New Clinical Guidance on Surgical Fire Prevention and Management

Presented for:
Charleston Area Medical Center (CAMC)
Health System
Charleston WVA
March 3, 2011
New Clinical Guidance on Surgical Fire Prevention and Management

Michael Argentieri, MS
Vice President and Senior Investigator
ECRI Institute
5200 Butler Pike, Plymouth Meeting, PA 19462
Tel: 610-825-6000, Ext. 5185   Email: argentieri@ecri.org

©2010 ECRI Institute
DISCLOSURE

Mr. Argentieri’s presentation includes discussion of a commercial product/service of which he does not have any significant financial interest or other relationship with the company who makes/provides this product/service.

Mr. Argentieri is an employee of and consultant for ECRI Institute.
New Clinical Guide to Surgical Fire Prevention

• New recommendations’ focus
  – Eliminate open O₂ delivery during sedation for head, face, neck, and upper chest surgery
  – Secure patient airway if increased O₂ needed
  – Use Pre-Op “Time-Out” to assess fire risks
• Developed in collaboration with the Anesthesia Patient Safety Foundation (APSF)

APSF Surgical Fire Educational Video (Preview Clip)
History – Surgical Fires

• 1800s-1980: Known and feared risk
  – Flammable anesthetics
  – Technological fix: antistatic precautions
• 1980-2009: Insidious Hazard
  – Oxygen enrichment under drapes
  – Alcohol prepping agents
  – Poor recognition of risk by clinicians
  – No collaborating stakeholders
  – NO technological remedies (e.g., no fire retardant drapes)
New Initiatives 2007-2010

- PA Patient Safety Authority Statistics 2007
- ASA: *Practice Advisory for the Prevention and Management of Operating Room Fires* (May 2008)
  - [http://www.asahq.org/publicationsAndServices/orFiresPA.pdf](http://www.asahq.org/publicationsAndServices/orFiresPA.pdf)
- ACS and AAO-HNS acceptance of ASA 2008 Practice Advisory
- ASA Educational Video (2010) and Online CME Course (2011)
Low-Incidence Medical Errors
(Technology and “Wrong Site”)

Surgical Fire Prevention:
Need for Action is Now Acknowledged

• **Top 3 Errors***:
  1. Retained Instruments
  2. “Wrong Site” Surgery
  3. Surgical Fires


**Others**
- Luer Mis-Connections
- Medical Gas Mix-ups
- Endoscope Sterilization Failures
- CP Bypass Gas Embolism
- Transplant Tissue Matching Errors
- Bed Crushings
- Suffocation (bed rail or mattress)
- ECG/Apnea electrode electrocutions
- MRI Projectiles

©2010 ECRI Institute
New Statistics: Surgical Fires

2007: Pennsylvania Patient Safety Reporting System (PA-PSRS)*

- 28 fires per year (based on 3 yrs of data)
- PA data scaled to USA
  - 550 to 650 fires per year
  - Mostly minor

Statistics: Anatomic Locations

- 44%   Face, Head, Neck, Upper Chest
- 21%   Airway
- 26%   Elsewhere ON body
-  8%   Elsewhere IN body
Surgical Procedures and Fires

- Facial surgery
- ECMO cut down
- Carotid endarterectomy
- Temporal arterectomy
- Tracheostomy
- Oral surgery
- Tonsillectomy
- Infant surgery (PDAs)
- Pneumonectomy
- Bronchoscopic surgery
- Cervical conization
- Hernia (infant)
- Circumcision (infant)
- C-section
- Pacemaker replaced
- Neurosurgery (laser)
News Media: Putting a Face on Patient Safety

‘I’M ON FIRE...’
Blazes sparked in surgery are on the rise

By Kit R. Roane
August 18-25, 2003

On fire in the OR: Hundreds are hurt every year
Latest data reveal about 600 people are set ablaze during surgery

By JoNel Aleccia

Medical group takes aim against fires during surgery
Anesthesiologists society plans guidelines against the rare but increasing problem.

