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Volatile organic compound breath testing detects *in-situ* squamous cell carcinoma of bronchial and laryngeal regions and shows distinct profiles of each tumour

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Abstract

Volatile organic compound (VOC) breath testing of lung and head and neck squamous cell carcinoma (SCC) has been widely studied, however little is known regarding VOC profiles of *in-situ* SCC. A prospective study of VOC in patients with histologically proven SCC, either *in-situ* or advanced, and controls. Breath samples were analysed using the E-nose Cyranose ®320 and by gas chromatography/mass spectroscopy. Predictive models were developed using bootstrap forest using all 32 sensors. Data from 55 participants was analysed: 42 SCC cases comprising 20 bronchial (10 *in-situ*, 10 advanced) and 22 laryngeal (12 *in-situ*, 10 advanced), and 13 controls. There were 32 (76%) male SCC cases with mean age 63.6 (SD = 9.5) compared with 11 (85%) male controls with mean age 61.9 (SD = 10.1). Predictive models for *in situ* cases had good sensitivity and specificity compared to controls (overall, 95% and 69%; laryngeal, 100% and 85%; bronchial, 77% and 80%). When distinguishing *in-situ* and advanced tumours, sensitivity and specificity 82% and 75% respectively. For different tumour types (bronchial versus advanced laryngeal) sensitivity and specificity were 100% and 80% respectively. VOCs isolated from *in-situ* cancers included some previously demonstrated in advanced cancers and some novel VOCs. *In-situ* bronchial and laryngeal cancer can be detected by VOC analysis. Distinction from normal controls and between the two tumour types could allow screening in high risk groups for these curable lesions.

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