Exhaled Endogenous Particles Contain Lung Proteins

Bob Barrett: This is the podcast from *'Clinical Chemistry'*. I'm Bob Barrett. Everyday our respiratory system is exposed to various air pollutants, allergens, pathogens, and microbes that may cause airway inflammation. The respiratory tract lining fluid serves as a protective interface between the external environment and epithelial cells.

The main component of this fluid is a lung surfactant, which consists of phospholipids and proteins. Alterations in the composition of respiratory tract lining fluid may reflect inflammatory changes in the airways. Changes in the protein composition can reveal stress to the respiratory tract.

The biological changes caused by airway inflammation are difficult to monitor without invasive methods such as Bronchoalveolar lavage or induced sputum, neither of which cannot be applied to large population studies.

In the February 2012 issue of *'Clinical Chemistry'* Anna Bredberg, a researcher from the Department of Occupational and Environmental Medicine at the University of Gothenburg in Sweden and her colleagues developed a noninvasive technique for collecting non-volatile material from the respiratory system where individuals exhale into a sampling device that collects endogenous particles in the exhaled air for subsequent chemical analysis.

Anna Bredberg joins us in this podcast to discuss this new technique. Ms. Bredberg you have been using a new noninvasive method, the PEx method for collection and subsequent analysis of proteins in exhaled particles, please tell us the basics of this method.

Anna Bredberg: PEx is an acronym for particles in exhaled air. And the participant sits comfortably and exhales into our sampling device, and the particles in the exhalation are collected on a silicon plate or a filter inside the device. And the filter or silicon plate can then be extracted and analyzed with method of choice.

Bob Barrett: And how does this differ from previous noninvasive methods?

Anna Bredberg: Well, for example, Exhaled Breath Condensate is the method where the breath is condensed into a solution, and in this solution some particles are tracked. But with the PEx method it's developed to collect the particles by infection, which is a more efficient method for particle collection.

Bob Barrett: Where and how are these particles formed?

Anna Bredberg: Some particles are formed when you breathe normally, but if you breathe with airway closure, more particles are formed. This we now as we count the particles during sampling.

We believe that when you exhale fully the small airways close and the respiratory tract lining fluid forms a film. And this film ruptures and forms particles with the next inhalation. These particles then follow the next exhalation and can therefore be sampled in our device.

Bob Barrett: And how do you know that the particles are endogenous and not from just the ambient air?

Anna Bredberg: Because the study participants wear a nose clip and they breathe through a particle filter to wash out the ambient air prior to sampling, and we have also collected and analyzed ambient air, and we did not find any interesting lung protein.

Bob Barrett: How many proteins do you identify?

Anna Bredberg: In total we identified 124 proteins in this study. And some of the more interesting were surfactant protein A, B, and C and Clara cell protein, and these proteins are typical of alveolar type II and Clara cells and this supports our hypothesis that takes ir forms in the distill airways.

We also identified the complement factor B and C, which have been reported to play a role in allergic airway inflammation, which we find interesting and we compared our list of proteins with two previously published papers and found that 83% of our proteins have been identified in bronchoalveolar lavage.

Bob Barrett: And how much breath do you need to identify all these proteins?

Anna Bredberg: In this study we used two samples, as our main focus was to identify as many proteins as possible, so in the first test there were six participants and we sampled in total 3000 liters of exhaled air.

Then we repeated the test with ten participants and 4400 liters of air. So this is a very time-consuming procedure.

Bob Barrett: Then how will you use this method to detect disease on an individual level if you need to breathe for thousands of liters?

Anna Bredberg: This was a process to see if the method is suitable for sampling of proteins. Now we know that it works, so our

next step is to sample pooled samples some different groups of patients and then compare the protein content in these groups.

(00:04:59)

When we know which proteins that are up or down regulated in different diseases then we can go for individual analysis, when we know what to look for, but then we will use ELISA, which needs a lot less material.

Bob Barrett: So do you think this method will work for say, ten minutes of breathing from a single individual?

Anna Bredberg: Yes, we have already used this method on an individual level. So XPA and albumin detection and this was with the ELISA technique.

Bob Barrett: Okay. So finally, what do you think will be the clinical relevance of this method?

Anna Bredberg: We believe that this is a very promising tool for the detection of early disease in the distal airways.

Bob Barrett: Anna Bredberg is a researcher from the Department of Occupational and Environmental Medicine at the University of Gothenburg in Sweden, and has been our guest in this podcast from *'Clinical Chemistry'*.

I'm Bob Barrett. Thanks for listening!

Total Duration: 6 Minutes