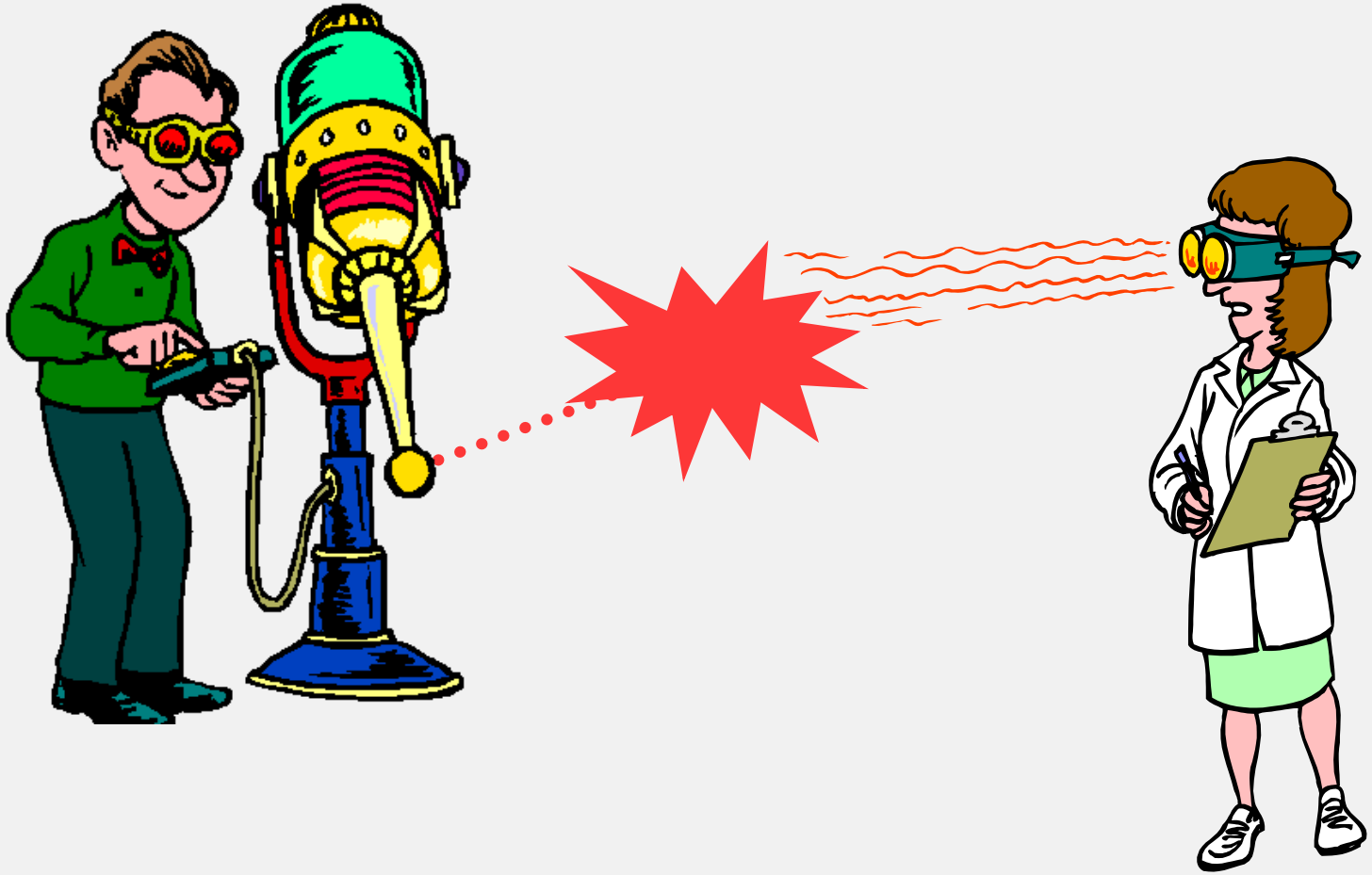
- All lead apparel should be evaluated regularly.
- The outer material should be evaluated for rips and tears and the lead should be evaluated for creases/holes.
- Those aprons/shields found to have outer tears or creases should be further evaluated under fluoroscopy.
- Damaged aprons should be disposed of as a hazardous waste.

EXPOSURE AND YOU

- Do not wear your personnel monitoring device outside of Navicent Health. This is used to measure your occupational exposure ONLY.
- Do not wear your dosimeter if you are having a medical procedure using radiation (radioactive materials or X-ray).
- Do acknowledge your RSO if you work elsewhere and wear a radiation monitor at another location.



