S. AUREUS, REDUCED SUSCEPTIBILITY TO VANCOMYCIN: Notes about the Disease

Traditionally, many North Carolina public health practitioners have viewed antibiotic resistance as a clinical problem that involves the practice of public health only to the extent that resistance to antimicrobials crops up in community cases of communicable diseases like tuberculosis, gonorrhea, or shigellosis. However, in recent years, the broadening of this problem has led to the realization that only a concerted effort involving private and public resources can hope to bring it under control.

There is probably no better example of the complexity of the general dilemma of antibiotic resistance than the evolution of problems treating infections caused by *Staphylococcus aureus*. This bacterium causes a wide range of human diseases, varying from superficial skin infections to overwhelming sepsis, and it is a leading cause of hospital-acquired (nosocomial) infections. When the beta-lactam antibiotic penicillin first became available to treat "staph" infections in 1942, penicillin resistance was not a problem. However, the first penicillinase-producing strains were recognized in 1944 and, by the late 1950s, about half of all staph isolates had become penicillin resistant.[1] Today, the level of resistance stands at 90%. Likewise, the semisynthetic penicillins (like methicillin) and cephalosporins, developed in the 1960s and 1970s to counteract this resistance, met with different resistance mechanisms in the staph organism's arsenal by the mid-1970s. Methicillin-resistant *S. aureus* (MRSA) increased from 2.4% of isolates in 1975 to 29% in 1991.[2] MRSA organisms are generally resistant not only to methicillin but to a range of other antimicrobials as well.

The glycopeptide vancomycin was developed in 1956 as another new weapon in the battle against antibiotic resistance. Although it took a back seat to the newer beta-lactam antibiotics in treating staph infections in its development, it eventually became the "antibiotic of last resort" as MRSA emerged. Then, as a harbinger of problems to come, strains of vancomycin-resistant enterococci (VRE) began to emerge in the late 1980s. (The enterococcus, formerly called "group D streptococcus," is second only to *S. aureus* as a cause of serious nosocomial infections.) Because the mechanism of vancomycin resistance in VRE can be transferred to other species of bacteria, this development sparked concerns about vancomycin's future as an effective antimicrobial. Finally, in 1996, the first case of human infection with a strain of staph showing partial resistance to vancomycin was documented in Japan.[1]

The susceptibility of *S. aureus* to vancomycin is changing. Low level resistance has been documented in NC,[3] and even higher levels in isolates from other states.[4] Detailed guidelines have been issued for dealing with this problem,[4] and primary attention centers on avoidance of improper vancomycin use, careful screening of staph isolates for resistance, and proper infection control procedures for infected patients.

1. Centers for Disease Control and Prevention. [Reduced Susceptibility of *Staphylococcus aureus* to Vancomycin—Japan, 1996]. *MMWR* 1997;46:[624-6], www.cdc.gov/mmwr/preview/mmwrhtml/00048375.htm.
2. KK Hoffmann and IP Kittrell, "North Carolina Guidelines for Control of Antibiotic Resistant Organisms, Specially Methicillin-Resistant *Staphylococcus aureus* (MRSA) and Vancomycin-Resistant Enterococci (VRE)," *North Carolina Statewide Program for Infection Control and Epidemiology (SPICE),* January 1997, www.unc.edu/depts/spice/guide2.html.
3. CW Woods, et al., "Endocarditis Caused by *Staphylococcus aureus* with Reduced Susceptibility to Vancomycin," *Clin Infect Dis* 38 (2004):1188-91, www.journals.uchicago.edu/CID/journal/issues/v38n8/30045/30045.web.pdf.
4. JC Hageman, et al. Investigation and control of vancomycin-intermediate and -resistant *Staphylococcus aureus*: A Guide for Health Departments and Infection Control Personnel. Atlanta, GA. 2006, www.cdc.gov/ncidod/dhqp/pdf/ar/visa_vrsa_guide.pdf.