Hand Hygiene: Surgical Hand Preparation

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Disclosure

3M is sponsoring this talk...
I developed the content
Overview

- History of Surgery
- Key changes in surgical asepsis
- Goals and barriers
- Products and how they are used
- Evidence for efficacy, tolerability, and outcome
- Implementation
Brief History of Surgery
Surgery has been performed since ancient times.

Usually a last effort.

Patients often died of infection.
  - Septic shock
  - Infection at the site
    - Pus was considered a sign of healing

Roman military surgeons used hot water to prepare instruments.
19th Century: Recognition that Doctors Could Cause Infection

1843 Oliver Wendell Holmes, Sr

1847 Ignaz Semmelweis
Hand Hygiene Intervention decreased mortality from 18% to 2%

Charles D. Meigs, ‘Doctors are gentlemen, and gentlemen’s hands are clean.’
19th Century Germ Theory

- Pasteur recognizes that micro-organisms spoil food
  - Pasteurization 1862

- Koch’s postulates 1884

- Julius Ferdinand Cohn –1872
Impact on Surgery

1860’s Joseph Lister – “Father of Modern Surgery”
- Sterilized instruments, dressings and wounds with good effects and published in The Lancet 1867
  - Death rates fall from 46% to 15%
- Surgeons dip fingers before and after surgery into 5% carbolic acid
  - Thought scrubbing palms created crevices where bacteria would proliferate
- Same solution used to wash instruments, spray ORs,
- Patients sprayed with poor effect

Rutkow, IM in Sabiston Textbook of Surgery: the biological basis of modern surgical practice 17th Ed. P7
Timeline of late 19th century Surgical Infection Control Interventions

- 1881 First Autoclave
- 1883 Sterile gowns and caps
- 1884 Gustav Adolf Neuber Aseptic hospital in Kiel
- 1890 First Rubber Gloves – Dr. Halsted’s assistant
- 1897 Surgical Masks

References:
- wikipedia
Evolution in 20th Century

**Early**
- Long scrub is best – 10 minutes!

**Mid**
- Reduce scrub time to 5 minutes
- Reduce further to 2-3 minutes

**Late**
- Recognition that scrub damages skin
- Introduction of alcohol based hand preparation
Surgical Hand Preparation: Goals and Barriers
Goal of Surgical Hand Preparation

- Decrease risk of Surgical Site Infection
  - Remove/kill transient flora on hands
  - Have persistent action to kill resident flora on hand skin
  - Counteract the ‘greenhouse effect’ of bacterial proliferation under gloves
  - Protect the patient from hand bacteria in event of glove puncture

WHO 2009 Clean care is safer care; Rotter M et al. Methods to evaluate the microbicidal Activities of hand-rub and hand-wash agents. *Jrnl Hosp Infect* 2009: 73, 191-9
Requirements for Surgical Hand Preparation Agents

- Must have continued kill of microorganisms
  - After 3 hours (EN 1500) better than isopropanol 60% volume [used to keep hands wet for 3 minutes]
  - Minimum bacterial kill required is not defined
  - ASTM E-1115
    - $1 \log_{10}$ reduction on each hand within 1 minute
    - Bacterial count can’t exceed baseline for 6 hrs on day 1
    - $2 \log_{10}$ reduction within 1 minute by the end of day 2
    - $3 \log_{10}$ reduction within 1 minute by the end of day 5 compared to baseline

WHO 2009 Clean care is safer care; Rotter M et al. Methods to evaluate the microbicidal Activities of hand-rub and hand-wash agents. *Jrl Hosp Infect* 2009: 73, 191-9
Obstacles to Hand Hygiene and Surgical Hand Preparation

• **Availability of Clean Water**
  - WHO report 54 countries: 38% of hospitals/care centers have NO access to “improved water source” within 500 meters
  - When continuous supply within the facility is measured, about 1/3 have access
  - Where water is available, location of sinks is important

• **Availability of Hand Hygiene Products**
  - WHO 35% had NO access to soap or alcohol for hand hygiene
  - Convenient placement of products within the work flow can help compliance

http://www.who.int/water_sanitation_health/publications/wash-health-care-facilities/
Obstacles to Hand Hygiene and Surgical Hand Preparation

- **Time & work flow**
  - Surgical Scrubbing
    - used to be 10 minutes
    - Now recommendations are for 3 minutes or per manufacturer’s instructions
  - Routine Hand Hygiene: 100% compliance/8hr ICU shift
    - With soap and water would take 16 hours (17% of workforce)
    - With alcohol would take 4 hours (3% of workforce)
  - Some specialties may need individualized recommendations
    - Anesthesia, long-term care, home care