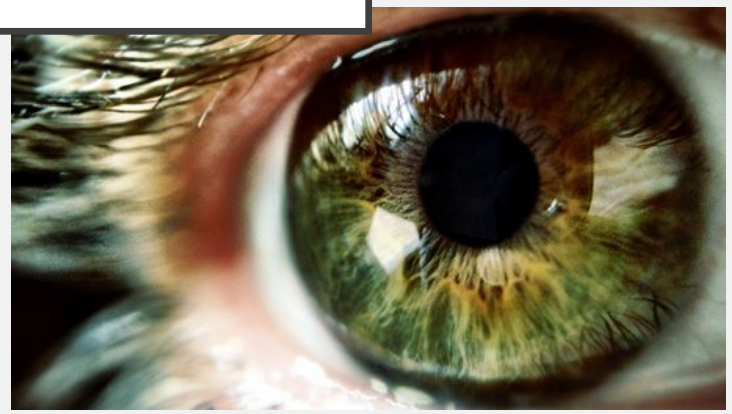
LASER HAZARDS



TYPES OF LASER HAZARDS

1. ***Eye***: Acute exposure of the eye to lasers of certain wavelengths and power can cause corneal or retinal burns (or both). Chronic exposure to excessive levels may cause corneal or lenticular opacities (cataracts) or retinal injury.
2. ***Skin***: Acute exposure to high levels of optical radiation may cause skin burns; while carcinogenesis may occur for ultraviolet wavelengths (290-320 nm).
3. ***Chemical***: Some lasers require hazardous or toxic substances to operate (i.e., chemical dye, Excimer lasers).
4. ***Electrical***: Most lasers utilize high voltages that can be lethal.
5. ***Fire***: The solvents used in dye lasers are flammable. High voltage pulse or flash lamps may cause ignition. Flammable materials may be ignited by direct beams or specular reflections from high power continuous wave (CW) infrared lasers.

LASERS AND EYES



- Effects of laser energy on the eye:
  - Laser light in the visible to near infrared spectrum (i.e., 400 - 1400 nm) can cause damage to the retina resulting in scotoma (blind spot in the fovea). This wave band is also know as the "retinal hazard region".
  - Laser light in the ultraviolet (290 - 400 nm) or far infrared (1400 - 10,600 nm) spectrum can cause damage to the cornea and/or to the lens.
- Photoacoustic retinal damage may be associated with an audible "pop" at the time of exposure.
- Visual disorientation due to retinal damage may not be apparent to the operator until considerable thermal damage has occurred.

SYMPTOMS OF LASER EYE INJURIES

- Exposure to the invisible ***carbon dioxide laser*** beam (10,600 nm) can be detected by a burning pain at the site of exposure on the cornea or sclera.
- Exposure to a visible laser beam can be detected by a bright color flash of the emitted wavelength and an after-image of its complementary color (e.g., a green 532 nm laser light would produce a green flash followed by a red after-image).
- *The site of damage depends on the wavelength of the incident or reflected laser beam.*
- When the retina is affected, there may be difficulty in detecting blue or green colors secondary to cone damage, and pigmentation of the retina may be detected.
- Exposure to the ***Q-switched Nd:YAG laser*** beam (1064 nm) is especially hazardous and may initially go undetected because the beam is invisible and the retina lacks pain sensory nerves.

SKIN HAZARDS

- Exposure of the skin to high power laser beams (1 or more watts) can cause burns. At the under five watt level, the heat from the laser beam will cause a flinch reaction before any serious damage occurs. The sensation is similar to touching any hot object; you tend to pull your hand away or drop it before any major damage occurs.
- With higher power lasers, a burn can occur even though the flinch reaction may rapidly pull the affected skin out of the beam. These burns can be quite painful as the affected skin can be cooked and forms a hard lesion that takes considerable time to heal.
- Ultraviolet laser wavelengths may also lead to skin carcinogenesis.

OTHER HAZARDS ASSOCIATED WITH LASERS

Chemical Hazards: Some materials used in lasers (i.e., excimer, dye and chemical lasers) may be hazardous and/or contain toxic substances. In addition, laser induced reactions can release hazardous particulate and gaseous products. (Fluorine gas tanks.)

Electrical Hazards: Lethal electrical hazards may be present in all lasers, particularly in high-power laser systems.

Secondary Hazards include:

