

## REFERENCES

- Coronado VG, Beck-Sague CM, Hutton MD, Davis BJ, Nicholas P, Villarreal C, et al. Transmission of multidrug-resistant *Mycobacterium tuberculosis* among persons with human immunodeficiency virus infection in an urban hospital epidemiological and restriction fragment length polymorphism analysis. *J Infect Dis* 1993;168:1052-1055.
- Beck-Sague C, Dooley SW, Hutton MD, Otten J, Breeden A, Crawford JT, et al. Hospital outbreak of multidrug-resistant *Mycobacterium tuberculosis* infections: factors in transmission to staff and HIV-infected patients. *JAMA* 1992;268:1280-1286.
- Aita J, Barrera L, Reniero A, Lopez B, Biglione J, Weisburd G, et al. Hospital transmission of multidrug-resistant *Mycobacterium tuberculosis* in Rosario, Argentina. *Medicina (B Aires)* 1996;56:48-50.
- Harries AD, Kamenya A, Namarika D, Msolomba IW, Salaniponi FM, Nyangulu DS, et al. Delays in diagnosis and treatment of smear-positive tuberculosis and the incidence of tuberculosis in hospital nurses in Blantyre, Malawi. *Trans R Soc Trop Med Hyg* 1997;91:15-17.
- Ritacco V, Di Lonardo M, Reneiro A, Ambroggi M, Barrera L, Dambrosi A, et al. Nosocomial spread of human immunodeficiency virus-related multidrug-resistant tuberculosis in Buenos Aires. *J Infect Dis* 1997;176:637-642.
- Wilkinson D, Crump J, Pillay M, Sturm AW. Nosocomial transmission of tuberculosis in Africa documented by restriction fragment length polymorphism. *Trans R Soc Trop Med Hyg* 1997;91:318.
- Menzies D, Fanning A, Yuan L, Fitzgerald M. Tuberculosis among health care workers. *N Engl J Med* 1995;332:92-98.
- Sepkowitz KA. AIDS, tuberculosis and the health care worker. *Clin Infect Dis* 1995;20:232-242.
- Centers for Disease Control and Prevention. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care facilities, 1994. *MMWR* 1994;43(RR-13):1-132.
- Maloney SA, Pearson ML, Gordon MT, Del Castillo R, Boyle JF, Jarvis WR. Efficacy of control measures in preventing nosocomial transmission of multidrug-resistant tuberculosis to patients and healthcare workers. *Ann Intern Med* 1995;122:90-95.
- Ponce-de-Leon S. The needs of developing countries and the resources required. *J Hosp Infect* 1991;18(suppl A):S376-S381.
- Harries AD, Maher D, Nunn P. Practical and affordable measures for the protection of health care workers from tuberculosis in low-income countries. *Bull World Health Organ* 1997;75:477-489.
- Dirección General de Epidemiología. Sistema nacional de información epidemiológica. *Epidemiología, Sistema Único de Información* 1999;15:7-8.
- Latin American Demographic Center. Latin America Population Projections Calendar Year 1950-2000. *Demographic Bulletin* 1991;48:186.
- García-García ML, Valdespino JL. Tuberculosis. In: Valdespino JL, Velasco O, Escobar A, eds. *Enfermedades Tropicales en México. Diagnóstico, Tratamiento y Distribución Geográfica*. México, D.F.: Secretaría de Salud; 1994:215-225.
- Magis-Rodríguez C, Bravo-García E, Anaya-López U, Uribe-Zúñiga P. La situación del SIDA en México a finales de 1998. *SIDA-ETS* 1998;4:143-155.
- García-García ML, Jiménez-Corona A, Ferreyra-Reyes L, Rivera-Chavira B, Martínez-Tapia ME, et al. Triage of tuberculosis patients: a low cost intervention for prevention of tuberculosis transmission in hospitals. *Int J Tuberc Lung Dis* 1999;9(suppl 1):S171.
- Secretaría de Salud. Norma Oficial para el Control y Prevención de la Tuberculosis en la Atención Primaria a la Salud. Norma No. NOM-006-SSAA2-1993. *Official Gazette*. 1995;496:20-29.
- Arnadóttir T, Rieder HL, Trebuq A, Waaler HT. Guidelines for conducting tuberculin skin test surveys in high prevalence countries. *Tuber Lung Dis* 1996;77(suppl 1):1-19.
- Sokal JE. Measurement of delayed skin-test responses. *N Engl J Med* 1975;293:501-502.
- Hosmer DW Jr, Lemeshow S. *Applied Logistic Regression*. New York, NY: Wiley Interscience; 1989:82-175.
- Hennekens CH, Buring J, Mayrent SL. *Epidemiology in Medicine*. Boston, MA: Little, Brown and Co; 1986:87-90.
- Molina-Gamboa J, Fivera-Morales I, Ponce-de-Leon-Rosales S. Prevalence of tuberculin reactivity among healthcare workers from a Mexican hospital. *Infect Control Hosp Epidemiol* 1994;15:319-320.
- Cardenas-Ayala VM, Bernal-Perez J, Cabrera-Coello L, Stetler HC, Pineda-Salgado J, Guerrero-Reyes P. Tuberculosis surveys in Guerrero and new estimates of the magnitude of tuberculosis infection in Mexico [in Spanish]. *Salud Publica Mex* 1989;31:73-81.
- Haas DW, Milton S, Kreiswirth BN, Brinsko VL, Bifani PJ, Schaffner W. Nosocomial transmission of a drug-sensitive W-variant *Mycobacterium tuberculosis* strain among patients with acquired immunodeficiency syndrome in Tennessee. *Infect Control Hosp Epidemiol* 1998;19:635-639.
- Kantor HS, Poblete R, Pusateri SL. Nosocomial transmission of tuberculosis from unsuspected disease. *Am J Med* 1988;84:833-838.
- Ktsanes VK, Williams WL, Boudreaux VV. The cumulative risk of tuberculin skin test conversion for five years of hospital employment. *Am J Public Health* 1986;76:65-67.
- Behrman AJ, Shofer FS. Tuberculosis exposure and control in an urban emergency department. *Ann Emerg Med* 1998;31:370-375.
- Ostrosky-Zeichner L, Rangel-Frausto S, García-Romero E, Vázquez A, Ibarra MJ, Ponce de León-Rosales S. Tuberculosis in health personnel: importance of surveillance and control programs [in Spanish]. *Salud Publica Mex* 2000;42:48-52.
- Ponce de Leon S, Rangel-Frausto MS, Elias-Lopez JI, Romero-Olivera C, Huertas-Jimenez M. Nosocomial infections: secular trends of a control program in Mexico [in Spanish]. *Salud Publica Mex* 1999;41(suppl 1):S5-S11.
- Bailey TC, Fraser VJ, Spitznagel EL, Dunagan WC. Risk factors for a positive tuberculin skin test among employees of an urban, midwestern teaching hospital. *Ann Intern Med* 1995;122:580-585.
- Menzies R, Vissandjee B, Rocher I, St Germain Y. The booster effect in two-step tuberculin testing among young adults in Montreal. *Ann Intern Med* 1994;120:190-198.
- Mirret-Cuadras P, Pina-Gutierrez JM, Juncosa S. Tuberculin reactivity in Bacillus Calmette-Guérin vaccinated subjects. *Tuber Lung Dis* 1996;77:52-58.
- García-García ML, Valdespino-Gomez JL, Garcia Sancho C, Mayar-Maya ME, Palacios-Martínez M, Balandrano-Campos S, et al. Underestimation of *Mycobacterium tuberculosis* infection in HIV-infected subjects using reactivity to tuberculin and anergy panel. *Int J Epidemiol* 2000;29:369-375.
- Granich R, Binkin N, Jarvis W, Simone P, Rieder H, Espinal M, et al. Guidelines for the prevention of tuberculosis in health-care facilities in resource-limited settings. (WHO/CDS/TB/99.269). Geneva, Switzerland: World Health Organization; 1999.

