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Review Article

An Oncolfaction Molecule? Canine Olfaction for Oncology Screening and Diagnosis?

Louis ZG Touyz*

McGill University School of Dental Health and Associated Sciences, Montreal, PQ, Canada

***Corresponding Author:** Louis ZG Touyz, McGill University School of Dental Health and Associated Sciences, Montreal, PQ, Canada.

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Abstract

Body malodors derives mainly from the mouth and other corporeal organs and products. Oral malodor (OM) may originate from non-oral causes. Different pathological conditions impart specific characteristics to body smells, and specific molecules may indicate original tissues of derivation. Costly volatile gas analytic chemistry technology allows for accurate detection of specific molecules. To avoid time delay, accelerate diagnosis and reduce cost, simpler methods are sought to facilitate use of odors as a clinical diagnostic tool. Animals have a higher sensitivity to smells; specifically, dogs detect ultra-diluted smells and some claim dogs can smell odors originating from cancers. Trained dogs seem to detect something emanating from certain cancers, but canines cannot always locate the exact source, and dog's canine olfactory skills remain a cumbersome if not undependable, clinical method for trustworthy diagnoses.

Keywords: *Cancer; Diagnosis; Dogs; Olfaction Smell*

Introduction

Oral malodor is among the most common ubiquitous symptom of which patients complain, and has both oral and non-oral causes. The non-oral etiologies maybe physiological like dehydration, menstruation, dietary, constipation and others, or pathological, such as from kidney disease uremia, from pancreatic ketosis in diabetes mellitus, and many others like gastritis, anorexia/bulimia, xerostomia, or even from the musty odor from hepatitis [1]. This has led to the notion that with a metabolic and/or cellular oncological change somewhere in the body, a specific cancer metabolic and/or catabolic metabolite unique oncology marker-molecule is released in minute quantities, and will exude from the body [2,3]. The assumption is made that metabolic changes and cancer in the body gives off specific smells from metabolism, which could be identified with a detector sensitive enough to distinguish the putative molecules. Since humans can only perceive smells in parts per billion (ppb), which does not reach required thresholds of detection for these molecules, other methods have been sought to try detect oncology emanations through smell. Accordingly, because dogs are renown for having an acutely evolved sense of smell [4,5], training dogs were suggested and used for research in clinical diagnosis [6-9].

Aim of the Study

This article appraises common body odors, and the use of canine olfaction as a method for screening to aid and facilitate diagnosing cancer.

Skills and technology available: Most clinicians have a well developed olfactory sense which acts as a chemical detector [2]. Subjective organoleptic identification of smelly molecules is unreliable as chemical compositions vary. Modern theory accepts both mechanical and electron vibratory theories of smell [2,11-13]. For objective accurate identification of contributing molecules for smell, analytical chemistry methods are used. These include: Gaseous Chromatography; Atomic Absorption Spectrophotometry; Flame Photometry; Halimeter Volatile Sulfur Compounds Monitor[1] (Accurate numerical parts per billion); Tanita dot Breath-Checker[2] (less accurate); and artificial noses which may use metallo-porphyrin polymers [2,5,14-16]. Bad breath and body odor are usually sensed through smell [16,17] and bodily secretions may also hold metabolic diagnostic clues with smells [18,19]. Humans can smell about 1:12 000 000 concentrations of molecules. By comparison with humans smelling at about 12 X 10^6, dogs and pigs can detect smells more accurately with extremely low concentrations at 10^9 molecules [20]. Some experiments with dogs sniffing human skin areas, people's breath, blood or urine, have positively indicated the existence cancer [8,9,21-26]. The canine olfactory sensitivity is so acute it is used to detect neural changes to act as an aura-warning prior to the onset of seizures [27].

Discussion

Smells may be designated different nomenclature depending on their origin. Fetor-oris stems from oral causes[dental/lingual biofilm]; ozostomia derives from organs above the carina [nose, pharynx, larynx and sinuses], stomatodysodia from organs below the carina [bronchus, bronchioles, lungs, pleura] [1,17]. The main putative molecules for odors are sulfur volatile compounds (VSCs). These include hydrogen sulfide (rotten eggs), cadaverine (decomposing corpse), putrescine (decaying proteins of meat/fish), methyl mercaptan (feces) ovalinic acid (smelly feet), indoles, skatoles, and all breakdown products from the sulfur-containing amino acids lysine and leucine [28]. These are detected organoleptically but more accurately with technology [2,5,11]. Most of these sulfur containing molecules, do not necessarily arise from oncogenic mutated cells, but from Gram-negative bacteria, which microbes can be identified [29]. An unique 'Oncolfaction molecule' [a neologism derived from an oncologic molecule, detected through olfaction, specifically to indicate an oncologic origin) is yet to be defined.

The most reliable diagnosis of cancer is through histopathology of specimens [30]. Yet many authors promote using dogs olfaction to detect, diagnose, or confirm the existence of cancers. Reports claim trained canines positively indicate the presence of cancers in various organs: Lung cancer [31], ovarian cancer [21-23] late stage breast [6,21,24,25] and melanomas [32] have used canine olfaction to detect oncologies; dog olfaction has been used as an adjunct to screening for cancers, like colorectal cancers [33]. Dogs have been used to smell out the presence of parasites such as screw-worms [34]. Some reports claim research trained dogs are more than 95 per cent accurate at finding cancer, with fewer than 40 per cent false positives [9,10,35]. If these data are correct, the figures show a high sensitivity but low specificity with a high positive predictive value.

Still, the 'gold standard' for definitive diagnosis of cancer remains with histopathology of (partial incisional or total excisional) biopsies or specimens [30]. The canine smell test is unresolved at best, an experimental one, and it is a test helpful for screening and possibly to facilitate detection. Once the existence of a cancer is suspected, proper special tests (such as biopsies, or other biochemical markers in blood, urine or other human tissues) are needed.

[1]Halimeter VSC Monitor: 2017. The Halimeter. Accurate numerical parts per billion) Interscan: Halimeter.com. © 2017 Interscan Corporation;4590 Ish Drive #110 • Simi Valley, CA 93063.

[2]Tanita HC-12SF Fitscan Breath Checker; http://www.tanita.com/es/hc212sf/.

Concluding Remarks

To date an 'Oncolfaction molecule' has not been identified. Accordingly canine detection of cancer through a trained dog's heightened ability to smell traces of cancer cell metabolites remains fascinating, suspicious at best, only confirmatory of diagnoses, but highly unreliable.

Authors Statement

The authors have no conflict of interest to declare.

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