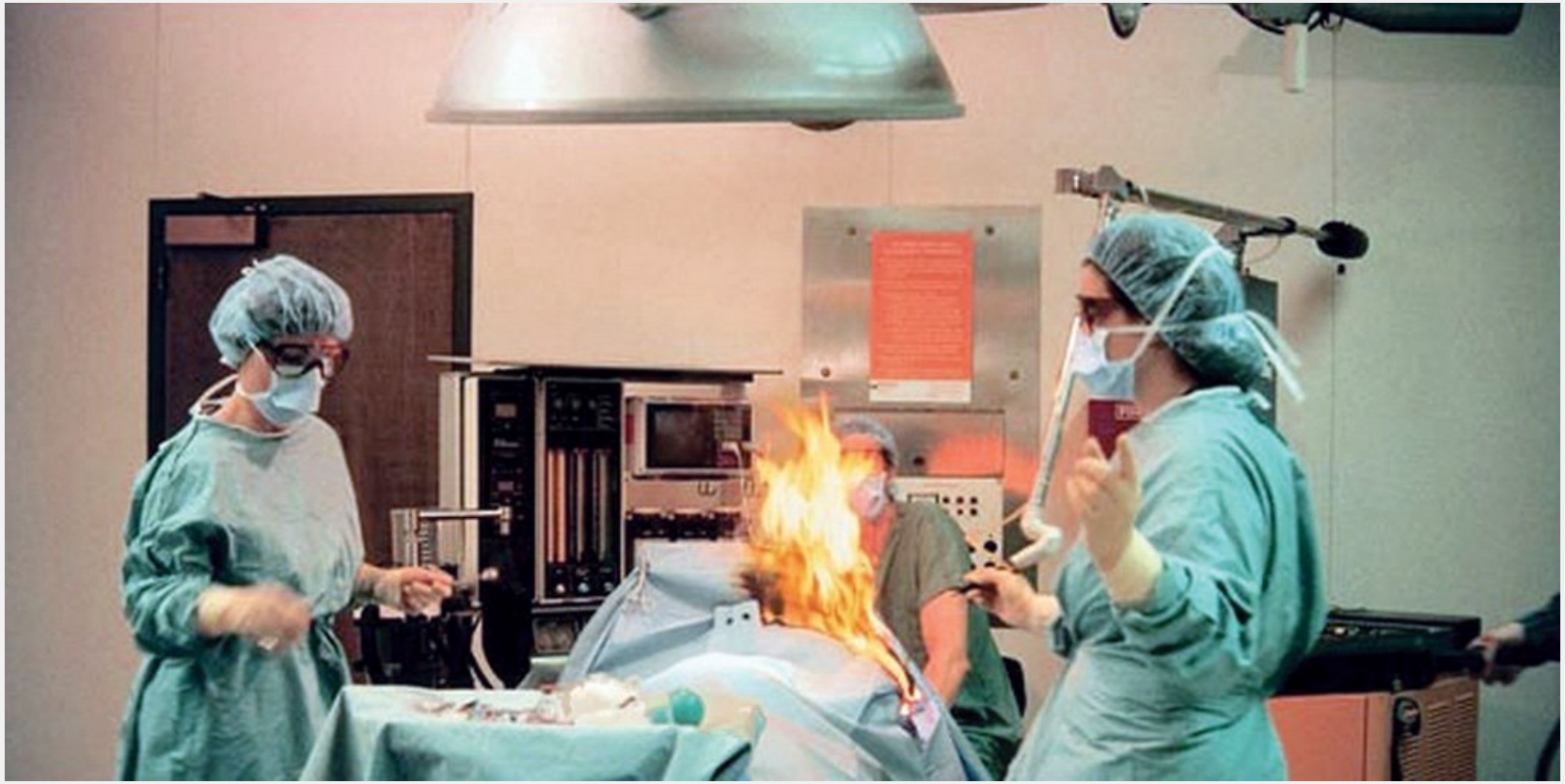
- cryogenic coolant hazards
- excessive noise from very high energy lasers
- X radiation from faulty high-voltage (>15kV) power supplies
- explosions from faulty optical pumps and lamps
- fire hazards

LASER PROTECTIVE EYEWEAR REQUIREMENTS

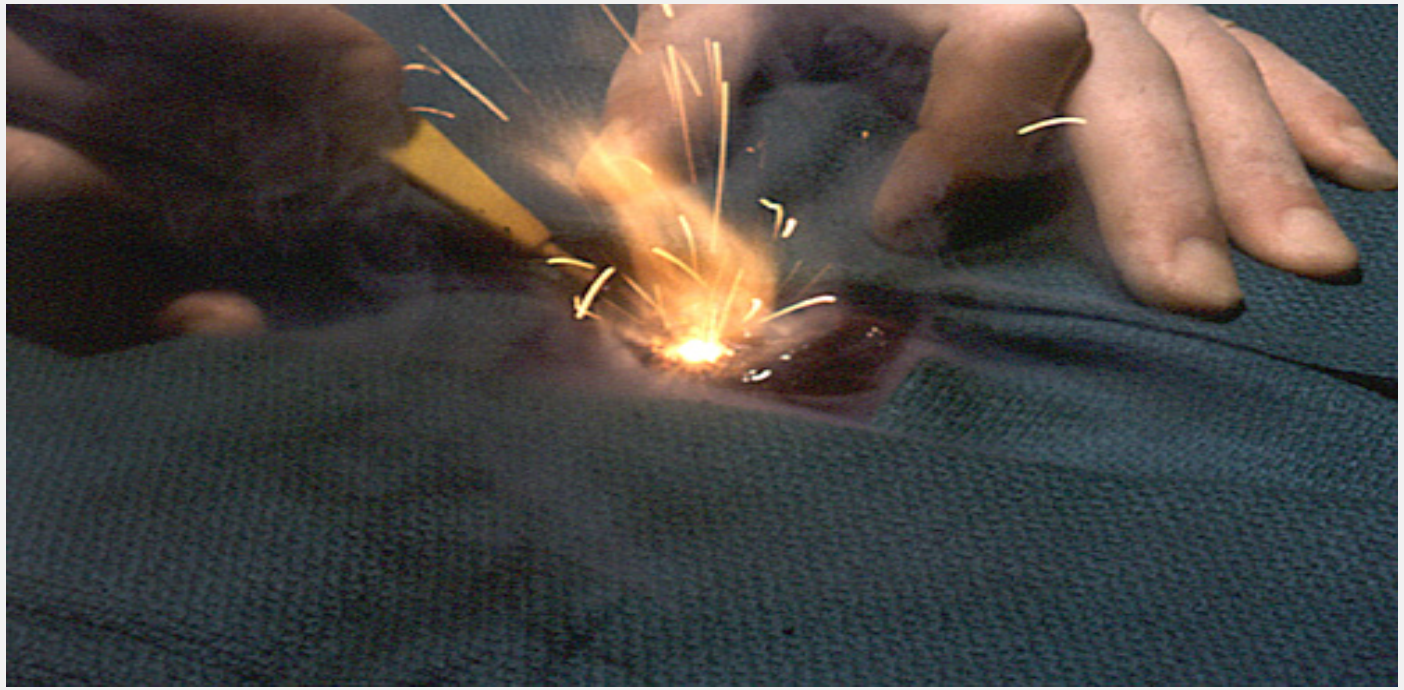
1. Laser Protective eyewear is to be available and worn in by all personnel within the Nominal Hazard Zone (NHZ) of Class 3 b and Class 4 lasers where the exposures above the Maximum Permissible Exposure (MPE) can occur.
2. The attenuation factor (optical density) of the laser protective eyewear at each laser wavelength should be specified by the Laser Safety Officer (LSO).
3. All laser protective eyewear should be clearly labeled with the optical density and the wavelength for which protection is afforded. This is especially important in areas where multiple lasers are housed.
4. Laser protective eyewear should be inspected for damage prior to use.

