

Peripheral airway function assessed by inert gas washout and impulse oscillometry

Akademisk avhandling

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Avhandlingen baseras på följande delarbeten

- I. Kjellberg S. Houltz B.K. Zetterström O. Robinson P.D. Gustafsson P. Clinical characteristics in adult asthma associated with small airway dysfunction. *Respiratory Medicine* 2016; 117: 92-102.
- II. Kjellberg S. Viklund E. Robinson P.D. Zetterström O. Olin A.C. Gustafsson P. Utility of single versus multiple breath washout in adult asthma. *Clinical Physiology and Functional Imaging* 2018 Jan 24. doi: 10.1111/cpf.12503
- III. Kjellberg S. Olin A-C. Schiöler L. Robinson P.D. Detailed characterization and impact of small airway dysfunction in school-age asthma. *Submitted*.
- IV. Kjellberg S. Holm A. Berguerand N. Sandén H. Schiöler L. Fagevik Olsen M. Olin A-C. Impaired function in the lung periphery following COVID-19 is associated with remaining respiratory symptoms. *Submitted*.

**SAHLGRENKA AKADEMIN
INSTITUTIONEN FÖR MEDICIN**



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Abstract

Small (peripheral) airways play a key role in asthma. Despite this is lung function tests for assessing small airway function not included in the routine asthma management. Undetected small airway dysfunction (SAD) may partly explain why uncontrolled asthma is frequently reported among both children and adults with asthma.

Respiratory symptoms are common after COVID-19, but the underlying pathophysiology is still unclear, and SAD can potentially be a partial explanation. The overall aim was to study the presence and extent of SAD in school age and adult asthma, as well as in individuals with a previous COVID-19 infection. We also aimed to study the relation between SAD and clinical symptoms in these patient groups.

One school age asthma, one adult asthma and one COVID-19 cohort were studied. SAD was assessed using inert gas washout (IGW) tests including “single breath washout; SBW” and “multiple breath washout; MBW”, as well as impulse oscillometry (IOS). In addition, all participants performed spirometry and different clinical characteristics of asthma were assessed. Cohorts of healthy controls were also included to derive reference values for IGW and IOS outcomes in children and adults, respectively.

We found that SAD was a prevalent finding in both school age and adult asthma as well as in COVID-19 cases. The presence and extent of SAD varied across reported outcomes and between the studied cohorts. In adults with asthma was SAD associated with a combination of three predictors: abnormal spirometry (FEV_1), blood-eosinophil count $> 4\%$ and having a smoking history. In school age asthma was MBW derived S_{cond} superior to other MBW and IOS derived indices in detecting SAD associated with clinical characteristics. In COVID-19 cases was MBW derived S_{acin} increased compared to non-COVID-19 cases, and even higher in those with remaining dyspnea.

In conclusion, SAD was a prevalent finding in the studied cohorts and MBW and IOS provide complementary information. Optimally, both methods should be used in the lung function laboratory when assessing SAD in individuals with asthma. There also seems to be a potential for MBW test in the assessment of lung function in individuals with a prior COVID-19 infection.

Keywords: multiple breath washout, single breath washout, asthma, SARS-CoV-2, COVID-19