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Angina pectoris during daily activities and exercise stress testing: The role of inducible myocardial ischemia and psychological distress

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Abstract

Physicians often consider angina pectoris to be synonymous with myocardial ischemia. However, the relationship between angina and myocardial ischemia is highly variable and we have little insight into the sources of this variability. We investigated the relationship of inducible myocardial ischemia on SPECT stress perfusion imaging to angina reported with routine daily activities during the previous four weeks ($N = 788$) and to angina reported during an exercise stress test ($N = 371$) in individuals with confirmed or suspected coronary disease referred for clinical testing. We found that angina experienced during daily life is more strongly and consistently associated with psychological distress and the personal threat associated with angina than with inducible myocardial ischemia. In multivariable models, the presence of any angina during routine activities over the prior month was significantly associated with age, perceived risk of myocardial infarction, and anxiety when compared to those with no reported angina in the past month. Angina during daily life was not significantly associated with inducible myocardial ischemia on stress perfusion imaging in bivariate or multivariable models. In contrast, angina experienced during exercise stress testing was significantly related to image and ECG ischemia, though it was also significantly associated with anxiety. These results suggest that angina frequency over the previous four weeks is more strongly associated with personal threat and psychosocial distress than with inducible myocardial ischemia. These results lend support to angina treatment strategies that aim to reduce threat and distress as well as to reduce myocardial ischemia.

Keywords: Health status; Quality of life; Coronary heart disease; Depression; Anxiety; Somatization; Symptoms; Chest pain; Visceral pain

1. Introduction

Chest pain has many potential causes, including diseases of the thoracic and abdominal viscera and disorders of muscles, bones or nerves of the chest wall. Angina pectoris, or chest pain due to myocardial ischemia, receives the most attention because of its association with ischemic heart disease, the leading cause of death throughout the world. Angina affects 3.1 million men and 3.3 million women in the United States and increases with age [1].

Angina was first defined by Heberden in 1768 solely in terms of chest pain characterized by 'the sense of strangling and anxiety.' In fact, angina was not consistently linked with coronary disease through the 19th Century, but was more often attributed to non-specific changes in the nervous system. But by the 1930s,

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'angina' was being reserved only for chest pain that could be attributed to coronary disease. Chest pain that was similar to angina, but not associated with myocardial ischemia, was considered 'pseudoangina,' now termed 'non-coronary chest pain' [3]. Angina pectoris is thus now often defined as chest pain caused by myocardial ischemia [19].

When exertion or mental stress increases myocardial oxygen demand, narrowed coronary arteries can lead to myocardial ischemia. But myocardial ischemia does not always produce angina. Twenty-five percent of acute myocardial infarctions and 60–80% of less severe ischemic episodes are not associated with angina [28]. Another study found 85% of ambulant ischemic episodes occurred without chest pain and 66% of anginal pain reports were made in the absence of ischemic ST-segment depression [31]. Other ambulatory monitoring studies have also found an inconsistent relationship between angina and ischemia [30]. This variability is clinically important. In one large recent study of patients presenting with anginal chest pain to emergency departments, only 2% were found to have an acute myocardial infarction and another 11% were found to have unstable angina. In 85% of these patients presenting with chest pain, there was no inducible ischemia on stress myocardial perfusion imaging [55].

It is well known that pain intensity in humans is more closely and reliably related to noxious stimulus intensity in controlled, experimental settings than in clinical settings [48]. Many dimensions of the personal threat and psychological distress associated with clinical pain are not possible to replicate in the experimental situation due to both scientific and ethical constraints. This distress may play an even more important role for visceral pain than cutaneous pain, because visceral pain has been shown to be more unpleasant, diffuse, and variable than cutaneous pain [52].

We therefore sought to compare the relative contributions of inducible myocardial ischemia and psychological distress to anginal chest pain experienced while performing daily activities during the previous four weeks and to anginal chest pain experienced during exercise stress testing. We used SPECT stress myocardial perfusion imaging to quantify inducible myocardial ischemia. We hypothesized that inducible myocardial ischemia would be significantly related to concurrently assessed anginal chest pain during exercise stress testing but not significantly related to anginal chest pain during daily life in the previous four weeks.

2. Methods

2.1. Subjects

Patients with suspected ischemic heart disease scheduled for clinically indicated, rest/stress myocardial perfusion imaging (MPI) at the University of Washington Medical Center (UWMC) and at the Seattle VA Medical Center (SVAMC) who were over 18 years and could read English were mailed questionnaires concerning the effects of their heart disease (including daily angina frequency) and psychosocial factors approximately one week prior to their appointment. They were asked to complete these before coming to the clinic. Patients who were interested in completing the questionnaires but forgot to complete them or bring them were asked to complete them in the waiting room while waiting for their imaging test to begin. All subjects provided informed consent. The study was approved by the University of Washington/Veterans Administration Institutional Review Board.

2.2. Outcome variables

2.2.1. Angina during daily activities: Seattle Angina Questionnaire

The Seattle Angina Questionnaire (SAQ) is a valid, reliable, sensitive and prognostically important disease-specific health status measure for patients with coronary artery disease. It has been validated in multiple studies over the past decade against treadmill test results, physician diagnoses, nitroglycerin refill rates, and other validated self-report measures [20,27,29,51].

The SAQ assesses the domains of angina frequency, angina stability, physical limitations, treatment satisfaction and quality of life. In this study, we focus on the angina frequency scale which comprises two items concerning chest pain, chest tightness or angina in the previous four weeks and nitroglycerin use in the previous four weeks. Because it assesses the frequency of angina during routine daily activities over the past month, it provided an ideal assessment of subjects' experience angina during daily life.

2.2.2. Angina during exercise stress testing: Duke Chest Pain

For those patients in whom exercise was used as a part of their stress test, the physician or nurse practitioner performing the stress test recorded the Duke Angina Index (none, non-limiting chest pain, limiting chest pain) from the Duke Treadmill Score to assess angina experienced during exercise stress (the 'experimental' setting). Since so few of our subjects (4%) experienced limiting chest pain, we collapsed the limiting and non-limiting categories and report on chest pain vs. no chest pain during exercise testing.

2.2.3. Self-reported descriptive variables

2.2.3.1. Pre-stress test angina-related physical limitations. Seattle Angina Questionnaire Physical Limitations Score.