APECIH – 30 ANOS

Controversies in endoscope processing

Biofilm in Endoscopy

Larissa Garms Thimoteo Cavassin-RN
Hospital Sírio Libanês
São Paulo-Brazil

What's biofilm?

Films in which bacteria adhere to one another and to a surface, secreting an extracellular matrix of polymers composed of polysaccharides, DNA and proteins that functions as a resistance structure.

Biofilm can be seen as an analogous (but simpler) form of multi-cellularity, even though bacteria within this sessile community adopt different roles

Donlan RM, Costerton JW. Biofilms: survival mechanisms of clinically relevant microorganisms. Clin Microbiol. 2002;15:167e93.

Biofilms: an emergent form of bacterial life

Hans-Curt Flemming, Jost Wingender, Ulrich Szewzyk, Peter Steinberg, Scott A. Rice & Staffan Kjelleberg

Affiliations | Corresponding author

Nature Reviews Microbiology **14**, 563–575 (2016) | doi:10.1038/nrmicro.2016.94
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- Importantly, bacteria in biofilms exhibit a set of 'emergent properties' that differ substantially from free-living bacterial cells.

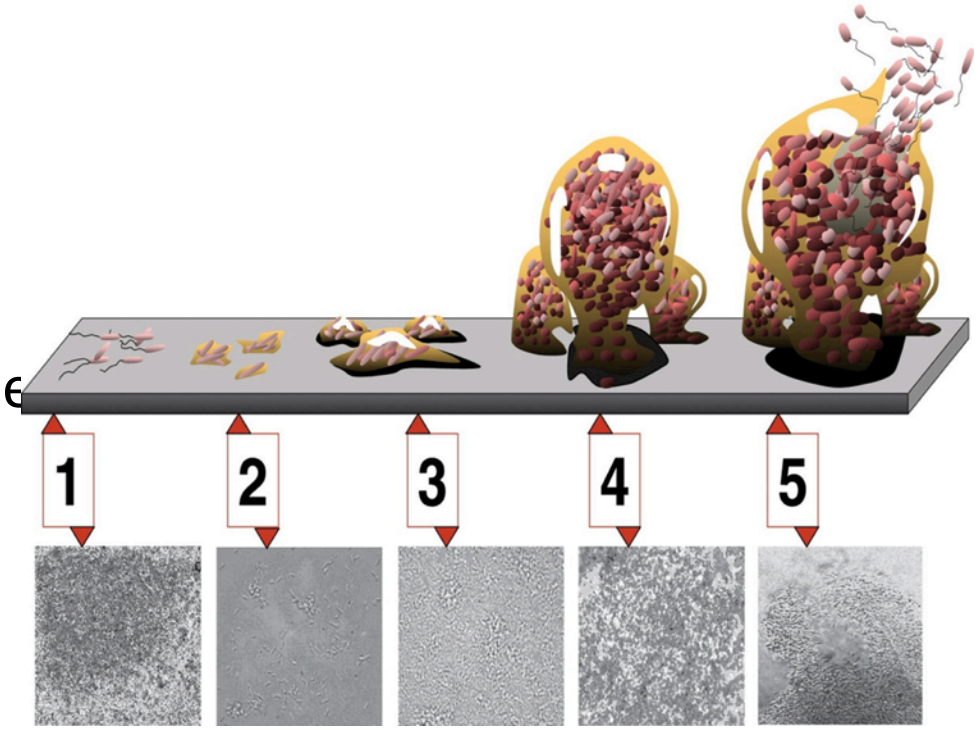
- In this Review, we consider the fundamental role of the biofilm matrix in establishing the emergent properties of biofilms, describing how the characteristic features of biofilms — such as social cooperation, resource capture and enhanced survival of exposure to antimicrobials — all rely on the structural and functional properties of the matrix.

- Finally, we highlight the value of an ecological perspective in the study of the emergent properties of biofilms, which enables an appreciation of the ecological success of biofilms as habitat formers and, more generally, as a bacterial lifestyle.

