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Shine on Flexible Endoscope Reprocessing

2025 Webinar 04 | Series

Improving Flexible Endoscope Reprocessing: the importance of drying and a role for artificial intelligence

ASP Advanced Sterilization Products

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Intro

This webinar focuses on the issue of endoscope-transmitted infections, highlighting inadequate drying as a contributing factor.[1-2] We will begin by outlining the challenge of endoscope transmitted infection and identifying key organisms and risk factors, with a particular emphasis on the importance of proper drying.[1,3-4] Residual fluid is often found in endoscope channels during inspections, underscoring the need for regular evaluations of flexible endoscopes used in clinical settings and more effective approaches to endoscope drying.[7-8] We will discuss the prevalence of inadequate drying and examine practices that contribute to this issue, such as the use of simethicone[5,15,] endoscope working channel[7-8] damage and suboptimal eprocessing methods.[3,9]

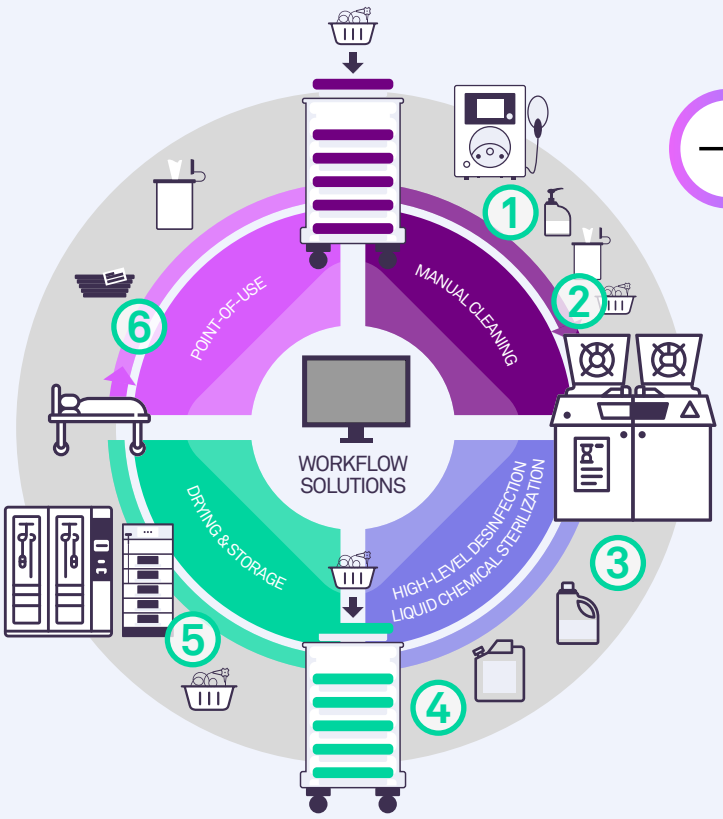
We will compare various drying techniques - including drying cabinets[1-2], automated systems, and manual methods - detailing their respective advantages and disadvantages while also presenting strategies to minimize human error and enhance patient safety.[3,13-14]

Finally, the session will address the practical challenges of endoscope inspection and introduce the emerging role of AI-assisted inspection, supported by pilot data and demonstration videos.[16]

Topic • 01

Endoscope transmitted infections

Endoscope-transmitted infections (ETIs) pose a significant threat to patient safety, as they can lead to severe health complications, including sepsis and prolonged hospital stays.[2]
The complexity of endoscope design makes thorough cleaning and disinfection challenging, increasing the risk of residual pathogens and endoscope transmitted infections.[1,3]
Inadequate adherence to reprocessing protocols can result in the transmission of harmful bacteria, viruses, and fungi, which may originate from patient flora or environmental sources.[2,5]
Outbreaks of ETIs have raised awareness and highlighted the need for stringent infection control measures in healthcare settings.[2,13]
Addressing the risks associated with ETIs is crucial for improving patient outcomes and ensuring the safety of endoscopic procedures.[3,13]



Endoscope Reprocessing is a complex process

1 Leak tests
2 Manual cleaning
3 Automated cleaning
4 High Level Disinfection / Liquid Chemical Sterilisation
5 Transport and or Storage & Drying
6 Clinical Application/ use

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Addressing the risks associated with ETIs is crucial for improving patient outcomes and ensuring the safety of endoscopic procedures.[3,13]

