Exhaled volatile organic compounds in unstable angina

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A. Study purpose

This study aims to find out the sensitivity of volatile organic compounds in unstable angina patients.

B. Study subjects and method of recruitment

This study will need to enroll 100 adult subjects when they present to the CPMC Emergency Department with unstable angina. Patients will be recruited by trained volunteer staff only after the ED physician ascertains that patient are willing to discuss the project.

C. Study procedures

The study patients will need to breath in to a portable breath collection apparatus for 2.0 minutes.

D. Issues

There are no practical problems related to the performance of this study.

A. Study Purpose and Rationale

Cardiac chest pain is accompanied by oxidative stress, which generates alkanes and other volatile organic compounds (VOCs) (1-3). Increased breath pentane has been reported in patients with acute myocardial infarction and congestive heart failure (2, 4) but these studies have since been challenged because the assay technique was nonspecific (5). In addition, breath pentane is now known to be a nonspecific marker of oxidative stress that can be increased immediately after smoking, in asthma, schizophrenia (6-8). However, improved microanalytic methods have been used to identify a comprehensive set of exhaled markers in oxidative stress. This set of markers has been termed the breath methylated alkane contour, which is made of measurement of over two hundred C4-C20 alkanes and their monomethylated derivatives (1). A relatively recent pilot study identified the presence of seven methylated and unmethylated alkanes (octane, 4-methyl; decane, 4,-methyl; hexane; pentadecane, 5-methyl; hexadecane, 7-methyl; propane, 2-methyl; pentane) that were deemed as best discriminators between patients with unstable angina pectoris and age-matched healthy controls (1).

The purpose of this study is to be able to use the 7 identified alkanes collectively as a definite single marker to differentiate between cardiac and non-cardiac chest pain in a population of patients presenting in an acute care setting.

B. Study Design and Statistical Analysis

This is a single center prospective observational pilot study. All patients presenting to the ED with chest pain, and later placed in the established level II chest pain protocol with plan for coronary angiography within 48 hours will be enrolled. Patients will be followed to assess the results of the angiography. Two groups, one with confirmed acute coronary syndrome and one without (normal vessels or no vessel with greater than 50 to 60 percent stenosis), will be created after results of coronary angiography is obtained.

I predict a sensitivity of 90% for the selected and combined VOC and assume the medical community will accept 80% sensitivity. The study will be powered to detect a sensitivity of 90% in ruling out non-cardiac causes of chest pain. Therefore, 100 subjects will be needed for enrollment. Outcome data will be analyzed by chi-square ascertainment of differences between the two groups.

C. Study Procedure

A portable breath collection apparatus will be employed to capute the VOCs in 1.0-L breath sorbent trap. The VOCs in 1.0L of room air will also be captured on a separate sorbent trap. Subjects will have to were a nose clip while breathing in and out of the disposable mouthpiece of the apparatus for 2.0 minutes. Light flap valves in the mouthpiece present low resistance to respiration thus enabling collection with minimal discomfort.

Breath collection will be done in the first 4 hours of presentation to the ED. The sorbent traps will be sent to a laboratory for analysis by automated thermal desorption, gas chromatography, and mass spectroscopy.

Assuming the presentation of 2 patients per day with level II chest pain, the study should not take longer than 2 months to complete. Each subject will participate for about 10 minutes, giving time for explanation of procedure and collection of breath sample.

D. Study Drugs

No study drugs will be used.

E. Medical Device

No therapeutic medical device will be used.

F. Study Questionnaires

No questionnaire will be used

G. Study Subjects

Inclusion criteria: all patient triaged in the ED to the level II ACS protocol.
Exclusion criteria:

- patients who are triaged to level I or level III ACS protocol,
- patients in cardiogenic shock,
- intubated,
- coronary artery bypass grafting within the previous 3 months,
- pregnancy,
- schizophrenia,
- smoking within last 2 hours,
- and no other acute major diagnosis for admission such as acute asthma, active COPD exacerbation, CHF exacerbation, PE, active systemic inflammatory disease.

H. Recruitment of Subjects

Subjects will be approached by the study staff after they are triaged to a level II ACS protocol and the ED physician will ascertain their positive willingness to be asked questions regarding the study.

I. Confidentiality of Study Data

All study data will be coded and related by a master code sheet to a unique code generated for each study participant. This data will be stored in a secure location accessible only to the investigators.

J. Potential Conflict of Interest

No investigators or the University have a proprietary interest in this procedure under investigation and therefore will not benefit financially.

K. Location of the study

The study will conducted within CPMC in the ED department or at the assigned cardiology floor bed.

L. Potential Risks

Patients do not have any real potential risk from the procedure.

M. Potential Benefits

Patients will not benefit from this procedure.

N. Compensation to Subjects

No compensation will be provided.

O. References

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