The process of biofilm formation

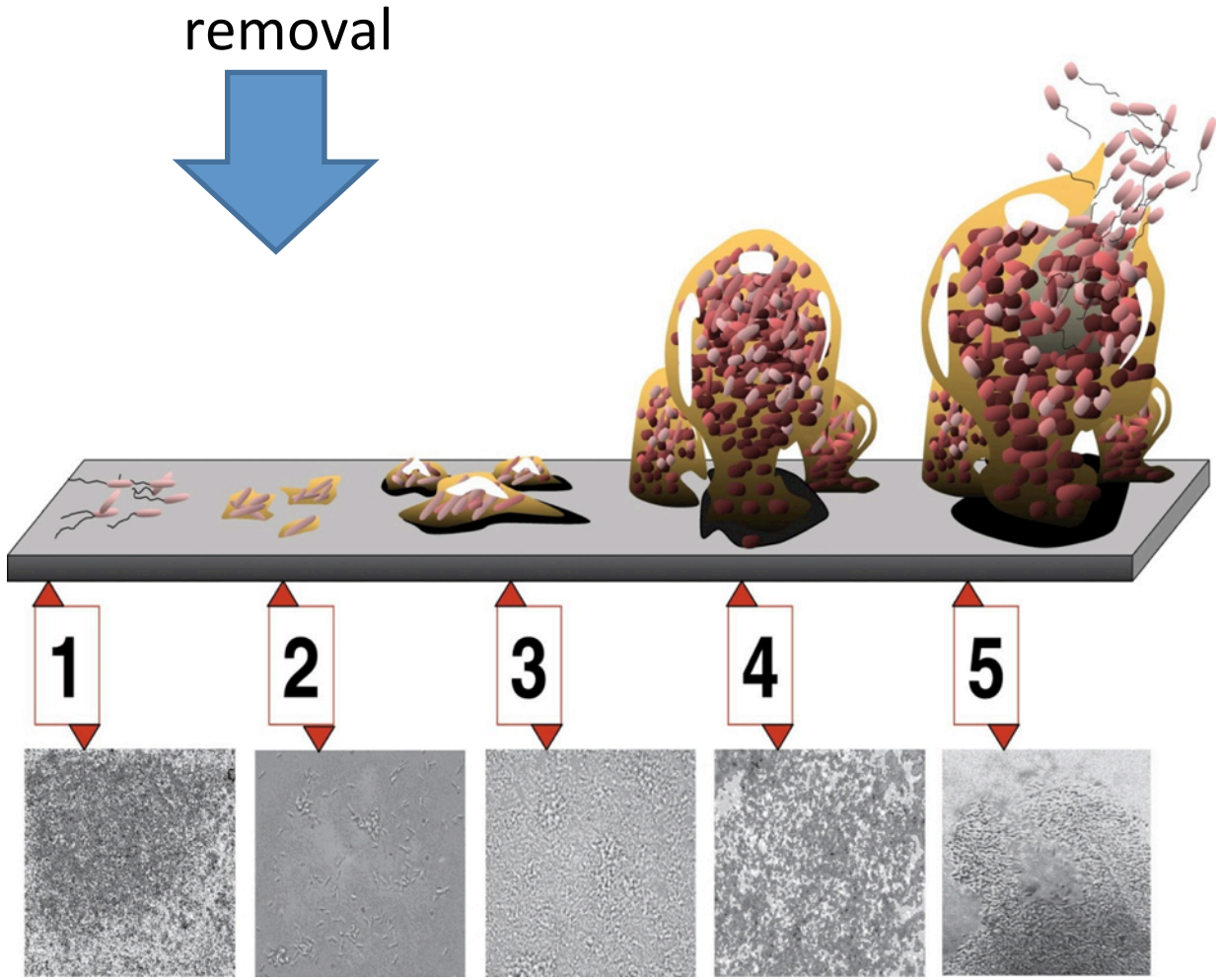
The first step of biofilm formation is the deposition of organic material from body fluids and tissues that provide nutrients to support the attachment, growth, and proliferation of colonizing microorganisms.

To survive and mature, a biofilm requires the presence of sufficient nutrients and water, acceptable temperature conditions, and sufficient time.

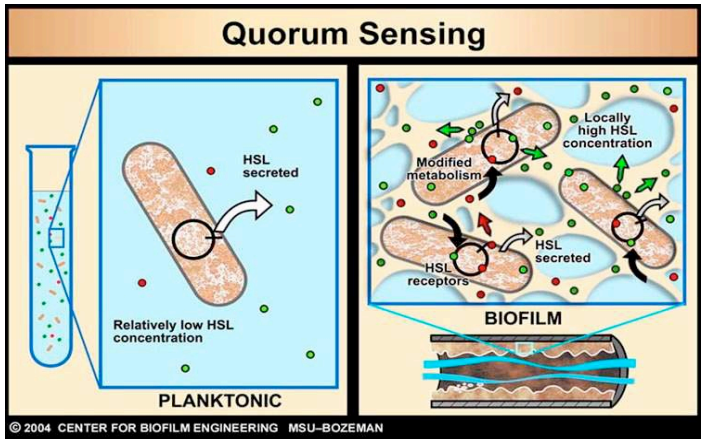


Guideline for processing flexible endoscopes. In: *Guidelines for Perioperative Practice*. Denver, CO: AORN, Inc; 2016:675-758.