Topic • 02

The importance of drying endoscopes

Complete drying of endoscopes is essential for preventing endoscope-transmitted infections (ETIs), because residual moisture can promote microbial growth and biofilm formation within endoscopes.[2,4,10,12]
Inadequate drying increases the likelihood of pathogens surviving the disinfection process, thereby heightening the risk of infection transmission to patients.[2,3,5,13]
Prioritizing endoscope drying during reprocessing and implementing effective drying protocols is essential to enhance the overall safety of endoscopic procedures and reduce the potential for healthcare-associated infections.[1,3,10,12]

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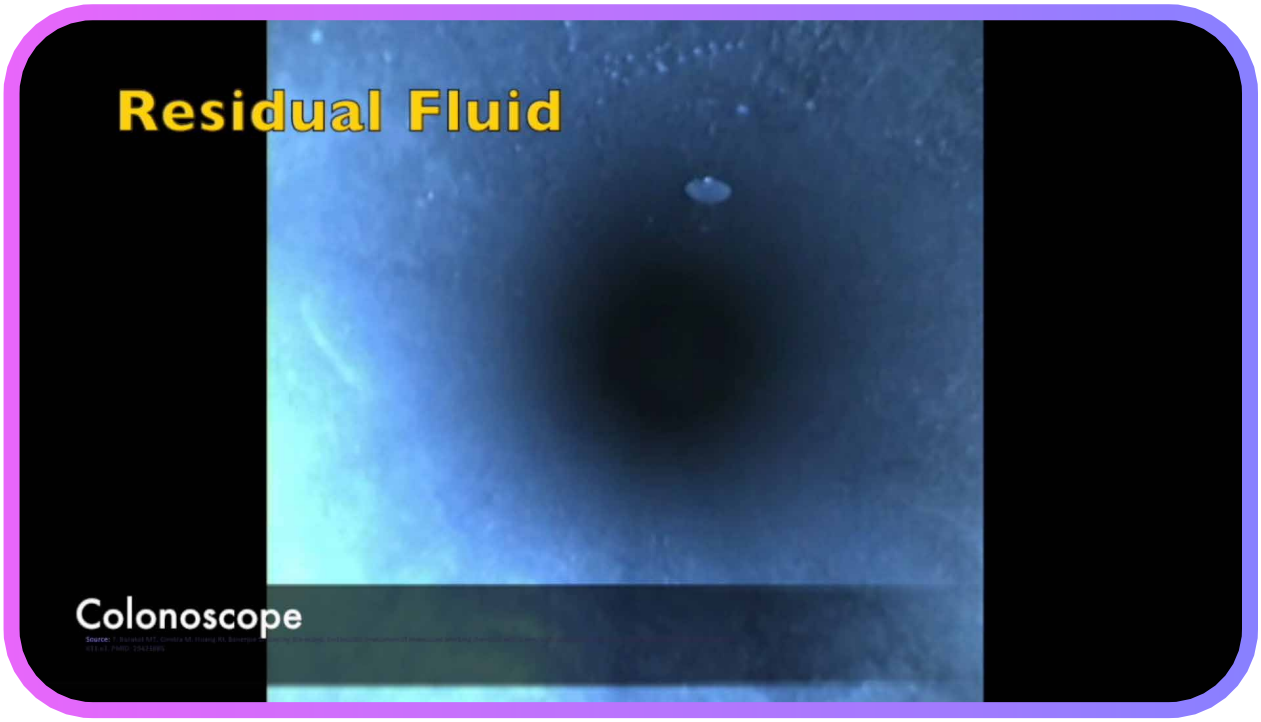
Image source: St George Endoscopy Department - drying cabinet - courtesy Mr David Bellamy, Sydney, Australia, 2025 Google photo search "flexible endoscope drying cabinet" access on 20250522 https://www.aorn.org/outpatient-surgery/article/2022-September-endoscope-cabinets **Source:** ISO 15883-4:2008 - Washer-disinfectors for thermolabile endoscopesÐhttps://www.iso.org/standard/63696.html / GENCA Guidelines 2025 (Australia), https://www.genca.org/public/5/files/Nurses%20info/IPCE%202021_Feb2022update.pdf / AAMI ST91:2021 (USA), https://www.aami.org/ST91 / AS 5369:2023 (Australia) - Reprocessing of reusable medical devices in health service organizations https://www.standards.org.au/blog/spotlight-on-as-5369-2023