Optical Density (OD)
The OD (absorbance) is used in the determination of the appropriate eye protection. OD is a logarithmic function.

PREVENTING FIRES IN THE OPERATING ROOM



HEAT, SPARKS, AND FLARES FROM ELECTRO-SURGERY UNITS (ESU) ARE OFTEN IGNITION SOURCES



O.R. FIRE FREQUENCY

- O.R. fires are rare events, but are devastating in terms of damage to human lives and the structural damage to equipment in O.R. suites.
- Frequency has decreased steadily over the past 40 years mainly because of greater awareness of contributory factors.
- Approximately 100 O.R. fires /year in the US. McCarthy PM, AORN J. 2004 Mar;79(3):588-597

FUELS

Ointments & solutions:

- Alcohol (also in chromic suture packet)
- Chlorhexidine
- Benzoin
- Acetone
- Aerosols
- Wax
- Drapes and dressings:
  - Cloth or paper drapes/towels
  - Cloth or paper gowns
  - Sponges, laps, ray-techs

Equipment in field:

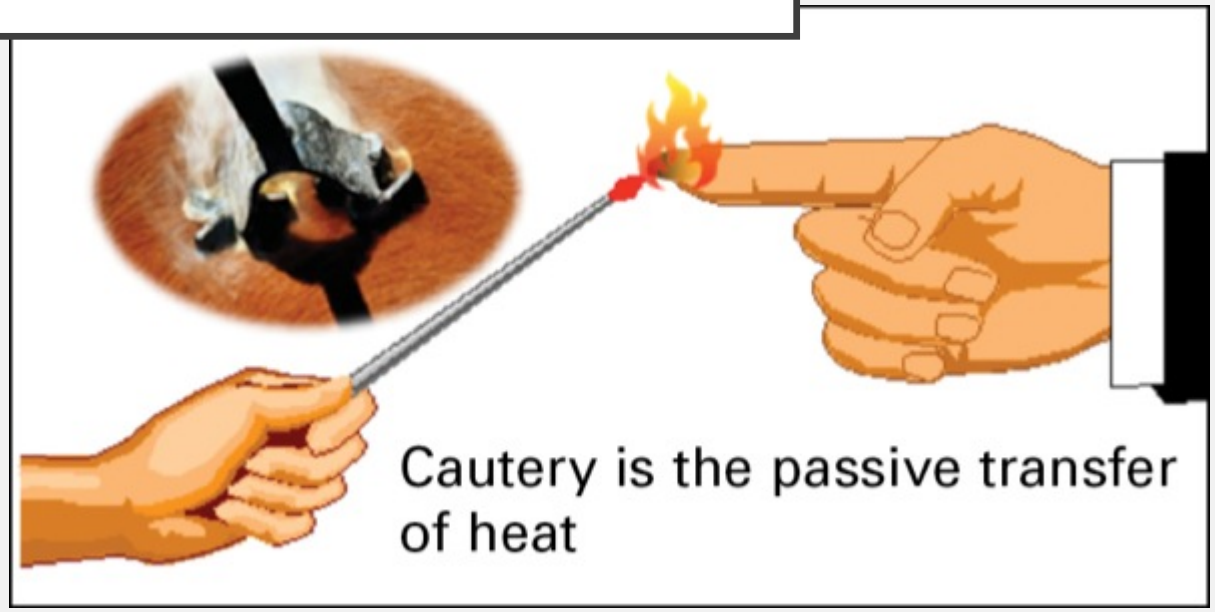
- Plastic: Steri-drape, Tegaderm, Nasogastric tubes, endotracheal tubes, oxygen line
- Latex Gloves
- Suture
- Mesh

