It's a Gas! Anesthesia and Infection Prevention

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- Safe Injection Practices/Medications
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  - BBP
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  - TB
  - Emerging Infectious Diseases
  - PPE - respirators

"Quantification of anesthesia providers' hand hygiene in a busy metropolitan operating room: What would Semmelweis think?"

Department of Nurse Anesthesia/Anesthesiology, Virginia Commonwealth University Medical Center, Richmond, VA.

- Hand hygiene
  - prior to first interacting with the patient
  - prior to donning sterile gloves
  - after any invasive procedure
  - after manipulation of the airway (e.g. artificial airway placement, suctioning)
  - after hanging a blood product
  - after touching the patient for surgical positioning
  - after patient handoff
  - after retrieving a soiled or dropped item off the OR floor

- Gloving
  - prior to arterial or IV line placement or other invasive procedure
  - gloving before and hand cleansing after suctioning of the airway

Results:
- Nearly 8,000 HH opportunities were observed.
- Aggregate failure rate was 82% with a range of 64% to 93% by provider group.

Conclusion:
- HH was very poor among anesthesia providers.
- The "task density of anesthesia" care may conspire with an intrinsic HH failure rate to create great opportunity for horizontal and vertical vectors for nosocomial infection.
Hand contamination of anesthesia providers is an important risk factor for intraoperative bacterial transmission

• 164 patients (82 1st case, 2nd case pairs)
• All providers with access to hand sanitizer on anesthesia cart and in room
• 11.5%: bacterial transmission to IV stopcock
  – 47% from anesthesia team
• 89% contamination of anesthesia environment
  – 12% from anesthesia team


• 1 case of horizontal transmission

• Independent risk factors for environmental transmission
  – Anesthesia provider supervising more than one room
  – First case of the day (66%)
  – Patient age
  – Discharge to ICU from the OR


Reduction in Intraoperative Bacterial Contamination of Peripheral Intravenous Tubing Through the Use of a Novel Device

• 27-fold increase in hourly hand decontamination events compared with baseline rates
• Intravenous tubing contamination
  – 32.8% of cases in the control group
  – 7.5% of cases in the treatment group
• Healthcare-associated infection rates were reduced
  – 3% Novel device group
  – 17.2% Control group
• 5 pt with same organism on IV stopcock/anesth workspace and HAI


• Hand hygiene
  – Hand sanitizer readily available
    • At each workspace
    • Portable device
  – Prior to: start of each case; donning sterile gloves
  – Accessing clean supplies from supply cart
  – Before charting
  – When changing from dirty to clean
    • Environmental areas
      – Anesthesia machine → anesthesia work cart/station
    • Surgical tasks
      – Intubation → administering IV meds
  – After glove removal (Controversy?)

What to recommend?

• Work flow issues:
  – Intubation → adjusting gases and vent settings
    • Double glove?
    • Remove gloves and not perform HH?
    • Wear gloves for identified “dirty environment”?

• Hand sanitizers in the OR environment?
  – Flash points of alcohol-based hand rubs range from 21°C to 24°C, depending on the type and concentration of alcohol present
  – Store away from high temperatures or flames
  – Alcohol rub users should rub their hands until dry, which indicates that the flammable alcohol has evaporated
  – Incidence of fires associated with such products has been low
  – “I’ve seen surgeons blow up in the operating room but never saw an operating room blow up.”
• Gloves
  – PPE (self protection)
    • Body fluids
      – Intubation
      – Airway management
      – Starting IV’s

Room for improvement
  – For contact with dirty environment
  • Anesthesia machine
  – Remove and HH before contact with clean work space

The “Clean” Environment

• Anesthesia work station
• Supply cart
  – Orderly
  – user friendly
• IV and supplies
• IV solution and tubing
• Medications
• Work space/shelf for clean supplies
• Hand hygiene products, gloves
• Keyboard

The “Dirty” Environment

• The environment
  – Anesthesia machine
    • Buttons and knobs
  – Location of
    • Used supplies – e.g. intubation
    • Trash
    • Sharps container
    • Used suction catheter/tubing
Dirty to Clean

