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Sexual Activity and Cardiovascular Disease : A Scientific Statement From the American Heart Association

Glenn N. Levine, Elaine E. Steinke, Faisal G. Bakaeen, Biykem Bozkurt, Melvin D. Cheitlin, Jamie Beth Conti, Elyse Foster, Tiny Jaarsma, Robert A. Kloner, Richard A. Lange, Stacy Tessler Lindau, Barry J. Maron, Debra K. Moser, E. Magnus Ohman, Allen D. Seftel and William J. Stewart

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AHA Scientific Statement

Sexual Activity and Cardiovascular Disease

A Scientific Statement From the American Heart Association

Endorsed by the American Urological Association, Society for Cardiovascular Angiography and Interventions, Society of Thoracic Surgeons, American Association of Cardiovascular and Pulmonary Rehabilitation, International Society of Sexual Medicine, American College of Cardiology Foundation, Heart Rhythm Society, and Heart Failure Society of America

Glenn N. Levine, MD, FAHA, Chair; Elaine E. Steinke, RN, PhD, FAHA; Faisal G. Bakaeen, MD; Biykem Bozkurt, MD, PhD, FAHA; Melvin D. Cheitlin, MD, FAHA; Jamie Beth Conti, MD; Elyse Foster, MD, FAHA; Tiny Jaarsma, RN, PhD, FAHA; Robert A. Kloner, MD, PhD; Richard A. Lange, MD, MBA, FAHA; Stacy Tessler Lindau, MD; Barry J. Maron, MD; Debra K. Moser, DNSc, RN, FAHA; E. Magnus Ohman, MD; Allen D. Seftel, MD; William J. Stewart, MD; on behalf of the American Heart Association Council on Clinical Cardiology, Council on Cardiovascular Nursing, Council on Cardiovascular Surgery and Anesthesia, and Council on Quality of Care and Outcomes Research

Sexual activity is an important component of patient and partner quality of life for men and women with cardiovascular disease (CVD), including many elderly patients.[1] Decreased sexual activity and function are common in patients with CVD and are often interrelated to anxiety and depression.[2,3] The intent of this American Heart Association Scientific Statement is to synthesize and summarize data relevant to sexual activity and heart disease in order to provide recommendations and foster physician and other healthcare professional communication with patients about sexual activity. Recommendations in this document are based on published studies, the Princeton Consensus Panel,[4,5] the 36th Bethesda Conference,[6–10] European Society of Cardiology recommendations on physical activity and sports participation for patients with CVD,[11–13] practice guidelines from the American College of Cardiology/American Heart Association[14–16] and other organizations,[17] and the multidisciplinary expertise of the writing group. The classification of recommendations in this document are based on established ACCF/AHA criteria (Table).

Acute Cardiovascular Effects of Sexual Activity

Numerous studies have examined the cardiovascular and neuroendocrine response to sexual arousal and intercourse, with most assessing male physiological responses during heterosexual vaginal intercourse.[18–24] During foreplay, systolic and diastolic systemic arterial blood pressure and heart rate increase mildly, with more modest increases occurring transiently during sexual arousal. The greatest increases occur during the 10 to 15 seconds of orgasm, with a rapid return to baseline systemic blood pressure and heart rate thereafter. Men and women have similar neuroendocrine, blood pressure, and heart rate responses to sexual activity.[24,25]

Studies conducted primarily in young married men showed that sexual activity with a person's usual partner is comparable to mild to moderate physical activity in the range of 3 to 4 metabolic equivalents (METS; ie, the equivalent of climbing 2 flights of stairs or walking briskly[26]) for a short duration. Heart rate rarely exceeds 130 bpm and systolic blood pressure rarely exceeds 170 mm Hg[4,18,27] in normoten-

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Table. Applying Classification of Recommendation and Level of Evidence

