For IC Practitioners, OR and Endoscopy Staff, CS and SPD Personnel, Materiel Managers, et al.

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What's News

On Friday, June 8 (2001), New York City health officials announced a Hepatitis C outbreak at a Brooklyn endoscopy clinic. Several patients tested positive for the disease. Hepatitis C infection following colonoscopy has been previously reported. (See: Bronowicki JP, et al. *NEJM* July 24, 1997;337(4):237-40.)

The *AORN Journal's* June issue (2001) includes the article, written by this newsletter's editor, "*Disinfecting endoscopes immediately before the first patient of the day*."

Editor-in-Chief

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What is 'Q-Net'?

Q-Net™ is a technology-assessment network of questions and answers. Its newsletter is *The* **Q-Net™** *Monthly*.

Q-Net™ main goal is to encourage the infection control and endoscopy communities to not only ask good questions but to also demand succinct and well referenced responses.

Q-Net™ addresses the needs of both the health care provider whose goal is to provide the best care possible, and the patient who deserves affordable quality health care.

A case study: Potential errors in instrument reprocessing

This article is a case study that details events at a fictional hospital. Breaches in reprocessing protocols are discussed, and considerations and recommendations are provided to minimize the risk of nosocomial infection. (The sole intent of this article is educational. Similarities between this case study and other published studies are purely coincidental.)

Background: A case study was performed by a fictional hospital to investigate a potential infection outbreak in its gastrointestinal (GI) endoscopy department. While preparing a patient for colonoscopy, a nurse noticed patient soil on the endoscope. An investigation was performed and determined that several hundred patients could potentially have been exposed to this contaminated colonoscope. Only those patients undergoing colonoscopy between the fall of 2000 and the spring of 2001 were deemed at risk. No patients displaying clinical infection have been identified.

Methods: During its investigation, this (fictional) hospital reviewed its infection control procedures, focusing on potential breeches in its GI endoscopy department's cleaning and disinfection practices. The hospital sampled several sites on most of its upper and lower GI endoscopes immediately after reprocessing. For the sake of clinical perspective and comparison, the hospital also sampled several sites on a 'dirty' (or control) colonoscope that had *not* been reprocessed following patient use.

Results: Several types of bacteria were identified on the reprocessed endoscopes. (See Table 1, page 10.) The cultured bacteria included: *Staphylococcus, Streptococcus, Pseudomonas, Klebsiella* and *Bordetella.* The control endoscope (which had not been cleaned and disinfected after use) was sampled and found to be contaminated with *Lactobacillus, Bacteroides,* and *Enterococcus.* (See Table 2, page 11.)

Discussion: During its investigation, this hospital cultured from several sites on its 'reprocessed' GI endoscopes bacteria that are often found in the GI tract's normal flora (Table 1, page 10). Moreover, several bacteria often isolated in water and on moist surfaces were also cultured from the hospital's reprocessed endoscopes. Since all of these bacteria are destroyed by proper cleaning, high-level disinfection, and drying, these results indicate that the hospital's endoscope reprocessing practices are inadequate.

In addition to indicating potential inadequacies in the hospital's reprocessing protocol, the results of the investigation suggested that the hospital's quality controls were lacking and warranted

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GENUS	SPECIES	SOURCE	SITE SAMPLED	NOTES
Staphylococcus (gram-positive cocci)	*epidermidis*	normal GI flora; resident skin flora	suction channel, suction button, suction port	Suggests improper cleaning and/or disinfection. Unclean hands; improper handling possible.
Streptococcus (gram-positive cocci)	*pneumoniae*	normal upper respiratory tract flora	suction channel, biopsy port	Suggests improper cleaning and/or disinfection.
Pseudomonas (gram-negative bacilli)	*aeruginosa*	transient skin flora; environment: soil, water, soaps and detergent solutions	air/water channel, air/water button, detergent container	Suggests moisture, inadequate drying. Destroyed by 70% alcohol rinse, drying. Often found in water and soap.
Klebsiella (gram-negative bacilli)	*pneumonia*	normal flora of skin, GI and respiratory tracts; environment: soil, water, infected soaps	detergent container	Suggests moisture, inadequate drying. Destroyed by 70% alcohol rinse, drying. Often found in water and soap.
Bordetella (gram-negative bacilli)	*bronchiseptica*	environment: water	sink used for cleaning the endoscope	Rarely causes disease; sensitive to drying, 70% alcohol.

Table 1: Types of bacteria, their source and the sites where each was sampled.

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significant improvement. For example, although the hospital's written policy required sampling microbiologically its GI endoscopes once a month, none had been sampled for more than six months prior to this investigation. Periodic sampling of its GI endoscopes had been discontinued, due in part to financial cutbacks that caused the hospital no longer to employ an infection control officer. (*Note:* Routine sampling of endoscopes is generally not recommended.)

