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| **Bronchoscopic polarisation-sensitive optical coherence tomography for airway smooth muscle remodelling** |
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| **Introduction/Aim:** Airway smooth muscle (ASM) remodelling is a deleterious component of obstructive disease, particularly asthma. We have developed bronchoscopic-guided polarisation-sensitive optical coherence tomography (PS-OCT) for quantification of ASM, that in the future can be used to identify structural phenotypes and inform asthma management. After thorough validation we report our first measurements in human subjects *in vivo* and demonstrate a protocol for detection of ASM remodelling, defined as having a measured thickness above the upper limit of normal.**Methods:** Patients undergoing a clinically indicated bronchoscopy at Sir Charles Gairdner Hospital were recruited for PS-OCT imaging of the lungs. PS-OCT uses polarised infrared laser light delivered to the airway wall via a rotating (20Hz) and translating (1mm/s, 10mm sections) probe.**Results:** To date, 98 airways from 13 subjects have been scanned, including a patient undergoing bronchial thermoplasty. There have been no adverse events associated with the PS-OCT procedure. The scanning process was completed within ~10 minutes and allowed quantification of small and large airways distributed over four generations, equivalent to over 500 biopsies per patient, but without injury to the lumen surface. Image resolution (11µm) and ASM contrast were high. Mechanical noise (breathing, heartbeat) was controlled for by an automated algorithm that detected and excluded motion artefact. Thickness of ASM was variable between and within subjects. Several patients were classified as having at least one airway with remodelling; two standard deviations above the mean of a non-asthmatic population reported in histological studies.**Conclusion:** Bronchoscopic-guided PS-OCT provides widespread quantification of ASM thickness which can be used to guide therapy and test therapeutics that target ASM remodelling.**GrantSupport:** This work was supported by the National Australian Health and Medical Research Council (PBN, NHMRC Grant number APP1180854). Further support provided by Sir Charles Gairdner and Osborne Park Health Care Group Research Advisory Committee Project Grants (MRGP22-23\_18) and the Charlies Foundation for Research (SGP21-22\_30). Biobank Interim Support Program 2021. Western Australian Future Health Research and Innovation Fund. BC acknowledges funding through the Brain Pool Program from the National Research Foundation of Korea funded by the Ministry of Science and ICT (2022H1D3A2A0109644511). KK acknowledges funding support from the Polish Returns program funded by the Polish National Agency for Academic Exchange (PPN/PPO/2018/1/00082/U/00001/01). QL acknowledges the financial support of the Australian Government International Research Training Program RTP Fee Offset Scholarships. MJH is supported by UWA Postgraduate Award and Ad Hoc Top Up Scholarship, and a Scholarship for International Research Fees.**Key words:**Airway smooth muscle, asthma, optical coherence tomography**Conflict of interest**R.A.M. is a co-founder and director of Miniprobes Pty Ltd., a company that develops novel optical imaging systems. Miniprobes Pty Ltd. did not contribute to this study.The other authors declare no conflict of interest. |