ESTIMATE OF CERTAINTY (PRECISION) OF TREATMENT EFFECT	SIZE OF TREATMENT EFFECT			
	CLASS I *Benefit >>> Risk* Procedure/Treatment **SHOULD** be performed/ administered	**CLASS IIa** *Benefit >> Risk* *Additional studies with focused objectives needed* **IT IS REASONABLE** to perform procedure/administer treatment	**CLASS IIb** *Benefit ≥ Risk* *Additional studies with broad objectives needed; additional registry data would be helpful* Procedure/Treatment **MAY BE CONSIDERED**	**CLASS III** *No Benefit* or **CLASS III** *Harm* Procedure/ Test / Treatment COR III: No benefit / Not Helpful / No Proven Benefit COR III: Harm / Excess Cost w/o Benefit or Harmful / Harmful to Patients
LEVEL A Multiple populations evaluated* Data derived from multiple randomized clinical trials or meta-analyses	■ Recommendation that procedure or treatment is useful/effective ■ Sufficient evidence from multiple randomized trials or meta-analyses	■ Recommendation in favor of treatment or procedure being useful/effective ■ Some conflicting evidence from multiple randomized trials or meta-analyses	■ Recommendation's usefulness/efficacy less well established ■ Greater conflicting evidence from multiple randomized trials or meta-analyses	■ Recommendation that procedure or treatment is not useful/effective and may be harmful ■ Sufficient evidence from multiple randomized trials or meta-analyses
LEVEL B Limited populations evaluated* Data derived from a single randomized trial or nonrandomized studies	■ Recommendation that procedure or treatment is useful/effective ■ Evidence from single randomized trial or nonrandomized studies	■ Recommendation in favor of treatment or procedure being useful/effective ■ Some conflicting evidence from single randomized trial or nonrandomized studies	■ Recommendation's usefulness/efficacy less well established ■ Greater conflicting evidence from single randomized trial or nonrandomized studies	■ Recommendation that procedure or treatment is not useful/effective and may be harmful ■ Evidence from single randomized trial or nonrandomized studies
LEVEL C Very limited populations evaluated* Only consensus opinion of experts, case studies, or standard of care	■ Recommendation that procedure or treatment is useful/effective ■ Only expert opinion, case studies, or standard of care	■ Recommendation in favor of treatment or procedure being useful/effective ■ Only diverging expert opinion, case studies, or standard of care	■ Recommendation's usefulness/efficacy less well established ■ Only diverging expert opinion, case studies, or standard of care	■ Recommendation that procedure or treatment is not useful/effective and may be harmful ■ Only expert opinion, case studies, or standard of care
Suggested phrases for writing recommendations	should is recommended is indicated is useful/effective/beneficial	is reasonable can be useful/effective/beneficial is probably recommended or indicated	may/might be considered may/might be reasonable usefulness/effectiveness is unknown/unclear/uncertain or not well established	COR III: No Benefit: is not recommended / is not indicated / should not be performed/ administered/ other / is not useful/ beneficial/ effective COR III: Harm: potentially harmful / causes harm / associated with excess morbidity/mortality / should not be performed/ administered/ other
Comparative effectiveness phrases†	treatment/strategy A is recommended/indicated in preference to treatment B treatment A should be chosen over treatment B	treatment/strategy A is probably recommended/indicated in preference to treatment B it is reasonable to choose treatment A over treatment B		

A recommendation with Level of Evidence B or C does not imply that the recommendation is weak. Many important clinical questions addressed in the guidelines do not lend themselves to clinical trials. Although randomized trials are unavailable, there may be a very clear clinical consensus that a particular test or therapy is useful or effective.

*Data available from clinical trials or registries about the usefulness/efficacy in different subpopulations, such as sex, age, history of diabetes, history of prior myocardial infarction, history of heart failure, and prior aspirin use.

