

# Erectile dysfunction in heart disease patients

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Atherosclerosis is a general health problem that not only affects the coronary arteries but also (in men) the penile arteries, thus contributing to organic causes of erectile dysfunction (ED) in heart disease patients. These organic causes are intertwined with psychological and pharmacological causes because medication prescribed for heart disease patients may also cause ED. The incidence of ED after myocardial infarction ranges from 38 to 78%. As sexual intercourse involves physical exertion, the medical history, ventricular function determined through echocardiography, and stress testing are used to classify patients into various groups where coital activity represents a greater or lesser cardiovascular risk. The energy requirements for intercourse are not high, ranging from 3.7 metabolic equivalents (METs) of energy expenditure at resting state during the preorgasmic phase to 5 METs during orgasm. The Bruce protocol for exercise stress testing is a six-stage protocol with changes in the slope and speed of the treadmill. As a general rule, a patient who completes the first two stages of the Bruce protocol has a functional capacity greater than 7 METs, which is considered sufficient for sexual intercourse. The physician or cardiologist concerned should institute first-line treatment with oral drugs according to the indications listed below. If sexual activity is not contraindicated, the treatment of choice for ED in heart disease patients is oral therapy with sildenafil, except in those cases in which its use is contraindicated. Specific recommendations are discussed.

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## Specific aspects of erectile dysfunction in patients with heart disease

Erectile dysfunction (ED) is very common in heart disease patients after acute myocardial infarction (AMI). In addition to organic causes arising from atherosclerosis, psychological issues, such as fear of triggering a new AMI with intercourse or anxiety due to the postinfarction situation, can contribute to the development of ED. The incidence of ED after myocardial infarction ranges from 38 to 78%.<sup>1</sup> Commonly prescribed medications such as beta-blockers, diuretics, digoxin, and lipid-lowering drugs may also be the cause of ED.<sup>2</sup>

### *Assessment of the heart disease patient with ED*

Adequate treatment of ED in a patient with heart disease requires careful assessment of functional

capacity because sexual activity may pose a risk due to the physical exertion involved. It is known that the energy requirements for intercourse range from 3.7 metabolic equivalents (METs) during the preorgasmic phase to 5 METs during orgasm;<sup>1,3</sup> however, it should be taken into account that environmental circumstances may modify this figure. For example, extreme temperatures,<sup>4</sup> anxiety or fear, alcohol intake,<sup>5</sup> heavy meals, or extramarital relations<sup>6,7</sup> may increase energy expenditure. In a Japanese study that investigated 5559 sudden deaths, 34 took place in relation to sexual activity.<sup>7</sup> Of these, 12 were preceded by high alcohol intake and 24 involved extramarital relations, factors that usually cause energy requirements to increase.

In summary, energy expenditure following sexual activity does not exceed that required to walk 1 km in 15 min (similar to the energy expenditure during the preorgasmic phase), followed by climbing up a flight of stairs in 10 s (orgasmic phase), and ranges from 3.5 to 5 METs. Based on the above, a functional capacity of 6 METs attained on exercise stress testing provides a sufficient margin of safety.<sup>8</sup> Therefore, the workup of the heart disease patient with ED should include the assessment of his functional capacity, in addition to the usual tests for ED.<sup>8</sup>

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## Diagnostic management of heart disease patients with ED

### Medical history

We should first assess the medical history and cardiological reports or tests from the patient to better control or modify risk factors and/or harmful habits:

1. Cardiovascular risk factors:
  - Hypertension.
  - Diabetes mellitus.
  - Smoking.
  - Hyperlipidemia.
  - Sedentary lifestyle.
2. Presence of peripheral artery disease.
3. Type and functional class of heart disease, either according to the New York Heart Association (NYHA) classification or measured in METs, which will allow us to classify the patient based on the risk entailed by sexual activity (Table 1).
4. Assess the results of the ventricular function studies previously performed on the patient (echocardiography or nuclear medicine).
5. Assess switching medications the patient is taking that may be the cause of ED, such as beta-blockers, diuretics, and digoxin. The use of nitrates in combination with sildenafil is absolutely contraindicated. In this case, assess the possibility of withdrawing or replacing nitrates.

### Physical examination

Data from a cardiovascular examination with attention to cardiac murmurs, leg pulses, and carotid murmurs are an essential complement to the detailed

**Table 1** Classification of clinical functional class in cardiology

#### NYHA Functional Classes for Heart Disease

Class I. Patients with heart disease, but no limitation of ordinary physical activity due to dyspnea, only symptoms with marked exertion.

Class II. Slight limitation of ordinary physical activity, but does not interfere with usual activities.

Class III. Limitation of usual daily activities. Climbing a flight of stairs causes dyspnea.

