Virulence factors, pathogenesis and antibiotic resistance in Staphylococcus aureus

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Abstract

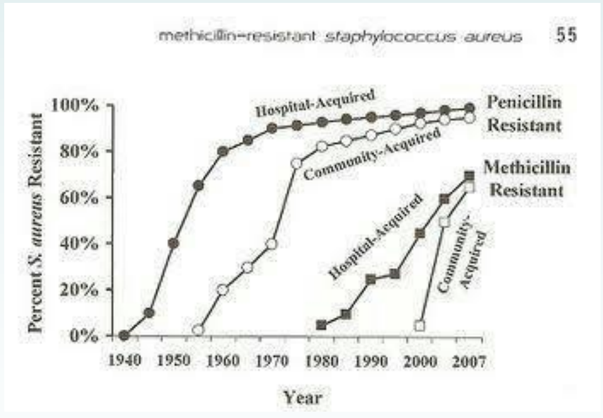
Airway epithelial cells play a major role in initiating inflammation in response to bacterial pathogens. S. aureus is an important pathogen associated with activation of diverse types of infection characterized by inflammation dominated by polymorphonuclear leukocytes. This bacterium frequently causes lung infection, which is attributed to virulence factors. Many of virulence determinants associated with S. aureus-mediated lung infection have been known for several years. In this paper, we discuss recent advances in our understanding of known virulence factors implicated in pneumonia. We anticipate that better understanding of novel functions of known virulence factors could open the way to regulate inflammatory reactions of the epithelium and to develop effective strategies to treat S. aureus-induced airway diseases.

Introduction

Staphylococcus aureus is a gram-positive, round-shaped bacterium that is a member of the Firmicutes,frequently found in the upper respiratory tract and on the skin. and is a facultative anaerobe. Although S. aureus usually acts as a commensal of the human microbiota it can become an opportunistic pathogen, being a common cause of skin infections including abscesses, respiratory infections such as sinusitis, and food poisoning. Pathogenic strains often promote infections by producing virulence factors& protein toxins, and cell-surface protein that binds and inactivates antibodies. The emergence of antibiotic-resistant strains of S. aureus such as methicillin-resistant S. aureus (MRSA). no vaccine for S. aureus has been approved.

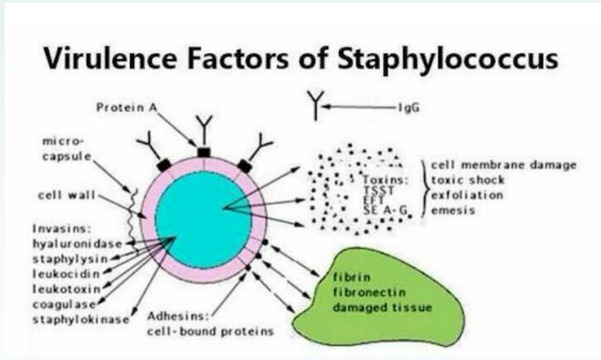
Antibiotic resistant

Staphylococcus aureus is notorious for its ability to become resistant to antibiotics. Infections caused by antibiotic-resistant strains often occur in epidemic waves initiated by one or a few successful clones. MRSA is prominently featured during these epidemics. The overall percentages of S. aureus sensitive to the tested antibiotics were as follows: methicillin 85%, penicillin 8%, gentamicin 89%, ciprofloxacin85%, erythromycin 80%, fusidic acid 96%, mupirocin 98%. Penicillinase-resistant penicillins (flucloxacillin, dicloxacillin) remain the antibiotics of choice for the management of serious methicillin-susceptible S. aureus



Factors

The broad range of infections caused by S. aureus is related to a number of virulence factors that allow it to adhere to surface, invade or avoid the immune system, and cause harmful toxic effects to the host . The majority of initial inflammatory responses to inhaled bacteria is signaled by mucosal cells lining the respiratory tract. S. aureus has a potential to activate the host inflammatory response in several different ways: through the adherence of intact bacteria to the host epithelial cells, by internalization of the bacteria and by direct interaction of bacterial adhesins and toxins with the mucosal epithelium. The main virulence factors that have potential to cause tissue injury and inflammation in the lung are SpA, α-toxin, β-toxin, and PVL



References: George Y. Liu. Molecular Pathogenesis of Staphylococcus aureus Infection. Pediatr Res . 2009 May. doi:10.1203
https://www.hindawi.com/journals/jpath/2011/601905/
https://iai.asm.org/content/70/2/631.short
https://www.nejm.org/doi/full/10.1056/nejm199808203390806

Pathogenicity

It's cause superantigen that cause unit disease such as toxic shock syndrome and staphylococcal scarlet fever ,it has acquired resistance to all antibiotics whole genome analysis toward development as mecithillin resistant staphylococcus aureus (MRSA) cause pneumonia cause acute respiratory disease with plueral effusion , hemoptysis , leucopenia ,cystic fibrosis , patient affected immunosuppressive therapy and serious health resistance. Pneumonia is intense host inflammatory response characteristic rapid and excessive recruitment of neutrophil ,inflammatory response cause lung injury.

Conclusion

The emergence of CA-MRSA heralded an era of uncertainty in public health and patient care as antibiotic resistance and virulence converged to create a major health crisis. As the epidemic evolved and expanded, research has strived to achieve the following goals: 1) identify the cause and mechanism underlying the epidemic; 2) develop antibiotics that do not promptly become obsolete; 3) develop an effective vaccine. So far, the goals have met with varying degrees of success. Our understanding of CA-MRSA epidemic is still limited despite an abundance of epidemiologic and basic studies. Ultimately, an effective vaccine is needed to solve the MRSA health crisis. At the height of the penicillin resistant S. pneumoniae problem eight years ago, introduction of an effective vaccine promptly decreased the incidence of invasive diseases and averted a major health crisis. A similar antibiotic resistance problem was solved by introduction of an effective