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Microbiology Challenges To Consider When Processing Flexible Endoscopes

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Continuing Education

CCI® The Leader in Perioperative Certification

Through a partnership with CCI®, it also meets CNOR® and CSSM® recertification requirements for perioperative nurses.

Learning Objectives

- Describe microbiology challenges related to flexible endoscope processing
- Recognize processing errors that could lead to infection and implement strategies to mitigate them

Microbiological Challenges Of Flexible Endoscopes

Surprising Infection Rates Of Endoscopy

Screening colonoscopies	Non-screening colonoscopies
1.1 / 1,000	1.6 / 1,000

10 Year Review Of Gastrointestinal Outbreaks

Root Cause

- Insufficient Drying
- Inadequate cleaning
- Inadequate high-level disinfection
- Biofilm formation

Microorganisms

- Klebsiella pneumoniae
- Pseudomonas aeruginosa
- Escherichia coli
- Salmonella enteritidis

All Flexible Endoscopes

MAUDE Report Key 2818381 (2012) - Cystoscopy

- No point of use treatment
- No leak testing of scope
- Improper cleaning
- Incorrectly performed manual HLD

MAUDE Report Key 7272402 (2018) - Bronchoscopy

- Incorrect point of use treatment
- Incorrect leak test
- Incorrect cleaning
- Incorrect use of AER

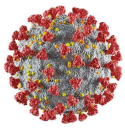
Points Of Transmission

Infected person

Environment

Types Of Microorganisms

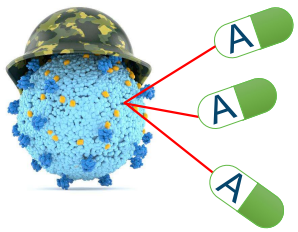
Bacteria (Antibiotic)



Virus (Antiviral)

Fungi/Yeast (Antifungal)

Antibiotic Resistance



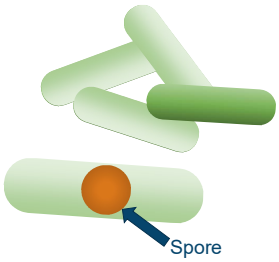
- Methicillin-resistant *Staphylococcus aureus* (MRSA)
- Carbapenem-resistant *Enterobacteriaceae sp.* (CRE)
- New Delhi metallo-β-lactamase-1 *Escherichia coli*

≠ High level disinfectant or sterilant resistance

Challenging Organisms To Decontamination

ENDOSPORE

- Dormant form
- Resistant to harsh conditions
- Resistant to chemicals
- Few bacteria strain make endospores
- Clostridioides difficile (C. diff.)

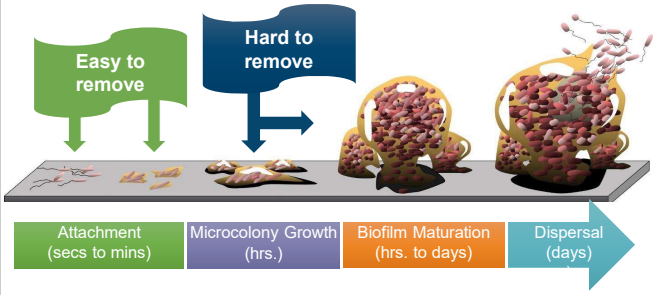


Challenging Organisms To Decontamination

Biofilms

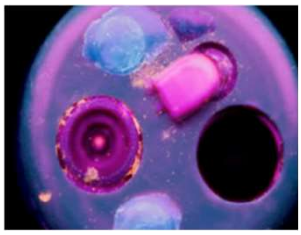
- Microbial colonies
- Extracellular Polymeric Substance (EPS)
- Protective barrier
- Pseudomonas species

