

## Defining the Test by Patient Profile

Certain patient populations are less likely to be able to exercise adequately for optimal stress myocardial perfusion imaging (MPI). In such cases, it may be appropriate to consider pharmacologic stress. Submaximal exercise (ie, reaching less than 85% of a person's heart rate) can decrease the sensitivity of MPI and lead to false-negative results.<sup>1</sup> Furthermore, it can lead to aborted exercise tests that compromise laboratory efficiency and inconvenience the patient.

While the inability to exercise adequately for testing can be obvious in patients with apparent disabilities or injuries, reduced exercise capacity may not always be evident. Following are some of the considerations that may affect a decision on the type of stress testing to perform.

### WOMEN AND EXERCISE TESTING

According to Isaac et al, women are less likely than men of the same age to be able to achieve an adequate heart rate during exercise.<sup>2</sup> Women generally present with coronary artery disease (CAD) 10 years later than men<sup>3</sup> and have a higher prevalence of obesity,<sup>4</sup> both of which can impact their ability to exercise. Comorbidities, including diabetes, may further compromise the utility of exercise testing in women because of decreased capacity for exercise and the inability to reach target heart rate.<sup>5,6</sup>

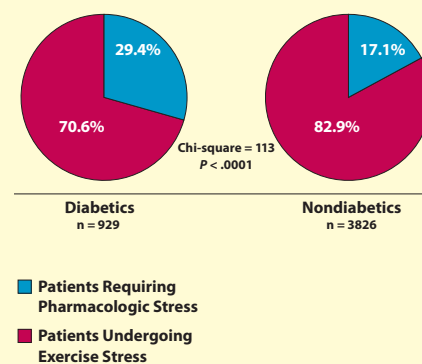
The American Society of Nuclear Cardiology recommends that women who are unable to perform a minimum of 5 metabolic equivalents of exercise should be considered candidates for MPI with pharmacologic stress.<sup>6</sup> In the same report, it was estimated that approximately 40% of women referred for MPI are candidates for pharmacologic stress testing.<sup>6</sup>

### DIABETES MELLITUS (TYPE 2)

More than 20 million Americans have diabetes, although more than 6 million of them remain undiagnosed.<sup>7</sup> Diabetes is now considered a coronary risk equivalent.<sup>8</sup> Therefore, many diabetic patients are referred for stress testing.

Autonomic neuropathy may attenuate heart rate in diabetics, contributing to submaximal exercise,<sup>9</sup> and their heart rate response to treadmill exercise is often blunted due to an elevated resting heart rate.<sup>10</sup> A recent report stated that a higher percentage of diabetic than nondiabetic patients undergo pharmacologic stress testing (Figure 1).<sup>11</sup>

**FIGURE 1. DIABETICS WITH CAD SYMPTOMS WHO UNDERWENT PHARMACOLOGIC OR EXERCISE STRESS TESTING**



Adapted from Giri S, et al. *Circulation*. 2002;105:32-40.

**Healthcare providers should be aware of subpopulations who may be unable to exercise adequately for stress testing. After appropriate evaluation, such patients could be candidates for pharmacologic stress.**

## OBESITY

Obesity is defined as a body mass index  $>30 \text{ kg/m}^2$  ( $\geq 34$  and  $\geq 41$  pounds overweight for women and men of average heights, respectively).<sup>12</sup> Obesity is a growing problem, and both the US Surgeon General and the Centers for Disease Control and Prevention have stated that obesity has reached epidemic proportions.<sup>13</sup>

Obesity is associated with a high risk for cardiovascular disease,<sup>14</sup> and many obese patients are referred for stress testing. However, many of these patients may be unable to exercise to an adequate heart rate and, therefore, may be candidates for pharmacologic stress testing.

## METABOLIC SYNDROME

The metabolic syndrome, or "syndrome X," refers to the clustering of metabolic risk factors in a patient. These risk factors include abdominal obesity, dyslipidemia, hypertension, insulin resistance or glucose intolerance, prothrombotic state, and proinflammatory state.<sup>15</sup> According to the National Cholesterol Education Program, the presence of 3 of the 5 risk factors in Table 1 is sufficient for a diagnosis of the metabolic syndrome.<sup>16</sup>

Eighty-four percent of people in the US with the metabolic syndrome are obese.<sup>17</sup> Women with the metabolic syndrome have been shown to be less physically active<sup>18</sup> and have poorer cardiorespiratory fitness levels than those without it.<sup>19</sup> Therefore, patients with the metabolic syndrome may be unable to exercise adequately for stress testing, and pharmacologic stress may be an option for these patients.

## RACE/ETHNICITY

African American and Hispanic women have a cluster of risk factors for heart disease. African American women are at greater risk for heart disease than other female populations, having a higher prevalence of coronary heart disease, angina pectoris, diabetes, and obesity.<sup>4</sup> And African American women with CAD are twice as likely to have a cardiac event compared with Caucasian women with CAD.<sup>20</sup> More than 25% of all Hispanics fall into the highest risk category for elevated cholesterol levels, and Hispanic women have a high rate of physical inactivity.<sup>4</sup>

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**TABLE 1. CLINICAL IDENTIFICATION OF THE METABOLIC SYNDROME**

Risk Factor	Defining Level
<b>1. Abdominal obesity (as waist circumference)</b>	
Men	$>40$ in
Women	$>35$ in
<b>2. Triglycerides</b>	
	$\geq 150$ mg/dL
<b>3. HDL cholesterol</b>	
Men	$<40$ mg/dL
Women	$<50$ mg/dL
<b>4. Blood pressure</b>	
	$\geq 130/\geq 85$ mm Hg
<b>5. Fasting glucose</b>	
	$\geq 110$ mg/dL

Adapted from *Circulation*. 2002;106:3143-3421.

Due to the risks among these populations, appropriate cardiac screening is critical. Given the rates of obesity and physical activity in populations of ethnic women, many of these patients may not be able to exercise adequately for stress testing, and pharmacologic stress may be an option.

## SUMMARY

Certain patients who are referred to nuclear cardiology laboratories for stress testing may have a limited capacity for exercise. Healthcare providers should be aware of subpopulations who may be unable to exercise adequately for stress testing. After appropriate evaluation, such patients could be candidates for pharmacologic stress. Remember that patients slated for exercise stress testing should be prepped as if they were undergoing pharmacologic stress. If such patients then fail to exercise adequately during testing, they can immediately convert to pharmacologic stress, avoiding potentially inaccurate results or a costly aborted study.

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