



# Biofilms in endoscopes - an unseen treat. Best practice in stopping infection transmission through flexible endoscopes.

Mr Olegs Rasheed Tucs  
Associate Lecturer, Decontamination Program Chair,  
Technological University Dublin, Ireland



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# What are biofilms?

- ✓ Attached and/or interconnected formation
- ✓ Microbial origin
- ✓ Cells embedded in a matrix
- ✓ Appearance and gene expression are different from free cells of same species



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# Biofilms – more than just slime

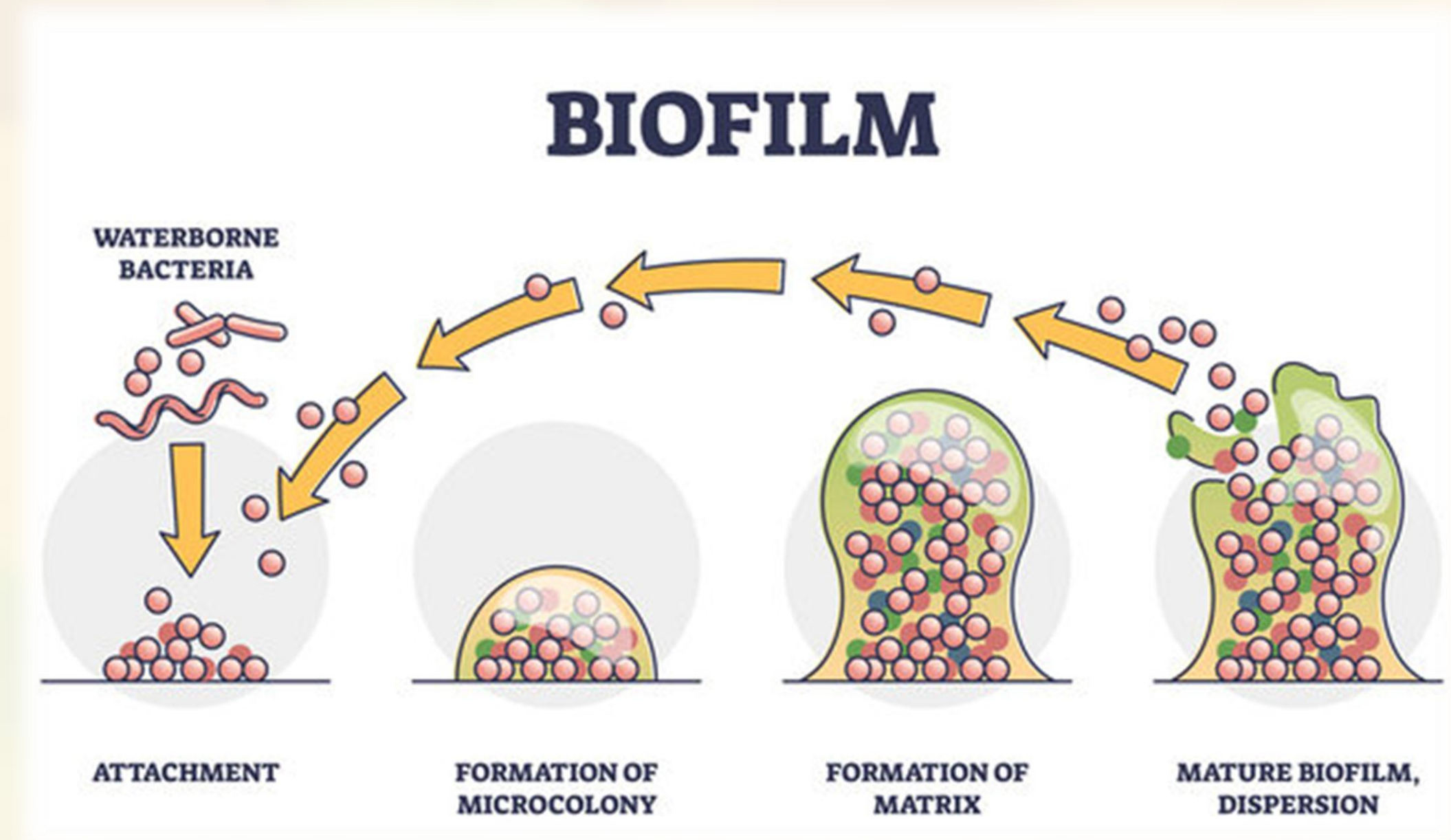
- ✓ Biofilm has **QUALITIES** which individual bacteria or simple colonies don't have **QUORUM SENSING**.
- ✓ Biofilm is both a **living thing** and an **environment**
- ✓ Biofilm has internal channels - **circulatory system** for uptake of nutrients and the removal of waste
- ✓ Microbes in a biofilm are **1000–1500** times more **resistant** to antibiotics than in their free state
- ✓ Microbes in a biofilm **communicate** and **exchange genes**
- ✓ Biofilms compete for space and resources