How Biofilm Forms

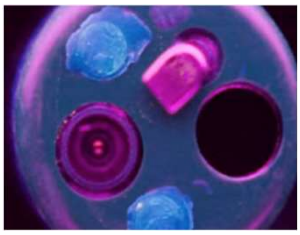


Effect Of Mature Biofilm

Biofilm After Cleaning And High Level Disinfection

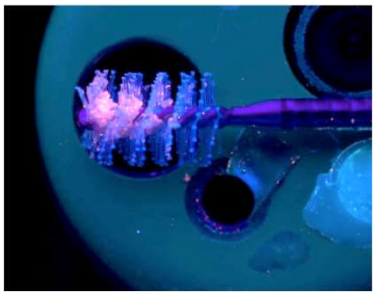


After HLD with glutaraldehyde



After HLD with PAA

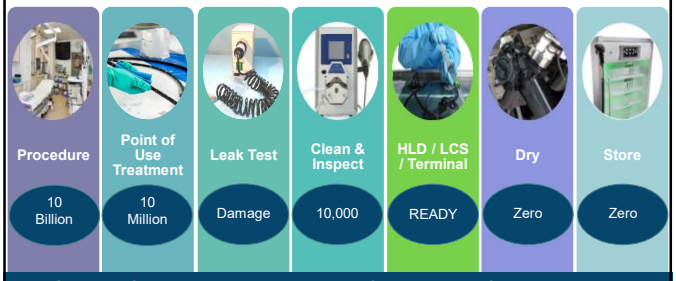
Mature Biofilm Within Un-brushable Channels



After brushing air/water channel

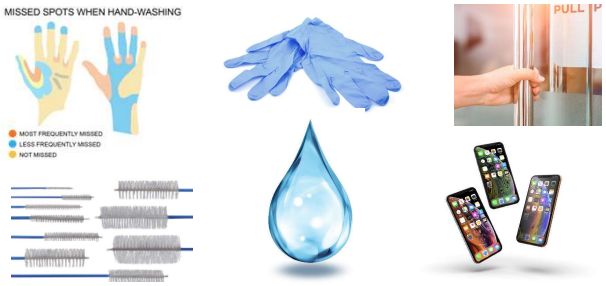
Processing Challenges Leading To Cross Contamination

The Rise & Fall Of Endoscope Contamination

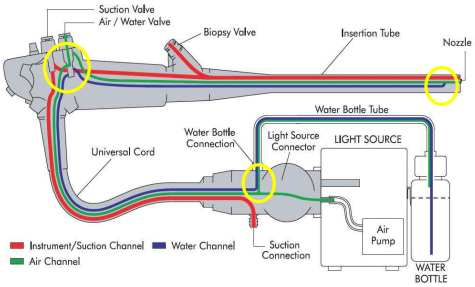


Success of each step depends on successful completion of previous the step

Sources Of Contamination



Challenges In Endoscope Processing: Design



Challenges In endoscope Processing: Forceps Elevator

Forceps Elevator Mechanism Close-up

Challenges In Endoscope Processing: Forceps Elevator

Cleaning considerations

- Three positions to clean
  - Up
  - Down
  - Middle

HLD/LCS considerations

- Flow Adapters / Connectors
- 45° angle for some

Challenges In Endoscope Processing: Undetected Damage & Debris

- Complete these steps immediately after manual cleaning!
- Inspect for:
  - Debris
  - Damage
  - Integrity of seals/gaskets
  - Lens clarity
  - Function of knobs & switches

Challenges In Endoscope Processing: Undetected Problems

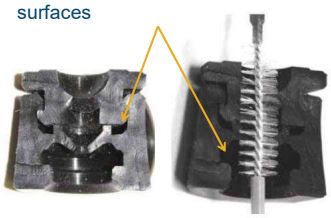
"Methods that are able to quantitatively or chemically detect organic residues that are not detectable using visual inspection should be implemented." (ANSI/AAMI ST91, 2021)

- After cleaning and rinsing
- High Risk Endoscopes – Every time
- All others – at facility established intervals

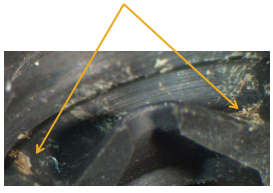
High risk examples:
- Duodenoscope
- Bronchoscope
- Ureteroscope

Challenges In Endoscope Processing: Reusable Valves

1. Brush can't reach valve surfaces

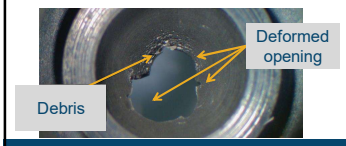


2. Contamination grew viable bacteria

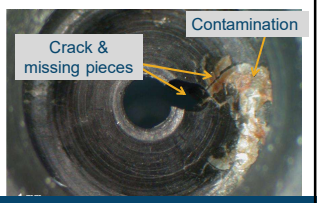


Challenges In Endoscope Processing: Reusable Valves

1
- Lumen is deformed
- Damage can't be cleaned
- Damage provides reservoir for microbes