By Dave Collins
Associated Press

L.A. Times
October 7, 1988
Medical References on Surgical Fires: Hundreds published over past 30 years.

AORN Guidance Statement: Fire Prevention in the Operating Room

Introduction

AORN recognizes that fire is an inherent risk in ORs. Fire can occur at any time and anywhere in the OR. OR personnel and fire staff must be aware of the potential fire sources and the methods to prevent them. Fire must be considered as a paramount concern in ORs.

Practice Advisory for the Prevention and Management of Operating Room Fires

A Report by the American Society of Anesthesiologists Task Force on Operating Room Fires

Bibliography: www.ecri.org/surgical_fires
2003: Joint Commission Sentinel Event Alert

- Administration should alert surgical staff about controlling ignition sources
- Manage fuels, especially flammable preps
- Establish guidelines for minimizing oxygen under drapes
- Establish testing procedure for staff
- Report fire incidents


©2010 ECRI Institute
2005-2009: Joint Commission

**Patient Safety Goals** for Ambulatory and Office-based Surgery

- **Educate** staff on how to:
  - Control heat sources
  - Manage fuels
  - Include independent licensed practitioners and anesthesia providers

- **Establish guidelines** to minimize $O_2$ under drapes

http://www.jointcommission.org/PatientSafety/NationalPatientSafetyGoals/06_npsg_amb.htm
New Initiatives 2008-2009

  - http://www.asahq.org/publicationsAndServices/orFiresPA.pdf
- Acceptance of ASA Practice Advisory by Amer Coll Surgeons and Amer Acad Otolaryngologists’Head and Neck surgeons
- ASA and APSF Educational Initiative
- ECRI Institute producing APSF peer-reviewed training video and CME accredited online course.
Surgical Fire –
Putting Prevention Into Action

• Trans-disciplinary challenges
  – Staff have different prevention responsibilities at different times during surgery
• Acute patient care needs vs. fire risks of open $O_2$ delivery on face
• Continuing education is not a panacea
• Do we accept that surgical fires may be unavoidable?
Surgical Fire Triangle
Shows the staff most capable of controlling the associated aspect.
Misconceptions


- **Drapes are fire retardant treated**
  - No: there are no fire retardant drapes. The technology does not exist to make a textile that is fire retardant in elevated O_2_ levels.

- **Betadine™ is flammable**
  - No: it’s water based.

- **Get a fire extinguisher first to fight the fire**
  - No: not enough time.

- **Lanugo hair is highly flammable in air**
  - No: only in oxygen atmospheres of >50%.
Oxidizers

O2 & N2O enriched atmospheres exacerbate fire risk.

Video –

O2 Enriched Ignition and Flame Spread

Royal Air Force Experiments c.1965

©2010 ECRI Institute
How do we prevent surgical fires?

Remedy lies within surgical team.

Poster available free at: www.ecri.org/surgical_fires
Prevention

► **NEW**: Control Airway to Prevent Oxygen Enrichment Under Drapes
  ► Control Heat Sources
  ► Control Fuels
  ► Communicate
  ■ Pre-Op Time Out
  ■ Exception cases for open O₂
Pre-Op “Time Out”*

- Identify and assess fire risks
- Use of open oxygen sources on the face?
  - If YES for exceptional cases, then what?
    - Alcohol-based skin prep?
    - If YES, must be dry before draping!

The applicability of these recommendations must be considered individually for each patient.

At the Start of Each Surgery:
- Enriched O₂ and N₂O atmospheres can vastly increase flammability of drapes, plastics, and hair. Be aware of possible O₂ enrichment under the drapes near the surgical site and in the fenestration, especially during head/face/neck/upper-chest surgery.
- Do not apply drapes until all flammable preps have fully dried; soak up spilled or pooled agent.
- Fiberoptic light sources can start fires: Complete all cable connections before activating the source. Place the source in standby mode when disconnecting cables.
- Moisten sponges to make them ignition resistant in oropharyngeal and pulmonary surgery.