Patient:

- Hair
- Clothing/gown
- Gastrointestinal gases

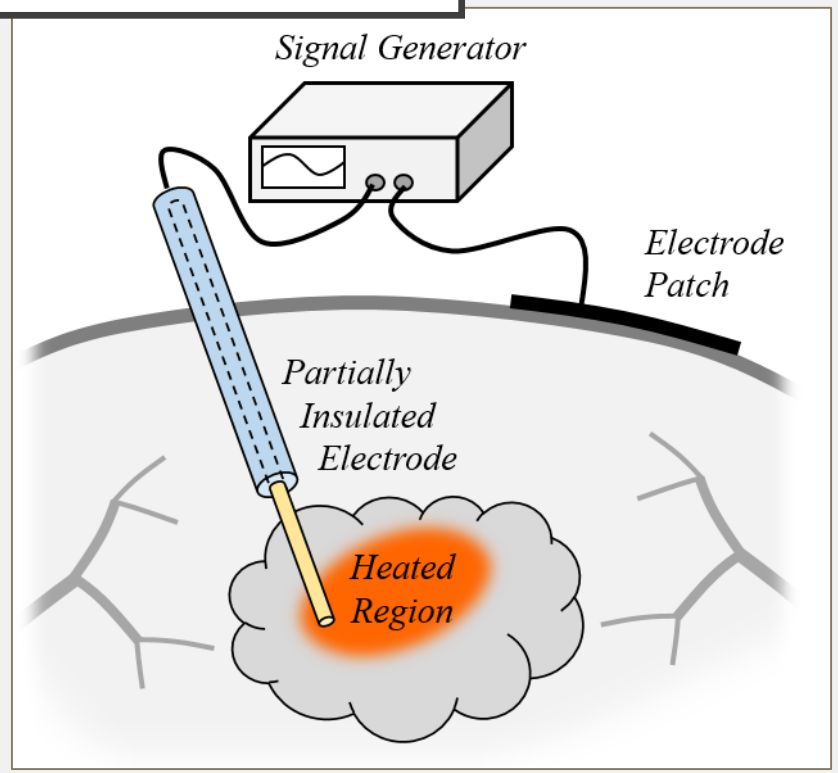
BOVIE CAUTERY MECHANISM: ELECTRICAL CURRENT

- Alternating current flows from the electrosurgical unit and a high current density occurs at the tip of the active electrode.
- The current density is lower at the pad and the current is returned to the ESU to complete the circuit.