2
- Microscopic damage leads to contamination



Alternatives To Reusable Accessories

Procedure Kits

Connectors

Valves

Water Bottle Adapters & Irrigation Tubing

Challenges In Endoscope Processing: Failure To Dry

47% of endoscopes had **residual moisture after 24+ hours of storage**

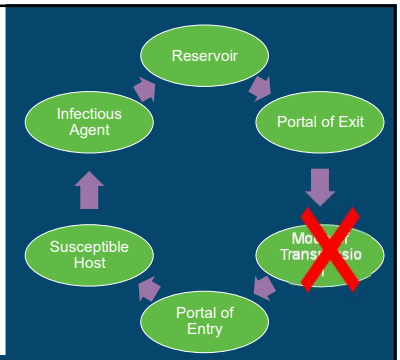
Ofstead et al (2016)

Chain Of Infection

Tools to Break the Chain

- Point of use treatment
- Contained transportation
- Decontamination
- Single use accessories
- Drying
- Storage
- Maintenance

The Bug Stops Here



Point Of Use Treatment

Proper point of use treatment can decrease bacteria level by billions of CFU/cm^2!

Contained Transport Of Flexible endoscopes

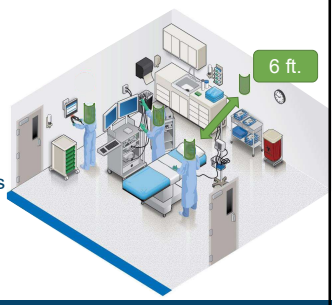
Rigid transport tray and liner

Personal Protective Equipment – Endoscopy Processing

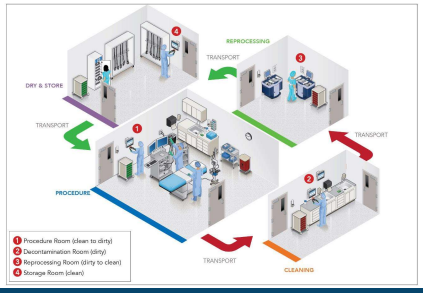
Gloves	Mask	Gown
		
Goggles / Eye Shields	**Shoe covers**	
		

Face Shields For Unseen Splashes

- Full length face shields
- 1100 procedures, 239 sessions
- Endoscopist: **5.6** per 100 half days
- Wall: **3.4** per 100 half days



Endoscopy Workflow Pattern



Cleaning

"This is the first and most important step in removing the microbial burden from an endoscope. Retained debris may inactivate or interfere with the capability of the active ingredient of the chemical solution to effectively kill and/or inactivate the microorganism."

(SGNA, 2018)

Cleaning Chemistries

AORN 2021 Selecting Cleaning Chemistry
Compatible and non-abrasive
Low foaming
Easily removed during rinsing
Non-toxic in use solution
Effective on clinically relevant soils
Provides soil dispersion
Biodegradable and environmental preferable
Cost effective with a long shelf life

Endoscopy Cleaning Chemistry Considerations

- Neutral Detergent (with or without enzymes)
- Dilution rate
- Temperature
- Contact time
- Storage conditions
- Shelf and Use life

New freshly-prepared cleaning solution for each flexible endoscope

Cleaning Chemistry Formulations

Water	• Largest component
Surfactant	• Decrease surface tension • "Wetting" agent
Enzyme	• Breaks down specific soil components
Buffer	• Controls pH
Chelating Agent	• Sequesters metal ions

High Level Disinfectants And Sterilants

High Level Disinfection	Liquid Chemical Sterilization	Terminal Sterilization
Kills all pathogenic microorganisms except high levels of endospores	Kills all microorganisms including high levels of endospores	Kills all microorganisms including high levels of endospores
Rinsing required	Rinsing required	Aeration may be required
Not sterile	No Sterile Storage	Sterile storage