Topic • 03

Endoscope channel inspection has revealed that drying is often inadequate

Inspections of endoscope channels have consistently revealed that a significant proportion of endoscopes are inadequately dried.[7,8,16] This inadequate drying poses a serious risk for endoscope-transmitted infections.[2,3,5,13] The presence of residual moisture in these channels can facilitate the growth of harmful pathogens, undermining the effectiveness of high-level disinfection protocols.[4,10,12,15] Endoscope working channel damage may predispose to fluid retention, with áreas of damage serving as a sanctuary for fluid and pathogens.[7,8,16] Recognizing and addressing the prevalence of inadequate drying is crucial for enhancing patient safety and preventing healthcare-associated infections during endoscopic procedures.[1,3,5,10]



Source: Barakat MT, Girotra M, Huang RJ, Banerjee S. Scoping the scope: endoscopic evaluation of endoscope working channels with a new high-resolution inspection endoscope. GIE 2018 Oct;88(4):601-611.e1. PMID: 29425885

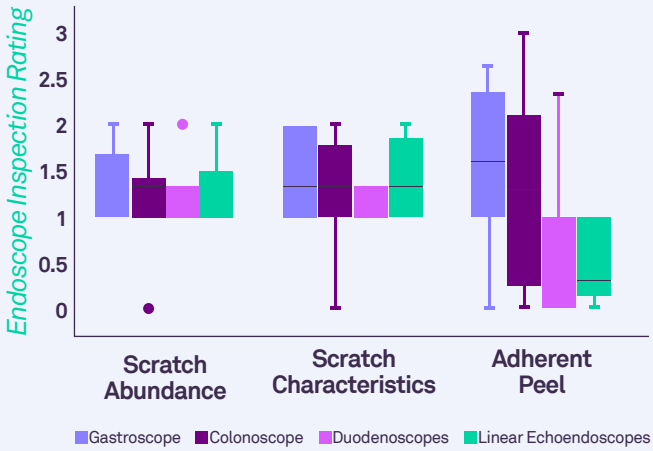
Spectrum of Endoscope Damage

Superficial scratches → Adherent Peel → Deep scratches → Burns → Channel Buckling → Stains → Perforation

Leak Test Failure

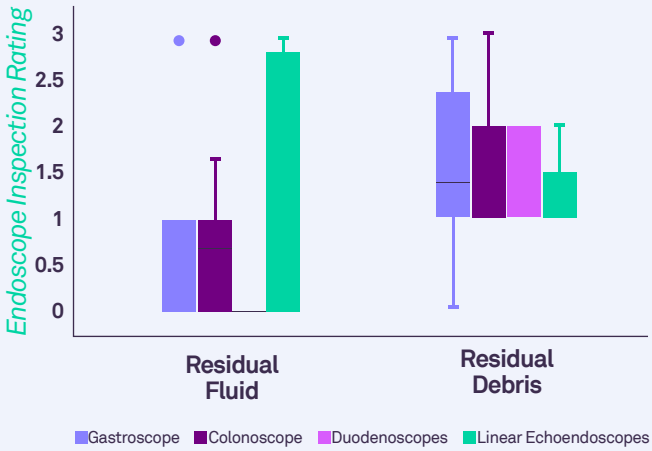
"Inspections of endoscope channels have consistently revealed that a significant proportion of endoscopes are inadequately dried. [7,8,16]"

Scope Inspection Results: Endoscope Damage



- Superficial scratches (98.5%)
- Scratches with adherent peel (76.5%).
- Rare channel buckling
- No channel perforations, stains, or burns.

Scope Inspection Results: Fluid & Debris



- Minor punctate debris was common (>90%)
- Fluid droplets were noted in 42.6% of endoscopes after reprocessing and drying.