Class IV. Dyspnea at rest.

#### Canadian Cardiology Society Classification of Angina Pectoris

Class I. Angina occurs with unusual strenuous exertion.

Class II. Usual daily activities without angina. Pain occurs with higher than usual activity.

Class III. Angina with usual daily activities.

Class IV. Angina at rest.

NYHA = New York Heart Association.

physical examination described in the core document. Signs of heart failure, including crackles, hepatic congestion, and edema, should also be elicited.

### Exercise testing in the assessment of the heart disease patient

**Conventional treadmill exercise testing.** As previously stated, engaging in sexual intercourse can be compared with a physical exertion. Thus, the conventional exercise stress test (the most widely used in Spain is the Bruce protocol) provides information about the patient's functional capacity. The Bruce protocol is a six-stage protocol with changes in the slope and speed of the treadmill. At the end of each stage, the patient's energy expenditure can be measured spirometrically via oxygen consumption or deduced from the level of exertion (Table 2). As a general rule, a patient who completes the first two of the six stages of the Bruce protocol has a functional capacity greater than 7 METs, which is considered sufficient for sexual intercourse.

**Bicycle and arm ergometry.** If a treadmill is not available or if a gait disorder is present, bicycle ergometry can be used. Protocols vary, and arm and leg ergometry can be performed with a special adaptation of the bicycle ergometer. METs are calculated for upper and lower extremities. As exercising the arms involves a smaller muscular mass and is more difficult to perform, it results in greater energy consumption.

Unlike the treadmill, the subject does not have to bear his own weight with the bicycle ergometer. Therefore, it is easier for heavier subjects to complete the exercise using the bicycle ergometer. The subject is required to maintain a pedaling rate of 50 or 70 revolutions per minute (rpm). Stages may last for 2 or 3 min. The most widely used protocol is given in Table 3.

**Table 2** Bruce protocol

Level <sup>a</sup>	Slope (%) <sup>b</sup>	Velocity (km/h)	VO <sub>2</sub> max, METS
1	10	2.7	5
2	12	4.0	7
3	14	5.5	10
4	16	6.8	14
5	18	8.0	16
6	20	8.9	20

<sup>a</sup>Every level has a duration of 3 min.

<sup>b</sup>The treadmill upward slope (%) depends on the level and increases the velocity.

VO<sub>2</sub> max = maximum consumption of oxygen at the end of level.

**Table 3** Energy expenditure during bicycle and arm ergometry

Stage	Watts	METs LE	METs UE
1	25	1.8	3.2
2	52	3.6	4.6
3	70	4.4	5.7
4	87	5.3	6.8
5	105	6.1	7.9
6	122	7.0	9.1
7	140	7.9	10.2
8	157	8.7	11.3
9	175	9.6	12.5

LE = lower extremities; UE = upper extremities.

Protocol calculated for a 70 kg subject at 70 rpm, each stage lasted 2 min. Watts are prescribed on the bicycle ergometer. METs are calculated for LE and UE. As the arm exertion involves a smaller muscular mass and is more difficult to perform, 25 W represents a 30% higher energy consumption, which is calculated in the table.

The relationship between METs measured on the treadmill and the bicycle ergometer is given by the following conversion formula:

$$\text{Treadmill METs} = 0.98(\text{bicycle ergometer METs}) + 1.85$$

When we use the protocol to calculate the maximum heart rate, we must keep in mind that this rate is 7–10 beats/min lower for the arm ergometer than the rate calculated using the standard formula of 220 minus the age.

**Assessment of ejection fraction.** Ventricular function provides an indication of the contractile capacity of the heart. It is usually determined by measuring left ventricular end-diastolic and end-systolic areas using echocardiography.<sup>9</sup> Ventricular function is classified as:

- *Normal*: values >55%.
- *Slightly depressed*: values ≥40 and ≤55%.
- *Moderately depressed*: values ≥30 and <40%.
- *Severely depressed*: values <30%.

Patients with moderate or severe ventricular depression are at special risk for complications related to sexual activity.

**Cardiovascular risk associated with sexual activity.** The cardiovascular risk of treating ED in a heart disease patient derives from the physical overload resulting from sexual activity. It is thus important to determine in each patient whether coital activity represents low, moderate, or severe cardiovascular risk before recommending sexual activity and treating ED (see the Princeton Consensus classification of cardiovascular risk below).<sup>3</sup>

Treatment of ED with oral sildenafil therapy (without concomitant nitrate therapy) does not pose an added cardiovascular risk. Studies have shown that it does not cause adverse cardiovascular effects

in healthy human subjects or in those affected by heart disease.<sup>10</sup> Standardized cardiovascular mortality rates are not different in patients taking sildenafil from those of the general population.<sup>11</sup>

## Recommendations for patient management based on cardiovascular risk

After obtaining the medical history, we can classify patients into various groups in which coital activity represents a greater or lesser cardiovascular risk. This risk is independent of treatment of ED, and each patient should be informed of the risk implied by sexual intercourse in his particular case.