# Life of a biofilm

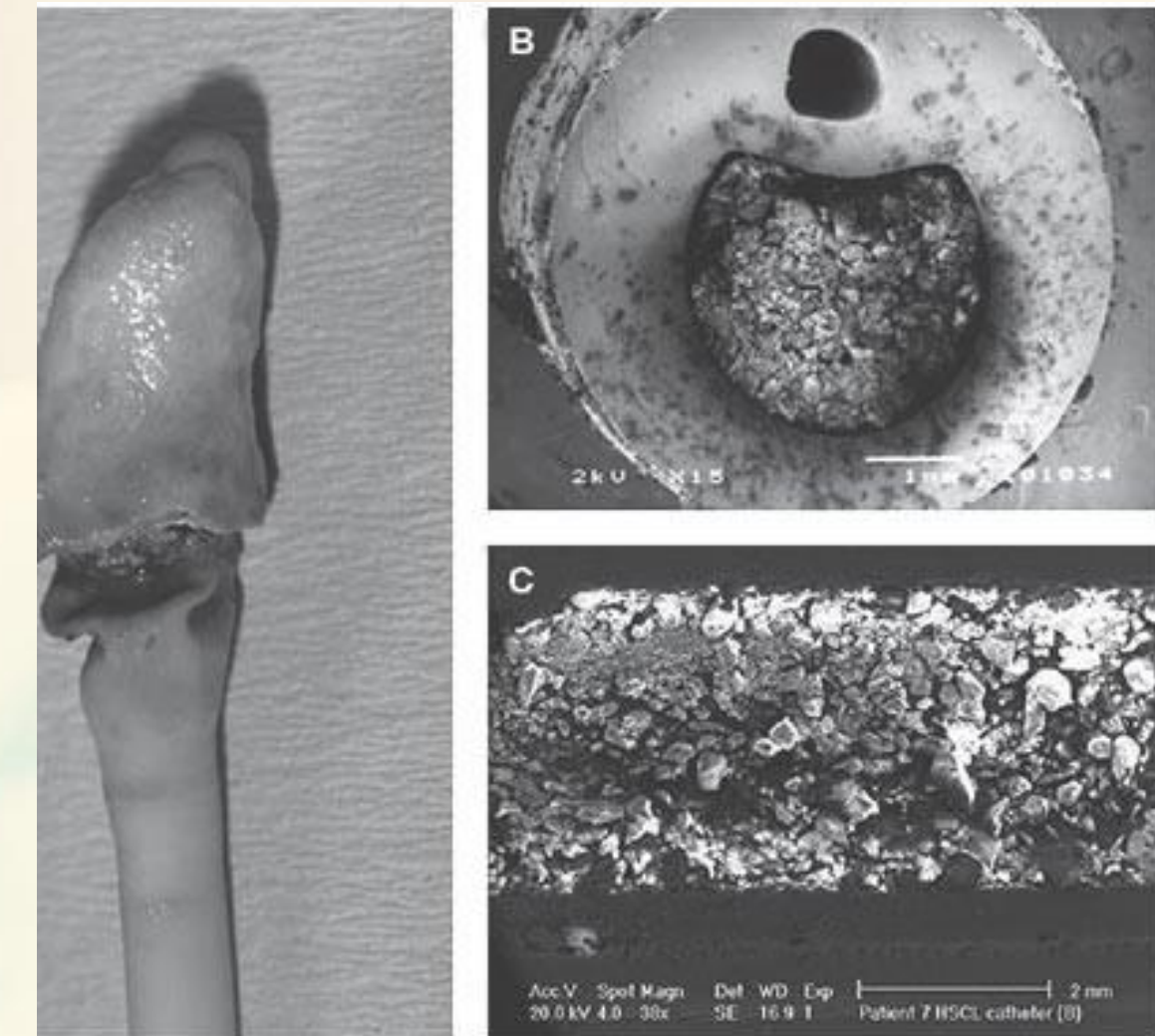
- ✓ Requires surface, water, food
- ✓ Founding bacteria permanently attach to a substrate
- ✓ Community grows and develops 3D structures
- ✓ Once matured sheds bacteria into environment colonising new sites





# Biofilms in human body

- ✓ Every exposed (semi-critical) surface can be colonised by biofilms
- ✓ 65% - 80 % of all human infectious diseases are caused by biofilm bacteria.
- ✓ Biofilm formation has been associated with infection of all types of implantable medical devices
- ✓ Biofilm bacteria are **major contributors to endoscope associated infections.**
- ✓ Experimental evidence of biofilms causing GI cancers
- ✓ FDA demands that pre-market submissions of medical devices must include anti-biofilm strategies.



