Chemical signature of colorectal cancer: case-control study for profiling the breath print

University “Aldo Moro” of Bari

Background:
Effective screening for colorectal cancer can reduce mortality by early detection of tumours and colonic polyps. An altered pattern of volatile organic compounds (VOCs) in exhaled breath has been proposed as a potential non-invasive diagnostic tool for detection of cancer. The aim of this study was to evaluate the reliability of breath-testing for colorectal cancer screening and early diagnosis using an advanced breath sampler.

Methods:
Exhaled breath of patients with colorectal cancer and non-cancer controls with negative colonoscopy was collected using the ReCIVA® Breath Sampler. This portable device is able to capture the alveolar breath fraction without environmental contamination. VOCs were desorbed thermally and analysed by gas chromatography–mass spectrometry. The discriminatory ability of VOCs in detecting colorectal cancer was evaluated by receiver operating characteristic (ROC) curve analysis for each VOC, followed by cross-validation by the leave-one-out method, and by applying stepwise logistic regression analysis.

Results:
The study included 83 patients with colorectal cancer and 90 non-cancer controls. Fourteen VOCs were found to have significant discriminatory ability in detecting patients with colorectal cancer. The model with the diagnosis of cancer versus no cancer resulted in a statistically significant likelihood of discrimination of 173.45 (P < 0.001), with an area under the ROC curve of 0.979. Cross-validation of the model resulted in a true predictive value for colorectal cancer of 93 per cent overall. Reliability of the breath analysis was maintained irrespectively of cancer stage.

Conclusion:
This study demonstrated that analysis of exhaled VOCs can discriminate colorectal cancer patients from non-cancer subjects. This finding may eventually lead to the creation of a smart online sensory device, capable of providing a binary answer (cancer/no cancer) and directing to further screening.