The process of biofilm formation

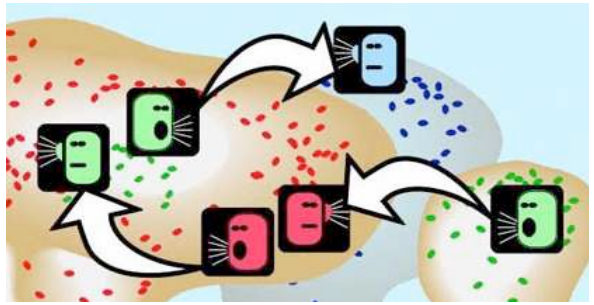


quorum sense



Control of cell density through the coordinated expression of genes in microbial populations as a response to thresholds of signaling molecules, that is followed by the induction of a joint response by the entire population.

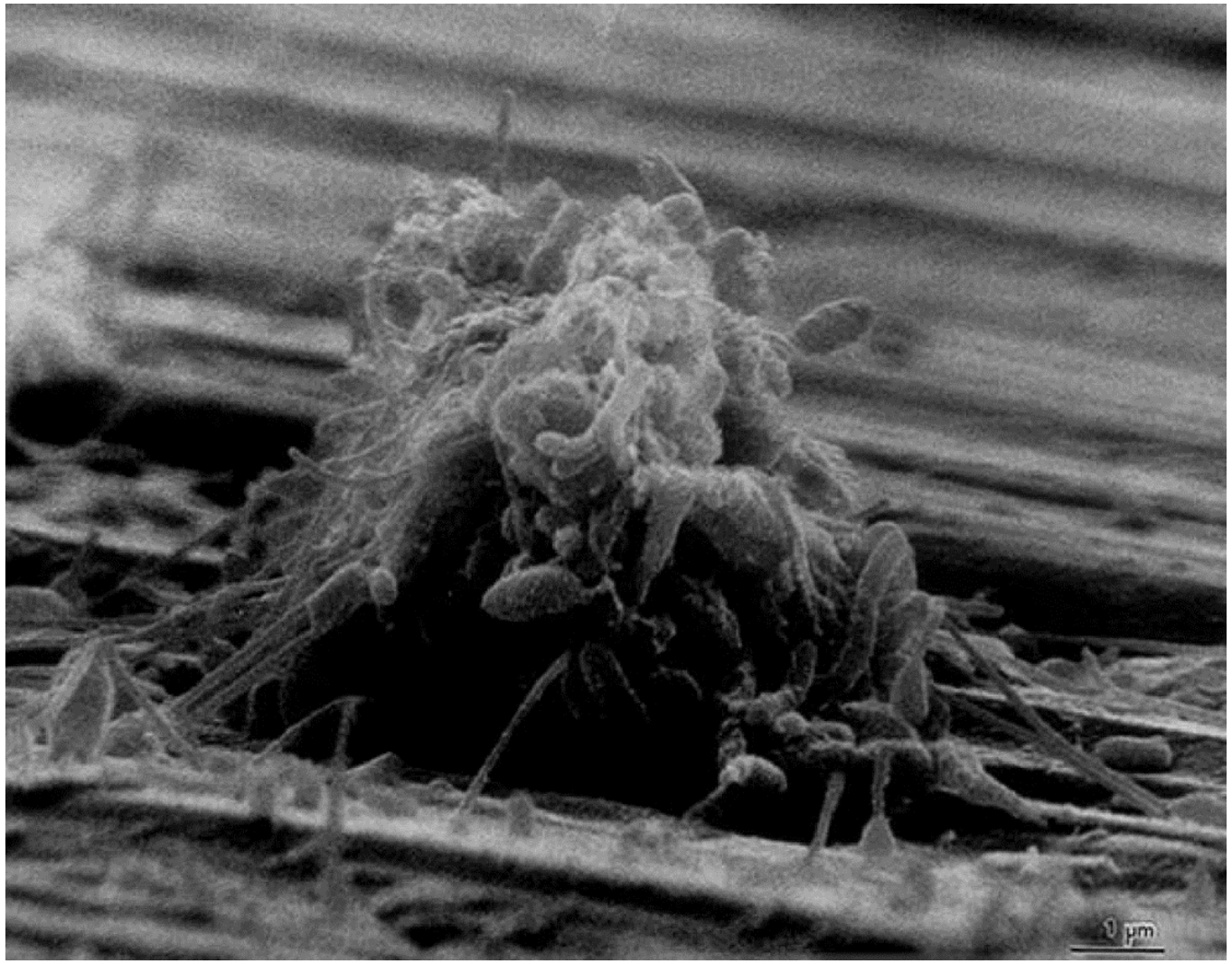
This process allows bacteria to maintain control over their population density and 'biofilms‘ formation.