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✓ **Very limited data on biofilm prevalence and distribution in healthy people**

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# Biofilms in the body and on the instruments

## Are they different?

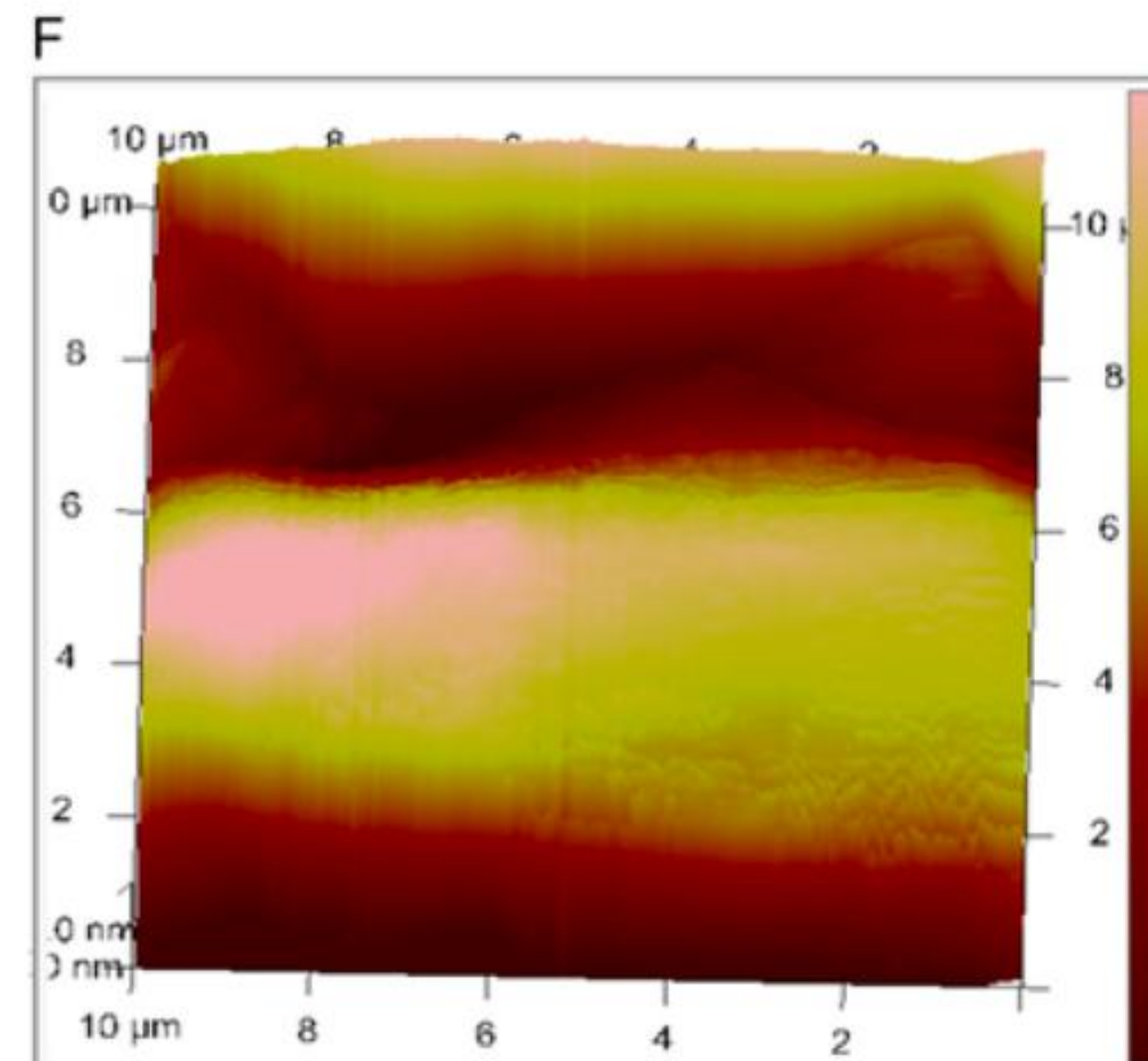
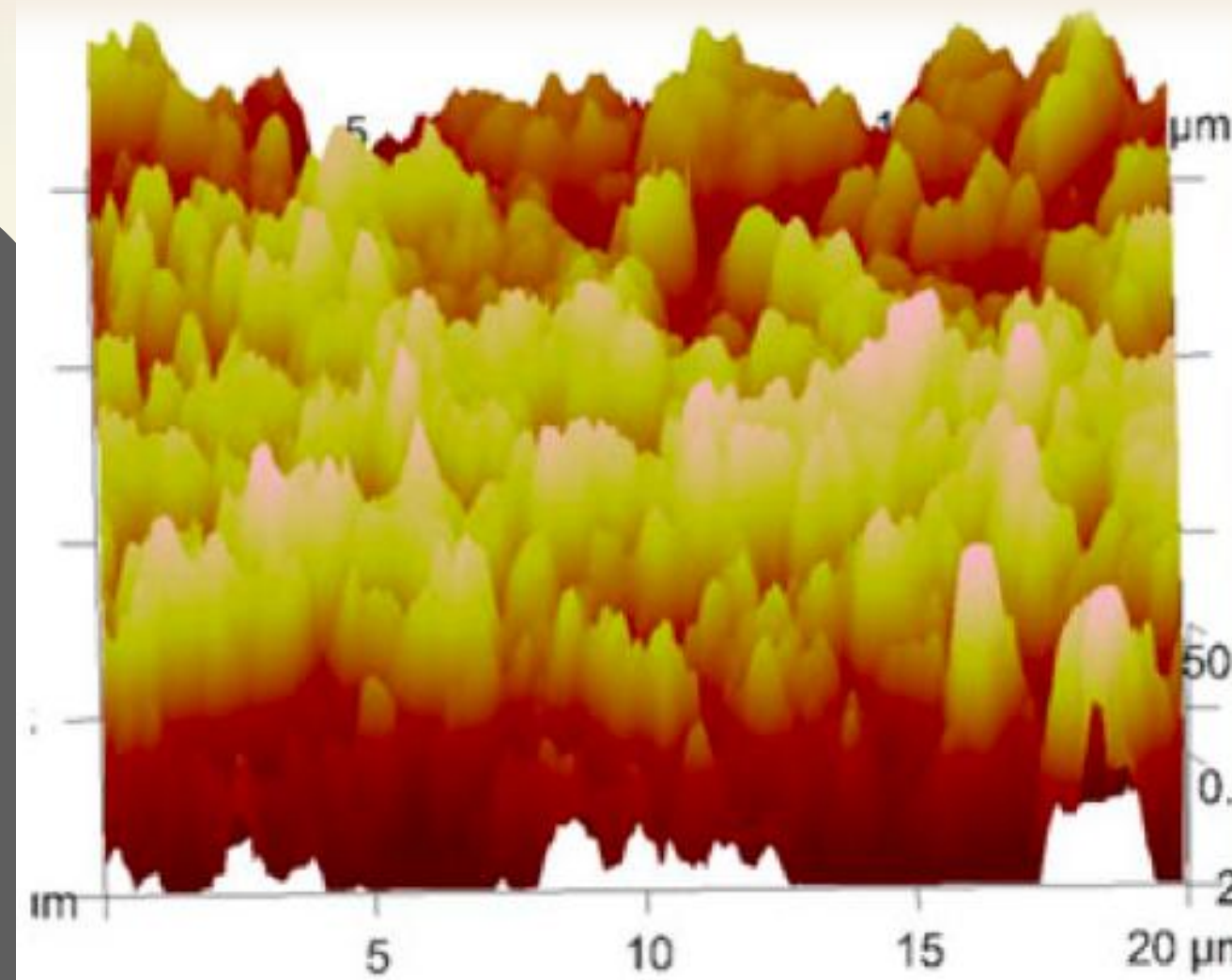
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### Traditional biofilm (TB)

