



Risk of Infection Associated with Endoscopy

MAIN POINTS

- More than 10 million gastrointestinal endoscopies are performed annually in the United States.¹
- Post-endoscopy infections can be serious.²
- Documented rates of post-endoscopy infection are low, but experts agree they underestimate the problem.³
 - 58 outbreaks of foreign microbe-caused infections were associated with endoscopy between 1974 and 2004.⁴
 - 21 foreign microbe-caused outbreaks were documented between 1994 and 2004, resulting in 6 deaths.⁴
- Lack of thorough cleaning has been implicated in post-endoscopy infections.³

PURPOSE

The purpose of this document is to describe recent scientific findings about the risk of infection associated with endoscopy.

INTRODUCTION

Endoscopy is a frequently used procedure for diagnostic and therapeutic purposes. In the United States, more than 10 million gastrointestinal (GI) endoscopies are performed annually.¹

ENDOSCOPY-RELATED INFECTIONS

Since endoscopes encounter non-sterile body cavities, they become contaminated with bacteria and other microbes.¹ There may be between 100,000 and 10 billion viable microbes in every milliliter (mL) of rinse water from a GI endoscope.¹

The rate of infections related to endoscopy is very low. However, endoscopes have been associated with more outbreaks of nosocomial infections than other medical devices.¹

Most endoscopy-related infections are caused by the patient's own bacterial flora, but exogenous (foreign) microbes have also caused outbreaks.⁴

Between 1974 and 2004 there were at least 58 outbreaks documented in the scientific literature that were due to foreign microbes being introduced to patients via different types of endoscopes.⁴

The microbes in Table 1 were the causative agents in 58 outbreaks identified in the scientific literature.

Table 1: Foreign Microbes Causing Post-Endoscopy Outbreaks

	# of Outbreaks
Fungal Agents	
<i>Rhodotorula rubra</i>	3
<i>Aureobasidium species</i>	1
<i>Sporothrix cyanescens</i>	1
<i>Trichosporon cutaneum</i> and <i>Penicillium</i>	1
Total Fungi	6
Viral Agents	
Hepatitis B	1
Total Viruses	1
Single Bacterial Agents	
<i>Pseudomonas aeruginosa</i>	15
<i>Mycobacterium tuberculosis</i>	7
<i>Mycobacterium chelonae</i>	4
<i>Mycobacterium abscessus</i>	2
<i>Salmonella newport</i>	2
<i>Serratia marcescens</i>	2
<i>Bacillus species</i>	1
<i>Helicobacter pylori</i>	1
<i>Methylobacter mesophilica</i>	1
<i>Mycobacterium gordonae</i>	1
<i>Mycobacterium intracellulare</i>	1
<i>Mycobacterium xenopi</i>	1
<i>Pneumococcus species</i>	1
<i>Pseudomonas cepacia</i>	1
<i>Pseudomonas pseudomallei</i>	1
<i>Pseudomonas species</i>	1
<i>Salmonella oslo</i>	1
Total Single Bacteria	45
Multiple Bacterial Agents	
<i>Mycobacterium chelonae</i> and <i>Methylobacterium mesophilicum</i>	1
<i>Mycobacterium tuberculosis</i> and <i>Mycobacterium avium</i>	1
<i>Pseudomonas aeruginosa</i> , <i>coagulase negative staphylococci</i> , and <i>Staphylococcus aureus</i>	1
<i>Pseudomonas aeruginosa</i> and <i>Enterobacter aerogenes</i>	1
<i>Pseudomonas aeruginosa</i> , <i>Proteus species</i> , and <i>Serratia marcescens</i>	1
<i>Pseudomonas aeruginosa</i> and <i>Serratia marcescens</i>	1
Total Multiple Bacteria	6

Source: Seoane-Vazquez et al. (2006)

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Salmonella species and *Pseudomonas aeruginosa* have been linked to GI endoscope-related outbreaks. *Mycobacterium tuberculosis* (the causative agent of TB) and *P. aeruginosa* have been linked to bronchoscopy infections.³

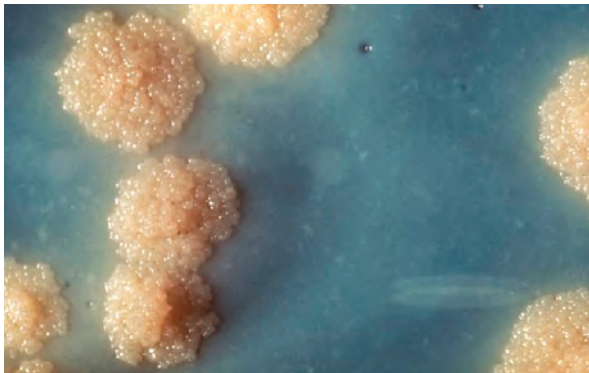


Figure 1. Close-up of a *Mycobacterium tuberculosis* growth Image Source: Public Health Image Library

Mycobacterium tuberculosis

M. tuberculosis has been associated with multiple bronchoscope-related infections.² Endoscope contamination with *M. tuberculosis* is particularly troublesome because this microbe is resistant to chemical disinfection. It has been shown that *Mycobacteria* can remain on endoscopes even after 10 disinfection cycles if the pre-disinfection cleaning was inadequate.²

Serratia marcescens

S. marcescens was the causative agent in an bronchoscope-related outbreak which resulted in several deaths. It persisted in spite of a processing through a sterilization cycle with ethylene oxide.

