AVVISO PUBBLICO, PER TITOLI E COLLOQUIO, PER L'ASSUNZIONE A TEMPO DETERMINATO DI N. 2 RISORSE NEL PROFILO DI COLLABORATORE PROFESSIONALE DI RICERCA, CATEGORIA D, PER LAUREATI IN INFERMIERISTICA (L/SNT/1) DA ASSEGNARE ALLA UOC UROLOGIA DELL'ISTITUTO REGINA ELENA - PROGETTO CODICE (GR)-2021-12373396 - P.I. DR. ALDO BRASSETTI

DOMANDE TECNICHE

1) Quali sono gli strumenti clinici per valutare con la massima accuratezza la funzionalità renale?

2) Quale scala viene più comunemente impiegata per valutare l'entità delle comorbidità del paziente? In cosa consiste? Quali parametri prende in considerazione?

3) Quali sono le complicanze di più comune riscontro in prima giornata post-operatoria dopo nefrectomia parziale? Come può sospettarne l'esistenza l'infermiere?

4) In consa consiste il processo di randomizzazione di un trial clinico? Perché viene eseguito? Quanti metodi di randomizzazione conosci?

Domande estratte: 2 - 3

Capecchi Lorenzo - domanda n. 2
Iuculano Cunga Sabrina - domanda n. 3

DOMANDE INFORMATICA

1) Definizione e utilizzo del programma Microsoft Word

2) Definizione e utilizzo del programma Microsoft Excel

3) Definizione e utilizzo del programma Microsoft Power Point

4) Cos'è un database

Domande estratte: 2 - 3

Capecchi Lorenzo - <u>domanda n. 2</u>
Iuculano Cunga Sabrina - <u>domanda n. 3</u>

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Article

Human Urinary Volatilome Analysis in Renal Cancer by Electronic Nose

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Abstract: Currently, in clinical practice there are still no useful markers available that are able to diagnose renal cancer in the early stages in the context of population screening. This translates into very high costs for healthcare systems around the world. Analysing urine using an electronic nose (EN) provides volatile organic compounds that can be easily used in the diagnosis of urological diseases. Although no convincing results have been published, some previous studies suggest that dogs trained to sniff urine can recognize different types of tumours (bladder, lung, breast cancer) with different success rates. We therefore hypothesized that urinary volatilome profiling may be able to distinguish patients with renal cancer from healthy controls. A total of 252 individuals, 110 renal patients and 142 healthy controls, were enrolled in this pilot monocentric study. For each participant, we collected, stabilized (at 37 °C) and analysed urine samples using a commercially available electronic nose (Cyranose 320®). Principal component (PCA) analyses, discriminant analysis (CDA) and ROC curves were performed to provide a complete statistical analysis of the sensor responses. The best discriminating principal component groups were identified with univariable ANOVA analysis. The study correctly identified 79/110 patients and 127/142 healthy controls, respectively (specificity 89.4%, sensitivity 71.8%, positive predictive value 84.04%, negative predictive value 80.37%). In order to test the study efficacy, the Cross Validated Accuracy was calculated (CVA 81.7%, $p < 0.001$). At ROC analysis, the area under the curve was 0.85. The results suggest that urine volatilome profiling by e-Nose seems a promising, accurate and non-invasive diagnostic tool in discriminating patients from controls. The low costs and ease of execution make this test useful in clinical practice.

Keywords: electronic nose; renal cancer; tumour biomarkers; volatilome; cancer screening

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1. Introduction

Domanda estratta 2

Renal cell carcinoma (RCC) accounts for approximately 3–4% of all new solid malignancies, with a median age at diagnosis in the sixth decade. In the United States, kidney cancer is the sixth and ninth most common cancer for men and women, respectively.

