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The Importance of Bronchoscope Reprocessing Guidelines: Raising the Standard of Care

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- 2 Cheng TO. Acronym aggravation. *Br Heart J* 1994; 71:107–109
- 3 Cheng TO, Julian D. Acronyms of cardiologic trials—2002. *Int J Cardiol* 2003; 91:261–351
- 4 Instructions to authors. *Chest* 2004; 125:A60

Help for Interpretation of Cardiopulmonary Exercise Testing

To The Editor:

In the January 2004 issue of *CHEST*, Drs. Irvin and Kaminsky¹ wrote an editorial regarding the American Thoracic Society (ATS)/American College of Chest Physicians (ACCP) statement on cardiopulmonary exercise testing (CPET) published in the *American Journal of Respiratory and Critical Care Medicine* in January of 2003.² In their article, they point out that the data generated from CPET are easily the most difficult set of results a director of a pulmonary function laboratory has to interpret. They go on to give the opinion that the resources available to help physicians in interpretation are limited. They state that although the ATS/ACCP statement is comprehensive, it must be approached with “zeal” in order not to be overwhelmed. It is their belief that most readers would be using the document for information about interpretation. However, they feel that they could not just hand it to their fellows and have any hope that it would be read.

We also believe that there is a significant interest in CPET, but many physicians find interpretation difficult. Therefore, to assist them, we have created an interpretation software program. The program is called XINT (exercise interpretation). The executable program is available free over the Internet at www.xint.org. The source code is open. This will allow physicians to review the logic and interpretive statements in detail and even make changes if desired. The program runs in a Windows environment (Microsoft; Redmond, WA) or on a Macintosh (Apple Computer; Cupertino, CA).

We have used XINT to interpret exercise data from actual patients, and have found it clinically useful. We have also used it on the case examples in the ATS/ACCP statement, and believe it gives results similar to those of the expert panel. It also provides a professional-looking report for the patient chart.

The program is being provided free to the medical community because we believe, as do the authors of the editorial, that assistance with interpretation will lead to greater utilization of CPET and improved patient care. Although a computer program can never substitute for a human, it can be of benefit.

In the not-too-distant future, computers will play an integral part in patient diagnosis and management. XINT is another small step in that direction.

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REFERENCES

- 1 Irvin CG, Kaminsky DA. Exercise for fun and profit: joint statement on exercise by the American Thoracic Society and the American College of Chest Physicians. *Chest* 2004; 125:1–3

- 2 American Thoracic Society; American College of Chest Physicians. ATS/ACCP statement on cardiopulmonary exercise testing. *Am J Respir Crit Care Med* 2003; 167:211–277

The Importance of Bronchoscope Reprocessing Guidelines

Raising the Standard of Care

To the Editor:

As expressed by Srinivasan et al (January 2004),¹ I agree that bronchoscope-specific reprocessing guidelines that provide step-by-step instructions similar to those developed for GI endoscopes are needed.² By familiarizing the pulmonary community with important infection control and reprocessing policies and details, the development and publication of bronchoscope-reprocessing guidelines would contribute to the establishment of a more consistent standard of care and to a reduction of the risk of disease transmission via contaminated bronchoscopes. Because specific reprocessing guidelines for bronchoscopes have not been published, some health-care practitioners may be unaware of the current minimum bronchoscope-reprocessing requirements, failing to practice important infection control principles that are crucial to the prevention of nosocomial infection. Others may “borrow” published reprocessing guidelines for GI endoscopes and apply them to bronchoscopes. Even though several of the reprocessing instructions and steps for GI endoscopes are similar to those for bronchoscopes, the application of reprocessing guidelines for one type of instrument to another can be confusing, can result in noncompliance, and can establish an unnecessary precedent.

