

MRSA epidemic clones from inside and outside hospital

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Objectives

In this lecture we will discuss the three waves of emergence and spread of *Staphylococcus aureus* (MRSA): emergence of the very first methicillin resistant MRSA its microbiological and molecular portrait including the origin of multidrug resistance, followed by the emergence of a handful of pandemic MRSA clones which achieved global spread. Finally, we will describe the worldwide emergence of MRSA in the community and animal husbandry.

Summary

MRSA was first isolated in the UK in 1961 and by the late 1980s and early 1990s MRSA spread globally in hospitals of the industrialized world primarily in the form of a few pandemic MRSA clones, which could be defined on the basis of their genetic background (MLST, *spa* type and PFGE) combined with the molecular type of the chromosomal cassette, *SCCmec*. By the late 1990s the epidemiology of MRSA has taken a radical turn through the appearance and rapid spread of resistant and highly virulent strains that emerged in the community and began to enter hospitals as well – blurring the traditional distinctions between risk factors of hospital acquired versus community acquired infections. It is now clear that clones of “successful” *S. aureus* lineages began to exchange not only drug resistance genes but virulent genes as well leading to the emergence of new highly virulent and drug-resistant clonal types, which can cause life-threatening infections in healthy individuals. The genetic background of the most “successful” MRSA and MSSA lineages appear to be similar suggesting that critical determinants of epidemicity reside in the genetic background of the bacteria.

Recommended reading

1. **Aires-de-Sousa M, B. Correia, H. de Lencastre; Multilaboratory Project Collaborators.** 2008. Changing patterns in frequency of recovery of five methicillin-resistant *Staphylococcus aureus* clones in Portuguese hospitals: surveillance over a 16-year period. *J Clin Microbiol.* **46**:2912-7.
2. **Enright, M. C, D. A. Robinson, G. Randle, E. J. Feil, H. Grundmann, and B. G. Spratt.** 2002. The evolutionary history of methicillin-resistant *Staphylococcus aureus* (MRSA). *Proc Natl Acad Sci USA.* **99**:7687-92.
3. **Gomes, AR, H. Westh, and H. de Lencastre.** 2006. Origins and evolution of methicillin-resistant *Staphylococcus aureus* clonal lineages. *Antimicrob Agents Chemother.* **50**:3237-44.
4. **Li M., B. A. Diep, A. E. Villaruz, K. R. Braughton, X. Jiang, F. R. DeLeo, H. F. Chambers, Y. Lu Y, and M. Otto.** 2009. Evolution of virulence in epidemic community-associated methicillin-resistant *Staphylococcus aureus*. *Proc Natl Acad Sci U S A.* **106**:5883-8.
5. **Tristan, A, M. Bes M, H. Meugnier, G. Lina, B. Bozdogan, P. Courvalin M.-E. Reverdy, M. C. Enright, F. Vandenesch, and J. Etienne.** 2007. Global distribution of Pantone-Valentine leukocidin-positive methicillin-resistant *Staphylococcus aureus*, 2006. *Emerg Infect Dis.* **13**:594-600.