Antibody-Based Therapeutic Approaches for Inhaled Delivery in Patients with Respiratory Tract Disorders

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Perspective

Infections in the lungs can be deadly. Before a vaccine is produced, therapeutic antibodies have the potential to provide protection against developing viral illnesses. For a successful outcome, the antibody delivery method must be chosen carefully. The frequent dosage of mAbs and the short half-life of nasal antibodies provide a significant obstacle for mucosal administration. The interaction of several pulmonary kinetic processes, including the physicochemical characteristics of the mAb, its composition, and the inhalation device, affects the concentration of active mAb in the lungs [1]. Furthermore, patient characteristics such as breathing skills may reduce pulmonary efficacy. To achieve sufficient concentrations of mucosal Abs, the mucosal airway environment, which includes continual production and removal of mucus coating, needs at least once-daily administration. By thickening the mucus, secondary infections (such as bacterial infections) and other pathological diseases (such as chronic sinusitis, COPD, and cystic fibrosis (CF)) might potentially decrease antibody therapeutic effectiveness. CF mucus has a greater density of disulphide cross-links, which tightens the mucus mesh space even more, reducing the treatment's total efficacy [2,3]. Higher concentrations of therapeutic biomolecules given in high doses can have a negative impact on drug absorption due to local side effects and, in certain cases, can harm the nasal mucosa. As a result, it's important to understand that the nasal cavity has a finite capacity and that nasal administration dosages must be kept to a minimum [4]. Improved mucosal delivery strategies have been attempted to address these limitations. When compared to systemic delivery, recent advances in mAb therapy through aerosol have considerably reduced the quantity of antibody required for protection [5]. Another strategy that has had a lot of success is the use of modified antibodies as a DNA delivery tool. A viral vector-based method might transport the modified antibody gene directly to nasal cells, resulting in antibody production and removing the need for continuing antibody dose. This gene-based antibody delivery technique is advantageous and safe for use in high-risk populations such as immunocompromised patients, pregnant women, and others.

Antibody-based treatments provide a number of benefits over vaccine-induced immunity, including rapid protection, effectiveness in high-risk groups, and the ability to be made accessible faster than vaccines in the event of an emergency or epidemic. The development of highly focused preventative and therapeutic antibody-based techniques at a quick and strategic pace has the ability to change the course of an epidemic. Recent viral disease outbreaks (SARS-COV2) have prompted us to look at developing alternatives to vaccines [6].

Passive antibody transfer via the intranasal or mucosal route for SARS-CoV2 prevention, treatment, and prophylaxis is a viable alternative strategy for a large population, particularly in poor countries. It offers a potential method for preventing SARS-CoV2 infection and controlling illness severity, and it may be employed as a stand-alone antiviral prophylactic tool or in combination with other antiviral treatments. This method is appropriate for preventing infection in persons who are at a high risk of transmitting or spreading disease in the community, such as front-line health-care workers, marginalised groups, the elderly, immunocompromised individuals, and those with comorbidities. In addition, unlike vaccinations, mAbs may be created and evaluated quickly, thus providing a speedy answer to both community transmission and disease progression. Clinical trials are expected to resolve safety concerns about the use of mucosal mAbs in humans in the future, opening a new path forward in the therapy of airborne respiratory diseases.

In conclusion, inhaled therapies are most successful when they are formulated and given in the desired location in the airways, in conjunction with a well-designed inhalation unit that provides optimal therapeutic concentrations in the respiratory system. The creation of cross-reactive and cross-protective antibodies in inhaled formulations that are effective against a variety of coronaviruses (MERS, SARS, CoV2) would broaden their usage and help in pandemic preparedness while reducing the financial burden.

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