- ✓ Develops in the body, in the water lines, in the decontamination equipment, etc.
- ✓ Thick slimy substance, rough surface, dispenses individual bacteria and biofilm fragments
- ✓ Easier to remove



### Cyclic build-up biofilm (CBB)

- ✓ In Endoscope and Instruments lumens
- ✓ Develops due to cyclical exposure to wet and dry phases during usage and reprocessing
- ✓ Dry surface biofilm is a reservoir for transmission of pathogens in health care
- ✓ Smooth surface, produces flakes
- ✓ Harder to remove

6  
Cyclic build-up biofilm and traditional biofilm: The impact of friction, and  
by. 2020;41(2):172-180. doi:10.1017/ice.2019.306

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# Inspecting instruments for biofilms

- ✓ Biofilms are macroscopic (large) objects
- ✓ No microscope needed, but detection can be difficult
- ❖ Can be transparent
- ❖ Tend to colonise lumens and hard to access surfaces such as box joints
- ✓ How to detect?
- ❖ Borescope inspection
- ❖ Protein/ATP tests
- ❖ UV fluorescence
- ❖ DNA sequencing
- ❖ Microbiological tests



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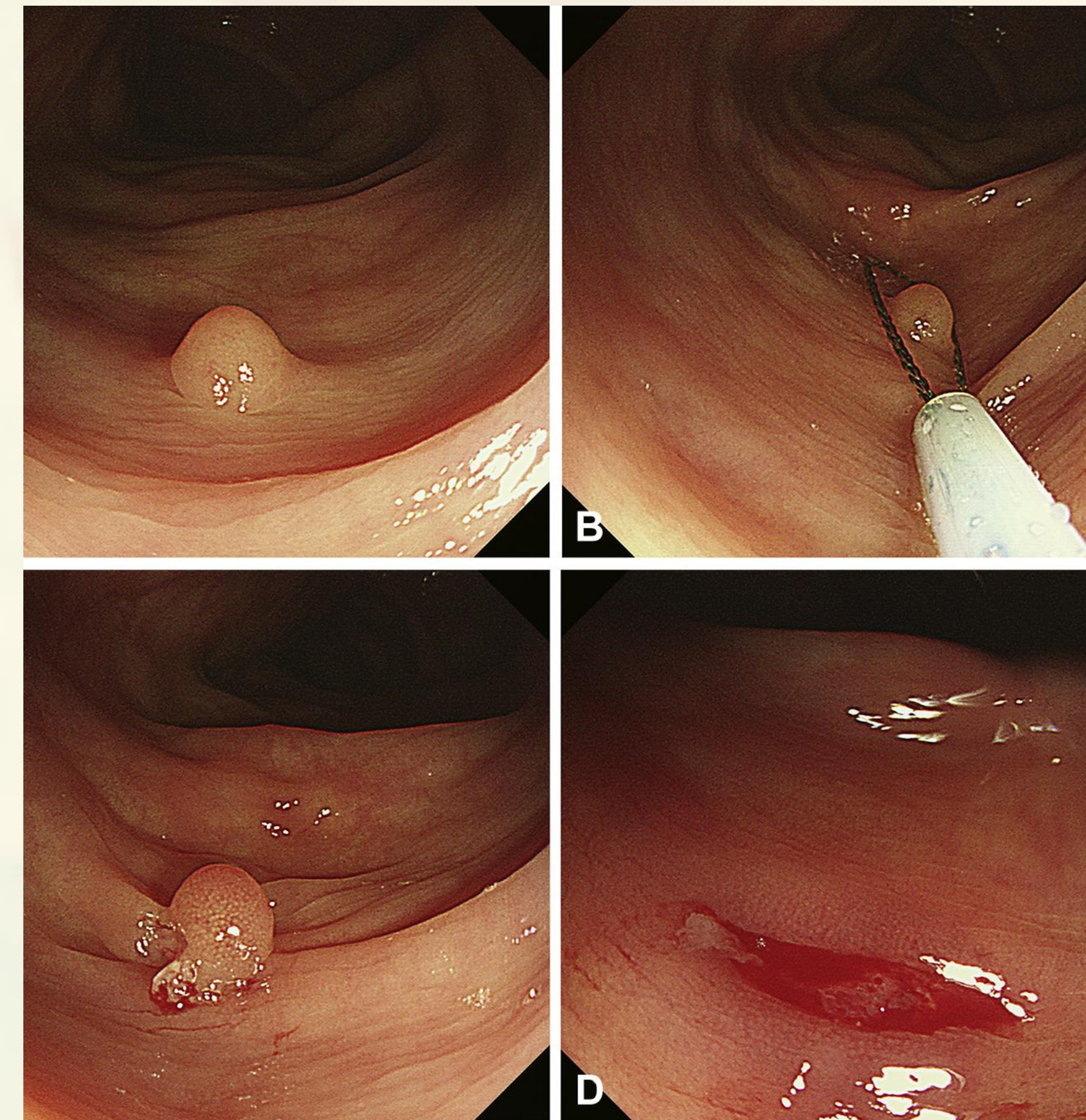


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# Interventional endoscopic procedures

- ✓ Snare polypectomy – one of the first invasive endoscopic procedures developed in 1969–1971
- ✓ Many more procedures developed over the years
- ✓ Endoscopic instruments damage mucosal membranes and cross into sterile tissues



