Recent Advances in The Prevention and Control of Highly Pathogenic Avian Influenza A (H5N1): A Review of Vaccine, Therapeutic and Surveillance Strategies

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Abstract: *H5N1 is a highly pathogenic avian influenza virus with significant zoonotic and pandemic potential due to its high fatality rate, rapid mutation, and cross-species transmission. This review summarizes recent advances in H5N1 vaccine development for humans and poultry, including novel adjuvants and viral vectors. It also explores therapeutic options such as broadly neutralizing antibodies and small-molecule antivirals, with a focus on viral pathogenesis and host interactions involving the NS1 protein. Genomic surveillance highlights global spread via migratory birds and mutations linked to mammalian adaptation. The review also addresses food safety and innovative neuraminidase-based virus-like particle vaccines. Emphasizing a One Health approach, it calls for coordinated international efforts to monitor and control H5N1 threats..*

Keywords: H5N1, Highly-pathogenic avian influenza (HPAI), Zoonosis, Viral vectors, Adjuvants, NS1 protein, Genomic surveillance, Mammalian adaptation, Virus-like particle (VLP) vaccines, Neuraminidase, One-Health, Cross-species transmission, Panzootic, Influenza pathogenesis

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