†For comparative effectiveness recommendations (Class I and IIa; Level of Evidence A and B only), studies that support the use of comparator verbs should involve direct comparisons of the treatments or strategies being evaluated.

sive individuals. However, one study of normotensive men demonstrated substantial variations in peak heart rate and systemic blood pressure during orgasm.[23] Because most of the studies that assessed the cardiovascular effects of sexual activity were conducted in healthy men who were young to middle-aged, equating the myocardial oxygen demand of intercourse to climbing 2 flights of stairs is a generalization that may not characterize all individuals, especially those who are older, are less physically fit, or have CVD.[18] Therefore, it is probably more reasonable to state that sexual activity is equivalent to mild to moderate physical activity in the range of 3 to 5 METS, taking into account the individual's capacity to perform physical activity. Some patients, particularly older people,[1] may have difficulty reaching an orgasm for medical or emotional reasons. In attempting to achieve a climax, it is possible that such individuals may exert themselves to a greater degree of exhaustion with relatively greater demand on their cardiovascular system (although specific data on this are lacking).

Sexual Activity and Cardiovascular Risk

Sexual Activity and Angina

Coital angina ("angina d'amour"), angina that occurs during the minutes or hours after sexual activity, represents <5% of

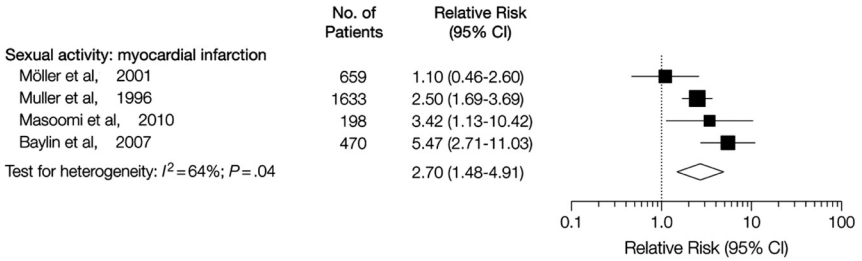

Figure. Forest plot of case-crossover studies assessing the association of sexual activity with myocardial infarction. CI indicates confidence interval. Modified from Dahabreh et al [30] with permission of the publisher. Copyright © 2011, American Medical Association. All rights reserved.[30]

all anginal attacks.[28] It is rare in patients who do not have angina during strenuous physical exertion and more prevalent in sedentary individuals with severe coronary artery disease (CAD) who experience angina with minimal physical activity. If a patient can achieve an energy expenditure of ≥3 to 5 METs without demonstrating ischemia during exercise testing, then the risk for ischemia during sexual activity is very low.[29]

Sexual Activity and Myocardial Infarction

Meta-analysis of 4 case-crossover studies, which consisted of 50% to 74% males predominantly in their 50s and 60s, showed that sexual activity was associated with a 2.70 increased relative risk of myocardial infarction (MI) compared with periods of time when the subjects were not engaged in sexual activity (Figure).[30] The relative risk of MI does not appear to be higher in subjects with a history of MI than in those without prior known CAD.[31] Sedentary individuals have a relative risk of coital MI of 3.0, whereas physically active individuals have a relative risk of 1.2.[31] The Stockholm Heart Epidemiology Programme (SHEEP) study of post-MI patients (50% women) similarly found that those who were sedentary had a higher risk of MI with sexual activity (relative risk 4.4) than did those who were physically active (relative risk 0.7).[32]

Although sexual activity is associated with an increased risk of cardiovascular events, the absolute rate of events is miniscule because exposure to sexual activity is of short duration and constitutes a very small percentage of the total time at risk for myocardial ischemia or MI. Sexual activity is the cause of <1% of all acute MIs.[31] The absolute risk increase for MI associated with 1 hour of sexual activity per week is estimated to be 2 to 3 per 10 000 person-years.[30] Individuals with higher habitual sexual activity levels experience smaller increases in risk than individuals with low activity levels. For the individual with a previous MI, the annual risk of reinfarction or death is estimated to be 10% (or as low as 3% if the individual has good exercise tolerance).[33] In such individuals, engaging in sexual activity transiently increases the risk of reinfarction or death from 10 chances in 1 million per hour to 20 to 30 chances in 1 million per hour.[31]

