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A Systematic Review of Tuberculosis Diagnosis Using a Breath Test

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Abstract

Despite concerted efforts over the last two decades to develop new diagnostics, drugs and vaccines, tuberculosis remains a global emergency. Several novel diagnostic technologies, such as nucleic acid-based amplification tests, imaging and volatile organic compound breath analysis, show promise for improved point-of-care rapid tests for tuberculosis. Advances in new and repurposed drugs for use in multidrug-resistant (MDR) or extensively drug-resistant (XDR) tuberculosis have focused on the development of several new drug regimens and their clinical trial evaluation and they now influence World Health Organization guidelines. Since the failure of the MVA85A vaccine two years ago, no new tuberculosis vaccine candidates have entered clinical trials.

Keywords: Tuberculosis • Diagnostics • Drugs • Vaccines • Management

Introduction

Mucormycosis is an angioinvasive fungal infection caused by Mucorales fungi. It is classified as rhinocerebral, pulmonary, cutaneous, gastrointestinal, disseminated, or other based on the clinical presentation, which includes uncommon rare forms such as endocarditis, osteomyelitis, peritonitis, renal and so on. The disease was first described in 1876, when Fürbinger described a patient who died of cancer and had a hemorrhagic infarct with fungal hyphae and a few sporangia in the right lung. Arnold Paltauf described the first case of disseminated mucormycosis, which he called "Mycosis mucorina [1].

Description

From November 2015 to February 2016, we conducted a crosssectional study to detect tuberculosis in an isolated indigenous population (Maskoy ethnic group, totaling 160 adults) in Livio Faria, Department of Alto Paraguay, 650 kilometres from Asunción. The Ethics Committee (CEI) of the Central Public Health Laboratory (LCSP) granted ethical approval (International Certification No. FWA00020088), with code CEILCSP No. 66/40915. All adult community members (>15 years old) were approached by their leader after we first informed her about the study's purpose and objectives. As a result of the community's widespread illiteracy, all adults received oral information about the study from their leader. Participants were included after signing informed consent.

The eNose Company conducted the VOC analysis of individual'smell prints.' The methodology for training the artificial neural network (ANN) was previously described in detail. The calibration training dataset from a previous study served as the basis for the analysis of the breath profiles in this study cohort, to which we added 47 participants from the actual study cohort and deblinded their diagnosis (clinical status and microbiological outcomes) to the company in order to further optimise the ANN to perform the analysis of the remaining study participants. The reason for optimising the previous ANN by including participants from the current cohort is that VOCs from this indigenous population have a different genetic background, living circumstances and diet than other populations [2-4].

6 pathogen-free offspring New Zealand's Covance Research Products, Inc. provided white rabbits weighing 2.5-3.5 kg (Denver, PA). Animals were housed in standard cages under biosafety level 3 conditions. Every 3-4 days, all rabbits were sensitised with five subcutaneous injections of 107 heat-killed M. bovis in incomplete Freund's adjuvant. The intradermal injection of 0.1 cc of old tuberculin resulted in the successful acquisition of delayed type hypersensitivity (DTH) reaction 25 days after the last sensitization injection (Synbiotics Corp, Kansas City, MO). The tuberculin reaction was read 48-72 hours later and skin fold thickness in two dimensions was measured. The volume of an oval spheroid formula was used to calculate the results [5].

Conclusion

Despite advances in TB diagnostic tool development over the last decade, more effort is required to have an impact on the time and accuracy of the results. The urea breath test may meet the criteria for service as an effective point-of-care diagnostic, which necessitates a simple, cost-effective and quickly implemented technology. UBT may also be useful for monitoring response to therapy and thus providing early warning of the possibility of drug-resistant infections. More clinical trials are needed to compare the benefits of metabolic breath tests to those currently available

Acknowledgement

None.

Conflict of Interest

There are no conflicts of interest by author.

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