Introducing the 3M Learning Connection: New Name, Same Great Courses

- It's an educational resource bringing you 3M™ Sterile U and other Infection Prevention courses. You’ll soon see some exciting new benefits as our program evolves!
- Improved features:
  - “Add to my Calendar” feature added this month!
  - Other 3M courses will be more accessible as we expand our offerings.
- What do you need to do?
  - Nothing. Your current registrations remain and our Sterile U offerings have not changed.

Welcome!

Topic: Biofilms: The Hidden Menace

Speaker: Steven Kubler, CSPDT
3M Infection Prevention Technical Service

For more information: www.3M.com/3MSterileU

Learning Objectives

- List the various types of biofilms and describe how they are formed.
- Discuss how biofilm formation increases the risk of disease transmission.
- Identify those instruments and devices that are most prone to biofilm formation.
- Explain why biofilm is so difficult to remove from surfaces.
- Compare the different methods for the control and removal of biofilm formation on surgical instruments and medical devices.
Biofilms in our daily life
What do these photos have in common?

Biofilm in nature
- Cleaning a ship hull
- Yellowstone Nat’l Park
- Wastewater treatment

Biofilm can be difficult to see!

Photos: Center for Biofilm Engineering, Univ. of Montana
What is a biofilm?

- A collection of microbes
- Encased in slime
- Attached to a surface
- A survival mechanism

How do biofilms form? A recipe

- Almost any surface will do
- Presence of water (even intermittent presence)
  - Hot, cold, acid, clean, dirty, low oxygen, no light, high pressure, disinfectants
- Microbes
  - All types of microbes can be found in biofilms
  - Yeast, molds, bacteria, viruses, protozoa, algae
  - Biofilms can be polymicrobial (more than one kind of microbe)

How Biofilms form: A closer look

Biofilm Formation: Attachment

- Microbes can exist in two states:
  - Free floating (planktonic) or Attached (sessile)
- Free floating bacteria encounter a surface and attach
  - Can take only minutes
- Microbes attach to a surface by means of a molecular “glue”:
  - Extra cellular polymeric substance (EPS)
- After a certain amount of time, attachment is permanent and irreversible
Biofilm Formation: Growth

- Growth can be slow or fast depending on environment
  - A full community can form within hours.
- Cells are held together by EPS to form complex 3D structures
  - Can be several cells thick to many inches thick
- Very resistant to
  - Antibiotic treatment
  - Killing by disinfectants
  - Physical removal

Biofilm Formation: Detachment

- Large or small clumps of the biofilm detach
- The microbes in these detached clumps “travel” downstream
- Find a new surface to attach and grow
- Mechanism for disease transmission

Interesting…but why should we care?

“Microbial biofilms, which often are formed by antimicrobial-resistant organisms, are responsible for 65% of infections treated in the developed world”


Some trends

- Rates of postoperative sepsis, or bloodstream infections, increased by 8%
- Postoperative catheter-associated urinary tract infections increased by 3.6%
- Rates of selected infections due to medical care increased by 1.6%
- There was no change in the number of bloodstream infections associated with central venous catheter placements, which are tubes placed in a large vein in the patient’s neck, chest, or groin to give medication or fluids or to collect blood samples.
- Rates of postoperative pneumonia improved by 12%
**Biofilm-related diseases**

- Otitis media (ear infection)
- Bacterial endocarditis (infection of heart)
- Cystic fibrosis (lung)
- Legionnaires Disease
- Periodontitis (gums)
- Sinusitis (sinuses)
- Osteomyelitis
- Surgical Site Infections
- Blood-stream Infections
- Urinary Tract Infections

**Sources of Biofilm**

- Implants
- Stents/Shunts
- Orthopedic Prostheses
- Catheters
- Wound Dressings
- Surgical Instruments
- Medical Devices
- Lint
- Environmental Surfaces