Safe Injection Practices

Prolonged Survival of Hepatitis C Virus in the Anesthetic Propofol

- Explored the influence of propofol on Hepatitis C virus stability and infectivity
- Viral titers prolonged in propofol emulsion vs. control (standard cell culture medium)

Clinical Infectious Diseases (Vol 53) November 1, 2011 p. 963-4

POSTOPERATIVE INFECTIONS TRACED TO CONTAMINATION OF AN INTRAVENOUS ANESTHETIC, PROPOFOL

• 1991-1993, 7 hospitals experienced outbreaks traced to mishandling of propofol
• Six different bacterial pathogens
• Wide variety of lapses in aseptic technique
  • "the larger vials look like multidose vials, and our investigations revealed that the vials are sometimes being used for an extended period of time, for more than one patient or procedure, and to refill syringes meant to be used only once."

Clinical Infectious Diseases (Vol 53) November 1, 2011 p. 963-4

Safe Injection Practices

The Children's Hospital
Room Turn Over Completed by:
Name: 
Date: 
PCD

Confirm: 
Signature:

The Children's Hospital
Room Turn Over Completed by:
Name: 
Date: 
PCD

Confirm: 
Signature:

Anesthesia Checklist for Room Turnover

Hi-hand hygiene & Gowns

Dirty

To

Clean

Propofol, 200mg/mL

Propofol, 200mg/mL
• Issue: Using Propofol syringe for multiple pts and changing the microbore tubing between pts.

  • Contamination can occur:
    – Handling
    – Fluid splatter
    – Retrograde flow
      • Specific gravity Blood > IV solutions so passive backflow against forward flowing fluid possible.
    – Lack of visible blood
      • Blood contamination found in 3.3% of tubing injection sites
        – Only 33% visible to naked eye \(^1\)

  \(^1\) Greene GS. ASA Newsletter. 2002;66(12):22-23

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Stability/transmission of HCV in different anesthetic agents

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Provider-to-Patient Transmission of Hepatitis C Virus Associated with Diversion of Fentanyl, Colorado 2009

• HCV-infected surgery technician stole fentanyl syringes that had been pre-drawn and left unattended in ORs
• Contaminated syringes were refilled with saline and swapped with unused syringes
• 24 patients infected; nearly 6000 notified

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Nurse may have stolen drugs, infected patients

March 16, 2011

MINNEAPOLIS — A nurse is suspected of inadvertently turning intravenous paclitaxel at St. Cloud Hospital while seeking drugs, spreading bacterial infections to 23 patients since October, the hospital said on Wednesday.

• 23 patients
• The nurse was identified as the common factor linking the patients via patient and medication access records.
• Klebsiella oxytoca and Ochrobactrum anthropi

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Dear “patient”,

Rose Medical Center is sending you this letter because a terminated employee — a surgical tech technician — may have put some surgery patients at risk for exposure to Hepatitis C. We are working closely with the Colorado Department of Public Health and Environment in its investigation of this situation. Hepatitis C is a virus that can potentially cause serious damage to the liver.

Our records indicate that you had surgery at Rose between October 21, 2008 and April 13, 2009.  Either in the hospital or in the outpatient surgery department in the Welch Building.  If this is correct, we believe, as does the State Health Department, that you should take a free, confidential blood test.  This test may help determine if you were exposed to Hepatitis C as a result of your surgery.

We first learned of this when the State Health Department contacted us about a cluster of cases with Hepatitis C who had surgery at Rose between the dates listed above.  We do not know at this point if those patients were exposed to the virus at our hospital, but we are cooperating with the State Health Department to try to get the facts.