During Head, Face, Neck, and Upper-Chest Surgery:
- Use only air for open delivery to the face if the patient can maintain a safe blood O₂ saturation without supplemental O₂.
- If the patient cannot maintain a safe blood O₂ saturation without extra O₂, secure the airway with a laryngeal mask airway or tracheal tube.

Exceptions: Where patient verbal responses may be required during surgery (e.g., carotid artery surgery, neurosurgery, pacemaker insertion) and where open O₂ delivery is required to keep the patient safe:
During Head, Face, Neck, and Upper-Chest Surgery:

- Use only air for open delivery to the face if the patient can maintain a safe blood $O_2$ saturation without supplemental $O_2$.

- If the patient cannot maintain a safe blood $O_2$ saturation without extra $O_2$, secure the airway with a laryngeal mask airway (LMA) or tracheal tube.
Supplemental Oxygen Exceptions

Exceptions for Open O₂ Delivery on Face:
Where patient verbal responses may be required during surgery (e.g., carotid artery surgery, neurosurgery, pacemaker insertion) and where open O₂ delivery is required to keep the patient safe.
During Head, Face, Neck, and Upper-Chest Surgery:

- Use only air for open delivery to the face if the patient can maintain a safe blood O₂ saturation without supplemental O₂.
- If the patient cannot maintain a safe blood O₂ saturation without extra O₂, secure the airway with a laryngeal mask airway or tracheal tube.

**Exceptions:** Where patient verbal responses may be required during surgery (e.g., carotid artery surgery, neurosurgery, pacemaker insertion) and where open O₂ delivery is required to keep the patient safe:

- At all times, deliver the minimum O₂ concentration necessary for adequate oxygenation.
- Begin with a 30% delivered O₂ concentration and increase as necessary.
- For unavoidable open O₂ delivery above 30%, deliver 5 to 10 L/min of air under drapes to wash out excess O₂.
- Stop supplemental O₂ at least one minute before and during use of electrosurgery, electrocautery, or laser, if possible. Surgical team communication is essential for this recommendation.
- Use an adherent incise drape, if possible, to help isolate the incision from possible O₂-enriched atmospheres beneath the drapes.
- Keep fenestration towel edges as far from the incision as possible.
- Arrange drapes to minimize O₂ buildup underneath.
- Coat head hair and facial hair (e.g., eyebrows, beard, mustache) within the fenestration with water-soluble surgical lubricating jelly to make it nonflammable.
- For coagulation, use bipolar electrosurgery, not monopolar electrosurgery.
The applicability of these recommendations must be considered individually for each patient.

During Oropharyngeal Surgery (e.g., tonsillectomy):
- Scavenge deep within the oropharynx with a metal suction cannula to catch leaking O₂ and N₂O.
- Moisten gauze or sponges and keep them moist, including those used with uncuffed tracheal tubes.

During Tracheostomy:
- Do not use electrosurgery to cut into the trachea.

During Bronchoscopic Surgery:
- If the patient requires supplemental O₂, keep the delivered O₂ below 30%. Use inhalation/exhalation gas monitoring (e.g., with an O₂ analyzer) to confirm the proper concentration.
When Using Electrosurgery, Electrocautery, or Laser:

- The surgeon should be made aware of open O₂ use. Surgical team discussion about preventive measures before use of electrosurgery, electrocautery, and laser is indicated.
- Activate the unit only when the active tip is in view (especially if looking through a microscope or endoscope).
- Deactivate the unit before the tip leaves the surgical site.
- Place electrosurgical electrodes in a holster or another location off the patient when not in active use (i.e., when not needed within the next few moments).
- Place lasers in standby mode when not in active use.
- Do not place rubber catheter sleeves over electrosurgical electrodes.
Extinguishing

EMERGENCY PROCEDURE
EXTINGUISHING A SURGICAL FIRE

Fighting Fires ON the Surgical Patient
Review before every surgical procedure.

