

APPENDIX. CONFERENCE DISCUSSION

Dr C. Pompili (Leeds, UK): Dr. Rocco, are you planning to use this technology for the follow-up of cancer patients and are you hoping to obtain the same sensitivity and specificity rate?

Dr Rocco: We have not yet evaluated patients from a post-surgical point of view. However, it is definitely a thought that we have for the future. We could also somehow establish an incontrovertible nexus maybe between PET scans integrated with the e-nose. That could be another issue to look at in the future.

Dr S. Grondin (Calgary, AB, Canada): Your excellent presentation embodies what the young investigator’s novel thinking should be. In Calgary we have been working with a canine model with a similar type of idea, but I like the idea of using your technology that is going to be coming out. Can you tell me, is there any information on the canine model sensitivity versus your instrument as to what might be more sensitive?

Dr Rocco: With regard to the literature, we did analyse a little bit the outcomes from the canine technology, and we found that the results were not as encouraging as in our e-nose model. Of course the numbers, even in that technology, were not very large; in fact they are not big numbers, but in terms of sensitivity and specificity we have had better results so far.

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EDITORIAL COMMENT

The needle in a haystack

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Lung cancer (LC) continues to be the number one cause of cancer-related deaths worldwide with an annual death toll of 376 000 in Europe [1]. Patient prognosis largely depends on tumour diagnosis at an early stage. Unfortunately, LC rarely produces symptoms at this state and escapes routine patient evaluation. Therefore, there is an urgent need for practicable and reliable screening examinations for LC. Until today, no suitable tumour markers have been identified in patient blood samples. Screening programmes applying low dose chest computer tomography (LDCT) have been shown to be able to detect LC at a very early stage in a selected risk population, but the very low specificity of computed tomography findings of less than 4% makes them unsuitable for widespread patient screening due to their high false-positive rates [2]. To overcome this limitation, the combination of multiple screening tests with complementary sensitivities and specificities is a promising strategy. The ongoing debate on suitable screening strategies for LC documents that thoracic surgeons have to be involved in identifying a reliable and suitable approach for our patients. In the present issue of the European Journal of Cardio-Thoracic Surgery, Rocco et al. [3] report the results of an LDCT screening programme and the additional clinical use of a new device for breath analysis with a specificity of 95% helping to reduce LDCT false-positive rates. While breath analysis is an established scientific field in different medical specialist areas such as occupational medicine, it is an unknown territory for most surgeons. Some main issues need to be highlighted.

In 1971, Pauling et al. [4] from the Department of Chemistry at Stanford University published their approach to analyse body composition and function by quantitative analysis of breath samples. In the last four decades, more than 3500 volatile organic compounds (VOCs) have been described in the human breath—most of them in picomolar concentrations (10^{-12} mol/l or particles per trillion). It has been hypothesized that tumours produce VOCs and breath analysis therefore might be a very sensitive and at the same time non-invasive method to screen for or diagnose cancer. In particular, this is interesting for LC due to its site of origin, prevalence in the industrialized societies and unfavourable prognosis. However, the metabolic origin of tumour-associated VOCs remains speculative.

Since 1982, research was conducted to develop sensor arrays and pattern recognition technologies, commonly referred to as ‘electronic noses’ that could detect and recognize odours and flavours [5]. Over the last three decades, ‘electronic sensing’ or ‘e-sensing’ technologies have undergone important developments and are now used to fulfil industrial needs. However, their applicability in a clinical setting has numerous limitations: (i) patients are required not to smoke and (ii) to fast before breath samples can be taken, (iii) an optimized sample collection is necessary (air humidity, room temperature, background odours), (iv) instruments are very sensitive, (v) high risks of signal interference. A word of caution is that the findings of four identical electronic noses that were operated by three established scientific groups to analyse the breath in the very same three individuals were incomparable [6].

Thus, despite a large body of experimental work, no LC-specific VOCs or VOC patterns have been identified to date. This is probably
because their concentration is below the detection threshold of the currently available technologies. And at the same time, there are thousands of potential compounds that have to be evaluated to find the ‘needle in a haystack’. But there is irrefutable evidence that the breath of patients with LC differs from healthy controls [7]. Therefore, the quest for an LC-specific VOC will continue with advancing analytical tools. And the surgical community is invited to participate.

REFERENCES


