Dogs Sniffing Urine: A Future Diagnostic Tool or a Way to Identify New Prostate Cancer Markers?

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There is a need to develop screening methods for early detection of cancer of all kinds. Although mammography and prostate-specific antigen (PSA) screening have been described as reducing mortality rates in breast and prostate cancer (PCa) [1,2], we need more specific and sensitive methods for cancer diagnostics. The low specificity of the PSA test in PCa detection has been a subject of discussion over the last decade [3].

Volatile organic compounds (VOCs) are chemical compounds (mainly the products of cell catabolism) found as gases in human breath but also detected in urine. Basic research studies have shown that changes in malignant cells during tumor progression lead to peroxidation of cell membrane components and subsequent release of VOCs [4].

Different methods have been developed to analyze VOCs. In 2007, Belda-Iniesta and collaborators reviewed the literature regarding studies comparing lung cancer patients with healthy controls and concluded that promising results were obtained [5]. Recent reports point in the same direction [6].

The idea of using dogs for cancer-screening purposes by sniffing VOCs in exhaled breath or urine is excellent; however, only a few studies are published on this topic. In 1989, a case of malignant melanoma was detected by a dog sniffing his owner's leg [7]. Later studies have shown that trained dogs were able to detect bladder, lung, or breast cancer by sniffing urine [8], but failures were reported in PCa patients [9].

In this issue of European Urology, Cornu et al. [10] report the first successful results using a dog in PCa detection. A Belgian Malinois shepherd was trained by a professional and dedicated team over 24 mo including a learning phase and a training period. The dog was trained to recognize in a double-blind fashion whether urine samples were from men with PCa or from healthy controls.

Urine samples from 42 men (26 cancers and 16 controls) were used in the training phase, after which the authors tested the dog’s ability to detect cancer in urine samples from 66 men, 33 with cancer and 33 controls. There was no major difference between the groups in terms of age (64.1 yr and 63.2 yr, respectively) or serum PSA (11.7 ng/ml for the cancer group and 8.3 ng/ml for the control group). The predominant Gleason scores were ≤6 (n = 16) and 7 (n = 14).

In each experiment, the dog had to identify the urine sample from one PCa patient among five samples from healthy controls. The results were much better than expected, with both specificity and sensitivity of 91%. The dog successfully recognized the PCa sample in 30 of 33 cases.

As in all other studies, promising results of this kind need to be externally validated and confirmed using an independent sample set. The current study, however, generates many hypotheses. One of the key questions is how to identify the specific components that give rise to the characteristic odor in urine from patients with PCa. What is the nature of these compounds? Can they be identified using mass spectroscopy or other advanced technologies? It is tempting to speculate that the findings presented in this study by Cornu et al are closely related to metabolomics rather than to specific RNA markers like PCA3 and the TMPRSS2:ERG fusion gene. It will certainly stimulate scientists in their search for new diagnostic urine markers in PCa.

Using dogs in PCa detection may be a too complicated a procedure to implement compared with mass spectroscopy or other kinds of assays in a laboratory setting, thus the use of dogs might be less likely in the future.
The present study by Cornu and collaborators may become a landmark paper, but this is still an open question until their promising results have been confirmed in an independent study.

Is “odoromics” perhaps our next “omics”?

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References