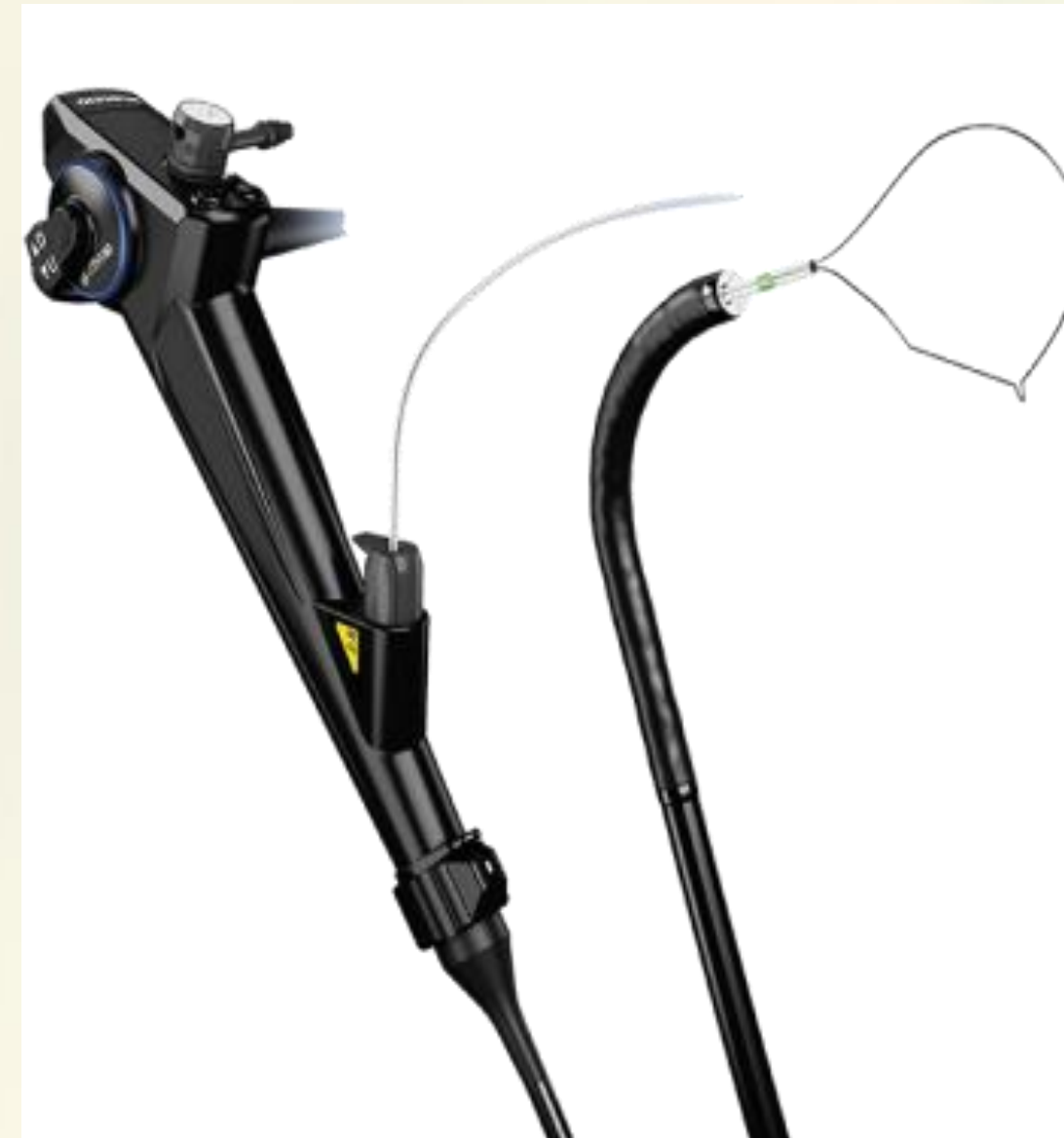


# Endoscopic Instruments

- ✓Critical medical devices
- ✓Single use
- ✓Purchased sterile
- ✓Not reprocessed

## Potential problems

- ✓Tight fit
- ✓Squeezing through long, narrow lumens
- ✓Instruments can dislodge contamination from lumens and inadvertently introduce it into procedure site