In addition to agreeing with the recommendation of Srinivasan et al that bronchoscope-reprocessing guidelines be developed and published, I would like to express my concern that the current standard of care, which condones, if not encourages, the clinical use of “just-reprocessed-and-wet-with-rinse-water” endoscopes including bronchoscopes, is potentially unsafe.³ Several organizations recommend drying bronchoscopes, GI endoscopes, arthroscopes, and other types of flexible and rigid endoscopes after high-level disinfection at the end of the day—that is, before storage of the endoscope—but not between patient procedures during the course of the day.⁴ Moreover, for automated endoscope reprocessors (AERs) that are labeled with instructions to “sterilize” endoscopes using a liquid chemical sterilant (LCS) and “sterile” rinse water, most organizations do not recommend drying the endoscope after reprocessing (and water rinsing) at any time, either between patient procedures or at the end of the day.⁴ To be clear, especially for a bronchoscope that may be reused several times in 1 day, the failure to dry the endoscope, including its external surfaces, suction channel, and biopsy port, immediately after reprocessing and before reuse all but ensures that the bronchoscope will be wet with rinse water when introduced into the patient’s lungs. Such a practice, while common, is dubious, because it can result in the transmission of waterborne bacteria during bronchoscopy and nosocomial infection, especially if the patient is critically ill and immunosuppressed. Several published reports^{5–9} have documented outbreaks (and pseudo-outbreaks) due to the transmission of waterborne bacteria via wet or improperly dried bronchoscopes (and GI endoscopes). As discussed in these reports, each bacterial outbreak was abruptly terminated once the bronchoscope was dried after manual or automated reprocessing (and water rinsing).

Therefore, I suggest, for the sake of clarity, completeness, and

the elevation of patient care, that future bronchoscope reprocessing guidelines, as well as documents published by the Food and Drug Administration (FDA) and the Centers for Disease Control and Prevention (CDC), recommend that, irrespective of the claim of the LCS or AER (*ie*, “high-level disinfection” or “liquid sterilization”), or the quality of the water used for rinsing (*eg*, tap water, “bacteria-free” water, or water labeled as “sterile”), the endoscope be dried after reprocessing both between patient procedures and prior to storage.³ It is unclear why some professional organizations do not recommend drying the endoscope immediately after the completion of each reprocessing cycle,⁴ especially since drying, which can be achieved by flushing the suction channel and biopsy port of the bronchoscope with 70% alcohol followed by forced (or compressed) air, is an inexpensive and a relatively simple and rapid process that does not require complex equipment. It is also unclear why the CDC does not recommend drying the endoscope between patient procedures, or why the FDA does not require that the labeling of endoscopic equipment underscore the importance of drying the endoscope after manual and automated reprocessing (and water rinsing).^{10,11}

Finally, I recommend that future bronchoscope (and current GI endoscope) reprocessing guidelines address the importance of microbiologically monitoring the rinse water used during endoscope reprocessing. Currently, save for a few investigators including this letter's author, the CDC does not recommend the monitoring of rinse water as required to determine its microbial quality.¹² As a result, the microbial quality and content of the rinse water is generally unknown (unless the health-care facility is, for example, investigating a bacterial outbreak or pseudo-outbreak linked to contaminated bronchoscopes). Although it is surprisingly often overlooked in reprocessing guidelines, the failure to monitor the rinse water and to determine its microbial quality renders meaningless any advertised claim that the endoscope was successfully “high-level disinfected” or “sterilized,” because the possibility exists that the endoscope was recontaminated with waterborne bacteria during the water-rinsing phase that follows high-level disinfection or “liquid sterilization.” To be sure, contaminated rinse water yields contaminated endoscopes, irrespective of the potency, strength, claims, or effectiveness of the LCS.

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The author is employed by Custom Ultrasonics, Inc., a manufacturer of automated devices used to reprocess (*eg*, cleaning and high-level disinfection) flexible endoscopes. Custom Ultrasonics funded the research and writing of this article. The article does not endorse a product or promote a proprietary technology. Reproduction of this article is prohibited without written permission from the American College of Chest Physicians (e-mail: permissions@chestnet.org).