1. Stop the flow of all airway gases to the patient.
2. Immediately remove the burning materials and have another team member extinguish them.
   If needed, use a CO2 fire extinguisher to put out a fire on the patient.
3. Care for the patient:
   — Resume patient ventilation.
   — Control bleeding.
   — Evacuate the patient if the room is dangerous from smoke or fire.
   — Examine the patient for injuries and treat accordingly.
4. If the fire is not quickly controlled:
   — Notify the operating room staff and the fire department that a fire has occurred.
   — Isolate the room to contain smoke and fire.
   — Save involved materials and devices for later investigation.

Exttinguishing Airway Fires
Review before every surgical intubation.

At the First Sign of an Airway or Breathing Circuit Fire, Immediately and Rapidly:
1. Remove the tracheal tube and have another team member extinguish it. Remove cuff-protective devices and any segments of burned tube that may remain coming in the airway.
2. Stop the flow of all gases to the airway.
3. Pour saline or water into the airway.
4. Care for the patient:
   — Reestablish the airway, and resume ventilating with air until you are certain that nothing is left burning in the airway, then switch to 100% oxygen.
   — Examine the airway to determine the extent of damage, and treat the patient accordingly.
   — Save involved materials and devices for later investigation.

Poster available free at: www.ecri.org/surgical_fires

©2010 ECRI Institute
Fighting Fires ON the Surgical Patient
Review before every surgical procedure.

In the Event of Fire on the Patient:

1. Stop the flow of all airway gases to the patient.

2. Immediately remove the burning materials and have another team member extinguish them.
   If needed, use a CO₂ fire extinguisher to put out a fire on the patient.

3. Care for the patient:
   — Resume patient ventilation.
   — Control bleeding.
   — Evacuate the patient if the room is dangerous from smoke or fire.
   — Examine the patient for injuries and treat accordingly.

4. If the fire is not quickly controlled:
   — Notify other operating room staff and the fire department that a fire has occurred.
   — Isolate the room to contain smoke and fire.

Save involved materials and devices for later investigation.
Extinguishing: Pat out if very small. Instinctive reaction by physicians.
Extinguishing: Rip off!
EMERGENCY PROCEDURE
EXTINGUISHING A SURGICAL FIRE

Extinguishing Airway Fires
Review before every surgical intubation.

At the First Sign of an Airway or Breathing Circuit Fire, Immediately and Rapidly:

1. Remove the tracheal tube, and have another team member extinguish it. Remove cuff-protective devices and any segments of burned tube that may remain smoldering in the airway.

2. Stop the flow of all gases to the airway.

3. Pour saline or water into the airway.

4. Care for the patient:
   — Reestablish the airway, and resume ventilating with air until you are certain that nothing is left burning in the airway, then switch to 100% oxygen.
   — Examine the airway to determine the extent of damage, and treat the patient accordingly.

Save involved materials and devices for later investigation.
Extinguishing: Pull out!

• Burned tracheal tube (top) from fatal fire during tracheostomy.

• Tube was not removed immediately when fire started.
Extinguishers: Rarely Needed in OR

For placement in each O.R. and use on patient:
**CO₂ Extinguisher**

**Not:**
Water, dry chemical, water mist, or fire blanket
New Clinical Guide to Surgical Fire Prevention

• New recommendations’ focus
  1. Eliminate open O₂ delivery during sedation for head, face, neck, and upper chest surgery
  2. Secure patient airway if increased O₂ needed
  3. Use Pre-Op “Time-Out” to assess fire risks

• Developed in collaboration with the Anesthesia Patient Safety Foundation (APSF)

See: www.ecri.org/surgical_fires
ONLY YOU CAN PREVENT SURGICAL FIRES
Surgical Team Communication Is Essential

The applicability of these recommendations must be considered individually for each patient.

At the Start of Each Surgery:
- Enrich O₂ and N₂O atmospheres can vastly increase flammability of drapes, plastics, and hair. Be aware of possible O₂ enrichment under the drapes near the surgical site and in the fenestration, especially during head/face/neck/upper-chest surgery.
- Do not apply drapes until all flammable preps have fully dried; soak up spilled or pooled agent.
- Fiberoptic light sources can start fires. Complete all cable connections before activating the source. Place the source in standby mode when disconnecting cables.
- Moisten sponges to make them ignition resistant in oropharyngeal and pulmonary surgery.

