Cochrane Database of Systematic Reviews - - Cochrane Review

Nebuliser systems for drug delivery in cystic fibrosis

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Study design (if review, criteria of inclusion for studies)

Randomised controlled trials or quasi-randomised controlled trials comparing nebuliser systems including conventional nebulisers, vibrating mesh technology systems, adaptive aerosol delivery systems and ultrasonic nebuliser systems.

List of included studies (33)

Byrne 2003; Clavel 2007; Devadason 1997; Devadason 2001; Dodd 2002; Eisenberg 1997; Elkins 2006; Fiel 1995; Geller 1998; Geller 2003; Griese 2009; Hubert 2009; Kastelik 2002; Köhler 2003; Lenney 2011; Marshall 1994; Newman 1988; Shah 1997; Thomas 1991; Westerman 2008

Participants

CF patients enrolled during a period of stability or during a pulmonary exacerbation

Interventions

nebuliser devices for delivering tobramycin, nebuliser devices for colistin, nebuliser devices for dornase alpha, nebuliser devices for hypertonic saline, nebuliser devices for other aerosolised medications. Conventional systems will be considered a compressor combined with a jet nebuliser, including open vent jet systems and breath assisted open vent systems. Systems for comparison will be: AAD incorporating membrane technology device, membrane system, ultrasonic nebuliser

Outcome measures

Primary outcomes: treatment time (for single nebulised treatment), QoL, deposition (measured by radio labelling or by serum levels of the studied medication)

Main results

The search identified 216 studies with 33 of these (2270 participants) included in the review. These studies compared the delivery of tobramycin, colistin, dornase alfa, hypertonic saline and other solutions through the different nebuliser systems in children and adults with CF. This review demonstrates variability in the delivery of medication depending on the nebuliser system used. The certainty of the evidence ranged from low to very low. Some conventional nebuliser systems providing higher flows, higher respirable fractions, and smaller particles decrease treatment time, increase deposition (the amount of drug reaching the lung), and may be preferred by people with CF, as compared to other conventional nebuliser systems providing lower flows, lower respirable fractions and larger particles. Newer nebuliser systems using AAD, or VMT (or both) reduce treatment time compared to conventional systems. Deposition (as a percentage of priming dose) with AAD is greater than with conventional systems. VMT systems may give greater deposition than conventional systems when measuring sputum levels. The available data indicate that these newer systems are safe when used with an appropriate priming dose, which may be different to the priming dose used for conventional systems. There is an indication that adherence is maintained or improved and that individuals prefer AAD or VMT systems, but also that some nebuliser systems using VMT may be subject to increased system failures. There is limited, unclear evidence on the impact of different nebuliser systems on lung function and a lack of data on the impact of different nebuliser systems on our outcomes of quality of life (QoL), adverse effects, respiratory exacerbations and related implications, adherence, satisfaction, cost and device reliability.

Authors' conclusions

Newer technologies e.g. AAD and VMT have advantages over conventional systems in terms of treatment time, deposition as a percentage of priming dose, preference and adherence. Data are lacking for all varieties of medications which are used in CF care, including different inhaled antibiotics or hypertonic saline, with all delivery (nebuliser system) possibilities. Longâ€•term RCTs are needed to evaluate different nebuliser systems to determine patientâ€•focused outcomes (such as QoL and burden of care), safe and effective dosing levels of a wide variety of medications, clinical outcomes (such as hospitalisations and need for antibiotics), and an economic evaluation of their use. There are insufficient data to establish whether one nebuliser system is better than another overall. Clinicians should be aware of the variability in the performance of different nebuliser systems, compatibility with specific nebulised medication, and they must work with their patients to choose the best nebuliser system for each individual. This is likely to be an ongoing process as the needs and circumstances of each individual change over time.

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See also

Stanford G, Morrison L, Brown C. Nebuliser systems for drug delivery in cystic fibrosis. Cochrane Database of Systematic Reviews 2023, Issue 11. Art. No.: CD007639. DOI: 10.1002/14651858.CD007639.pub3. Accessed 16 December 2023.

Keywords

Inhalation OR nebulised; non pharmacological intervention - devices OR physiotherapy; nebuliser; Tobramycin; Aminoglycosides; Colistin; Other anti-bacterial agents; Hypertonic Solutions; Respiratory System Agents; Deoxyribonuclease; Airway clearance drugs -expectorants- mucolytic- mucociliary-; pharmacological_intervention; Anti-Bacterial Agents; Dornase alpha; Pulmozyme;