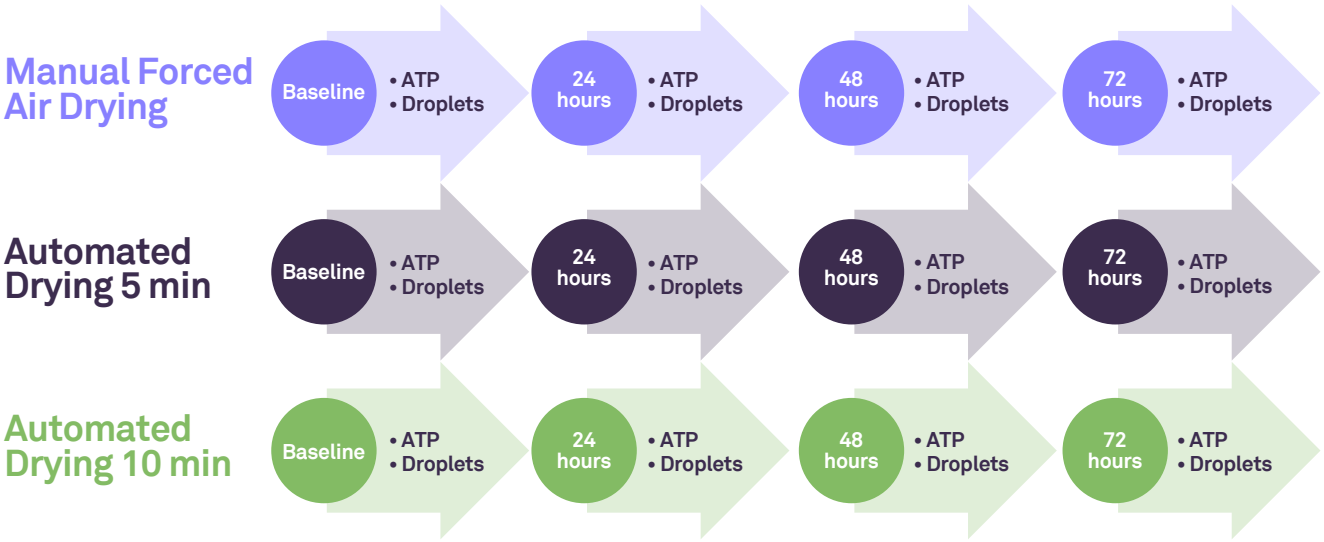
Recognizing and addressing the prevalence of inadequate drying is crucial for enhancing patient safety and preventing healthcare-associated infections during endoscopic procedures.[1,3,5,10]

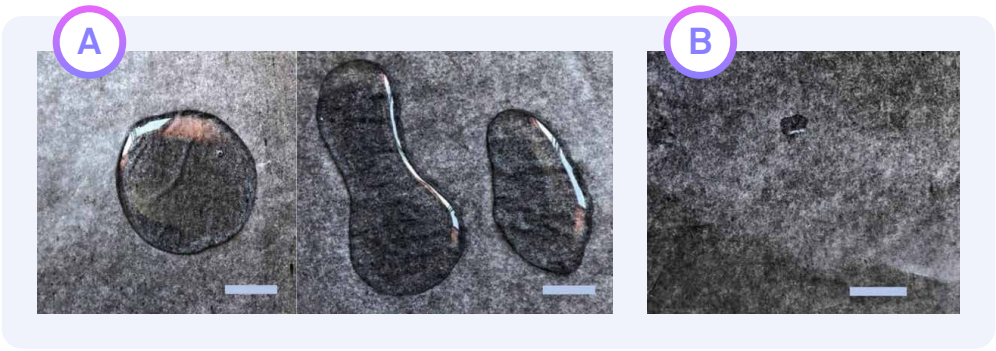
Topic • 04

Evidence-based approaches to effective endoscope drying

Identification of optimal approaches for endoscope drying has been an area of active research and evidence-based approaches for effective drying of endoscopes during reprocessing have been identified.[1,3,10,12] These approaches include implementing fixed duration of manual or automated forced air drying systems, which can significantly reduce drying time and enhance the efficacy of the drying process by delivering high-velocity air into the endoscope channels.[10,12]

Qualitative Visual Assessment of Residual Fluid after Automated Drying





Source: Barakat M T, Huang R J, Banerjee S. Comparison of automated and manual drying in the elimination of residual endoscope working channel fluid after reprocessing (with video) Gastrointest Endosc. 2019;89:124–132.

