Using nanoparticles to detect emphysema

Aaltonen, H Laura; Jakobsson, Jonas; Diaz, Sandra; Piitulainen, Eeva; Löndahl, Jakob; Wollmer, Per

2015

Document Version:
Publisher's PDF, also known as Version of record

Link to publication

Citation for published version (APA):

General rights
Unless other specific re-use rights are stated the following general rights apply:
Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.
- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

Read more about Creative commons licenses: https://creativecommons.org/licenses/

Take down policy
If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.
Using nanoparticles to detect emphysema
Hanni Laura Aaltonen¹, Jonas Jakobsson², Sandra Diaz¹, Eeva Piitulainen³, Jakob Löndahl², Per Wollmer¹
¹Department of Translational Medicine, Lund University, Malmö, Sweden; ²Division of Ergonomics and Aerosol Technology, Lund Technical University, Lund, Sweden; ³Department of Respiratory Medicine, Malmö University Hospital, Malmö, Sweden

Introduction: Spirometry, the standard method to diagnose COPD, has poor sensitivity for early emphysema. This may delay diagnosis and lead to a poorer prognosis. Nanoparticles are deposited in the lungs by diffusion only, which makes their deposition depend on time and diffusion distance in distal airspaces. Aim: To determine whether emphysema can be identified and graded according to nanoparticle deposition after a single inhalation. Emphysema patients are expected to have reduced deposition relative to controls, due to a larger diffusion distance in enlarged distal airspaces. Further, we expect a correlation between disease severity and nanoparticle deposition. Methods: 22 patients with COPD and 15 normal subjects underwent Airspace Dimension Test (ADT) and spirometry after bronchodilation. ADT is performed as a single, maximal inhalation of nanoaerosol. Particle concentration is measured in the inhaled aerosol and an alveolar sample exhaled after a standardised breath-hold. The difference in particle concentration reflects deposition. CT was performed in the patient group. The images were reconstructed and processed with syngo.via Pulmo3D software to perform CT densitometric analysis. Low attenuation regions were quantified as the 15th percentile point (PD15). Results: All COPD patients fulfilled the GOLD criteria, while all healthy subjects had normal spirometry. There was highly significant difference in deposition of nanoparticles between the two groups (p<0.0001). In the patients, we found a significant correlation between the deposition of nanoparticles and PD15 (r=-0.64, p<0.01). Conclusion: The ADT can identify emphysema in patients with COPD. The results show a correlation to the extent of emphysema as measured by CT densitometry.