Rapid Breath Analysis for Lung Cancer Detection using an Automated Micro Portable Gas Chromatography Device

Objective: Breath analysis examining specific patterns of volatile organic compounds (VOCs) has been demonstrated to be able to discriminate lung cancer (LC) patients from healthy controls (HC). However, the existing technology uses complex, expensive, and low throughput analytical platforms to give an offline response, thus preventing its applicability for mass screening. The reliability of a new portable device to enable rapid, on-site LC diagnosis is tested.
Methods: The breath of patients with histologically proven LC and HC (negative chest X-rays) was sampled into Tedlar bags through a Nafion filter and a one-way mouthpiece. The breath samples in the bags were then analyzed by an automated micro portable gas chromatography (GC) device developed in-house, which consisted of a thermal desorption tube, thermal injector, separation column, and photoionization detector, as well as other accessories such as pumps, valves, and a helium cartridge. The chromatograms were analyzed by chemometrics, machine learning, principal component analysis and linear discriminating analysis.
Results: 25 LC patients and 25 HC well matched for age, sex, smoking habit and comorbidities, entered the study. After a training set (20 LC and 20 HC), and a testing set (5 LC and 5 HC), an overall specificity of 96.0%, a sensitivity of 88.0% and an accuracy of 95.7% to identify LC patients were found based on four VOCs (Figure 1).
Conclusions: These preliminary results represent a step forward to develop a simple, inexpensive, easy-to-access, and easy-to-use tool for rapid and on-site mass screening of LC.

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