Sexual Activity and Ventricular Arrhythmias/Sudden Death

In an autopsy report of 5559 instances of sudden death, 34 (0.6%) reportedly occurred during sexual intercourse.[34] Two other autopsy studies reported similarly low rates (0.6%–1.7%) of sudden death related to sexual activity.[35,36] Of the subjects who died during coitus, 82% to 93% were men, and the majority (75%) were having extramarital sexual activity, in most cases with a younger partner in an unfamiliar setting and/or after excessive food and alcohol consumption. The increase in absolute risk of sudden death associated with 1 hour of additional sexual activity per week is estimated to be <1 per 10 000 person-years.[30]

There are minimal data on the effect of sexual activity in patients with or at risk for ventricular arrhythmias. In a study of post-MI patients, sexual activity did not elicit an increase in ventricular ectopic activity compared with other activities.[37] In another report, the frequency of ventricular ectopy and other dysrhythmias was less during sexual activity than during standard exercise testing in male post-MI patients.[38] In a small study of 43 patients (8 females) with an internal cardioverter-defibrillator (ICD), the relative risk of tachyarrhythmic events was comparable during physical exertion, mental stress, and sexual activity.[39]

Sexual Activity and CVD: General Recommendations

1. **Women with CVD should be counseled regarding the safety and advisability of contraceptive methods and pregnancy when appropriate *(Class I; Level of Evidence C)*.**
2. **It is reasonable that patients with CVD wishing to initiate or resume sexual activity be evaluated with a thorough medical history and physical examination *(Class IIa; Level of Evidence C)*.**
3. **Sexual activity is reasonable for patients with CVD who, on clinical evaluation, are determined to be at low risk of cardiovascular complications *(Class IIa; Level of Evidence B)*.[30–32,40]**
4. **Exercise stress testing is reasonable for patients who are not at low cardiovascular risk or have unknown cardiovascular risk to assess exercise capacity and development of symptoms, ischemia, or arrhythmias *(Class IIa; Level of Evidence C)*.**
5. **Sexual activity is reasonable for patients who can exercise ≥3 to 5 METS without angina, excessive dyspnea, ischemic ST-segment changes, cyanosis, hypotension, or arrhythmia *(Class IIa; Level of Evidence C)*.[5]**
6. **Cardiac rehabilitation and regular exercise can be useful to reduce the risk of cardiovascular complications with sexual activity for patients with CVD *(Class IIa; Level of Evidence B)*.[31,41]**
7. **Patients with unstable, decompensated, and/or severe symptomatic CVD should defer sexual activity until their condition is stabilized and optimally managed *(Class III; Level of Evidence C)*.**

8. **Patients with CVD who experience cardiovascular symptoms precipitated by sexual activity should defer sexual activity until their condition is stabilized and optimally managed *(Class III; Level of Evidence C)*.**

Men and women with stable CVD who have no or minimal symptoms during routine activities can engage in sexual activity. This includes patients with (1) Canadian Classification System class I or 2 angina; (2) New York Heart Association (NYHA) class I or II heart failure; (3) mild to moderate valvular disease; (4) no symptoms after MI; (5) successful coronary revascularization; (6) most types of congenital heart disease (CHD); and (7) ability to achieve ≥3 to 5 METS during exercise stress testing without angina, ischemic electrocardiographic changes, hypotension, cyanosis, arrhythmia, or excessive dyspnea. In patients with unstable or decompensated heart disease (ie, unstable angina, decompensated heart failure, uncontrolled arrhythmia, or significantly symptomatic and/or severe valvular disease), sexual activity should be deferred until the patient is stabilized and optimally managed. In patients whose exercise capacity or cardiovascular risk is unknown, exercise stress testing can be useful to assess exercise capacity and development of symptoms, ischemia, cyanosis, hypotension, or arrhythmias.

