[Pasteurella] pneumotropica as a Potential Mouse Infection Model for Assessment of Substantial Opportunistic Bacterial Infections

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[Pasteurella] pneumotropica (Pp) is a gram-negative respiratory pathogen that commonly colonizes laboratory rodent species. Infected immunocompetent animals exhibit no clinical signs; however, this bacterium can cause a broad range of infections in immunodeficient and immunosuppressed rodents, from relatively mild diseases to life-threatening pneumonia [1]. Thus, infections caused by Pp are an issue in the management of laboratory rodents.

Recently, the draft genome sequences of Jawetz and Heyl biotypes of Pp has been reported [2,3]. With respect to putative virulence-associated genes possibly involved in pathogenicity, hemaggulutinins, adhesins, hemolysins, type VI secretion proteins, RTX exoproteins [4,5], and outer membrane components were identified in both biotypes of Pp. Almost all of these factors have been biologically and molecularly characterized in human or animal pathogens.

In immunocompetent mice, Pp colonizes the oral cavity, upper respiratory tract, conjunctiva, intestines, and vagina without typical clinical signs. According to Patten et al. [6], chronic infection caused by Pp induced upregulation of selected inflammatory cytokines in C57BL/6 mice. Against that background, Pp infection might be considered a robust model to study bacterial infections in mice. Co-infection of severe acute respiratory syndrome coronavirus and Pp induced exacerbated pneumonia in mice, resembling that found in humans [7]. Further, there are no endodontic pathogens specific for laboratory rodents, and therefore oral Pp infection is used as a mouse endodontic model [8]. Similarly, the oral infection caused by the bacterium that is genetically related to Pp is suggested to be a potential periodontitis in a murine ligature-induced disease model [9].

Immunological studies showed that recombinant outer membrane proteins (OMPs) homologous to the OMPs of Haemophilus influenzae protected mice from pneumonia [10]. Multiple intranasal immunizations with recombinant PnxIIIa protein successfully elicited PnxIIIa-specific secretory IgA and defended mice against opportunistic infection by Pp [11]. These studies not only focused on prevention of Pp infection in mice but also on a broad perspective of vaccination strategies as a countermeasure against important human opportunistic pathogens.

The Pp infection model has become a substantial infection model for assessment of responsible infectious agents in mice, even though there are still issues to be addressed. For instance, diversified genetic and biochemical properties of Pp in wild-type strains, and in particular, the significant differences in various characteristics between mouse and rat isolates [12-14] might make this model unsuitable for studies, depending on experimental conditions. Furthermore, some virulence factors associated with the host pathophysiology are not exhaustively identified. These relationships involving strain diversity and bacterial virulence need to be clarified in future studies.

References


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