

Atypical Chest Discomfort: A Practical and Efficient Diagnostic Approach

Primary-care physicians need a sound understanding of the tools available when investigating a patient with chest discomfort.

By John C. Peterson, MD, FRCPC (Cardiology), DABIM

Considering all the syndromes presenting to the primary-care physician, it is perhaps the constellation of symptoms involving atypical chest discomfort that is among the most perplexing.

As we begin the 21st century, the number of investigational tools at our disposal must be used thoughtfully and appropriately, in order to avoid skyrocketing costs and, in some cases, unnecessary exposure to the risks routinely associated with invasive procedures. There is a three in 1,000 chance of a major cardiovascular complication, including myocardial infarction, stroke, or

death. There is also a three in 100 chance of local vascular complication at the arterial access site.

This review details a thorough, yet expedient, approach to this challenging issue, one which is often faced by primary-care physicians.

Overview

When a patient presents to your office with chest discomfort, and a cardiac condition is a potential etiology, you can subdivide the approach to such a patient by answering four important questions:

1. What is the patient's pretest likelihood of significant ischemic heart disease (IHD)?
2. What is the impact of the patient's modifiable risk factors?
3. What non-invasive screening investigations should I begin with?
4. When should left heart catheterization with coronary angiography be considered?

Determining the answers to these four questions is crucial, since over-investigation of a patient with atypical chest discomfort may expose the patient to unnecessary risk, especially if the patient has too low a pretest probability of significant ischemic heart disease (IHD).

Conversely, under-investigation of a patient with atypical chest discomfort may result in failure to identify a life-threatening, and possibly preventable, condition, or, at the very least, delay important therapeutic options, particularly if the patient has a high pretest probability of significant IHD.



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What is the patient's pretest likelihood of significant IHD?

Although dozens of questions can be asked when taking the history of an outpatient with chest discomfort but no prior known IHD, there are three crucial ones which have been shown to be of independent predictive value in determining if the chest discomfort is due to IHD. These three questions, as detailed by Diamond and Forrester in their landmark research paper in the June 1979 edition of the *New England Journal of Medicine*¹ are:

1. What is the location of the chest discomfort? While angina can theoretically be sensed in many locations, the location of the chest discomfort must be retrosternal for it to count as one point in



Dr. Peterson is a cardiologist in Toronto, Ontario.

the Diamond and Forrester classification of angina.

2. Do any aggravating factors, such as exercise, predictably cause the chest discomfort to occur?
3. Are there any consistent relieving fac-

tors, such as rest or sublingual nitroglycerine, which relieve the chest discomfort within ten minutes?

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Depending upon how many of the above three questions are answered in the affirmative, the patient can be classified as having "non-anginal" discomfort

(if one of the three factors is present), "atypical" discomfort (if two of the three factors are present), or "typical" discomfort (if all three of the factors are present).² While the pretest likelihood of significant IHD varies depending upon the age and gender of a patient, as a general rule, if a patient is asymptomatic (if none of the three factors are present) they have a 1% to 10% pretest likelihood of significant IHD. If a patient has "non-anginal" discomfort, there is a 10% to 40% pretest likelihood of significant IHD. If a patient has "atypical" discomfort they have a 40% to 70% pretest likelihood of significant IHD. If a patient

has "typical" discomfort, there is a 70% to 99% pretest likelihood of significant IHD.

Whether a patient has a pretest likelihood at the higher or lower end of the aforementioned ranges is dependent upon their age, gender, and how many conventional risk factors (tobacco use, diabetes mellitus, dyslipidemia, hypertension, and family history) they have for IHD.

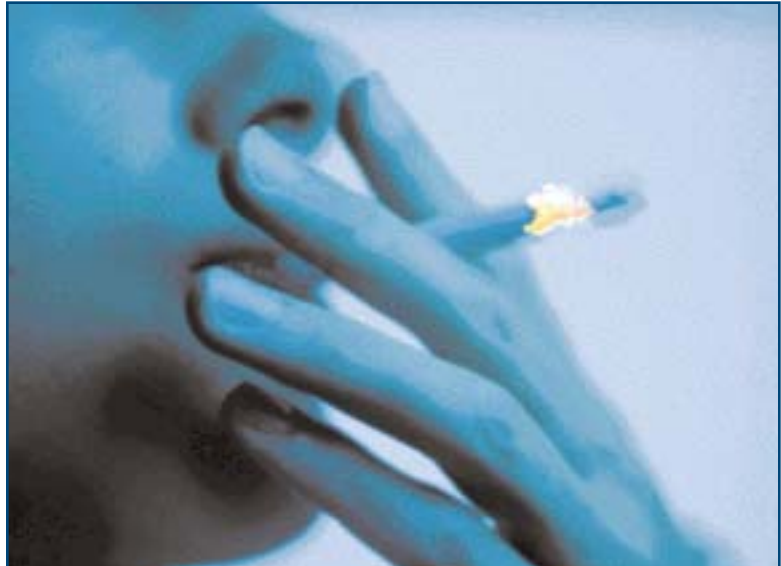
It is crucial to first determine, by history and physical examination, what a patient's pretest likelihood is prior to performing any non-invasive screening investigation. A patient should have a 20% to 80% pretest likelihood of IHD when selecting a screening test for diagnosis. If an investigation, such as a graded exercise stress test (GXT), is conducted on a patient with a pretest likelihood of disease of less than 20%, according to Bayes' Theorem³, the test has a high likelihood of being a false positive. This may result in unnecessary, and potentially even harmful, further invasive testing. If an investigation, such as a GXT is conducted on a patient with a pretest likelihood of disease greater than 80%, according to Bayes' Theorem, the test has a high likelihood of being a false negative. This may result in an unnecessary delay in the performance of an invasive test, such as an angiogram, which is truly needed. A proper understanding of the need to perform a thorough and directed history and physical examination, together with the correct employment of Bayes' Theorem, is particularly important given the abundance of investigations available to primary-care physicians as we begin the new millennium. In order to provide the