Donlan RM, Costerton JW. Biofilms: survival mechanisms of clinically relevant microorganisms. Clin Microbiol. 2002;15:167e93.

Resistance to biocides

Biofilms make these communities resistant not only to antibiotics and biocids, disinfectants but also to phagocytosis by human mononuclear cells



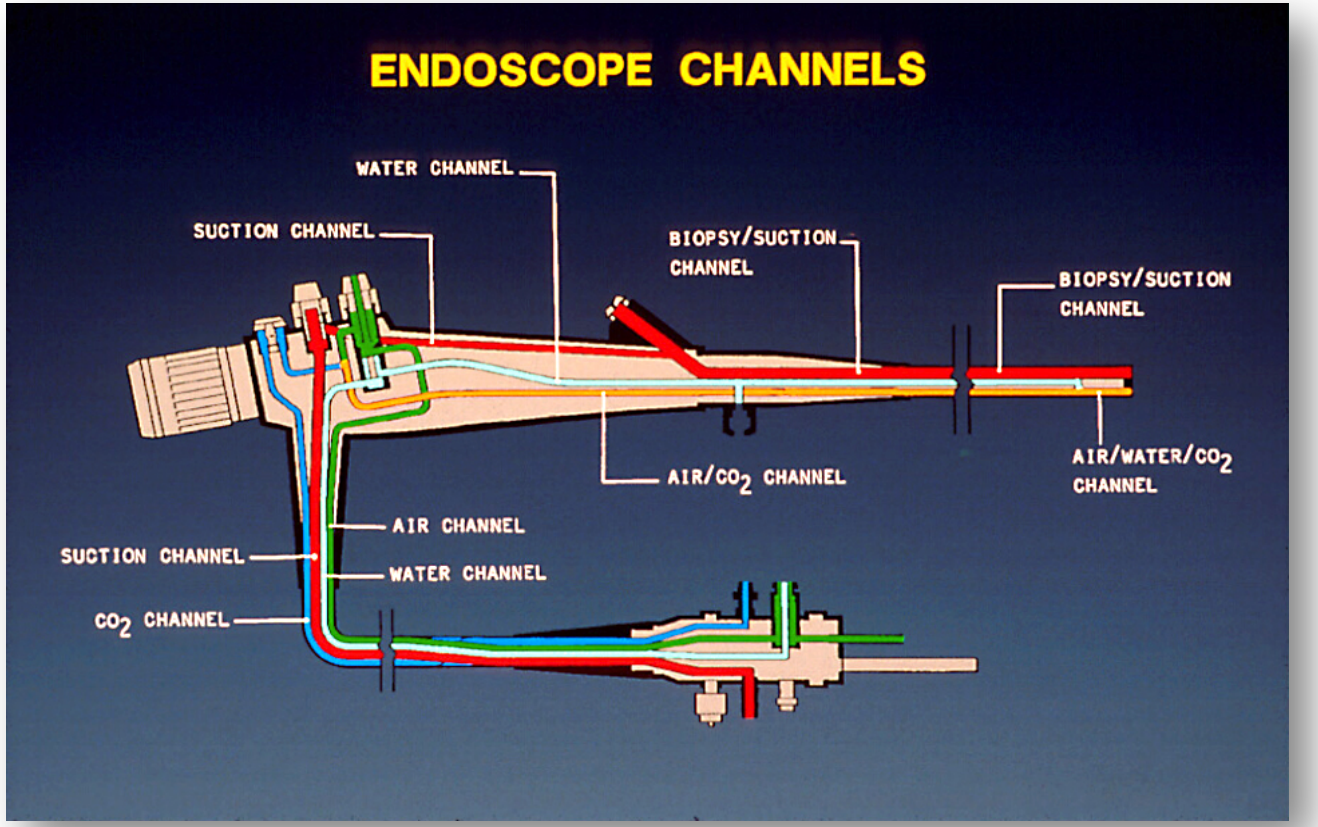
Donlan RM, Costerton JW. Biofilms: survival mechanisms of clinically relevant microorganisms. Clin Microbiol. 2002;15:167e93.