Voss A & Widmer A. 1997 ICHE 18(3) 205
Obstacles to Hand Hygiene and Surgical Hand Preparation

- **Skin tolerance**
  - Irritant Contact Dermatitis
    - Most frequent skin problem
    - Impacted by temperature/humidity
    - Harsh detergents
    - Rough towels
    - Scrubbing
  - Allergic Contact Dermatitis
    - Rare complication of hand hygiene
    - Allergy to a component of the product
  - Damaged skin sheds more bacteria: scrubbing can increase skin shedding 18x.

Products & Process
Surgical Scrub Agents: Povidone iodine/Iodophors

- Penetrates bacterial cell wall and impairs protein synthesis of cell wall
- Not effective in presence of organic substances (blood, sputum)
- Controversy over persistence of activity
- More irritating to skin than Chlorhexidine
- Still widely used
- Colored, can see where skin has been scrubbed
Surgical Scrub Agents: Chlorhexidine Gluconate (4%)

- Disrupts cytoplasmic membrane-cell contents precipitate
- Excellent Gram-positive coverage, limited mycobacterial coverage
- Not inactivated by organic materials (blood, sputum)
- Can be inactivated by incompatible soaps and creams (with anionic emulsifiers)
- Has persistent activity
Before ANY Hand Preparation

- No jewelry or artificial nails
- Clean hands with regular wash upon entry to OR
- Use nail pick as indicated (not nail brush)
- Dry hands thoroughly
- Don Mask
Scrub Technique

- Use sponge to apply scrub product

- Apply each side of each finger of left hand for several seconds in moving around to assure coverage of all surfaces, move up to the hand and wrists. Repeat for opposite hand

- Proceed to scrub the forearms up to elbows. Keep hands higher than elbows to prevent recontamination
Scrub Technique

- Rinse hands and arms by passing through water with hands up – water running from fingertips to elbows

- Go to OR – keeping hands above elbows, and dry with a sterile towel
Surgical Hand Rubs

- **Alcohol** – ethanol, isopropanol, n-propanolol* (60-95%)
  - Denatures proteins, active vs. bacteria and fungi.
  - Rapid action, $3.5 \log_{10}$ reduction in 30 seconds, $4-5 \log_{10}$ reduction after 1 minute application
- Often combined with long-acting agent 50-95% alcohol plus Chlorhexidine, Quaternary ammonium compound for persistence
- These are NOT the same as standard alcohol-based hand rubs

*not on FDA approved list in USA

Application Technique

- Follow Manufacturer’s Instructions...
  - This is not always easy
  - Staff may require extensive education
    - This is not the same product as routine alcohol
    - This requires significantly different application
    - In US, regulators will cite if staff don’t use properly
Application Technique (Cont’d)

- Pump one dose into DRY Left hand, dip fingertips of Right hand into rub and rotate to disinfect nails/fingertips
- Apply up the right hand and forearm to the elbow, using circular motion and covering all areas.
- Apply 2\textsuperscript{nd} dose to opposite hand and repeat.
- Apply 3\textsuperscript{rd} dose to left hand, rub hands together up to the wrist ensuring that all surfaces of hands, fingers, thumbs are covered with the product.
Evidence
French Surgical Collaborative

- Randomized equivalence 30 day study of SSI
- 4387 consecutive surgical patients at 4 French hospitals 1/1/2000- 4/30/2001
- Clean and Clean-contaminated surgeries
- Alternated hand prep regimens each month
  - Alcohol hand rub (75% alc propanol 1 & 2 with mecetronium etilsulfate)
  - Hand scrubbing with either 4% povidone iodine or 4% CHG

Parienti JJ et al. JAMA 2002; 288:722-7
Results

- SSI rates were equivalent: 2.44% rubbing vs. 2.48% scrubbing
- Compliance with duration n=278 observations: 44% rubbing vs. 28% scrubbing p=0.008
- Skin condition n=77 staff members
  - Visual analogue scales scores improved with rubbing period, worsened with scrub (p=0.046)
  - Skin irritation decreased significantly during rubbing period
Cochrane Systematic Review 2008