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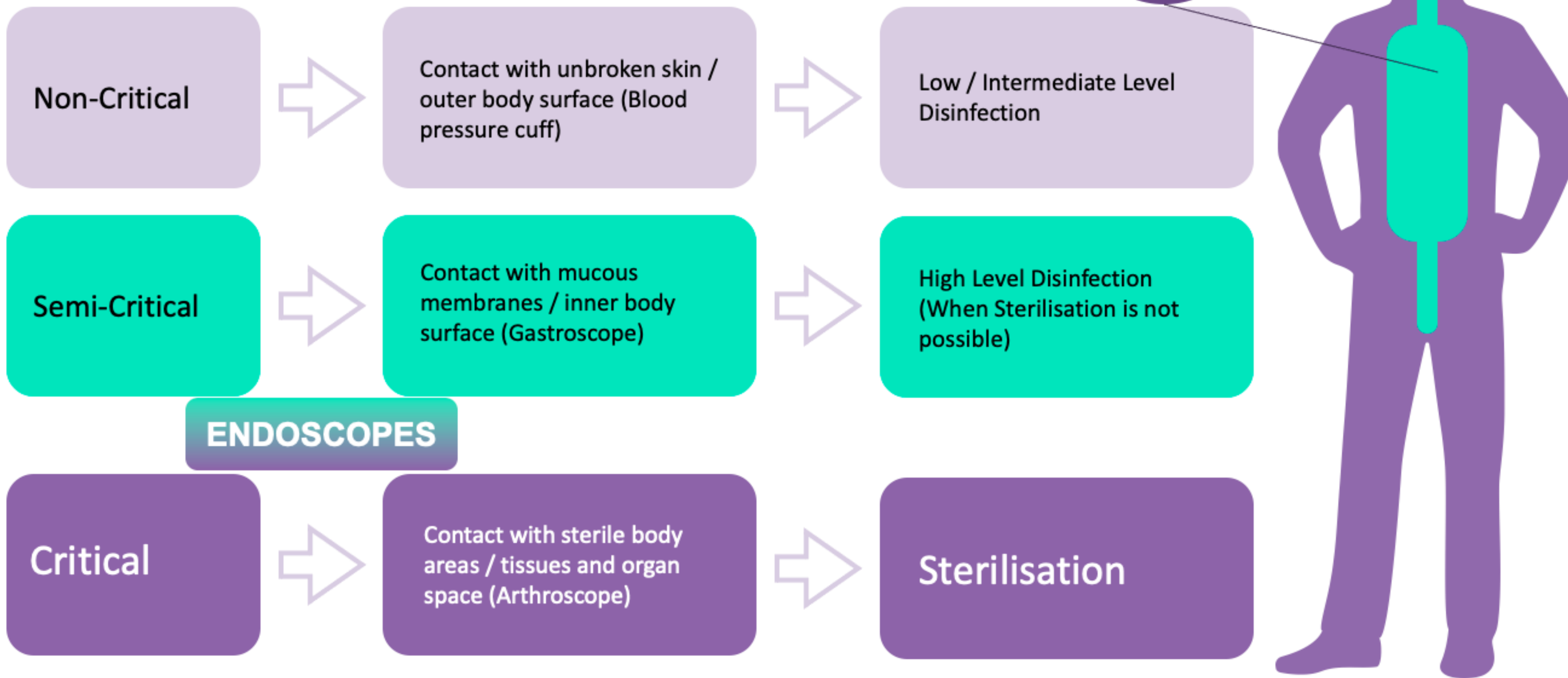


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## Spaulding Classification of Medical Devices