Choosing A Biocidal Process

- Based on Risk Assessment
  - High-risk endoscope
  - Patient population
  - Infection rates
  - Outbreak organisms

Water

Water Use	Type of Water Required
Making Cleaning Solution	Utility Water
Rinse Water Following Cleaning	Utility Water
HLD or LCS Solution	Critical Water
Rinse Water following HLD or LCS	Critical or Sterile Water

AORN Guidelines for Perioperative Practice "Flexible Endoscopes", 2021

Alcohol – Channel Drying Assistance

- 60-90% ethyl or isopropyl alcohol
- Endoscope manufacturer's IFU
- Isopropyl is fixative

Dry Before Storage

External

- Remove from AER
- Fresh non-linting cloth
- Clear crevices /recesses

Internal

- No Drip Dry
- ≥ 10-minutes channel drying
- Instrument or HEPA filtered Air
- Drying Cabinet

Wet valves = contamination

Air Types

HEPA Filtered Air

- 0.3-micron filtration
- H13 or H14 grade
- Typically, room temperature and humidity

Instrument Air

- 0.01-micron filtration
- ANSI/ISA S-7.0.01 Quality standard for instrument air
- No water droplets or hydrocarbon vapors

Mistakes & Om

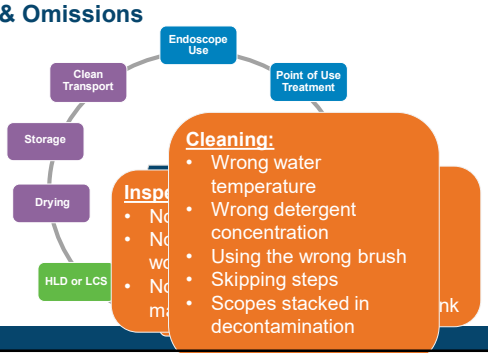
Use:
- Missing p
- Missing e identifier
- Missing d

Point of Use:
- Skipping it: "It's just next door"
- Skipping it: "It won't take lon
- No trea cor

Dirty Transport:
- No biohazard label
- Wrong container type

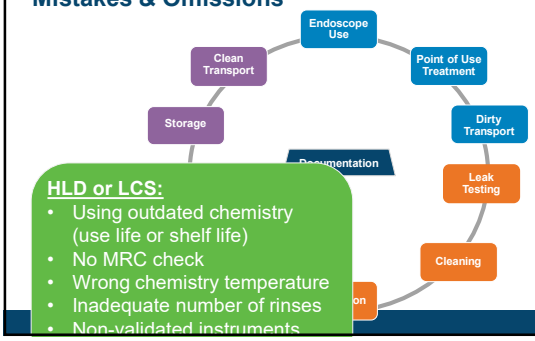
Storage
Drying
HLD or LCS
Inspection
Cleaning
Documentation

Mistakes & Omissions



Cleaning:
- Wrong water temperature
- Wrong detergent concentration
- Using the wrong brush
- Skipping steps
- Scopes stacked in decontamination

Mistakes & Omissions



HLD or LCS:
- Using outdated chemistry (use life or shelf life)
- No MRC check
- Wrong chemistry temperature
- Inadequate number of rinses
- Non-validated instruments

Mistakes & Omissions

Clean Transport:
- No clean gloves
- Not cleaning/disinfecting transport container type

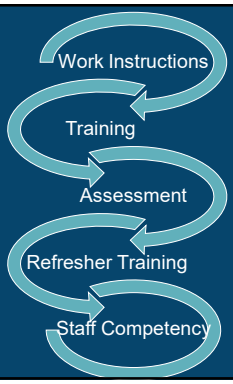
Storage:
- Can't identify ready to use scope
- Drying with wrong quality air

Mistakes & Omissions

Documentation:
MISSING:
- Patient unique identifier
- Scope unique identifier
- Person doing point of use treatment
- Person doing processing
- Signature of person performing step
- Preventative maintenance care
- Chemistry MRC results
- Printouts are lost
- Splashes create illegible ink (Wet Logbook)

Competency-Based Training

- Product Competency
- Equipment Competency
- Process Competency
- Certification recommended



Action Items

- Review infection reports for trends linked to endoscopy
- Review manufacturer instructions for use (IFU)
- Audit processing area
- Revise to a competency-based training

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