

1,000 L of air should be sampled, since the likelihood of detecting 1 CFU/m<sup>3</sup> is reduced with volumes smaller than this.<sup>13</sup> Until now, this number has not been studied during an outbreak. Originally, we used a volumetric air sampler, which was portable and convenient to use, but only sampled 160 L of air in 4 minutes. With large volumes of air (1,200 L), several cultures of air samples throughout the hospital and the oncology unit grew *Aspergillus* species. Given the number of colonies detected with the large-volume air sampler, it is evident why cultures from the low-volume sampler did not grow fungi. Thus, we propose that, when volumetric air sampling is used in an indoor environment, a minimum of 1,000 L of air should be sampled in high-traffic areas during a busy part of the day.

This investigation highlights the importance of evaluating pressure relationships not only in individual rooms but also in attached buildings. To ascertain critical pressure relationships, a pressure gauge with sensitivity to 0.001 in water gauge (250 Pa=1 in water gauge) is essential. Recommendations for the number of air exchanges per hour to maintain a positive pressure in immunocompromised patient rooms exist,<sup>14</sup> but little information is available for determining the proper pressure in rooms for protecting compromised patients.<sup>15</sup> We advocate further research to determine how best to assess an environment with high-risk patients.

In conclusion, critical aspects of both prevention and outbreak investigations are as follows: (1) to develop novel ways to protect patients, especially in older hospitals, and (2) to assess accurately the environment, which includes studying appropriate pressure relationships and obtaining accurate volumetric air samples. Until now, there has been no established standard for air sampling, but this outbreak supports sampling large volumes of air when using volumetric air sampling. We propose that 1,000 L (1 m<sup>3</sup>) be the standard minimum when obtaining volumetric air samples to assess the healthcare environment for *Aspergillus*. In addition, further research is needed to determine optimal pressure relation-

ships for protecting immunocompromised patients. We feel that establishing standards for pressure testing and volumetric air sampling can help to prevent nosocomial aspergillosis.

## REFERENCES

- Weems JJ Jr, Davis BJ, Tablan OC, Kaufman L, Martone WJ. Construction activity: an independent risk factor for invasive aspergillosis and zygomycosis in patients with hematologic malignancy. *Infect Control* 1987;8:71-75.
- Walsh TJ, Dixon DM. Nosocomial aspergillosis: environmental microbiology, hospital epidemiology, diagnosis and treatment. *Eur J Epidemiol* 1989;5:131-142.
- Arnou PM, Andersen RL, Mainous PD, Smith EJ. Pulmonary aspergillosis during hospital renovation. *Am Rev Respir Dis* 1978;118:49-53.
- Goodley JM, Clayton YM, Hay RJ. Environmental sampling for aspergilli during building construction on a hospital site. *J Hosp Infect* 1994;26:27-35.
- Klimowski LL, Rotstein C, Cummings KM. Incidence of nosocomial aspergillosis in patients with leukemia over a twenty-year period. *Infect Control Hosp Epidemiol* 1989;10:299-305.
- Aisner J, Schimpff SC, Bennett JE, Young VM, Wiernik PH. *Aspergillus* infections in cancer patients: association with fireproofing materials in a new hospital. *JAMA* 1976;235:411-412.
- Krasinski K, Holzman RS, Hanna B, Greco MA, Graff M, Bhogal M. Nosocomial fungal infection during hospital renovation. *Infect Control* 1985;6:278-282.
- Wheeler JH, Fishman EK. Computed tomography in the management of chest infections: current status. *Clin Infect Dis* 1996;23:232-240.
- Arnou PM, Sadigh M, Costas C, Weil D, Chudy R. Endemic and epidemic aspergillosis associated with in-hospital replication of *Aspergillus* organisms. *J Infect Dis* 1991;164:998-1002.
- Buffington J, Reporter R, Lasker BA, McNeil MM, Lanson JM, Ross LA, et al. Investigation of an epidemic of invasive aspergillosis: utility of molecular typing with the use of random amplified polymorphic DNA probes. *Pediatr Infect Dis J* 1994;13:386-393.
- Leenders A, van Belkum A, Janssen S, de Marie S, Kluytmans J, Wielenga J, et al. Molecular epidemiology of an apparent outbreak of invasive aspergillosis in a hematology ward. *J Clin Microbiol* 1996;34:345-351.
- Girardin H, Sarfati J, Traore F, Camet JD, Derouin F, Latge JP. Molecular epidemiology of nosocomial invasive aspergillosis. *J Clin Microbiol* 1994;32:684-690.
- Streifel AJ. *Aspergillus* and construction. In: Kundsinn RB, ed. *Architectural Design and Indoor Microbial Pollution*. New York, NY: Oxford University Press; 1988:198-216.
- Health Care Facilities. 1995 ASHRAE Handbook: Heating, Ventilating, and Air-Conditioning Applications. Atlanta, GA: American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc; 1995:7.1-7.13.
- Rice N, Streifel A, Vesley D. Room pressure: a critical parameter for special ventilation rooms. Eighth Annual Meeting of the Society for Healthcare Epidemiology of America; Orlando, FL; April 5-7, 1998.

## Risk of Cross-Patient Infection With Use of a Needleless Injector Device

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Needleless injection devices use multiple-dose vials for the administration of local anesthetics to patients, and there is a theoretical risk of iatrogenic infection associated with use of these devices. Suria and coinvestigators investigated the potential for transferring microbial pathogens among patients by using the Syrijet (Keystone Industries, Inc, Cherry Hill, NJ). *Staphylococcus aureus* and coagulase-

negative staphylococci were used to determine whether patient skin flora could contaminate the instrument internal canal by postejecion reverse flow and whether the staphylococci could survive on the ejection surface, in the internal canal, or in the anesthetic vial.

The ejection surface was contaminated by firing the device while it was in contact with a contaminated surface. Postejecion reverse flow drew contaminants into the device, but did not reach the multidose vial, and staphylococci did not grow in the commercial anesthetic solution typically administered

with the device. Surface, but not internal, contamination could be removed by swabbing with disinfectant. The authors concluded that, although autoclaving is the only way to ensure sterilization of this device, frequent cleaning of the ejection surface during clinical use minimizes the risk of cross-patient bacterial transfer.

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