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Narcotics Theft a.k.a. “Diversion”

• Diversion has emerged as the leading cause of provider to patient HCV transmission
• Prevention needs extend beyond traditional “infection control”
  – Limit opportunities for access or deception
• Good example of need for safety-engineered solutions and system approach
Viral Hepatitis Outbreaks (n=15) in Outpatient Settings due to Unsafe Injection Practices, 2001-2009

<table>
<thead>
<tr>
<th>State</th>
<th>Setting</th>
<th>Year</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>NY</td>
<td>Private MD office</td>
<td>2001</td>
<td>HCV</td>
</tr>
<tr>
<td>NY</td>
<td>Private MD office</td>
<td>2001</td>
<td>HBV</td>
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<tr>
<td>NE</td>
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<td>2002</td>
<td>HCV</td>
</tr>
<tr>
<td>OK</td>
<td>Pain remediation clinic</td>
<td>2002</td>
<td>HBV+HCV</td>
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<tr>
<td>NY</td>
<td>Endoscopy clinic</td>
<td>2002</td>
<td>HCV</td>
</tr>
<tr>
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<td>Pain remediation clinic</td>
<td>2003</td>
<td>HCV</td>
</tr>
<tr>
<td>NY</td>
<td>Endoscopy/surgery clinics</td>
<td>2006</td>
<td>HBV+HCV</td>
</tr>
<tr>
<td>NY</td>
<td>Anesthesiologist/pain clinic</td>
<td>2007</td>
<td>HCV</td>
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<tr>
<td>NV</td>
<td>Endoscopy clinic</td>
<td>2008</td>
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<tr>
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<td>Cardiology clinic</td>
<td>2008</td>
<td>HCV</td>
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<td>NJ</td>
<td>Oncology clinic</td>
<td>2009</td>
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Nearly half of these outbreaks were caused by unsafe injection practices related to anesthesia/sedation

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Survey Finds ‘Discouraging’ Injection Habits Among Anesthesiologists

- 49% - same vial for > 1 patient
- 31% - use Propofol on > 1 patient
- ~25% don’t always use a new needle or syringe when drawing from a vial
- ~25% use an open vial w/o knowing who accessed it prior
- Reused syringes on different patients
  - 8% residents
  - 2% anesthesiologists

Reported in Anesthesiology News Jan 2012 (Gounder P. et.al. Formal publication pending...)

Single-use/Single-dose Medication Vials

- **Single-dose (SDV):**
  - A vial containing a single unit of a parenteral drug product.
- **Single-use:**
  - A vial where a single dose can be removed and then the vial and its remaining contents is discarded.

**Recommended whenever possible (a.k.a. unless unavailable)
- APIC
- CDC
- WHO

Medication Shortages:

- 2005 – 61; 2010 - 178
- Primary causes:
  - 43% Manufacturing
    - Contamination/Stability
    - particulate/organisms
  - 15% Delays in manufacturing or shipping
  - 10% Active pharmaceutical ingredient shortages
- 2010/2011 – reviewed 127
  - 80% sterile injectables
    - 28% oncology drugs
    - 13% antibiotics
    - 11% electrolyte/nutrition
  - Neostigmine –reverses paralyzing agents
  - Norepinephrine - BP
**Medication Shortages**

- Even if a single-dose or single-use vial appears to contain multiple doses or contains more medication than is needed for a single patient, that vial should not be used for more than one patient nor stored for future use on the same patient.
- In times of "critical need", contents from unopened single-dose/single-use vials can be repackaged for multiple patients.
  - performed by qualified healthcare personnel
  - USP General Chapter <797>Pharmaceutical Compounding – Sterile Preparations.
- Healthcare facilities can proactively arrange for these doses to be split, in accordance with USP standards, when necessary.