Observations: Table 1 lists the bacteria cultured from several of the hospital's reprocessed (that is, 'ready-for-use') endoscopes and environmental surfaces during the investigation. Based on these results, several considerations and conclusions are provided:

(1) Culturing *Staphylococcus epidermidis* and *Streptococcus pneumoniae* (both gram-positive cocci) from the suction channel and other surfaces of a ready-for-use endoscope indicates that the hospital's endoscope reprocessing practices in general and its cleaning step in particular are inadequate. The presence of *S. epidermidis* on a ready-for-use endoscope could also indicate environmental contamination, possibly due to improper handling using dirty gloves or unclean hands.

(2) The hospital found during its investigation that the air/water channels and the air/water button of its ready-for-use endoscopes were contaminated with gram-negative bacilli, specifically *P. aeruginosa* (Table 1). This result likely indicates that the endoscope was not adequately dried after reprocessing.

This investigation also found that the hospital was not cleaning, disinfecting (or sterilizing) and drying its reusable irrigation water bottles and tubing sets at the end of the day. This reprocessing oversight could also explain why *P. aeruginosa* was cultured from the endoscope's air/water channels (Table 1). If improperly reprocessed, the irrigation water bottle and tubing set can become colonized with *P. aeruginosa* (and other gram-negative bacteria) during overnight storage and recontaminate the sterile water added to it the next day and the endoscope.

Also, if a bacterial filter is used to improve the quality of the rinse water used during endoscope reprocess-

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ing, culturing *P. aeruginosa* from a reprocessed endoscope could indicate that the bacterial water filter is failing (ie, allowing bacteria to pass) and requires replacement. This same result could also indicate that the filter's housing contains a biofilm and requires decontamination.

(3) Both *P. aeruginosa* and *Klebsiella pneumonia* were cultured from the hospital's detergent container (Table 1). This finding should not necessarily warrant concern. Detergents are used to clean the endoscope before—not after—chemical immersion. They therefore are not required either to be sterile or bacteria-free. A contaminated detergent container has not been reported to increase the risk of patient infection. Only if the detergent were to contact and recontaminate the endoscope *after* reprocessing might the patient be potentially at risk.

(4) *Bordetella bronchiseptica* was cultured in the sink used by the hospital to wash its endoscopes (Table 1). But this finding too should not necessarily warrant concern, as this bacterium is commonly isolated on moist surfaces. It could pose a risk to the patient, but only if it were to contact the endoscope *after* reprocessing.

(5) As listed in Table 2, the hospital sampled *Lactobacillus, Bacteroides,* and *Enterococcus* on a dirty (that is, not reprocessed) endoscope. This finding is not unexpected. These bacteria are often found in the GI tract's normal flora and therefore culturing them on a dirty endoscope need not necessarily rouse concern. Culturing these bacteria from a ready-for-use endoscope, however, would be of concern and would indicate that the reprocessing protocol was ineffective.

Conclusions and recommendations: In conclusion, a case study was performed at a fictional hospital. This investigation was prompted by a (fictional) GI nurse who observed patient debris on a ready-for-use colonoscope. No patient infections were reported, but fear of the potential for an outbreak warranted review of the hospital's infection control and reprocessing practices.

During the investigation, several GI endoscopes and environmental sites were sampled for possible contamination. The results indicated that several essential reprocessing practices were being breeched. The endoscopes, cleaning sink and detergent container were found to be contaminated with both gram-negative and gram-positive bacteria (Table 1). As part of the investigation, the sampled bacteria were typed to assess patient risk and identify specific breeches in protocol.

Provided the entire endoscope, including each of its channels, its biopsy port, and both its suction and air/water valves, has been: (1) thoroughly cleaned using a brush and detergent; (2) soaked in a liquid chemical sterilant at the proper temperature, time and concentration to achieve high-level disinfection; (3) rinsed with bacteria-free (or sterile) water; (4) flushed with 70% alcohol followed by forced air drying before storage; and (5) handled properly, hung vertically, and stored in a dry and well-ventilated environment, the risk of patient infection is very small.

Based on the specific types of bacteria cultured by the hospital (see Tables 1, 2), several recommendations are provided to reduce the risk of patient infection:

(A) Prior to chemical immersion, manually pre-clean the entire endoscope using detergent and appropriately sized cleaning brushes. Review and adhere to any of several (eg, SGNA, APIC, ASTM) published reprocessing guidelines for cleaning, disinfecting and drying endoscopes and their accessories. Standardize as much of the reprocessing regimen as possible to minimize the potential for breeches in protocol.