"Identification of optimal approaches for endoscope drying has been an area of active research and evidence-based approaches for effective drying of endoscopes during reprocessing have been identified."[1,3,10,12]

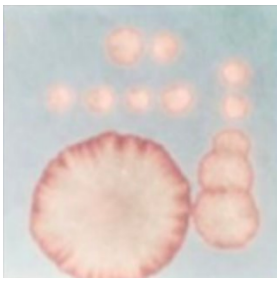
The use of automated drying cabinets that provide controlled environments to ensure thorough moisture removal has also been validated.[12] With any protocol implemented, regular monitoring and validation of drying protocols is essential to maintain compliance and ensure optimal drying outcomes, ultimately minimizing the risk of endoscope-transmitted infections.[1,3,11]

Automated Drying Cabinets Effectively Dry Endoscopes & Bronchoscopes

Fluid from Scopes, if present, on Cobalt Chloride Paper

A
No Fluid

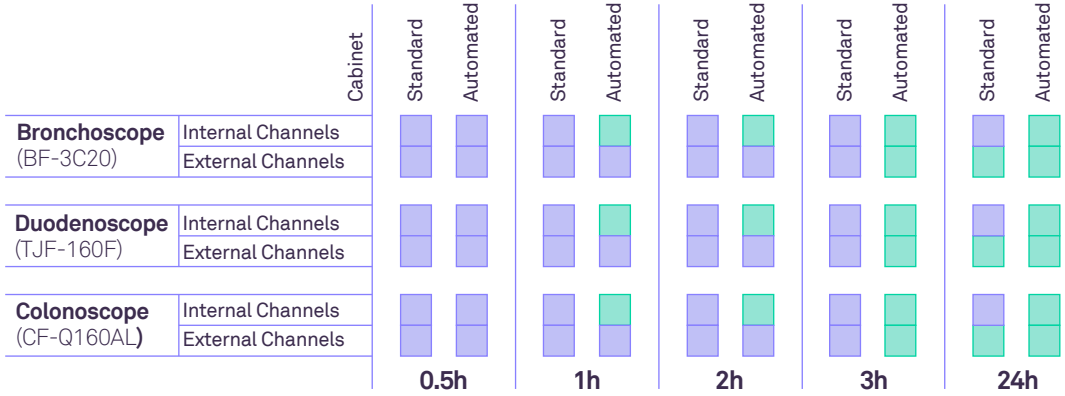
B
Fluid Present



Cobalt Chloride Paper Analysis

Dry

Wet



Source: Perumpail RB, Marya NB, McGinty BL, Muthusamy VR. Endoscope reprocessing: Comparison of drying effectiveness and microbial levels with an automated drying and storage cabinet with forced filtered air and a standard storage cabinet. Am J Infect Control. 2019 Sep;47(9):1083-1089. doi: 10.1016/j.ajic.2019.02.016. Epub 2019 Apr 6. PMID: 30962022.

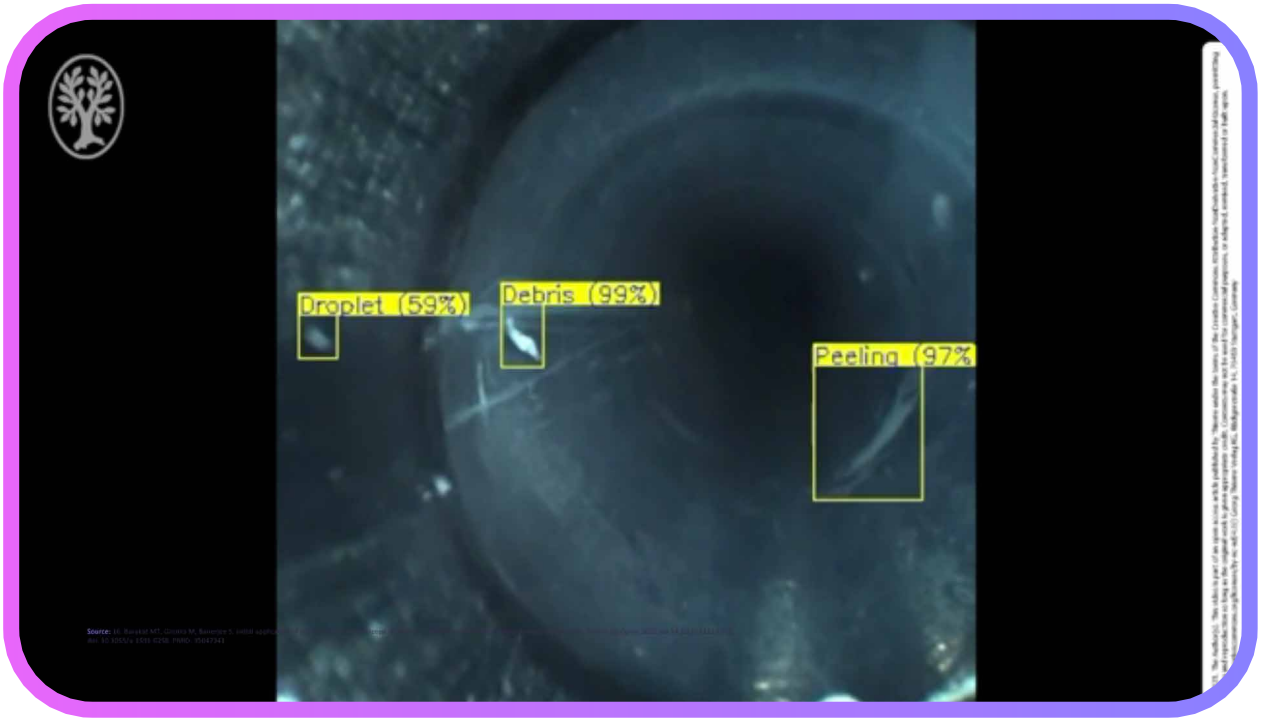
With any protocol implemented, regular monitoring and validation of drying protocols is essential to maintain compliance and ensure optimal drying outcomes, ultimately minimizing the risk of endoscope-transmitted infections.[1,3,11]