**CSSD Perspective: What are the issues?**

- Remember – biofilms form anytime there is water, a surface and bacteria
- Biofilms can be microscopic therefore you can’t see them most of the time
- Surgical instruments and medical devices are prone to biofilm formation
- Biofilms are very resistant to disinfectants
- Fast turnaround times needed during reprocessing promote biofilm formation
**Surfaces: Surgical Instruments**

**What affects biofilm formation?**

**Instrument Complexity**
- Crevices
- Pores
- Edges
- Serrations
- Shape
- Lumens

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**Biofilm Formation on Surgical Instruments**

**Water Quality Is Important!!!**
- Presence of minerals (hard water)
- Water quality affects your detergents and disinfectants
- Contaminated water
  - Does rinse water contain bacteria, organic material?
- Rinsing
  - Volume
  - Type of water
  - Duration

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**Biofilm Formation on Surgical Instruments**

**Reprocessing**

**Handling**
- Scratches, lubricant not removed, poor assembly
- Presence of particles (lint, hair, fibers, glove powder)
- Etching – use of harsh chemicals

**Practices**
- Time – too much time between use and reprocessing
- Multiple reprocessing of single-use items
- Loaner instruments
- Poor rinse techniques
  - Leave behind particles, soil, detergents

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**What can you do to prevent biofilm formation?**

**CLEANING......**
- Cleaning is the primary mechanism for preventing biofilm formation
- Factors for success
  - Proper training
  - Effective Policies and Procedures
  - Supportive monitoring to make sure process is in control
  - Time to do the job correctly
  - Up to date IFUs
- Proper tools
  - Chemicals
  - Brushes (size, diameter, length, design)
  - PPE

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*Partially adapted from: Wava Truscott, Ph.D., IAHCSSM 2011, Biofilms in Medicine and What it means to Central Services*
**Cleaning (Manual and Automated) Points to Consider…..**

- the quality of the water
- the quality, concentration, and type of detergent or enzymatic cleaner
- an acceptable washing method, Manufacturer Instructions!!
- proper rinsing and drying
- correct preparation of the items to be processed by cleaning equipment
- time temperature parameters for equipment
- load capacity of the equipment
- operator performance

**Biofilm Removal Enzymatics + Mechanical Action**

- Instruments should not be allowed to dry out before reprocessing
- Enzymatics – “chews up” the molecular glue that holds the biofilm to the surface.
  - Most enzymatics do not have biofilm removal claims (EPA)
  - Enzymatics can be contaminated with bacteria
  - Contact time
  - Elbow grease!

**Biofilm Resistance to Detergents and Disinfectants**

- Back to the slime layer and 3D structure….
  - Protects microbes from action of detergents, enzymes, disinfectants as well as antibiotics
  - Biofilms have been shown to be up to 1000 times more resistant to environmental and antimicrobial stress than their planktonic counterparts
- Proper use of detergents:
  - temperature, dilution, pH
  - EPA claim for biofilm removal?

**Make sure the instruments are dry!!**

- No water = No biofilm
- Instruments should be dry before they are sterilized or disinfected
- Store instruments so they stay dry
Biofilm Formation: Flexible Endoscopes

• Flexible endoscopes are reportedly associated with more documented cases of healthcare-acquired infections than any other type of reusable medical device.
• Of these scopes, bronchoscopes and duodenoscopes account for the highest number of transmitted infections.


“The biggest problem is that we can’t see inside these scopes. To put it bluntly, we’re just taking a shot in the dark with reprocessing.”
Nancy Chobin, RN, St. Barnabas Health Care System. Livingston, New Jersey
“Probing the Challenges of Endoscopes”
Biomedical Instrumentation & Technology May/June 2011

In other words….

“Failure to adhere to established reprocessing guidelines accounts for most, if not all, of the reported cases of bacterial and viral transmissions.”

Why are flexible endoscopes difficult to reprocess?