Exercise training during cardiac rehabilitation has been shown to increase maximum exercise capacity and decrease peak coital heart rate.[41] Regular exercise is associated with a decreased risk of sexual activity–triggered MI.[31] Thus, cardiac rehabilitation and regular exercise are reasonable strategies in patients with stable CVD who plan to engage in sexual activity.

In addition to the physical demands of sexual activity, the safety and advisability of contraceptive methods and pregnancy should be considered in women with CVD, especially those with CHD, valvular heart disease, or dilated cardiomyopathy.[42] Combination hormonal oral contraceptives increase the risk of thromboembolic complications, and recommendations for their use in various cardiovascular conditions have been published.[42] Pregnancy is associated with physiological changes that may adversely affect women with certain cardiac conditions and is of particular concern for those undergoing anticoagulation therapy with warfarin because it poses a risk to the fetus (ie, teratogenicity) and mother (ie, bleeding). Conversely, inadequate anticoagulation may lead to complications such as acute prosthetic valve thrombosis and thromboembolism.

Sexual Activity and Specific Cardiovascular Conditions

Coronary Artery Disease

Recommendations

1. **Sexual activity is reasonable for patients with no or mild angina *(Class IIa; Level of Evidence B)*.[30–32,40]**
2. **Sexual activity is reasonable 1 or more weeks after uncomplicated MI if the patient is without cardiac symptoms during mild to moderate physical activity *(Class IIa; Level of Evidence C)*.**
3. **Sexual activity is reasonable for patients who have undergone complete coronary revascularization *(Class IIa; Level of Evidence B)*[30–32,40] and may be resumed (a) several days after percutaneous coronary intervention (PCI) if the vascular access site is without complications *(Class IIa; Level of Evidence C)* or (b) 6 to 8 weeks after standard coronary artery bypass graft surgery (CABG), provided the sternotomy is well healed *(Class IIa; Level of Evidence B)*.[43,44]**
4. **Sexual activity is reasonable for patients who have undergone noncoronary open heart surgery and may be resumed 6 to 8 weeks after the procedure, provided the sternotomy is well healed *(Class IIa; Level of Evidence C)*.**
5. **For patients with incomplete coronary revascularization, exercise stress testing can be considered to assess the extent and severity of residual ischemia *(Class IIb; Level of Evidence C)*.**
6. **Sexual activity should be deferred for patients with unstable or refractory angina until their condition is stabilized and optimally managed *(Class III; Level of Evidence C)*.**

Stable Ischemic Heart Disease

For patients with stable ischemic heart disease, evaluation of their cardiovascular risk before they initiate or resume sexual activity is reasonable. Patients with mild, stable angina are considered to be at low risk for cardiovascular events, whereas those with unstable or refractory angina are considered to be at high risk.[4,5] For patients whose symptoms are intermediate or whose risk cannot be determined during initial evaluation, exercise testing may (1) provide an objective assessment of exercise tolerance and capacity; (2) determine whether angina occurs with exertion (and at what level of exertion); and (3) assess the severity of ischemia with physical activity.

Previous MI

Patients with previous MI who are asymptomatic or have no ischemia with stress testing or who have undergone complete coronary revascularization are at low risk for coital MI. Before the routine use of reperfusion therapy, it was recommended that sexual activity be avoided for 6 to 8 weeks after MI. In 2005, the Princeton Conference suggested that post-MI patients who had undergone successful coronary revascularization or had a treadmill test without ischemia could resume sexual activity 3 to 4 weeks after MI.[5] In contrast, the 2004 "ACC/AHA Guidelines for the Management of Patients with ST-elevation Myocardial Infarction" condoned sexual activity as early as 1 week after MI in the stable patient.[15] Because participation of stable patients in cardiac rehabilitation exercise programs 1 week after MI has proved safe,[45] resumption of sexual activity soon after uncomplicated MI seems reasonable in the stable patient who is asymptomatic with mild to moderate physical activity (eg, 3–5 METS).