highest quality of care we can give our patients, primary-care physicians must avoid the temptation to order an electrocardiogram (ECG), GXT with or without imaging, echocardiogram, and 24-hour Holter monitor on every patient presenting with chest discomfort.

What is the impact of the patient's modifiable risk factors?

The 1996/97 National Population Health Survey⁴⁻⁹ revealed many interesting and pertinent data regarding modifiable risk factors for IHD. The prevalence of significant tobacco use, defined as greater than 20 pack-years (for example, one pack per day for 20 years, or two packs per day for 10 years) in the adult population is 24%,⁴ and this increases the risk of IHD two- to fourfold; however, the mortality risk reduction for secondary prevention following tobacco cessation is 50% to 75% after five years.

The prevalence of inactivity (defined as not even engaging in 20 to 30 minutes of aerobic exercise three times per week) in the adult population is 57%,⁵ and this increases the risk of IHD twofold; however, the mortality risk reduction for secondary prevention following a regular aerobic exercise program is approximately 20% after five years. The prevalence of hyper-



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tension (defined as a blood pressure consistently greater than 140/90 mmHg) in the adult population is 22%,⁶ and this increases the risk of IHD twofold; however, the mortality risk reduction for secondary prevention following normalization of blood pressure is 15% to 20% after five years. The prevalence of dyslipidemia (defined as a total cholesterol level greater than 5.2 mmol/L) in the adult population is 44%,⁷ and this increases the risk of IHD two- to threefold; however, the mortality risk reduction for secondary prevention following normalization of cholesterol, is 25% to 40% after five years. The prevalence of obesity (defined as a BMI greater than 27 kg/m²) in the adult population is 48%,⁸ and this increases the risk of IHD twofold; how-

A GXT is the most common non-invasive screening investigation ordered for patients with chest discomfort.

ever, the mortality risk reduction for secondary prevention following a sustained weight loss is approximately 20% after five years. Finally, 5% of the adult population has diabetes mellitus,⁹ and this increases the risk of IHD three- to fivefold; however, the mortality risk reduction for secondary prevention following optimal blood sugar control (to a glycosylated hemoglobin of less

than 7%) is greater than 50% after five years.

What non-invasive screening investigations should one begin with?

A GXT is the most common non-invasive screening investigation ordered for patients with chest

discomfort. A GXT can be performed both for diagnosis (to determine if IHD may be present in a patient with no prior documented IHD) and for prognosis (to quantify the degree of ischemic burden in a patient with documented IHD). There are two questions which must regularly be asked prior to ordering a GXT:

1. Should the test be done while the patient is taking an antianginal medication?
2. When should added imaging also be used, such as stress echocardiography or stress sestamibi?