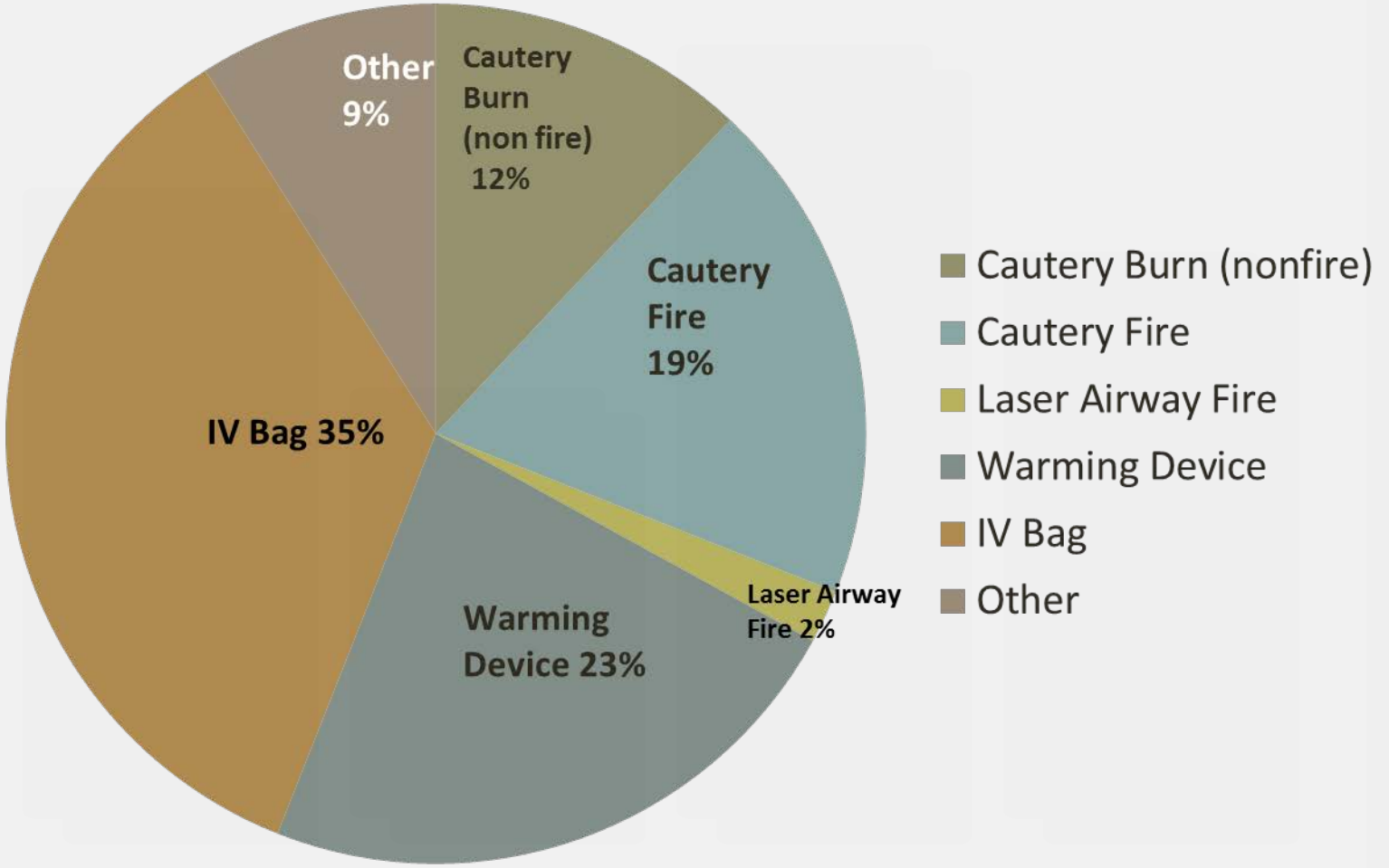


RADIOFREQUENCY ABLATION (RFA)

The high current density in tissue within a few millimeters of the needle electrode causes a rapid local temperature rise, to a range of 50–90°C, within seconds to minutes, resulting in thermal injury and irreversible tissue destruction.

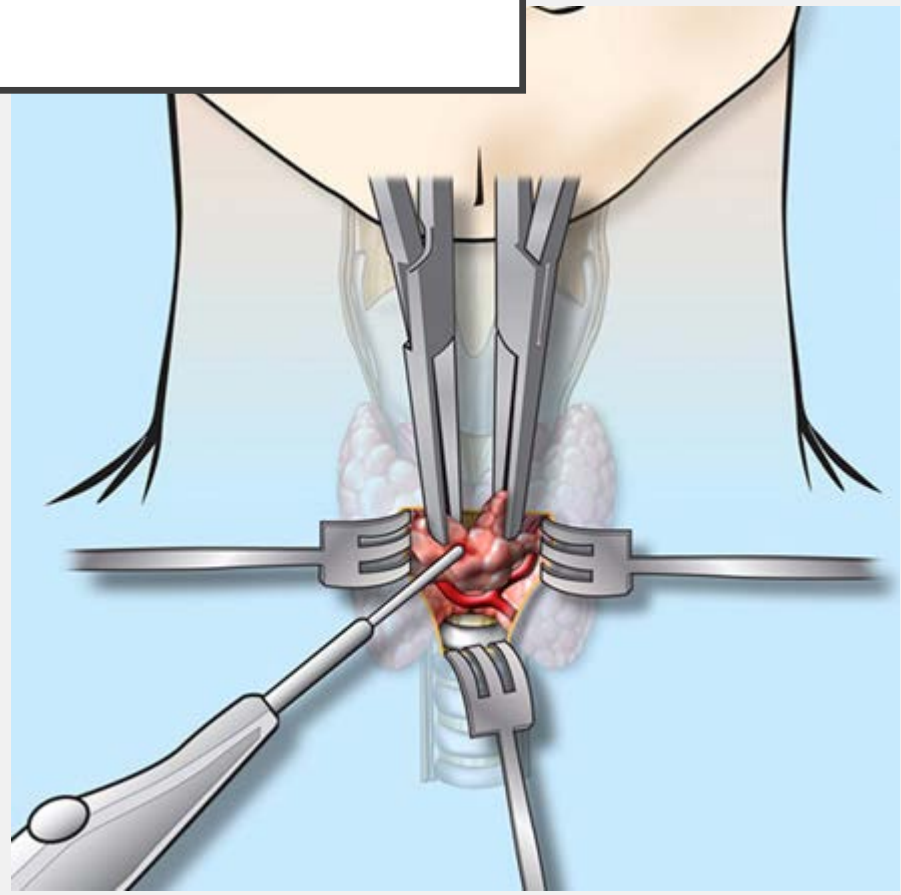


DEVICES CAUSING BURNS IN THE OPERATING ROOM



FIRES INVOLVING ENDOTRACHEAL TUBES

The technique of using the electrocautery to incise the trachea for tracheostomy can cause a catastrophic fire if the cautery contacts the endotracheal tube or its balloon.