Post-PCI

The cardiovascular risk of sexual activity after PCI is likely related to the adequacy of coronary revascularization. Patients with complete revascularization should be able to

resume sexual activity within days of PCI, provided there are no complications related to femoral vascular access. Patients in whom there is reason to suspect a vascular complication should undergo appropriate evaluation before resuming sexual activity. Patients who undergo PCI via radial access should be able to resume sexual activity as early as if not earlier than those who undergo PCI via the femoral access. In patients with incomplete coronary revascularization, exercise stress testing may be of benefit in assessing the extent and severity of residual ischemia.

Post-CABG and Noncoronary Open Heart Procedures

CABG and most other heart surgeries (eg, valve repair/replacement) are commonly performed through a median sternotomy, with sternal healing typically complete, or nearly so, 8 weeks after surgery. Because sexual activity may involve considerable stress on the chest and breathing patterns that generate high intrathoracic pressures that could compromise sternal wound healing, it is generally recommended that sexual activity be delayed for 6 to 8 weeks after CABG and noncoronary open heart procedures. Patients who have undergone surgery should be counseled to avoid positions that cause discomfort or put undue stress on the surgical site, particularly in the early postoperative months. Physical vigor in such patients is best reintroduced in a gradual fashion. After successful recovery after CABG, sexual activity is usually resumed and sexual satisfaction is usually maintained for many patients.[43,44]

Minimal access cardiac surgery that involves no or a limited sternotomy may allow earlier resumption of sexual activity. Robot-assisted surgery avoids a sternotomy incision and is an iteration of a less-invasive surgical procedure; patients treated with this procedure may similarly be able to resume sexual activity earlier than those undergoing median sternotomy.

CABG usually achieves complete or near-complete revascularization. In those in whom there is reason to believe there is significant incomplete revascularization (or graft failure), stress testing may be of benefit in assessing the extent and severity of residual ischemia.

Heart Failure

Recommendations

1. **Sexual activity is reasonable for patients with compensated and/or mild (NYHA class I or II) heart failure *(Class IIa; Level of Evidence B)*.[46–49]**
2. **Sexual activity is not advised for patients with decompensated or advanced (NYHA class III or IV) heart failure until their condition is stabilized and optimally managed *(Class III; Level of Evidence C)*.**

Hemodynamic, vascular, hormonal, and neurohormonal abnormalities may contribute to the sexual dysfunction that commonly occurs in heart failure patients.[50] Approximately 60% to 87% of heart failure patients report sexual problems, including a marked decrease in sexual interest and activity, with one quarter reporting cessation of sexual activity altogether.[51–53] Sexual function correlates with symptomatic status (ie, NYHA functional class and 6-minute walk test) but not with ejection fraction.[52] Interestingly, many heart failure patients place greater importance on improving quality of life (including sexual activity) than on improving survival.[54,55]

Optimal medical treatment of heart failure patients increases the likelihood of safe and satisfactory sexual activity. Exercise training improves quality of life[56] in heart failure patients and may favorably impact their sexual activity.[57] Heart failure patients who experience shortness of breath or fatigue during sexual activity can be advised to use a semireclining or "on-bottom" position during coitus, which decreases the level of physical exertion, and to rest if dyspnea occurs.[58]

The safety of sexual activity can reasonably be assumed to be related to the symptomatic severity of heart failure (ie, NYHA class) and whether or not the patient is decompensated (eg, volume overloaded). Studies involving stable heart failure patients have shown that it is safe for such patients to engage in sexual activity.[46–49]

Valvular Heart Disease

Recommendations

1. **Sexual activity is reasonable for patients with mild or moderate valvular heart disease and no or mild symptoms *(Class IIa; Level of Evidence C)*.**
2. **Sexual activity is reasonable for patients with normally functioning prosthetic valves, successfully repaired valves, and successful transcatheter valve interventions *(Class IIa; Level of Evidence C)*.**
3. **Sexual activity is not advised for patients with severe or significantly symptomatic valvular disease until their condition is stabilized and optimally managed *(Class III; Level of Evidence C)*.**