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REFERENCES

- 1 Srinivasan A, Wolfenden LL, Song X, et al. Bronchoscope reprocessing and infection prevention and control: bronchoscopy-specific guidelines are needed.” *Chest* 2004; 125:307–314
- 2 Society of Gastroenterology Nurses and Associates. Standards of infection control in reprocessing of flexible gastrointestinal endoscopes. *Gastroenterol Nurs* 2000; 23:172–179
- 3 Muscarella LF. Bronchoscope reprocessing: are changes needed? Available at: <http://www.chestjournal.org/cgi/eletters/125/1/307>. Accessed August 19, 2004
- 4 Association of Perioperative Registered Nurses. Recommended practices for cleaning and processing endoscopes and endoscope accessories. *AORN J* 2003; 77:434–438, 441–442
- 5 Alvarado C, Stolz SM, Maki DG. Nosocomial infections from contaminated endoscopes: a flawed automated endoscope washer; an investigation using molecular epidemiology. *Am J Med* 1991; 91(suppl):272S–280S
- 6 Allen JI, Allen MO, Olson MM, et al. Pseudomonas infection of the biliary system resulting from use of a contaminated endoscope. *Gastroenterology* 1987; 92:759–763
- 7 Kolmos HJ, Lerche A, Kristoffersen K, et al. Pseudo-outbreak of *Pseudomonas aeruginosa* in HIV-infected patients undergoing fiberoptic bronchoscopy. *Scand J Infect Dis* 1994; 26:653–657
- 8 Fraser VJ, Jones M, Murray PR, et al. Contamination of flexible fiberoptic bronchoscopes with *Mycobacterium chelonae* linked to an automated bronchoscope disinfection machine. *Am Rev Respir Dis* 1992; 145:853–855
- 9 Struelens MJ, Rost F, Deplano A, et al. *Pseudomonas aeruginosa* and Enterobacteriaceae bacteremia after biliary endoscopy: an outbreak investigation using DNA macrorestriction analysis. *Am J Med* 1993; 95:489–498
- 10 Centers for Disease Control and Prevention. Bronchoscopy-related infections and pseudoinfections: New York, 1996 and 1998. *MMWR Morb Mortal Wkly Rep* 1999; 48:557–560
- 11 Muscarella LF. Deja vu . . . all over again? The importance of drying. *Infect Control Hosp Epidemiol* 2000; 21:628–629
- 12 Muscarella LF. Application of environmental sampling to flexible endoscope reprocessing: the importance of monitoring the rinse water. *Infect Control Hosp Epidemiol* 2002; 23:285–289

To the Editor:

We greatly appreciate the recent thoughtful communication from Dr. Muscarella regarding our report that was recently published in *CHEST* (January 2004).¹

We strongly agree with the importance of a terminal alcohol rinse and the air-drying of bronchoscopes prior to their use. We found this to be a particular area of uncertainty among the bronchoscopists whom we surveyed, with over half being unaware of the institutional approaches to such aspects of reprocessing. This issue represents an important practical dilemma, as busy bronchoscopists might feel pressured to abbreviate this important component of instrument reprocessing. Although we are not aware of any instance in which the use of wet endoscopes is “encouraged,” this practice may well occur in busy endoscopy suites. The practice of drying the inner lumen of endoscopes with alcohol and compressed air impedes the growth of microorganisms, and helps to reduce the risk of bacterial contamination. Given that this step is inexpensive, universally available, adds very little time to the reprocessing procedure, and may enhance safety, we agree that expanding this practice to every reprocessing cycle, and not just those at the end of the day or in instances in which nonsterile rinse water is used, is reasonable.

In contrast, routine microbiological sampling of endoscope rinse water, while intuitively potentially worthwhile, would be much more expensive and time-consuming, and would require equipment and systems that are not available at all endoscopy sites. As noted in our report, the optimum approaches to surveillance measures (*eg*, periodic instrument/equipment/environmental cultures and computerized analyses of culture isolates from bronchoscopy procedures) require further definition, and the impact of such approaches on patient outcomes requires investigation. Before making such a recommendation, we believe that studies should be performed to define the utility of this practice and to clarify optimum approaches. Rather than proposing such a practice in the absence of data, we believe that a current focus for the bronchoscopy community should be the development, dissemination, and implementation of broncho-

scope-specific reprocessing guidelines, including personal reappraisal of the bronchoscopy infection control programs at one's own institution¹⁻⁴.

Importantly, the American College of Chest Physicians has been attuned to this need for the prevention of bronchoscopy-associated infection and pseudoinfection, and, in collaboration with the American Association of Bronchology, has sponsored the development of a consensus statement through its Interventional Chest/Diagnostic Procedures Network. It is noteworthy that instrument drying is a component of these recommendations. We hope that this effort, coupled with the resolve to implement these procedures by bronchoscopists, will enhance the safety of this procedure, which is integral to patient care.