(B) The risk of *P. aeruginosa* infection can be reduced significantly if the endoscope is thoroughly dried before storage (and ideally between patient procedures). Rinsing each of the endoscope's channels with 70% alcohol, followed by forced air, facilitates drying. Hanging the endoscopes vertically in a clean and well-ventilated storage area, with their valves and biopsy inlet cap removed, further facilitates drying.

The risk of *P. aeruginosa* infection can also be reduced by cleaning, high-level disinfecting (or steriliz-

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GENUS	SPECIES	SOURCE	SITE SAMPLED	NOTES
Lactobacillus (gram-positive bacilli)	*casei*	normal GI flora	exterior surface of a dirty insertion tube	Culturing these bacteria from the exterior surface of a dirty endoscope (ie, one that has not been cleaned and disinfected) is an expected result.
Bacteroides (gram-negative bacilli)	*fragilis*	normal GI flora	exterior surface of a dirty insertion tube	
Enterococcus (gram-positive cocci)	*faecalis*	normal GI flora	exterior surface of a dirty insertion tube	

Table 2: Bacteria cultured from the exterior surface of a dirty (control) endoscope.

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ing) and drying the irrigation water bottle and its connecting tubing at least daily. (Disposable water bottles and tubing sets may be available.) Use only sterile (or fresh tap) water during irrigation, as reusing the irrigation water from day to day may pose an infection risk.

(C) Monitoring the rinse water used during endoscope reprocessing is recommended to reduce the risk of nosocomial *P. aeruginosa* infection. *P. aeruginosa* is often found in moist environments. And if present in the hospital's water supply, it can recontaminate the endoscope during terminal rinsing. *(For a detailed discussion of the importance of monitoring the rinse water, see this newsletter's February, March and April 2001 issues, which can be downloaded at: www.myendosite.com)*

If a bacterial filter is used to improve the rinse water's quality, monitoring the filtered rinse water is also recommended to confirm the filter's effectiveness and its labeled claims (eg, '*bacteria-free*' or '*sterile*' water). Identifying bacteria in filtered rinse water may indicate that the filter is failing and requires replacement. More frequent changing of the filter and proper decontamination (eg, cleaning and sterilization) of its housing reduces the risk of patient infection.

(D) When using an automated endoscope reprocessor (AER), ensure that each of the endoscope's internal channels (and accessories, such as the suction and air/water buttons) are being reprocessed. Failure to connect to and reprocess *every* endoscope channel using the appropriate channel adapters provided by either (or both) the endoscope or AER manufacturer can result in patient infection. Contact the endoscope and/or AER manufacturer for specific reprocessing instructions.

(E) Adhere to a good-housekeeping policy that requires regular decontamination of the sinks and basins used to wash and reprocess endoscopes. Changing the detergent bottle more frequently to prevent the development of biofilms may be advantageous. Also, although aseptic handling of endoscopes is not indicated, wearing sterile gloves when handling ready-for-use endoscopes may aid in reducing the risk of instrument recontamination. More frequent hand washing is recommended.

(F) Leak-test the endoscope before reprocessing. Confirm that the suction channel is not torn or damaged, allowing patient debris, *P. aeruginosa,* and other types of bacteria to collect inside the endoscope and remain viable after reprocessing. ■ *The End*

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Detailed reports like the one presented in this month's newsletter can be prepared confidentially and upon request for any facility investigating an outbreak (or pseudo-outbreak) or seeking outside review of its reprocessing practices. Contact this newsletter's editor for more information.

Endoscope storage:
A population explosion?

✓ *Discussed in its past three issues, this newsletter recommends monitoring the rinse water used during endoscope reprocessing.*

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For hemodialyzer reprocessing, maintaining the rinse water's microbial concentration below 200 colony forming units per milliliter (CFUs/ml) is recommended. Until more data are available, this newsletter recommends applying this same microbial threshold to the rinse water used to reprocess endoscopes between patient procedures.

But this recommended microbial threshold of 200 CFU/ml for endoscopes warrants clarification. Bacteria can double in population every 20 to 30 minutes. As a result, one bacterium inside a moist endoscope channel can multiply during overnight storage and yield the next day tens of thousands of bacteria capable of causing serious patient infection. Therefore, in light of gram-negative bacteria's rapid growth curve, this newsletter recommends considering the importance of rinsing the endoscope before storage using only bacteria-free or sterile water (ie, 0 CFUs).

Thank you for your interest in this newsletter. *I have addressed each issue to the best of my ability. Respectfully, the Publisher:* ***Lawrence F. Muscarella, PhD, Editor in Chief.*** Please direct all correspondence to:

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