### Princeton Consensus, 2000<sup>3</sup>

Classification of cardiovascular risk associated with sexual activity:

#### 1. *Low risk.* Management in primary care:

- Asymptomatic patients with less than three cardiovascular risk factors for coronary artery disease.
- Controlled hypertension.
- Class I stable angina.
- Successful coronary revascularization.
- Mild valvular disease.
- NYHA Class I heart failure.

Check-ups every 6–12 months. Sexual activity is not contraindicated; therefore, patient is a candidate for treatment of ED.

#### 2. *Intermediate risk.* Management in primary care with tests or management by a specialist:

- Three or more cardiovascular risk factors for cardiovascular disease (CVD), excluding sex.
- Classes II–III stable angina.
- *Recent AMI*: >2 weeks and <6 weeks.
- Class II heart failure.
- *Noncardiac sequelae of arteriosclerosis*: cerebrovascular accident (CVA) or peripheral artery disease.

Restratify based on exercise stress testing into low- or high-risk category. Check-ups every 6 months.

#### 3. *High risk.* Refer patient to secondary care for assessment:

- Unstable or refractory angina.
- Uncontrolled hypertension.
- Classes III–IV heart failure.
- AMI within 2 weeks or CVA.
- High-risk arrhythmias.
- Hypertrophic cardiomyopathy.
- Moderate or severe valvular disease.

The patient should be stabilized before treatment of ED.

### Therapeutic proposal and referral criteria

The treating physician or cardiologist should institute first-line treatment with oral drugs (see core document) according to the indications listed later. In general, the patient should be referred to a specialist when first-line treatments fail or more aggressive therapy is needed.

If sexual activity is not contraindicated, the treatment of choice for ED in heart disease patients is oral therapy with sildenafil, except in those cases when use is contraindicated (see contraindications and precautions in the core document).

According to published studies, sildenafil is effective in 70% of patients with ischemic heart disease or hypertension.<sup>12</sup> It has also shown to be safe and effective in patients treated with different or multiple antihypertensive drugs,<sup>13</sup> as well as in patients with CVD.<sup>14</sup> The incidence of both general and cardiovascular adverse effects was similar in patients treated with sildenafil who had CVD, including ischemic heart disease, compared with those receiving placebo.<sup>12</sup> Currently under investigation is the potential benefit that sildenafil may have owing to its vasodilatory action on the epicardial arteries.<sup>15</sup>

### Specific recommendations for treatment of ED in patients with heart disease

1. Inform patients with heart disease of the precautions required for intercourse. Although some positions for intercourse require less physical exertion, the ideal position is the one that is most comfortable for the couple. The woman-on-top/man-below position requires less effort for the man, as well as *vice versa* for the woman. It is advisable to avoid environments with extreme temperatures because they increase the exertion required. Finally, engaging in intercourse after excessive use of alcohol or a very heavy meal is not prudent, and it is better to wait approximately 4 h in these circumstances. Genital caressing and masturbation require less physical capacity than intercourse, and therefore do not change the recommendations.
2. For patients who are to start treatment with sildenafil, the physician should discuss the contraindication of nitrates and give instructions on what to do if an episode of angina occurs.
3. If the patient has precordial pain or an episode of ischemic heart disease occurring within 24 h of taking sildenafil, do not administer nitrates. Owing to the known interactions between sildenafil and nitrates, severe hypotension may occur after ingestion of these two drugs and therefore simultaneous administration is contraindicated. If angina occurs in this situation:
  - Attempt to control angina with other drugs such as beta-blockers or oral or intravenous (i.v.)

calcium channel blockers if required (propranolol, atenolol or diltiazem i.v.), with the usual monitoring.

- Treatment of AMI in a patient who has recently taken sildenafil should be the standard, except for the administration of nitrates. Precordial pain can be treated with narcotic analgesics, beta-blockers or analgesics, aspirin, thrombolytics, angioplasty, or anticoagulants following the standard treatment.<sup>16</sup>
4. Patients who have a functional capacity of less than 6 METs as measured on the exercise stress test should be advised to refrain from sexual activity. They can be included in an exercise program with cardiac rehabilitation to improve their functional capacity. These patients are usually under treatment with nitrates. If use of sildenafil is being considered, the physician can discuss with patient the possibility of replacing the nitrates with other drugs, such as amlodipine or a similar treatment that has no effect on sexual function, to increase the patient's threshold for ischemia.

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