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REFERENCES

- 1 Srinivasan A, Wolfenden LL, Song X, et al. Bronchoscope reprocessing and infection prevention and control: bronchoscopy-specific guidelines are needed. *Chest*, 2004; 125:307-314
- 2 Srinivasan A, Wolfenden LL, Song X, et al. An outbreak of *Pseudomonas aeruginosa* infections associated with flexible bronchoscopes. *N Engl J Med* 2003; 348:221-227
- 3 Culver DA, Gordon SM, Mehta AC. Infection control in the bronchoscopy suite. *Am J Respir Crit Care Med* 2003; 167:1050-1056
- 4 Prakash UBS. Does the bronchoscope propagate infection? *Chest* 1993; 104:552-559

Open-Lung Biopsy for ARDS Patients

To the Editor:

We read with interest the article by Patel and colleagues (January 2004),¹ who presented the results of a retrospective study evaluating open-lung biopsy (OLB) in a cohort of 57 patients with clinically diagnosed ARDS. The main observation of this study was that a pathologic diagnosis other than diffuse alveolar damage (the histologic hallmark of ARDS) was found in 60% of cases, resulting in a change in therapy in a majority of patients (*ie*, discontinuation of unneeded therapy, 37% of patients; addition of specific therapy, 60% of patients). Surprisingly, however, the therapeutic alterations guided by these precise histopathologic findings did not confer any survival benefit.¹ Such an observation is disappointing, as it contradicts the clinical principle that knowing the underlying pathology and instituting a specific therapy should positively affect outcome.

A plausible explanation for these negative results is that complications related to the surgical procedure may have cancelled out any potential benefit of obtaining a definitive diagnosis. Indeed, complications were noted in as much as 39% of patients, were defined as *major* (*eg*, death, myocardial infarction, stroke, institution of dialysis, or hemothorax within 48 h of surgery) in 7% of patients, and were defined as *minor* (*eg*, acute renal failure, 11% of patients; persistent air leak for > 1 week, 21% of patients)

in 32% of patients.¹ We do not agree with the authors' statement that, due to its low rate of major complications, OLB is a safe procedure in ARDS patients. In contrast, we think that the impact of the so-called minor complications has been underestimated by the authors, especially when it comes to the problem of persistent air leak. Persistent air leak (in effect, a bronchopleural fistula) requires prolonged chest tube drainage, may pose important problems in achieving adequate ventilation, and is associated with a poor prognosis in mechanically ventilated patients with severe respiratory failure.²⁻⁴ As such, the occurrence of a bronchopleural fistula has to be regarded as an ominous complication of OLD, rather than a minor complication, in the series reported by Patel et al. It would be meaningful to know about the outcomes of patients who developed such a complication in this study.

In summary, although this study provides important information on a pathologic viewpoint, we think that it does not support the use of OLB in mechanically ventilated patients with ARDS. Rather, it suggests that complications related to the procedure may be severe enough to negate any potential benefit provided by a precise histopathologic diagnosis.

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REFERENCES

- 1 Patel SR, Karpaliotis D, Ayas NT, et al. The role of open-lung biopsy in ARDS. *Chest* 2004; 125:197-202
- 2 Baumann MH, Sahn SA. Medical management and therapy of bronchopleural fistulas in the mechanically ventilated patient. *Chest* 1990; 97:721-728
- 3 Pierson DJ, Horton CA, Bates PW. Persistent bronchopleural air leak during mechanical ventilation: a review of 39 cases. *Chest* 1986; 90:321-323
- 4 Pierson DJ. Management of bronchopleural fistula in the adult respiratory distress syndrome. *New Horiz* 1993; 1:512-521

To the Editor:

We thank Drs. Oddo and Liaudet for their interesting and insightful comments. We also were disappointed that therapeutic changes made in response to the etiologic diagnosis were not associated with an improved outcome.¹ We do not, however, believe that this lack of improvement is due to an offset from morbidities related to the lung biopsy procedure, as the risk of surgical complications (including prolonged air leakage) was independent of the etiologic diagnosis or the institution of specific therapy. Rather, we think that the lack of improvement was a reflection of the lack of efficacious therapies that are currently available for many of the causes of ARDS that were discovered. These findings highlight the need for further research into better therapies for diffuse alveolar damage and other pathologies causing ARDS.

While we agree that the occurrence of bronchopleural fistula (BPF) in mechanically ventilated patients with emphysema has poor prognostic implications, we think that this is a reflection of the severity of the patient's underlying parenchymal lung disease rather than of the air leak itself.² Thus, we do not think that BPF

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