Classificação of Spauding 1968

Table 3.3.3. **Spaulding classification of equipment decontamination *(15)***

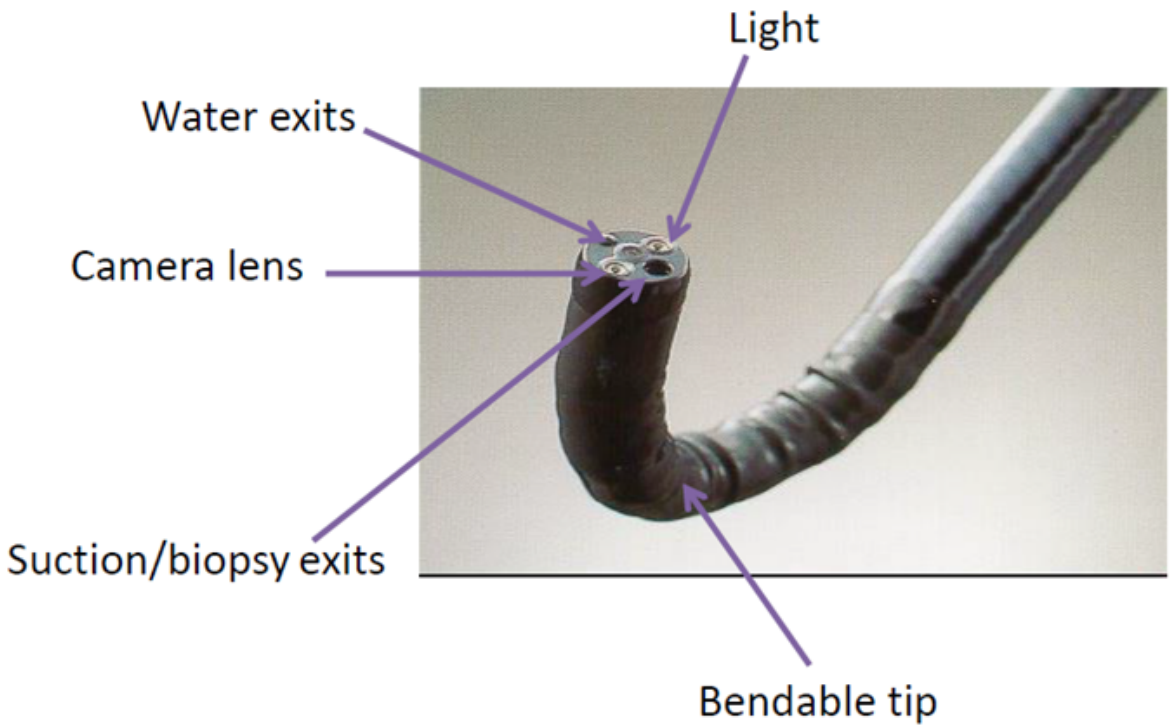
Category	Definition	Level of microbicidal action	Method of decontamination	Example of common items/equipment
High (critical)	Medical devices involved with a break in the skin or mucous membrane or entering a sterile body cavity.	Kills all microorganisms.	Sterilization (usually heat if heat-stable or chemical if heat-sensitive).	Surgical instruments, implants, prostheses and devices, urinary catheters, cardiac catheters, needles and syringes, dressing, sutures, delivery sets, dental instruments, rigid bronchoscopes, cystoscopies, etc.
Intermediate (semi-critical)	Medical devices in contact with mucous membranes or non-intact skin.	Kills all microorganisms, except high numbers of bacterial spores.	High-level disinfection by heat or chemicals (under controlled conditions with minimum toxicity for humans).	Respiratory therapy and anaesthetic equipment, flexible endoscopes, vaginal specula, reusable bedpans and urinals/ urine bottles, patient bowls, etc.
Low (non-critical)	Items in contact with intact skin.	Kills vegetative bacteria, fungi and lipid viruses.	Low level disinfection (cleaning).	Blood pressure cuffs, stethoscopes, electrocardiogram leads, etc. Environmental surfaces, including the OR table and other environmental surfaces.

Endoscopes
Great challenge!!!

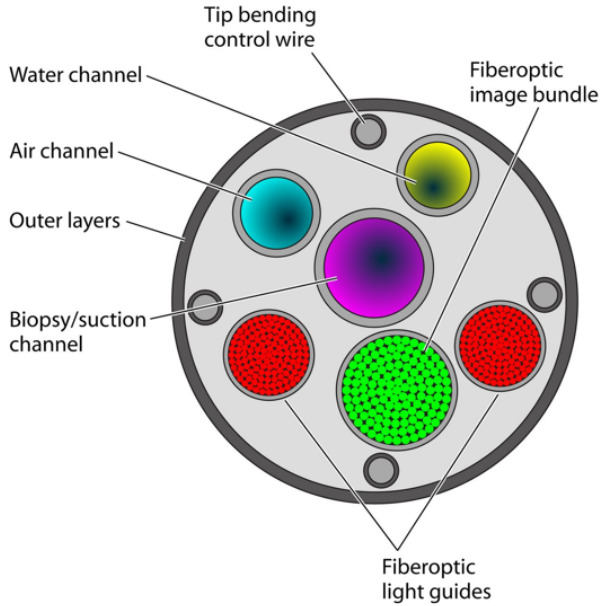


- ✓Non-collapsible
- ✓Not transparent
- ✓Long Channels
- ✓Narrow lumens
- ✓Valve channels
- ✓Thermosensitive

Distal End of a Gastrointestinal scope



Schematic drawing of a cross section of a flexible endoscope showing the complex design and multiple internal channels (inner diameter, 2.8 to 3.8 mm).