## Hospital Outbreak of *P aeruginosa* From Whirlpool Drain

Gina Pugliese, RN, MS  
Martín S. Favero, PhD

Berrouane and coworkers from the Department of Internal Medicine, University of Iowa College of Medicine, Iowa City, Iowa, have reported on an outbreak of infections associated with use of a whirlpool. During a 14-month period, seven patients with hematological malignancies acquired serious infections caused by a single strain of multiresistant *Pseudomonas aeruginosa*. A case-control

study, culture surveys, and pulsed-field gel electrophoresis implicated a whirlpool bathtub on the unit as the reservoir. All case-patients and 32% of control-patients used this bathtub ( $P=.003$ ). The epidemic strain was found only in cultures of samples taken from the bathtub. The drain of the whirlpool bathtub, which was contaminated with the epidemic strain, closed approximately 2.54 cm below the drain's strainer. Water from the faucet, which was not contaminated, became contaminated with *P aeruginosa* from the drain when the tub was filled. The design of the drain

allowed the epidemic strain to be transmitted to immunocompromised patients who used the whirlpool bathtub. Such tubs are used in many hospitals, and they may be an unrecognized source of nosocomial infections. Using whirlpool bathtubs with drains that seal at the top could eliminate this potential source of infection.

FROM: Berrouane YF, McNutt LA, Buschelman BJ, Rhomberg PR, Sanford MD, Hollis RJ, et al. Outbreak of severe *Pseudomonas aeruginosa* infections caused by a contaminated drain in a whirlpool bathtub. *Clin Infect Dis* 2000;31:1331-1337.