Phenotype breath tests for personalized medicine

Stable isotope 13C labeled compounds have been widely used as diagnostic probes in research laboratories for over 30 years. The wide availability of low cost 13C-substrates and the development of bench top non-dispersive isotope selective IR spectrometers, research groups from around the world have increasingly used these tracers in nutritional, medicinal, and veterinary research.

The feasibility of administering an oral dose of a 13C-substrate and procuring metabolic or diagnostic information from its metabolism and conversion to 13CO2 is attractive due to its noninvasive nature. The salient features of the 13C-breath test are that they are noninvasive, non-radioactive, safe, simple, and effective. Breath tests have the potential to be useful screening methods that can be applied at the point of care (e.g., hospitals and physicians' offices) and do not require patients to wait for hours or days for results. The noninvasive method is especially attractive for infants, children, pregnant and lactating women, seniors in poor health and subjects averse to the use of needles. The simplicity of the 13C breath test makes it very applicable in a clinical setting: The physician can obtain valuable diagnostic information by distinguishing between two groups or populations on the basis of the recovery of 13CO2 from the ingested 13C-substrate.

The following 13C-breath tests will be discussed for detection of enzyme deficiencies and personalizing medications:

- Urea-13C breath test for detection of Helicobacter pylori
- Uracil breath test for detecting pyrimidine metabolic disorder prior to 5-Fluorouracil therapy (Colorectal cancer)
- Dextromethorphan breath test for evaluating CYP 2D6 enzyme activity & personalizing breast cancer endocrine therapy
- Pantoprazole breath test for evaluating CYP 2C19 enzyme activity and personalizing antiplatelet therapy (Cardiology).
- Methacetin breath test for evaluating liver function and CYP1A2 enzyme activity.
- Levodopa breath test for detecting DDC enzyme deficiency and personalizing CD/LD medication (Parkinsons disease)

The diagnostic breath tests will enable physicians and patients to benefit from rapid, novel and noninvasive ways to detect enzyme deficiencies, to monitor the progress of disease severity or medication efficacy, to trace acquired and/or congenital metabolic defects, to study in vivo the pharmacokinetics of xenobiotics, and to optimize individually tailored treatment therapies.

Biography

Anil Modak, the Associate Director of Medical Products R&D at Cambridge Isotope Laboratories, Andover, MA has been involved in the design, R&D of novel noninvasive breath tests for personalized medicine using stable isotope substrates for the diagnosis of disease states and evaluation of enzyme activity. He is the author of several patents, publications and a book chapter. He serves on the Editorial board of the Journal of Breath Research, Journal of Pharmacogenomics & Pharmacoproteomics and International Journal of Clinical Pharmacology & Toxicology. His previous experience includes working for Ribozyme Pharmaceutical, Boulder, CO and Monsanto, St Louis, MO. His postdoctoral research was conducted at the University of Iowa and Kings College London.

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