Julia Kovaleva et al. Clin. Microbiol. Rev. 2013;26:231-254

Clinical Microbiology Reviews

Elevator Chanel

Distal end of a duodenoscope

'Superbug' linked to 2 deaths at UCLA hospital

Doug Stanglin, USA TODAY 11:09 a.m. EST February 19, 2015

Scope disinfection failure suspected in superbug cluster, leads UPMC to alter methods

CBS NEWS / January 22, 2015, 12:29 PM

Deadly superbug infected patients at Seattle hospital

Superbug outbreak extends to Cedars-Sinai hospital, linked to scope

281 Hartford Hospital Patients Exposed to Drug-Resistant E. Coli

Taking a Closer Look at the Dirt on Flexible Endoscopes

Cori L. Ofstead, MSPH
President and CEO
Ofstead & Associates, Inc.

IAHCSMM 50TH ANNUAL CONFERENCE & EXPO

Medical scope now tied to Wisconsin superbug outbreak

Transmission of Infection by Endoscopy

Kovaleva et al. Clin Microbiol Rev 2013. 26:231-254

Scope	Outbreaks	Micro (primary)	Pts Contaminated	Pts Infected	Cause (primary)
Upper GI	19	Pa, *H. pylori*, *Salmonella*	169	56	Cleaning/Dis-infection (C/D)
Sigmoid/Colonoscopy	5	*Salmonella*, HCV	14	6	Cleaning/Dis-infection
ERCP	23	Pa	152	89	C/D, water bottle, AER
Bronchoscopy	51	Pa, Mtb, Mycobacteria	778	98	C/D, AER, water
Totals	98		1113	249	

Based on outbreak data, if eliminated deficiencies associated with cleaning, disinfection, AER , contaminated water and drying would eliminate about 85% of the outbreaks.

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Available at www.sciencedirect.com

ScienceDirect

journal homepage: www.elsevier.com/locate/IJMYCO

Full Length Article

Mycobacterial contamination of bronchoscopes: Challenges and possible solutions in low resource settings

Dania Khalid Saeed, Sadia Shakoor, Seema Irfan, Rumina Hasan *

Department of Pathology and Laboratory Medicine, Aga Khan University Hospital, Karachi, Pakistan

American Journal of Infection Control 44 (2016) e221–e226

Contents lists available at ScienceDirect

American Journal of Infection Control

journal homepage: www.ajicjournal.org

Major Article

Pseudooutbreak of rapidly growing mycobacteria due to *Mycobacterium abscessus* subsp *bolletii* in a digestive and respiratory endoscopy unit caused by the same clone as that of a countrywide outbreak

Thaís Guimarães MD, PhD [a,*], Erica Chimara MSc [b], Gladys Villas Boas do Prado MD [a], Lucilaine Ferrazoli MSc [b], Natalia Garcia Fernandes Carvalho MSc [b], Fernanda Cristina dos Santos Simeão MSc [b], Andréia Rodrigues de Souza MSc [b], Christiane A.R. Costa MSc [b], Cristina Viana Niero MSc [c], Urze Adomaitis Brianesi MSc [c], Thais Romano di Gioia MD [a], Laura Maria Brasileiro Gomes MSc [a], Fernanda de Souza Spadão MSc [a], Maria das Graças Silva MSc [a], Eduardo Guimarães Hourneaux de Moura MD, PhD [a], Anna S. Levin MD, PhD [a]

[a] *Hospital das Clínicas, University of São Paulo, São Paulo, Brazil*
[b] *Instituto Adolfo Lutz, São Paulo, Brazil*
[c] *Federal University of São Paulo, São Paulo, Brazil*

Why? How? What?

1. Purpouse - Increase safety: process, professional, patient, prevent outbreaks
2. Good practices actions – safe and suitable
3. Ensure clean endoscope for patient use

The best time to act?