Topic • 05

Role for AI in endoscope reprocessing

In conclusion, addressing endoscope-transmitted infections (ETIs) is critical for ensuring patient safety, as these infections can lead to severe health complications and highlight the need for stringent infection control measures.[2,3,5,13] Complete drying of endoscopes is essential to prevent microbial growth and biofilm formation, as inadequate drying significantly increases the risk of infection transmission.[2,4,10,12,15] Inspections have revealed that many endoscopes are inadequately dried, underscoring the importance of implementing effective drying protocols and regular monitoring of moisture elimination within the endoscope channels to enhance patient safety.[7,8,10,12,16] Finally, the integration of artificial intelligence (AI) in the inspection process offers a promising avenue for improving efficiency and accuracy, ultimately contributing to better outcomes in endoscope reprocessing and the safety of patients who undergo endoscopy.[16]

The inspection of endoscope working channels in a clinical setting presents significant demands in terms of time to conduct the inspections and expertise to identify, quantify and summarize working channel findings.[7,8,16]



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"To streamline this process of endoscope working channel inspections and enhance accuracy, the integration of artificial intelligence (AI) is emerging as a promising solution, offering the potential to automate and improve inspection efficiency.[16]"

Conclusion

In conclusion, addressing endoscope-transmitted infections (ETIs) is critical for ensuring patient safety, as these infections can lead to severe health complications and highlight the need for stringent infection control measures.[2,3,5,13] Complete drying of endoscopes is essential to prevent microbial growth and biofilm formation, as inadequate drying significantly increases the risk of infection transmission.[2,4,10,12,15] Inspections have revealed that many endoscopes are inadequately dried, underscoring the importance of implementing effective drying protocols and regular monitoring of moisture elimination within the endoscope channels to enhance patient safety.[7,8,10,12,16] Finally, the integration of artificial intelligence (AI) in the inspection process offers a promising avenue for improving efficiency and accuracy, ultimately contributing to better outcomes in endoscope reprocessing and the safety of patients who undergo endoscopy.[16]

Take home messages

1. *Endoscope-transmitted infections (ETIs) pose a significant threat to patient safety, necessitating stringent infection control measures to prevent severe health complications.*[2,3,5,13]

2. *Complete drying of endoscopes is essential to prevent microbial growth and biofilm formation, thereby reducing the risk of endoscope-transmitted infections (ETIs).*[2,4,10,12,15]

3. *Inspections have consistently shown that inadequate drying of endoscopes significantly increases the risk of endoscope-transmitted infections, highlighting the need for improved drying protocols.*[7,8,16]

4. *Implementing evidence-based drying approaches, such as automated drying systems and regular monitoring, is crucial for ensuring optimal drying outcomes and minimizing the risk of ETIs.*[1,3,10,11,12]

5. *The integration of artificial intelligence (AI) in endoscope inspections offers a promising solution to enhance efficiency and accuracy, addressing the significant demands of the inspection process.*[16]

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