10 trials included
- 4 trials of Alcohol vs. scrubs
  - 2 found alcohol better than various scrubs
  - 1 found alcohol equivalent to CHG
  - 1 found CHG better than alcohol
- 4 trials of different scrubs
  - 3 found CHG better than povidone iodine
  - 1 found CHG equivalent to povidone iodine+triclosan
- 1 had surgical site infection as outcome –and found alcohol equivalent to scrubs
Taiwan, 128 Healthcare Workers

% positive hand cultures before and after surgery
Coagulase neg staph were most prevalent (43% before in scrub group)
Reported better skin condition in alcohol group, but methods unclear

Shen N-J et al. http://dx.doi.org/10.1016/j.jmii.2013.08.005
Newer Comparison of Various Formulas

- 70% ethanol compared to rubs with 70% ethanol, 80% ethanol +CHG, CHG scrub
- Found significant differences in effectiveness among various preparations
- Weaknesses
  - Not all were commercially available products
  - Unclear why second methodology differed from first in study
  - No comment on effect of products on skin

Macinga D et al. AORN Journal 2014;100:641
Cost

Costs in one study in France ranged from:
- 0.062 Euro per use for less expensive rub alone to
- 1.1 Euro per use for hand scrub with water filter.
- Did not include cost of excess time for scrub in cost calculation.

Tavolacci MP et al. J. Hosp Infect. 2006;63:55-9
Environmental Considerations

- **Prospective study in Saudi Arabia 2008**
  - Subjects unaware they were being monitored for scrub technique
  - Timed actual contact of hands to water in 3 and 10 minute scrubs
  - Measured amount of water used in 1 minute of scrubbing
  - Calculated water used vs. wasted

- **Results**
  - Water touched skin 0.7 mins/3 min scrub (23%), and 1.6min/10 min scrub (16%)
  - Significant waste of 77% and 84% of water in 3 and 10 min scrubs, respectively

Al-Qahtani A & Messahel F. Internet Journal of Surgery 2008; 20:1
Rubs have been found equivalent to scrub, or better if clean water is not available by:
Implementation

THE 4 E’S

ENGAGE

EDUCATE

EXECUTE

EVALUATE
Engage

- **Multidisciplinary team – includes leadership support**
  - Discuss evidence supporting rubs
  - Define barriers to change
    - Ritual/Habit
    - Lack of knowledge about new products
    - Lack of perceived problem
  - Select products – include lotion to support skin health
- **People**
  - Local role models
  - Peer engagement
  - Involve Healthcare workers in product selection
- **Recognition/rewards**
Educate

- Educate staff about the new products that are available
- Stress difference between surgical hand prep and alcohol hand rub for routine care
  - Different product package
  - Persistent action
- Educate about procedure for use
  - RETURN DEMONSTRATION may be helpful
Make Education Engaging

What's **WRONG** with this picture?

AORN teaching tool
Execute

- Implement multi-modal program where possible
  - Baseline measures
    - Surgical Site Infection Rates
    - Staff knowledge, attitudes, and beliefs
    - Staff skin condition
    - Staff compliance with hand prep protocols
  - Access to product
  - Posters
  - Kick-off
  - Product reps to provide support
  - Peers/champions available
Evaluate

- Measure compliance
  - Are staff using products correctly?
  - Are there differences in who uses?

- Measure outcome
  - Staff knowledge, attitudes and beliefs
  - Staff skin condition
  - Surgical Site Infection Rates
  - Microbial counts

REPEAT!!

- This is a continuous process with multiple re-iterations
- Staff need to be able to tweak processes
- May need to reject portions of interventions
- Will need to update information, posters
- Educate new staff – consider incorporating into housestaff rotations
Summary

- Surgery was perilous until rapid improvements in infection prevention and asepsis in 19\textsuperscript{th} and early 20\textsuperscript{th} century
- Evidence did not mean rapid adoption – also took exceptional leaders
- Hand preparation is a key part of surgical asepsis
- Barriers are clean water, time/work flow and skin tolerability
  - The more hand hygiene, the greater risk for skin problems
There is ample evidence that alcohol based surgical hand rubs are:

- Equal or better than traditional scrubs for microbial reduction
- Better tolerated than traditional scrubs
- Can be used where clean water is not available
- Environmentally sensitive
- Cheaper to use than traditional scrubs
- Equivalent to scrubs for patient outcome
Change is hard - El cambio es dificil!

Provide Support and Knowledge

Recognize that there will be bumps In the road.

Let go, but be nearby. Continued support is necessary.
But the rewards are great!
Pero las recompensas son grandes!
Mil Gracias!

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