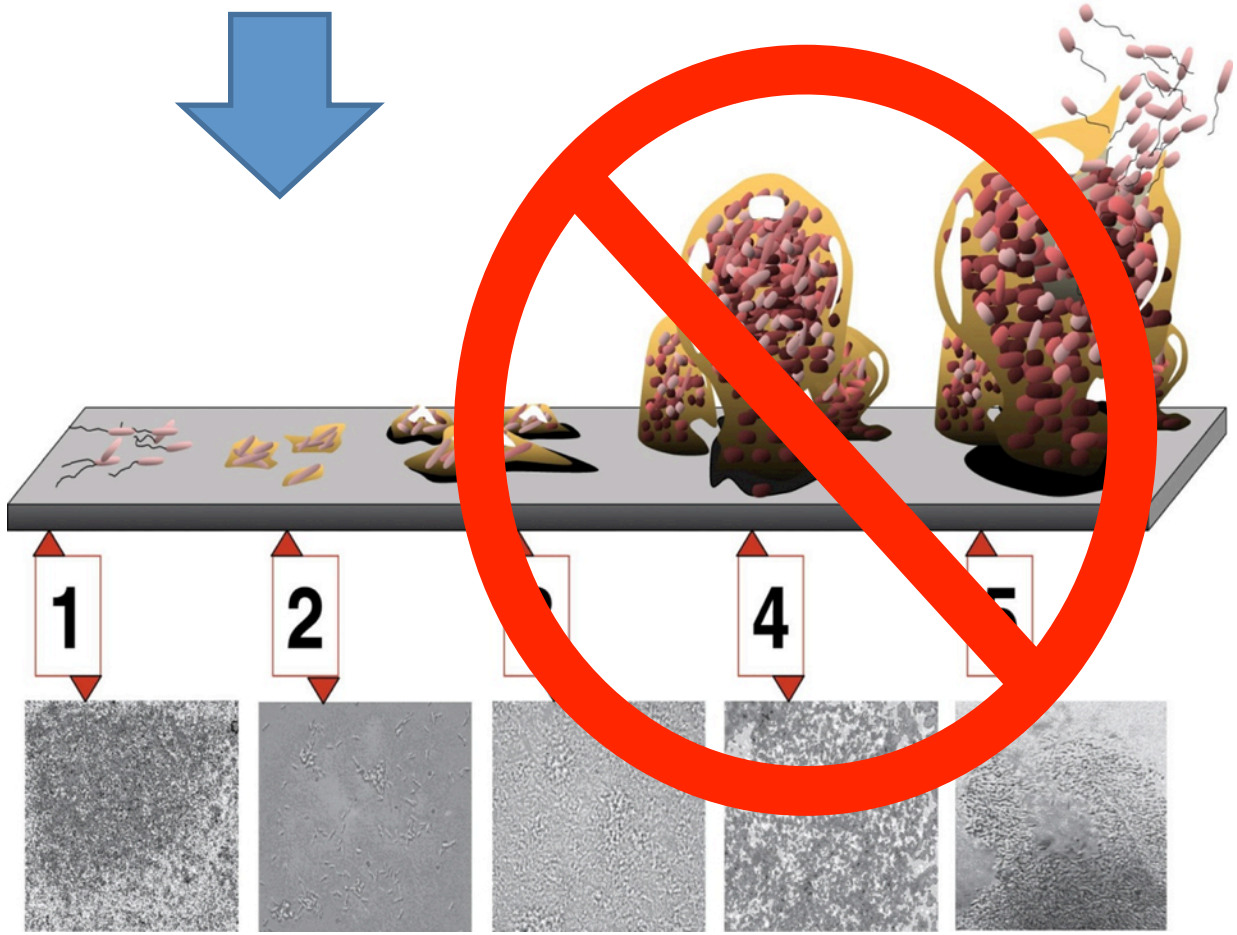
During the initial stages of biofilm formation, bacteria are only loosely attached to the surface and can be easily detached by cleaning.

However, as the bacteria proliferate and the biofilm matures, the attachment becomes much stronger, limiting the effectiveness of cleaning solutions and scrubbing.

Colonizing bacteria from the top layers of a biofilm are not as firmly attached as those near the device surface and can migrate to form new biofilms on available surfaces.

Guideline for processing flexible endoscopes. In: *Guidelines for Perioperative Practice*. Denver, CO: AORN, Inc; 2016:675-758.

Preventing biofilm formation



Why is it so difficult?

- The biofilm structure confers a degree of protection to microorganisms, and elimination is difficult.
- In a biofilm, cells are less susceptible to dehydration.
- Nutrient recycling supports growth in low-nutrient environments.
- Matrix surrounded cells are less accessible to disinfecting solutions.

If the biofilm dries, the remaining organic material can inactivate disinfectants, render enzymatic cleaners less effective, and require additional scrubbing to be removed.

Why is so difficult?

Residual organic material that remains after device processing can promote the formation of a new biofilm when the device comes in contact with more colonizing bacteria (i.e., during the next procedure).

