Editorial: Respiratory diseases in veterinary medicine: Time for some fresh air

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Respiratory diseases are a major cause of illness in veterinary medicine, leading to extensive economic losses, especially in animal production settings, with detrimental consequences to animal health and welfare (1–5). Infections by bacterial agents require the use of antibiotics, raising concerns about antimicrobial resistance risks for animal and human health (6, 7). Respiratory diseases are complex and multi-layered. Infection may involve a single agent or a myriad of pathogens, and both the host and environmental factors play a role in disease occurrence, severity, and outcome. This Research Topic is all-encompassing in order to bring light (or a breath of fresh air, if you will) to this complex subject, covering many aspects of respiratory disease in veterinary science including host-pathogen interaction, the impact of respiratory diseases on work animals, disease prevention, and immunity.

Bovine Coronavirus (BCoV) has long been identified as a causative agent of cattle diarrhea. However, its role as a respiratory pathogen is less clear. Frucchi et al., report that BCoV, as well as Pasteurella multocida and Mannheimia haemolytica, were frequently detected in nasal swabs samples from heifer calves in high-production dairy herds in Brazil, suggesting a role of BCoV in Bovine respiratory disease complex (BRDC). Molecular characterization of BCoV N and S1 genes in swab samples revealed that the detected strains are ancestrally different from strains previously reported in the region. The high frequency of BCoV (56%) detection and the identification of a different variant circulating in Brazil suggest that BCoV may be a major BRDC pathogen among heifer calves. Corroborating with this finding, Soules et al. experimentally infected calves intranasally with virulent BCoV. The detection of BCoV in bronchoalveolar lavage, nasal turbinate, and trachea along with histopathologic lesions in the upper and lower respiratory tract further implicates BCoV plays a role in respiratory disease in cattle.
Rotavirus (RV) is also known to cause acute gastroenteritis worldwide, affecting various species, including pigs, cattle, poultry, and humans. While epidemiological studies report respiratory symptoms concurrently with fecal and nasal shedding, RV respiratory infections have scarcely been investigated. Nelsen et al. at SDSU screened swine lung clinical samples submitted to the diagnostic laboratory for the presence of porcine rotavirus A (RVA) genome by quantitative reverse transcription PCR (qRT-PCR). RV was detected in 30.8% (22 samples) of lung samples obtained from conventionally reared pigs with respiratory signs. In situ hybridization (ISH) showed that RV genome localization in positive lung samples was restricted to alveolar and interstitial macrophages and bronchiolar epithelial cells. Analysis of 120 archival formalin-fixed and paraffin-embedded lung samples by ISH revealed another 10 RV-positive cases with similar RV genome localization patterns.

Mycoplasma hyopneumoniae is another relevant swine respiratory pathogen. This bacterium is the primary agent in the swine enzootic pneumonia infectious and plays a role in the swine respiratory disease complex (SRDC) with significant economic losses to the swine industry worldwide. Despite its impact, control and prevention are challenging due to the limited characterization of the antigenic repertoire, virulence profile, and resistance to antimicrobials. Additional complicating factors regarding M. hyopneumoniae epidemiology are distinct circulating strains and the intrinsic resistance against β-lactam antibiotics, sulfonamides, and trimethoprim. A few reports have shown acquired antimicrobial resistance against some antibiotics and associated resistance mechanisms. However, a clear picture of the virulence and pathogenicity of M. hyopneumoniae is still missing, and the potential impact of strain variability on disease severity is likewise not always well-defined. Therefore, the identification and characterization of M. hyopneumoniae strains circulating within a population or geographical region are essential. In the current topic, Zong et al. evaluated the growth and morphology, pathogenesis, and antimicrobial sensitivity characteristics of an M. hyopneumoniae strain isolated from Chinese native Enshi black pig lungs (M. hyopneumoniae strain ES-2). The study also identified 2 genes only present in pathogenic M. hyopneumoniae strains, with great potential as a virulence marker and a tool in clinical diagnosis.

Although usually considered pets, dogs are frequently raised as working animals. Dogs serve, for example, as guides for vision-impaired owners, livestock guardian dogs, and as scent detectors. Canine olfactory detection has a broad range of purposes, including detection of drugs and explosives, medical detection, or search and rescue (8–12). No different from other animals, dogs raised in groups are at higher risk of respiratory infections (13). Bordetella bronchiseptica is responsible for severe respiratory disease in dogs, swine, and rabbits and is a significant contributor to canine infectious tracheobronchitis (also known as “kennel cough”). While upper respiratory infections and their usual clinical signs can have obvious implication for the ability of these dogs to carry out their scent detection duties, the potential impact of the intranasal anti-Bordetella vaccine administration on the olfactory capabilities of dogs have not been evaluated. The delivery to the nasal mucosa epithelium elicits a local immune response, and this localized inflammation could cause hyposmia/anosmia, hampering the dog’s ability to conduct detection work safely and effectively. Collins et al. evaluated different anti-Bordetella vaccine regimens, including oral and intra-nasal vaccine delivery. Luckily, odor thresholds were not influenced by any vaccine strategy. Single intranasal or oral Bordetella vaccine did not impact detection by dogs, while prime with an oral vaccine followed by intranasal boost led to a slight increase in time to detection but not the ability to detect the target odor.

Studies included in this Research Topic portrayed the ever-evolving nature of respiratory infectious diseases, especially under intensive production settings that favor transmission and spread. This Research Topic aimed to highlight and promote discussion regarding respiratory diseases in veterinary science. The compiled research portrayed the investigation of new pathogens, but mostly ways to re-think old pathogens and their role in newly identified problems. It is noteworthy that detection, treatment, and prevention of respiratory diseases in animals is not only limited to protecting animal health and welfare but also supports food security and has a profound positive impact on human health.

Author contributions

MM, FB, and AJ-K wrote the editorial. All authors contributed to the article and reviewed and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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