- Complex design
- Multiple, long, narrow, channels that are difficult to clean
- Lack of consistent effective training
- Lack of time and resources for adequate reprocessing
- Visual inspection not adequate to monitor efficacy of reprocessing.

Basic steps for Reprocessing Flexible Endoscopes

- Pre-cleaning – Bedside
- Transport to Reprocessing - <1 hour
- Manual Cleaning
- Rinsing
- High-level disinfection – Manual, Automated (AER)
- Drying (Alcohol flush, Air flush)
- Storage

Everyone of these steps has implications for biofilm formation

Manual Cleaning – a little more detail

Multi-Society Guideline on Reprocessing Flexible Gastrointestinal Endoscopes 2011 Infection Control & Hospital Epidemiology 32(6) pp.527-537

- Meticulously clean the entire endoscope
- Clean all valves, channels, connectors, all detachable parts
- Flush/brush all accessible channels to remove all organic and other residues
- Clean external surfaces
- Rinse

Manual Cleaning is not an option!

Manual cleaning of endoscopes is necessary immediately after removing the endoscope from the patient and prior to automated or manual disinfection. 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 microorganisms.

Standards of Infection Control in Reprocessing of Flexible Gastrointestinal Endoscopes. 2009
How do we know a scope is clean?

Visual Inspection is the current method for monitoring effectiveness of manual cleaning.
*SGNA says: “Continue brushing until there is no debris visible on the brush.”

Just because it looks clean… doesn’t mean it is clean.

You can’t see biofilm or microbes
You can’t see biological residues
You can’t see inside the lumens

How do you monitor cleaning efficacy?

• A hot topic!
• 3M Sterile U offers a webinar focused on this topic.
• Here is how to access the archived webinar.
    • Click “Webinars”
    • Click “Previously Recorded Session”
    • Click “February 16, 2012: "You Can’t See Clean: Clean Monitoring in the CSSD”

Biofilm Formation: Flexible Endoscopes
Water, microbes, suitable surface…..

How does a clean scope acquire biofilm?

• Surface:
  • As a scope is used the surface is “coated” or “conditioned” with body fluids that contain proteins, polysacharides
  • Changes the surface to allow attachment of microbes
• Water
  • Residual moisture left after reprocessing
• Microbes
  • Microbes present in contaminated water
  • Incomplete removal of microbes from endoscope
Removing Biofilm from an Endoscope

• Goal? Don’t let biofilms establish a “foot hold”
• Using proper procedures, the initial biofilm can be removed
  • Manual pre-cleaning – bed side flush!
    • Critical to removing bioburden
    • Prevents biofilm formation
  • Brushing accessible channels
    • Use proper tools that fit the channel size
  • High level disinfection
  • Thorough drying
  • Proper storage (always vertical!)

Biofilm formation may cause failure of disinfection procedures

• Biofilms form a protective barrier around infectious microbes; allows infectious microbes to survive the disinfection process.
• Young biofilm may be more susceptible to disinfection when compared to “old” biofilm.
• Most biocides are not tested against biofilms
  • Free (planktonic bacteria) are used to test biocides
    • More susceptible
  • Biofilms (not generally used to test biocides)
    • More resistant
    • Oxidizing agents and some enzymatics are effective

Drying – A Critical Step in Reprocessing

• The drying step
  • Between cases
  • At the end of the day
  • Hang vertically
• Drying agents
  • Air
  • Alcohol
• How to tell if a scope is not dry?
  • Look for fluid underneath scopes that are vertically stored
  • Smell – any odors?

Conclusions

• Biofilms will form anywhere there is water, a surface and microbes
• Biofilms are almost impossible to remove once they have been established.
• Failure to completely clean and dry instruments and endoscopes using the current guidelines may lead to biofilm formation
• Biofilm must be completely removed or
  • Risk continued growth
  • Risk disease transmission
• Ensure that reprocessing personnel:
  • Are properly trained
  • Have access to current IFU’s and proper tools
  • Have time to perform their job