Biofilm is prone to form in the inner channels of endoscopes and on scratched or damaged endoscope surfaces that may not be reached easily by brushes during the cleaning steps, highlighting the need for visual inspections to assess cleanliness and damage (should we use a lens or a microscope?).

Damp inner channels caused by inefficient drying, favor bacterial growth; drying cabinets that circulate filtered air can prevent this.

Guideline for processing flexible endoscopes. In: *Guidelines for Perioperative Practice*. Denver, CO: AORN, Inc; 2016:675-758.

How to do?

Thorough cleaning, especially at the point of use, can limit biofilm formation and help ensure effective disinfection (and sterilization) in subsequent processing steps.

Putnam K, Preventing biofilm formation in flexible endoscopes. AORN, v. 103, n. 1, jan 2016.

Preparing endoscopes for processing after use

"Having a process for recording the times that the procedure ended and cleaning was initiated enables processing personnel to ascertain how long the endoscope has been awaiting processing, to establish priority order, and to determine whether routine processing within the manufacturer's recommended time to cleaning is achievable—and if not, to implement the manufacturer's procedures for delayed processing"

Sharon A. Van Wicklin, MSN, RN, CNOR, CRNFA(E), CPSN-R, PLNC, senior perioperative practice specialist at AORN and lead author of the guideline.

"This is a simple task that can make a big difference in effective processing."

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Point-of-use pre-cleaning

By moistening, diluting, softening, and removing organic soils, prompt point-of-use pre-cleaning can reduce biofilm formation and limit the amount of organic material that dries on the surface of the endoscope.

“We have to do everything we can possibly do to make sure the scopes are meticulously cleaned, and this begins with pre-cleaning the endoscope immediately after use,” said Van Wicklin.

Time constraints and the pressure to efficiently turn over procedures or rooms can lead to omission of the point-of-use pre-cleaning step;

However, this is the first step in ultimately preventing infections because it increases the effectiveness of all subsequent processing steps.

Cleaning

How to ensure effective cleaning?

ATP - Adenosine Triphosphate

- ATP is present in all living cells, as a main source of energy for cellular metabolism.
- Consequently, it is present in any organic residue, for example: body fluids, skin cells, microorganisms, etc.
- Thus, it represents an excellent marker for organic contamination or source of biological contamination.
- After cleaning, ATP levels on the inner channel (wash or brush) should be significantly reduced and the test monitors these levels, (< 100 RLU or <200 RLU, depending on the test brand)

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Available online at www.sciencedirect.com

Journal of Hospital Infection

journal homepage: www.elsevierhealth.com/journals/jhin

Short report

Adenosine triphosphate bioluminescence to validate decontamination of endoscopes

E. Gillespie [a,*], W. Sievert [b], M. Swan [b], C. Kaye [a], I. Edridge [a], R.L. Stuart [b]

[a] Monash Health, Melbourne, Australia
[b] Monash Health, Monash University, Melbourne, Australia

INFECTION CONTROL & HOSPITAL EPIDEMIOLOGY

ORIGINAL ARTICLE

Adenosine Triphosphate Quantification Correlates Poorly with Microbial Contamination of Duodenoscopes

Lovisa B. Olafsdottir, MD;[1,2] Sharon B. Wright, MD, MPH, FIDSA, FSHEA;[1,2] Anne Smithey;[1] Riley Heroux;[1] Elizabeth B. Hirsch, PharmD;[3,4] Alice Chen;[1] Benjamin Lane, BS;[1] Mandeep S. Sawhney, MBBS MS;[5] Graham M. Snyder, MD, SM[1,2]

Key points

- ✓ Endoscopes are hard to clean and disinfect and may lead to healthcare related infections
- ✓ Biofilms are the main mechanism of bacterial transmission between patients and efforts to prevent its formation are essential
- ✓ Trained and stimulated reprocessing personnel are essential for safety
- ✓ Immediate point of care pre-cleaning is highly desirable
- ✓ Devices should be completely dried before stored

What do we do now?

- ✓ Make sure you are following manufacturers' recommendations
- ✓ Make sure your employees are trained and fit
- ✓ Use and follow evidence-based guides
- ✓ Supervise and audit processes
- ✓ Consider implementing a program to ensure cleanliness monitoring (ATP, protein)

What do we do now?

- ✓ Review and update POPs
- ✓ Consider patients' informed consent for the risk of transmission of infection and report possible symptoms
- ✓ Surveillance
- ✓ Attention is needed to ensure the quality of water used to rinse disinfected equipment.
- ✓ Share what happened to learn from the facts!

“Success is the sum of repeated small efforts day after day“

Robert Collier

Thank you!

larissa.cavassin@hsl.org.br