Lai HC, Acta Anaesthesiol Sin. 2002 Mar;40(1):47-51

GASTRIC SURGERY AND CAUTERY

- Pyloric stenosis and obstruction allows for more prolonged degradation of stomach contents by gastric acid and proliferating bacteria to occur, resulting in increased amounts of flammable gases.
- It is advisable not to use cautery on an obstructed gastrointestinal tract.
- Many incidents have been reported where dilated stomach was opened with the cautery unit and a loud explosion occurred.
- A holster should be used for safety with the cautery unit for prevention of patient injury.

Carrol KJ, BMJ 1964

LAPAROSCOPIC SURGERY

- Initially, when oxygen or nitrous oxide were used for peritoneal insufflation during laparoscopies there were incidents of fire and explosions.
- CO2 is used today for insufflation. It has high blood solubility and thus causes less danger of gas embolus.
- Inhibitory effect on flammability.
- The light cable end registers a temperature of 101 degrees C with the potential for causing skin burns.
- It is recommended that the light source should be switched on only when used. The light cable end must not rest on the drapes once the light source has been switched on, as thermal burns will occur within seconds.

MacDonald AG. Br J Anaesth 1994;73:847–56

CASE STUDY: AN UNUSUAL POSTOPERATIVE BURN. ANESTHESIA. 2004 MAY;59(5):510.

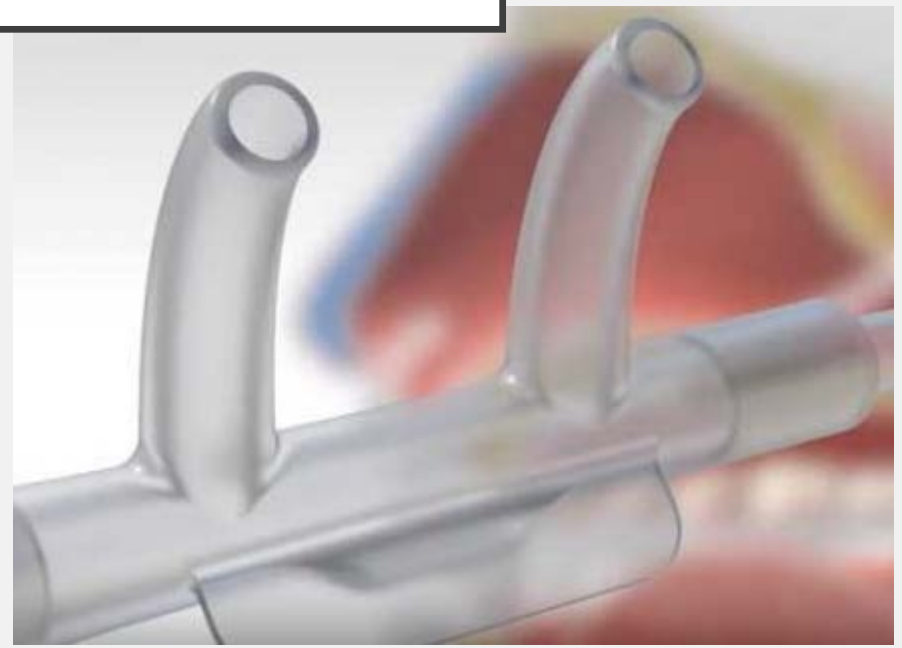
- Burn corresponds to the position of the axillary roll.
- The roll was comprised of a liter bag of crystalloid wrapped and placed under the dependent axilla.
- The bag of fluid was obtained from a warming cabinet that maintains a fairly constant temperature of 37 °C.
- The pressure exerted by the patient's weight on the dependent area contributed to the burn.

SAFE USE OF OXYGEN

- Oxygen supplementation during head and neck surgery under local anesthesia, with or without sedation, carries the risk of fire.

Things to consider:

- It is generally safe to place the O2 prongs in the patient's mouth when operating on the upper face.
- The tubing should be taped.
- Use O2 at the lowest clinically appropriate setting (2 to 3 L/min) when possible.



SAFE USE OF HEAT SOURCE

- When not in use, the fiber-optic light source should be turned off. The light, if left on dry drapes, over time, can cause ignition - especially near areas of high oxygen concentration.
- Cautery should be set to the lowest power setting that still allows it to function efficiently.
- A clean cautery tip must be maintained to avoid carbon accumulation, which will also tend to cause heat buildup.
- A holster should be used when the cautery is not in use.

FUEL SOURCES

Drapes and virtually everything that comes in contact with the patient and parts of the patient are fuels.

SAFE HANDLING OF FIRES ON THE PATIENT

For small fires, smother them or remove burning material from the pt. DO NOT pat the fire as this can cause flames to spread. Sterile water or saline kept near the field can also be used.

For large fires:

1. Stop flow of breathing gases to the pt.
2. Remove burning materials from pt.
3. Care for the patient:
    a. Resume ventilation
    b. Control bleeding
    c. Examine for injuries

USE OF FIRE EXTINGUISHERS

- Fire extinguishers are the last resort in the operating room.
- Don’t use fire blankets on patient fires.