CDC, April 27, 2012

**Multi-dose vials**

- No MDV in the immediate patient Treatment Area (CDC)
- "Immediate Patient Treatment Area"
  - Surgery/Proc. room where anesthesia is administered
  - Any anesthesia med carts used in or for those rooms
- 2 acceptable techniques
  - Draw entire contents of vial (SDV/MDV) into a sterile syringe
    - Sequential doses for same patient
  - Sequential doses taken from MDV vial
    - Use a new needle/cannula/syringe each time
- Drugs that do not come in SDV?
  - Neostigmine, succinylcholine
  - Discard vial after using for one patient
- On-site satellite pharmacy

**CDC**

- Minimize contamination risk by scrubbing the access port with an appropriate antiseptic (chlorhexidine, povidone iodine, an iodophor, or 70% alcohol) and accessing the port only with sterile devices [189, 192, 194–196]. Category IA

**CMS**

**Safe Use of Single Dose/Single Use Medications to Prevent Healthcare-associated Infections**

June 15, 2012

**Deficiency Citation Policy**

- Healthcare facilities that do not adhere to USP <797> standards but reuse SDVs for multiple patients must be cited for deficiencies under the applicable infection control standards for each type of provider/supplier

**Stopcocks**

- Closed catheter access systems are associated with fewer CRBSIs than open systems and should be used preferentially
- Stopcocks represent a potential portal of entry for microorganisms into vascular access catheters and IV fluids.
- Stopcocks not in use
  - Sterile cap or syringe

I.V. Tape: A Potential Vector for Infection

University of Texas Health Science Center at San Antonio

- Why is nonsterile tape being used initially to secure a catheter hub at the patient’s fresh puncture wound?
  - Concern: Chevoning IV sites with tape under TSM dsg.


Opening Ampules and Vials

Drug contamination from opening glass ampules.

Department of Anesthesiology, University of California, San Diego

- Glass ampules of 1% propofol and 1% lidocaine swabbed with S. epi
- 50% alcohol pad prep prior to being opened. 50% no alcohol prep
- Aliquot from each ampule was cultured
- Results: Not cleaned with alcohol = bacterial contamination
  - 3 of 8 lidocaine ampules
  - 6 of 8 propofol ampules
  - No growth from ampules wiped with alcohol
    - p < 0.001 for propofol ampules
    - p = 0.20 for lidocaine ampules


Department of Anesthesiology, Univ of California, San Diego

Weening CS. Anesthesiology: March 1998 - Volume 88 - Issue 3 - p 838 Correspondence

Study #1
- 100 fentanyl and diamorphine ampoules
  - 50 wiped with alcohol
  - 50 not wiped alcohol
- Contents aspirated and cultured.
- Alcohol group - No growth (0/50)
- Non-wiped group (18%) (9/50)
- p = 0.004

Study #2
- 100 glass ampoules of saline - coated with Staphylococcus aureus
- 4 groups:
  - Wiped/not wiped with alcohol and with/without a filter straw.
- Most contamination occurred in the unwiped groups and although numbers were small, filtering appeared to reduce contamination further.
  - also reduce the risk of injecting glass particles (even if not contaminated)

Spiking/priming IV bags “in advance”

- **USP**
  - 1 hour time limit from preparation (spiking bag) until beginning administration if not prepared in a *ISO 5 environment
    - Precludes microbial growth in the event of contamination
    - Organism replication can occur within 1-4 hours
      - Exponential ↑ thereafter
    - ? Role for 4 hours?
  - Longer timeframes if primed by pharmacy in *ISO 5 environment

*International Organization for Standardization (laminar flow, air quality, ventilation, personnel and surface sanitation requirements)*

**Concerns**

- Cost
- Technique in busy setting
- ? Higher risk of contamination due to breaks in technique
- Many settings don’t have ISO 5 environments
- Difficult to comply
- Limited data on actual contamination in real practice

**APIC**

- Unresolved issue for non-ISO 5 environment

- Supports
  - Risk Assessment
  - Preparing as close as possible to time of administration as feasible
    - Not right before
  - Educate designated staff
    - Tactile learning environment
    - Verify competency
    - Periodic monitoring
  - Clean, dry workspace
  - Controlled setting
  - Properly labeled bag/tubing. Date/time/initials
  - Facility P&P


**TJC FAQ’s - Spiking of IV bags “in advance”**

- **What would a Joint Commission surveyor look for?**
  - A: Joint Commission standards do not specifically address this issue. However, IC.01.05.01 EP 1 requires that, “When developing infection prevention and control activities, the hospital uses evidence-based national guidelines or, in the absence of such guidelines, expert consensus.”
  - Therefore, The Joint Commission does not require that an organization place a specific time restriction on most IV fluids (other than those specified in **CDC IX.C.1-3**). However, if an accredited organization has a policy that specifies a hang time, or delineates how quickly fluids must be hung after being spiked, a surveyor may issue a Requirement For Improvement related to compliance with the organization’s own policy.