Although mortality is decreasing, worldwide the incidence of RCC has been increasing from 2009 by around a 1% rate each year, due to the widespread use of imaging tests (Ultrasounds, CT or RMI scan) performed in asymptomatic patients for other clinical reasons (stones, hypertension, backache, diabetes, etc.). An estimated of 13,000 deaths from this disease occurred in the United States in 2021 [1]. For patients with RCC localized only in the kidney, the 5-year survival rate is high (approximately 93%), while in subjects with

Domanda estratta 3

cancer that has spread to the surrounding organs and/or regional lymph nodes the rate decreases dramatically to 60–70%. Lastly, in the case of metastatic renal disease, the 5-year survival rate becomes less than 10–14%. Despite recent advances in medical treatment, especially with targeted therapy and immunotherapy, the RCC diagnosis still has a high economic impact on national health systems worldwide [2].

Within this perspective arises the need to develop new approaches for the early diagnosis of kidney cancer using, above all, non-invasive biomarkers. Based on the recent literature, urinary Volatile Organic Compounds (VOCs) analysis has emerged as a promising field of application with the potential to develop new biomarkers for early cancer diagnosis.

In humans, VOCs are easily found in biological samples of urine, blood, breath, faeces, skin and tissue, but among of all these possible biological samples urine has the advantage of being economic to collect and simple to handle. We know that several metabolic and inflammatory pathways in the body are capable of releasing thousands of volatile organic compounds in the urine. Numerous studies have shown more than 100 urinary VOCs in the urine, mainly ketones from protein degradation. Surprisingly, some changes in the composition of urinary VOCs are associated with the presence of pathological clinical conditions such as tumours, foreign bodies and infections. For this specific reason, we can consider urinary VOCs as alternative biomarkers. Currently, however, there is still no strong evidence of a specific molecular model for renal cancer [3].

In the literature, several studies have reported that dogs trained to smell urine (called sniffer-trained dogs) are able, with various success rates, to identify different types of human neoplasms (melanoma, prostate, breast, lung and bladder cancer), but significant results have not yet been stated [4,5]. In particular, it has been reported that post specific olfactory training, dogs obtain the capacity to identify some urological tumours by smelling urine, with encouraging outcomes. Unfortunately, the difficulty of this approach lies in the poor reliability and large-scale reproducibility of these results and in the problematic employment of the dogs' olfaction in health care settings.

To overcome these critical aspects, specific advanced technologies have been tested—especially a gas sensors array, also called Electronic Nose (EN or e-Nose). This device, being able to reproduce a dog's sense of smell for the identification of volatile compounds in human biological fluids, could represent a promising diagnostic tool for several medical conditions [6]. The e-Nose can be described as a complex technological device consisting of several thin-film nanocomposite sensors that produce various chemical interactions, in *primis* reversible electron transfer reactions, for the correct measurement of gases, acids, bases and many other compounds. However, its operation is relatively simple: when the tool is exposed to a sample, it provides a unique smell-print which, through a specific pattern recognition system, can be analysed in order to identify its origin and nature [7].

With this prospect, the e-Nose proves to be a particularly suitable tool for the quantitative and qualitative analysis of complex gaseous molecular blends [8].

For a long time, indeed, this type of device has been applied in areas where the intrinsic analytical capacity of the instrument is indispensable: in chemical industries, agricultural and food quality controls, air or environmental pollution, safety, odour monitoring and in some military applications, for example [9–14].

Based on this, different attempts have been carried out to expand this analytical technique to various medical applications; in particular the electronic nose has proved useful in the analysis of breathed air for early cancer diagnosis. [15].

However, in clinical practice, sampling urine appears less problematic because it is easier to obtain and store, while exhaled air usually requires an immediate analysis or specific storage (in Tedlar/Nalphan bags or sorption tubes) and deep technical cooperation on the part of the patient.

To corroborate this thesis, we know that several studies in the metabolic field have analysed urine through gas/liquid chromatography–mass spectrometry techniques. Preliminary data suggest that it is possible to detect some urological malignancies using urine headspace [16]. We can therefore consider the electronic nose as a useful device for VOCs