Although recommendations on physical activity in patients with valvular heart disease are available,[6,11,14] there are no published studies that specifically address the issue of sexual activity in such patients. Because patients with mild or moderate valve disease can safely participate in physical activities involving light or moderate exertion, it is also reasonable for such patients to engage in sexual activity, presuming that such activity does not precipitate significant cardiovascular symptoms. In patients with severe valvular disease with significant symptoms (or even mild symptoms with severe valvular aortic stenosis), it is prudent to defer sexual activity until medical or surgical treatment addresses these conditions. There is no reason to preclude sexual activity in patients with normally functioning prosthetic valves. The timing of return to sexual activity after surgical valve repair or replacement is discussed above in the section on Post-CABG and Noncoronary Open Heart Procedures.

In patients whose symptoms or valve disease severity are indeterminate and in those with asymptomatic severe valvular disease, exercise stress testing may provide an assessment of symptomatic and hemodynamic response to physical activity, as well as the possible precipitation of arrhythmias. It can be particularly helpful in assessing the individual with asymptomatic moderate or severe aortic stenosis and patients with severe valve dysfunction of other types who are asymptomatic. Exercise echocardiography can provide additional infor-

mation on the physiological response to exercise, including ventricular function, inducible increases in valve gradients, and inducible pulmonary hypertension.

The physiological effects of pregnancy are of particular concern in female patients with moderate to severe mitral or aortic stenosis and in those whose valvular lesions have caused symptoms, arrhythmias, pulmonary hypertension, ascending aortic dilation, or significant left ventricular dysfunction or dilation.[59] In addition, females with a mechanical prosthetic valve on warfarin therapy should be informed that warfarin poses a risk to the fetus (ie, teratogenicity) and mother (ie, bleeding), whereas inadequate anticoagulation may lead to acute valve thrombosis and thromboembolism.

Arrhythmias, Pacemakers, and ICDs

Recommendations

1. **Sexual activity is reasonable for patients with atrial fibrillation or atrial flutter and well-controlled ventricular rate *(Class IIa; Level of Evidence C)*.**
2. **Sexual activity is reasonable for patients with a history of atrioventricular nodal reentry tachycardia, atrioventricular reentry tachycardia, or atrial tachycardia with controlled arrhythmias *(Class IIa; Level of Evidence C)*.**
3. **Sexual activity is reasonable for patients with pacemakers *(Class IIa; Level of Evidence C)*.**
4. **Sexual activity is reasonable for patients with an ICD implanted for primary prevention *(Class IIa; Level of Evidence C)*.**
5. **Sexual activity is reasonable for patients with an ICD used for secondary prevention in whom moderate physical activity (≥3–5 METS) does not precipitate ventricular tachycardia or fibrillation and who do not receive frequent multiple appropriate shocks *(Level of Evidence C)*.**
6. **Sexual activity should be deferred for patients with atrial fibrillation and poorly controlled ventricular rate, uncontrolled or symptomatic supraventricular arrhythmias, and spontaneous or exercise-induced ventricular tachycardia until the condition is optimally managed *(Class III; Level of Evidence C)*.**
7. **Sexual activity should be deferred in patients with an ICD who have received multiple shocks until the causative arrhythmia is stabilized and optimally controlled *(Class III; Level of Evidence C)*.**