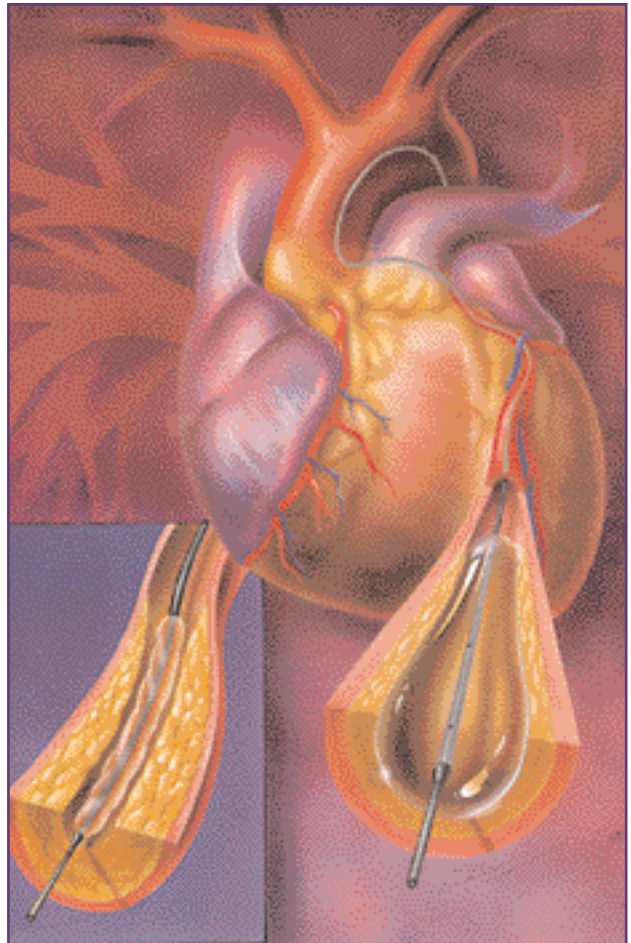
Whether the GXT should be done while the patient is taking an antianginal medication depends upon whether the test is being done for diagnosis or prognosis. If the test is being conducted for diagnosis (to determine if IHD may be present in a patient with no prior documented IHD), the patient's antianginal medications should be discontinued for 48 hours prior to the test, if this can be done safely, in order to optimize the sensitivity of the test. A common dilemma occurs if a patient with no documented IHD is taking a calcium- or beta-blocker which also serves as an antihypertensive, and the primary-care physician is concerned that stopping the medication prior to the test may result in an exacerbation of the hypertension. In such a case, an antihypertensive which does not function as a conventional antianginal, such as an ACE inhibitor (for example, enalapril 10 mg to 20 mg per day) or an angiotensin receptor blocker (for example, valsartan 80 mg to 160 mg per day) can be substituted during the 48 hours prior to the test. Furthermore, the patient should be instructed to take nitroglycerine and seek immediate medical attention if chest discomfort lasting longer than 20 minutes occurs during the 48 hours prior to the test while they are not taking their calcium- or beta-blocker. On the other hand, if the GXT is being done for prognosis (to quantify the degree of ischemic burden in a patient with documented IHD), the patient should remain on the antianginal medication(s), as the primary-care physician is most interested as to whether their antianginal medications are effective in

reducing the patient's ischemic burden. However, if the patient has a relatively high likelihood of ischemic heart disease, the decision as to whether anti-ischemic medication can be discontinued prior to a stress test should be individualized.

There are two common reasons why added imaging, such as stress echocardiography or stress sestamibi, is used. If a patient has an abnormal resting ECG, the superimposed exercise-induced ECG changes may be uninterpretable, and added imaging is necessary for clinical correlation. Also, if a patient is unlikely to reach 85% of their target maximal heart rate (due to osteoarthritis, for example, which may limit exertional ability), added imaging is necessary to improve the specificity of a plain GXT.

When should left heart catheterization with coronary angiography be considered?

There are many indications for ordering left heart catheterization with coronary angiography. For instance, coronary angiography should be performed if the patient is experiencing angina despite optimal medical therapy. Optimal medical therapy may be defined as an antiplatelet agent combined with at least one antianginal medication, with the patient's blood pressure less than 130/80 mmHg, resting heart rate 55 bpm to 60 bpm, LDL cholesterol 2.5 mmol/L, and glycosylated hemoglobin less than 7% in diabetics. In addition, if a patient is prescribed a beta-blocker, inadequate beta-blockade is present if the peak



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exercise heart rate is greater than 120 bpm.

Coronary angiography should also be ordered if a non-invasive screening test is dramatically positive, such as ST segment changes at a low work load, defined as less than three minutes of exercise or a heart

rate less than 130 bpm in a non-beta-blocked patient. Other relevant features are:

- ST changes in five or more leads;
- very deep ST segment depression greater than 3 mm;
- ST segment elevation in a lead with no Q wave at rest;
- prolonged ECG changes lasting greater than eight minutes into recovery;
- a drop in blood pressure with exercise, and;
- prolonged complex exercise-induced ventricular dysrhythmias.

If a patient continues to experience chest discomfort, but the coronary angiogram is normal, several cardiac and non-cardiac etiologies of chest pain must be considered. These, however, are beyond the scope of this review. Cardiac etiologies, other than coronary heart disease, include aortic stenosis, hypertrophic cardiomyopathy, syndrome X (microvascular angina), great vessel abnormalities, and right ventricular ischemia. Non-cardiovascular etiologies include gastrointestinal, pulmonary, musculoskeletal, and dermatological abnormalities.

Conclusion

In this review we have discussed:

1. How can you determine the patient's pretest likelihood of significant IHD?
2. What is the impact of modifiable risk factors?
3. What non-invasive screening investigations should be used to commence the diagnostic plan?
4. When should left heart catheterization

with coronary angiography be considered? **Dx**

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