Viral Infections

While most outbreaks related to endoscopes are caused by bacterial agents, one documented outbreak did result in a Hepatitis B infection.⁴ Because of the long latent period between infection with Hepatitis B and Hepatitis C and the display of related symptoms, it can be very difficult to identify the source of infection for many individuals. Therefore, researchers often rely on "indirect evidence" to trace infections.³

For example, one study found that patients who had undergone endoscopic biopsy procedures were more likely to test positive for Hepatitis C antibodies than those who had not.³

See Figure 2.

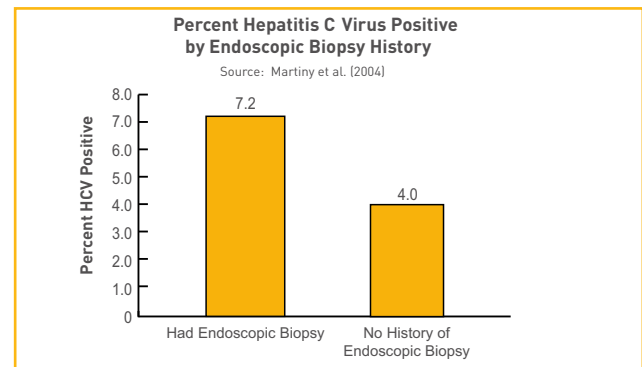


Figure 2

IMPACT OF INFECTION

Prevention of endoscopic related infections is important because they can cause serious complications and can be fatal. In the 58 published outbreaks due to microbial causes, nine (or 15.5%) of the outbreaks resulted in at least one death.⁴

Twenty-one of the 58 outbreaks occurred between 1994 and 2004, and three of these recent outbreaks resulted in the deaths of six people.⁴

In fact, between 2000 and 2004:

- More than 558 people were reported in published articles to have been exposed to contaminated endoscopes.
- 124 people were infected or colonized by the microbes contaminating the endoscopes.
- Four of these infections resulted in death.⁴

RISK FACTORS FOR INFECTION

Risk factors related to infection transmission by endoscopes are:

- Number and types of microbes on the endoscope post-procedure
 - Certain types of microbes are more resistant to disinfection
- Procedures that disrupt or penetrate tissue, like biopsies
- Procedures that require devices to enter blocked ducts
- Patient factors
 - Compromised immune system
 - "Integrity of endovascular surfaces"²



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The reasons cited for documented endoscope-related infections have included:

- Endoscope defects
- Insufficient cleaning
- Not following cleaning and disinfection protocols
- Incorrect choice of disinfectant
- Flaws in automated endoscope reprocessor design.¹

“Flexible endoscopes are particularly difficult to disinfect and easy to damage because of their intricate design, including narrow long lumens, and delicate materials. Meticulous cleaning must precede any sterilization or high-level disinfection of these instruments.”¹

ROUTES OF INFECTION

In addition to infections caused by patients' own bacterial flora,⁴ some of the main routes of transmission for endoscope-related infections include:

- From one patient, to the endoscope, to a different patient (when microbes survive the cleaning and disinfection process).
- From contamination with non-sterile rinse water used in reprocessing.
- From contamination caused by bacteria growing in or on washers, water filters, and other equipment in hospitals.²

According to Rutala and Weber (2004): “Failure to perform good cleaning may result in a sterilization or disinfection failure and outbreaks of infection may occur.”¹



Figure 3. Physicians performing an endoscopic procedure Image Source: National Institutes of Health Image Bank

COSTS ASSOCIATED WITH INFECTIONS

To date, there has not been a comprehensive cost analysis of the economic burden of endoscope related infections.⁴ However, one study estimated that medical care-related infections added \$38,656 in additional costs. This estimate did not include postsurgical sepsis, which resulted in even higher excess costs.⁵ Another study estimated arthroscopy-related infections cost an additional \$9,155 per infected patient.⁴

Any attempt at estimating the overall cost of endoscopic infections would likely be an underestimate because not all infections are documented or reported.⁴

According to Seoane-Vazquez et al. (2006), the following costs should be included in any cost estimate of endoscope-related exogenous outbreaks:

- **Healthcare Costs**
 - Patient Diagnosis
 - Patient Treatment
 - Epidemiological Investigation
- **Non-Medical Care Costs**
 - Patient Transportation to Medical Appointment
 - Patients' Time
- **Indirect Costs**
 - Patients' lost productivity⁴

“These studies emphasize that currently recommended reprocessing protocols have a lower than desirable margin of safety, and that failure is likely if the cleaning steps are not followed in meticulous detail.”²

UNDER-REPORTING OF INFECTIONS

Researchers have used patient surveys and literature reviews to estimate the incidence of post-endoscopic infections. The reported incidence of infection is one infection per 1.8 million procedures, which is very low.² However, this is probably an underestimate of the true rate of infection.²

Three teams of researchers have stated that the incidence of endoscope-related infections may not be accurately documented (See box on page 4).



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According to Rutala and Weber (2004):

"It should be acknowledged that the incidence of post-endoscopic procedure infections resulting from an improperly processed endoscope has not been rigorously assessed."¹

According to Cowen (2001):

"The risk of endoscopy-associated infections that are due to the contamination of instruments or accessory items with hospital environmental pathogens, or infections with the patient's own endogenous flora, is considerably higher."²

According to Martiny et al. (2004):

"The number of recognized infectious cases is certainly an underestimate: clearly, no clinic or private practice will be interested in publishing their documented endoscopy-related infections as this would result in the disclosure by name of the relevant institution or physician."³

REFERENCED ARTICLES

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