During Head, Face, Neck, and Upper-Chest Surgery:
- Use only air or open delivery to the face if the patient can maintain a safe blood O₂ saturation without supplemental O₂.
- If the patient cannot maintain a safe blood O₂ saturation without extra O₂, secure the airway with a laryngeal mask airway or tracheal tube.

Exceptions: Where a patient’s verbal responses may be required during surgery (e.g., carotid artery surgery, neurosurgery, pacemaker insertion) and where open O₂ delivery is required to keep the patient safe:
- At all times, deliver the minimum O₂ concentration necessary for adequate oxygenation.
- Begin with a 30% delivered O₂ concentration and increase as necessary.
- For unavoidable open O₂ delivery above 30%, deliver 5 to 10 L/min of air under drapes to wash out excess O₂.
- Stop supplemental O₂ at least one minute before and during use of electrosurgery, electrocautery, or laser, if possible. Surgical team communication is essential for this recommendation.
- Use an adherent incision drapes, if possible, to help isolate the incision from possible O₂-enriched atmospheres beneath the drapes.
- Keep fenestration towel edges as far from the incision as possible.
- Arrange drapes to minimize O₂ buildup underneath.
- Cool head hair and facial hair (e.g., eyebrows, beard, moustache) within the fenestration with water-soluble surgical lubricating jelly to make it nonflammable.
- For coagulation, use bipolar electrosurgery, not monopolar electrosurgery.

During Oropharyngeal Surgery (e.g., tonsillectomy):
- Scrape deep within the oropharynx with a metal suction cannula to catch leaking O₂ and N₂O.
- Moisten gauze or sponges and keep them moist, including those used with uncuffed tracheal tubes.

During Tracheostomy:
- Do not use electrosurgery to cut into the trachea.

During Bronchoscopy Surgery:
- If the patient requires supplemental O₂, keep the delivered O₂ below 30%. Use inhalation/exhalation gas monitoring (e.g., with an O₂ analyzer) to confirm the proper concentration.

When Using Electrosurgery, Electrocautery, or Laser:
- The surgeon should be made aware of open O₂ use. Surgical team discussion about preventive measures before use of electrosurgery, electrocautery, and laser is indicated.
- Activate the unit only when the active tip is in view (especially if looking through a microscope or endoscope).
- Deactivate the unit before the tip leaves the surgical site.
- Place electrosurgical electrodes in a holder or another location off the patient when not in active use (e.g., when not needed within the next few moments).
- Place lasers in standby mode when not in active use.
- Do not place rubber catheter sleeves over electrosurgical electrodes.


Full guidelines: see Health Devices 2009 Oct; 38(10).

Poster available free at: www.ecri.org/surgical_fires

©2010 ECRI Institute
New Continuing Education Video and On-line Web Course

- A new video on surgical fire prevention has been produced by ECRI Institute for the Anesthesia Patient Safety Foundation (APSF). Released in April 2010. Free on the Web.

- On-line course with CME credits: Spring 2011 (from APSF through ECRI Institute)
For More Information

Posters and Bibliography:  www.ecri.org/surgical_fires
Video and CME course:   www.apsf.org

- For complete information, refer to the October 2009 issue of *Health Devices* (Vol. 38, No. 10) for the following article:

  – New Clinical Guide to Surgical Fire Prevention

  Questions?  Contact:
  Mark Bruley, CCE
  Vice President, Accident and Forensic Investigation
  ECRI Institute
  +1 (610) 825-6000 ext. 5223
  Email: mbruley@ecri.org
New Clinical Guidance on Surgical Fire Prevention and Management

Michael Argentieri, MS
Vice President and Senior Investigator
ECRI Institute, 5200 Butler Pike, Plymouth Meeting, PA
Tel: 610-825-6000, Ext. 5185    Email: margentieri@ecri.org