SURGICAL PREPARATION OF THE SKIN

Use of Alcohol Antiseptic Solutions:

- Alcohol-based antiseptic solution are skin preparations that are used on patients to prepare the skin prior to procedures, such as surgical procedures. Alcohol helps to rapidly reduce bacteria that potentially can cause skin infection and optimizes the effects of other antiseptics such as iodine or chlorhexidine, by promoting rapid drying.
- Although these agents have benefits in reducing risk of surgical site infection, they increase the risk of SURGICAL FIRE.
- ONLY prepackaged unit dose applicators should be used, to ensure controlled delivery of the antiseptic solution.
- DO NOT allow the alcohol prep solution to soak into patient's hair or linens.
- Allow the alcohol prep solution to dry completely prior to draping; the area will be inspected to confirm proof of drying prior to draping.

SURGICAL PREPARATION OF THE SKIN, CONTINUED

- **Warnings**: Manufacture's recommendation for use must be followed for each product. Alcohol is flammable. Keep alcohol based skin preps away from fire or flame. Vapors are flammable.
- Use in a well ventilated area.
- Do not microwave or heat alcohol based skin prep solutions.
- DO NOT USE:
  - On patients with known allergies to any ingredients in the product.
  - On infants less than two (2) months of age.
  - On open wounds, mucous membranes, or as a general skin cleanser.

APPLYING THE PREP SOLUTION

- Tuck prep towels or chux, as needed, to absorb excess solution. Remove towels before draping.
- Avoid getting solution in hair. If this occurs, wipe hair with towel. Dry time in hair will be much longer than 3 minutes.
- When preparing skin folds, toes, or fingers use a sterile gloved hand to hold skin apart until completely dry, otherwise skin may adhere to itself.
- DO NOT SCRUB. Paint a single uniform application and do not re-prep the area.
- DO NOT ALLOW SOLUTION TO POOL. Use a sponge applicator to absorb excess solution and continue to apply a uniform coating. If solution accidentally gets outside of prep area, remove excess with gauze.
- Clean umbilicus with enclosed swabs, when applicable.
- Allowing the solution to dry completely (generally 3 minutes on the skin) will reduce the risk of fire. Solution will turn from a shiny to dull appearance on the skin.
- To reduce the risk of fire, begin draping and/or using cautery only after solution is completely dry and all solution soaked materials are removed.

AFTER THE PROCEDURE

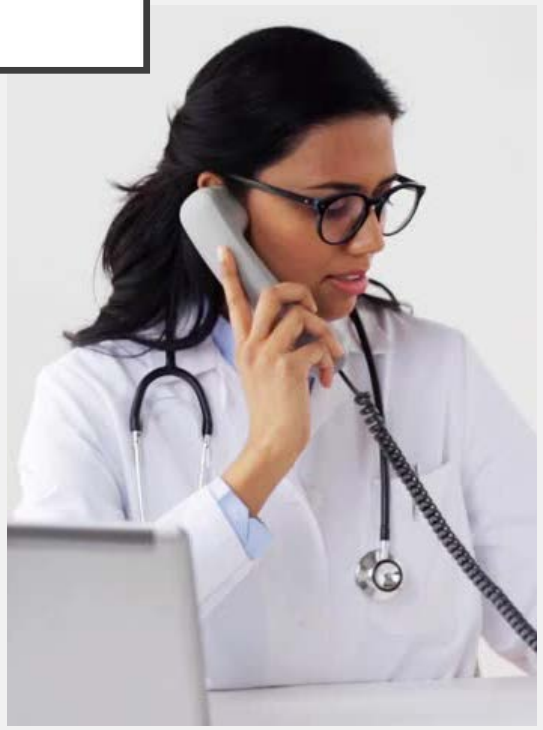
- To avoid skin injury, use care when removing drapes, tapes, etc. applied over the film.
- Alcohol-based skin prep solution may be left on the skin after the procedure. The film will gradually wear away.
- If removal of Alcohol-based prep is desired:
  - Apply remover lotion to the prepped area, keeping away from the wound edge or punctured site. Wipe off with a disposable towel.
  - If remover lotion is not available, soak gauze with 70% isopropyl alcohol and place on the prepped area for at least 40 seconds. Lightly scrub to remove the solution.

TINCTURES & OINTMENTS

- Avoid tinctures and ointments that contain alcohol.
- Be aware that chromic (gut) suture is stored in an 89% alcohol solution in the pack.
- Petroleum jelly (Vaseline) and petroleum-based ointments can ignite in the presence of oxygen.
- A water-soluble lubricant (K-Y jelly) should be used instead of petrolatum on the field because it is not flammable.
- Lugo's solution's can be very flammable.

REPORTING REQUIREMENTS

- ANY Fire in an O.R. must be reported to the DOH as a Serious Event *even if* there has been NO patient injury.
- Follow the CHART reporting guidelines available in the O.R. and notify the RISK MANAGER extension 3-1270 (or 478-633-1270).
- In cases of significant injury to the patient or to hospital property the Fire Marshall must also be notified and the O.R. taken out of use until the Fire Marshall declares it safe.
- Other Hospital Fire Safety Procedures should also be followed (see Safety Manual).



Operating Room Safety Orientation