  - Additional guidance can be obtained from the Association for Professionals in Infection Control and Epidemiology, Inc. (APIC) or U.S. Pharmacopeia. State health departments, pharmacy boards or hospital licensing acts may also contain further regulations.

  July 30th, 2010
You'll be awake during the entire procedure. The anesthesiologist is on vacation.

STATEMENT ON STANDARD PRACTICE FOR INFECTION PREVENTION AND CONTROL INSTRUMENTS FOR TRACHEAL INTUBATION

Committee on Quality Management and Departmental Administration (QMDA)
(Approved by the ASA House of Delegates on October 20, 2010)

Statement: All instruments used for intubation of the trachea (endotracheal tubes, LMA’s, laryngoscopes, fiberoptic devices, stylets, forceps, or other airway devices) should be properly cleaned using standard methods for decontamination and high-level disinfection between each patient use and stored in a clean environment. Sterility is not required.

Prepackaged endotracheal tubes can be opened, cuffs checked for any leaks, stylets placed for future use, cuff syringes attached, and placed back into the package. Data suggest that storage and subsequent use of such prepared endotracheal tubes is reasonable for up to 48 hours [2, 3].

Rationale: The mouth (where such instruments pass on their way to the trachea) is not a sterile environment. However, cleanliness and prevention of contamination from patient to patient is essential and consistent with patient safety.

A focused review of the ASA Closed Claim Database (data search of 8954 claims through December 2008), shows that there were no cases of infection from placement of an endotracheal tube or LMA. Neither were there any claims of infections from dirty instruments for tracheal intubation in this database.

References:
1. Guidelines for Preventing Health-Care-Associated Pneumonia, 2003

Laryngoscope blades

- Semi-critical item – mucous membranes
- HICPAC:
  - Reprocess between patients (1A)
  - Sterilization
  - Pasteurization (>158°F (>70°C) for 30 minutes)
  - Packaging
- TJC:
  - Sterilization or HLD disinfection.
  - Storage – prevent recontamination
    - Long term: Peel pack
    - Short term: sterile towel
  - Noncompliance = unwrapped blades in anesthesia drawer or on top of code cart.

Neuraxial procedures

- Epidural anesthesia, lumbar puncture
  - epidural; spinal, or combined spinal– epidural administration of anesthetics, analgesics, or steroids; lumbar puncture or spinal tap; epidural blood patch; epidural injection of adhesives; intrathecal chemotherapy; epidural or spinal injection of contrast agents for imaging; lumbar or spinal drainage catheters; or spinal cord stimulation trials

- Infection
  - epidural abscess
    - 50-60% Staph aureus
    - 15-20% Streptococcus species
  - meningitis
    - 45% Viridans Streptococcus
    - 16% Strep. Salivarius

References:
2. TJC FAQ: Laryngoscope Blades. October 24, 2011

Practice Advisory…Anesthesiology. 2010;112:530-545

What to wear:
- CAP
- MASK
- STERILE GLOVES
- ...and Eye protection!

Remove rings/watches
Skin prep w/ dry time
Sterile drape
Sterile occlusive dsg.

Limit opening line
Remove unwitnessed disconnects

No sterile drape

References:
- Practice Advisory…Anesthesiology 2010;112:530-545
Breathing circuits and filters

- **Bacterial filter**
  - Efficiency rating of >95% for particle sizes 0.3 micron
  - Routinely placed on anesthesia circuit
    - Protect the machine from contamination
    - Expiratory → machine → Inspiratory circuit

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