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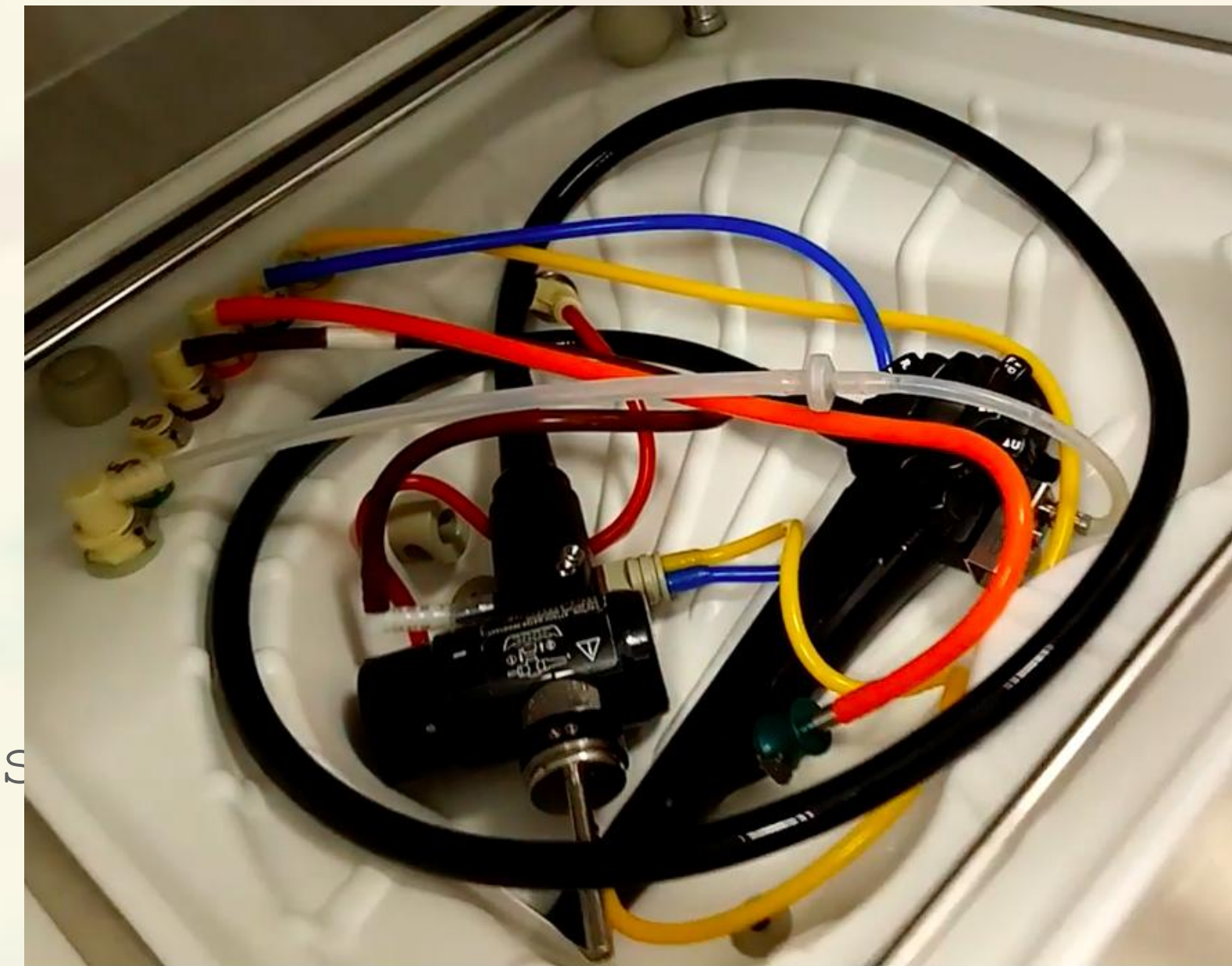






## Best practice in endoscope reprocessing

- ✓ Immediate bedside clean
- ✓ Transport to dedicated decontamination area
- ✓ Leak test
- ✓ Manual wash
- ✓ Automated wash
- ✓ Automated High Level Disinfection
- ✓ Use in 3 hours or store in drying cabinets/vacuum systems
- ✓ *Optional hydrogen peroxide sterilization*
- ✓ Every scope is tracked through it's use and decontamination
- ✓ All equipment validated to ISO Standards







# What is high level disinfection?

## There are survivors in HLD

- ✓ High-level disinfection is complete elimination of all microorganisms in or on an instrument, except for small numbers of bacterial spores.
- ✓ The FDA definition of high-level disinfection is a sterilant used for a shorter contact time to achieve a 6-log<sub>10</sub> kill of an appropriate Mycobacterium species.
- ✓ Efficiency of HLD depends on level of initial contamination and successful cleaning





# Sometimes the best practice is not enough

- ✓ Some microorganisms will survive disinfection especially in biofilms
- ✓ Lower safety margin compared to sterilization
- ✓ Impossible to remove established biofilm from endoscopes by following manufacturer's reprocessing guidelines

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Gastrointestinal Endoscopy

Volume 82, Issue 3, September 2015, Pages 477-483



Original article

Clinical endoscopy

## A quarantine process for the resolution of duodenoscope-associated transmission of multidrug-resistant *Escherichia coli*

Andrew S. Ross MD<sup>1</sup> , Christopher Baliga MD<sup>1</sup>, Punam Verma PhD<sup>1</sup>, Jeffrey Duchin MD<sup>2</sup>, Michael Gluck MD<sup>1</sup>

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# How do we get rid of biofilms?

- ✓ Use of non-adhesive materials
- ✓ Mechanical action in cleaning
- ✓ Careful inspection
- ✓ Sterilisation whenever possible
- ✓ Single use instruments?





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