Nebulize High Value Therapeutic Drugs

ENHANCING INHALATION THERAPY BY REINTRODUCING ANTIBIOTICS USING MESH TECHNOLOGY

In this article, Edgar Hernan Cuevas Brun, Marketing Manager at HCmed Innovations, looks at how the administration of some old antibiotics could be a valuable response to fight infections.

The last three decades have seen a slow movement when it comes to the development of new antibiotics. Different reasons can be attributed, mostly involving regulations governing drug approval, market forces and scientific bottlenecks.[1] As a result, a new antibiotic resistance era was confirmed in 2015, and it has not been brought under control so far. There is no doubt that there is a need for new antibiotics. However, in the meantime, clinicians around the world have started to reappraise the use of antibiotics that have not been used for a long time – colistin being one of them.[2]

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REINTRODUCING COLISTIN

Colistin, also known as polymyxin E, is an antibiotic that belongs to the polymyxin class and is mostly effective against Gram-negative bacilli.[3] It was discovered in 1949 and initially used in Japan, Europe and the US in the 1950s.[4] Its usage was eventually reported to cause nephrotoxicity. Consequently, its application was largely reduced only 20 years after its discovery.

In recent years, colistin has regained the interest of clinicians and scientists alike, leading to the need for a deeper understanding of the pharmacodynamics, pharmacokinetics and toxicodynamics of this old antibiotic to properly set the right administration regimens.[5,6]

For patients suffering from cystic fibrosis, colistin has become an important tool to fight infections. At the same time, the critical practice guidelines from the Infectious Diseases Society of America and the American Thoracic Society have also cited the administration of inhaled colistin to treat ventilator-associated pneumonia.[7] Nowadays, finding the most efficient and effective pathways to deliver colistin is undoubtedly a top priority for the reintroduction of this drug.

INHALATION THERAPY: MESH NEBULISERS

Inhalation therapy has mainly been associated with the treatment of respiratory diseases. Metered dose inhalers, dry powder inhalers and nebulisers are among the most commonly used devices to treat diseases that affect the respiratory system. Invented in the early 1990s, mesh nebulisers have gradually attracted pharmaceutical companies to evaluate the delivery of inhalation drugs. They are a type of nebuliser that has been praised for providing a better performance while improving conditions of usage.[8,9]

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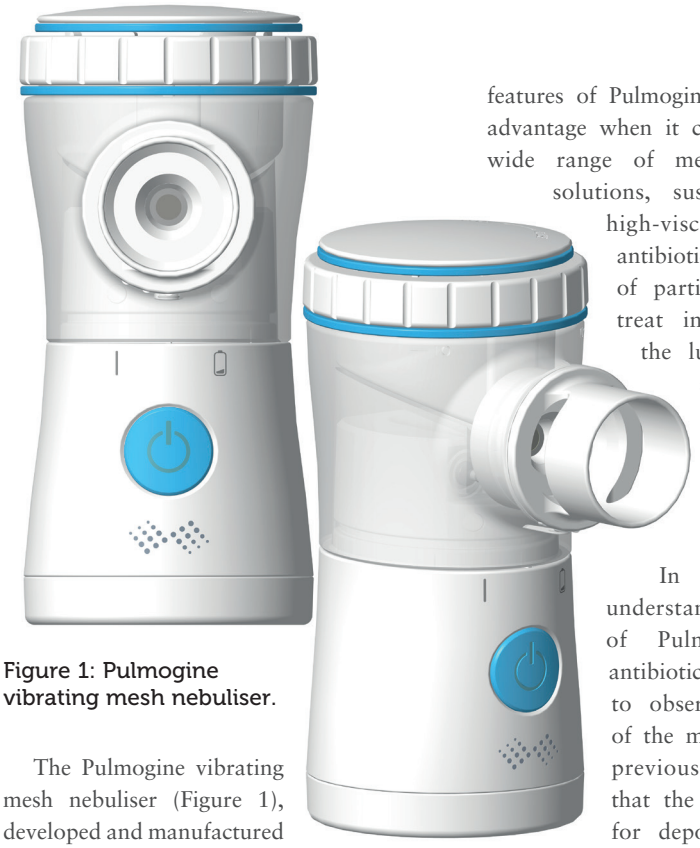

Figure 1: Pulmogine vibrating mesh nebuliser.

The Pulmogine vibrating mesh nebuliser (Figure 1), developed and manufactured by HCmed Innovations, aims to improve the efficiency of drug delivery. Pulmogine has been designed based on a customisable platform intended to improve diverse parameters. The tailoring features of Pulmogine provide it with an advantage when it comes to delivering a wide range of medications, including solutions, suspensions, biologics, high-viscosity drugs and antibiotics – the last one being of particular importance to treat infectious diseases in the lungs and under the scope of the study in this article.

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DELIVERING ANTIBIOTICS

In order to further understand the capabilities of Pulmogine to deliver antibiotics, colistin was used to observe the performance of the mesh nebuliser. It had previously been reported that the optimal particle size for deposition in the lungs is between 1 and 5 µm.[10] Different concentrations of colistin were aerosolised during the study to identify any meaningful variabilities. Nonetheless, it is relevant to point out that appropriate prescriptions are indispensable to effective treatment and also to avoid major side effects.

Throughout the series of tests, standard indicators were measured to examine aerosol characteristics. The conducted tests demonstrated that mass median diameter (MMD) remained between 3.578 and 3.996 µm even after quadrupling the initial concentration, while the fine particle fraction (FPF) remained above 58% at all times.

Moreover, the output rate was also seen to stay high, although there was a more considerable decrease when the concentration of colistin was increased. The summary of the mean values obtained from the tests performed with three devices is displayed in Table 1.

Colistin Conc. (mg/mL)	MMD (µm)	FPF (%)	Output Rate (mg/min)
16.7	3.578	63.85	0.493
33.4	3.647	63.39	0.407
50.1	3.755	61.39	0.347
66.8	3.996	58.82	0.280

Table 1: Mean Pulmogine performance values when aerosolising different colistin concentrations.

CONCLUSION

Given recent concerns caused by antibiotic resistance, the administration of some old antibiotics has become a valuable response to fight infections. When it comes to respiratory infections, inhalation therapy can be used as a primary pathway of treatment by using new technologies that are able to increase the efficiency of drug delivery. The platform offered by Pulmogine is a clear example of advancements.

ABOUT THE COMPANY

HCmed Innovations was founded in 2014 and completed the development of its first-generation portable mesh nebulisers in less than five years. Since 2017, its medical device has successfully received regulatory approvals in Europe, Taiwan, Brazil and Indonesia. Currently, HCmed also collaborates with one of the world's top pharma companies in Brazil. In the future, HCmed plans to build up its manufacturing facility in Wuxi, China, to co-operatively expand into China's large healthcare market.

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