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"MRSA: CHALLENGES IN EPIDEMIOLOGY, TREATMENT, AND FUTURE DIRECTIONS"

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Actuality. Methicillin-resistant Staphylococcus aureus (MRSA) has emerged as a significant pathogen, responsible for both healthcare-associated (HA) and community-acquired (CA) infections (Calfee, 2017). Initially confined to healthcare settings, MRSA has evolved into a global threat, with the emergence of community-associated strains, particularly the USA300 clone, which has become a leading cause of skin and soft-tissue infections (SSTIs) (Stryjewski & Corey, 2014). The distinction between HA-MRSA and CA-MRSA is increasingly blurred, as community-associated strains infiltrate healthcare settings, complicating infection control and treatment strategies (Henderson & Nimmo, 2017).

HA-MRSA is associated with multidrug resistance and is prevalent in hospitals, particularly among patients with invasive medical devices or prolonged hospital stays (Calfee, 2017). In contrast, CA-MRSA strains, such as USA300, often carry virulence factors like Panton-Valentine leukocidin (PVL), which enhance pathogenicity in community settings (Stryjewski & Corey, 2014). Both HA-MRSA and CA-MRSA can cause severe infections, including bacteremia, pneumonia, and endocarditis, with high morbidity and mortality rates (Hassoun et al., 2017).

The epidemiology of MRSA has shifted over the past two decades, with a notable decrease in HA-MRSA infections due to improved infection control measures, such as hand hygiene and antimicrobial stewardship (Calfee, 2017). However, CA-MRSA remains a significant public health concern, particularly in high-risk populations like children, athletes, and incarcerated individuals, where transmission is facilitated by close contact and poor hygiene (Henderson & Nimmo, 2017). Interventions targeting community transmission, such as decolonization and educational programs, show promise but require further research for validation (Henderson & Nimmo, 2017).

Treatment of MRSA infections is complicated by increasing resistance to first-line antibiotics, including vancomycin and daptomycin (Proctor, 2015). The emergence of vancomycin-intermediate S. aureus (VISA) and vancomycin-resistant S. aureus (VRSA) underscores the need for novel therapeutic strategies. Promising approaches include new antibiotics (e.g., ceftaroline, tedizolid), phage therapy, antimicrobial peptides, and nanotechnology (e.g., silver nanoparticles) (Proctor, 2015).

Conclusion. MRSA remains a formidable pathogen, with evolving epidemiology and resistance patterns complicating clinical management. The convergence of HA-MRSA and CA-MRSA strains underscores the necessity for sustained infection control, rigorous antimicrobial stewardship, and innovative therapies such as phage-based treatments, nanotechnology antimicrobials (e.g., silver nanoparticles), and novel antibiotics (e.g., ceftaroline, tedizolid). Emerging research on these therapies, alongside vaccine development targeting conserved virulence factors (e.g., ClfA, IsdB), offers promise for future breakthroughs. A comprehensive understanding of MRSA's molecular and epidemiological dynamics remains critical to designing effective prevention and treatment strategies, ultimately reducing its burden on public health (Henderson & Nimmo, 2017).