As discussed above, sudden death is an extremely rare occurrence during sexual activity in the general population. There are limited data on the incidence of arrhythmias induced with sexual activity in patients with a known history of arrhythmia. The risk of ventricular arrhythmia during sexual activity in patients with CVD, including those with an ICD, does not appear to be greater than during comparable physical exertion or exercise testing.[38,39] Thus, it is reasonable to recommend that patients with arrhythmias who are considered safe to participate in leisure (or more active) sporting activities are able to participate in sexual activity. These would include patients with (1) atrial fibrillation or atrial flutter and a well-controlled ventricular response; (2) a history of atrioventricular nodal reentrant tachycardia, atrioventricular reentry tachycardia, or atrial tachycardia with controlled arrhythmias; (3) a pacemaker; (4) an ICD implanted for primary prevention who have not received multiple shocks appropriate to the patient's arrhythmia; and (5) an ICD implanted for secondary prevention in whom comparable levels of physical activity do not precipitate ventricular tachycardia or ventricular fibrillation and who do not receive frequent appropriate shocks.[4,12,13,60] In patients who have received multiple ICD shocks, it is prudent to first stabilize and optimally control the arrhythmia (and underlying cause) before the patient engages in sexual activity. A history of multiple shocks per se is not necessarily a contraindication to the patient ever engaging in sexual activity.

As noted above, the presence of an ICD is not a contraindication for sexual activity, and it is reasonable for most patients with an ICD to continue sexual activity. In the patient with an ICD, partner overprotectiveness and the fear of shock with sexual activity are important concerns for the patient and his or her partner.[61,62] Accordingly, sexual activity often decreases after ICD implantation.[62–64] The sexual partner is not believed to be at risk from defibrillation if the ICD discharges during sexual activity.[61,64] Stress testing may provide reassurance to the patient and spouse or partner that sexual activity is unlikely to precipitate or exacerbate arrhythmia.[65] Strategies are available for healthcare specialists to use in counseling ICD patients and their partners,[61,64] and an excellent "Cardiology Patient Page" (http://circ.ahajournals.org/content/122/13/e465.long) addresses the concerns of patients and partners.[61]

Congenital Heart Disease

Recommendation

1. **Sexual activity is reasonable for most CHD patients who do not have decompensated or advanced heart failure, severe and/or significantly symptomatic valvular disease, or uncontrolled arrhythmias (*Class IIa; Level of Evidence C*).**

There are estimated to be more than 1 million CHD patients >21 years of age in the United States. Patients with simple, as well as more complex, disease are at risk for atrial and ventricular arrhythmias, stroke, and rarely coronary ischemia. To date, however, there are only rare reported deaths or strokes during sexual activity in this population. In 1 study, 9% of women with CHD reported symptoms during sexual activity, which included dyspnea, perceived arrhythmia, increased fatigue, or syncope.[66] Symptoms were more common in those with severe lesions, worse functional status, or cyanosis. In a survey of men with CHD, 9% reported dyspnea, 9% reported subjective arrhythmias, and 5% reported chest pain with sexual activity, with symptoms more common in patients with greater functional impairment (NYHA class III).[67]

Published guidelines allow for unlimited physical activity in asymptomatic CHD patients with closed or small atrial or ventricular septal defects, mild coarctation of the aorta, closed patent ductus arteriosus, and other mild congenital defects with normal right-sided heart volume, no pulmonary

hypertension, and no significant outflow obstruction on the right or left side of the heart.[7,11] On the basis of these recommendations, sexual activity appears to be reasonable in most patients with CHD. Patients in whom the safety of sexual activity is less certain or unclear include those with significant pulmonary hypertension, cyanotic heart disease, severe left-sided heart outflow obstruction, uncontrolled arrhythmias, and anomalous coronary artery passing between the pulmonary artery and aorta.

Issues regarding contraception and pregnancy are particularly important in women with CHD. A study of women with CHD lesions associated with a high risk of pregnancy-related cardiovascular complications showed that 28% were not using adequate birth control methods, 20% were using methods considered contraindicated for their condition, 43% had not been counseled about contraception, and 48% had not been informed of pregnancy-related risks.[66]

Hypertrophic Cardiomyopathy

Recommendations

1. **Sexual activity is reasonable for most patients with hypertrophic cardiomyopathy (HCM) *(Class IIa; Level of Evidence C)*.**
2. **Sexual activity should be deferred for patients with HCM who are severely symptomatic until their condition is stabilized *(Class III; Level of Evidence C)*.**

HCM is a heterogeneous genetic cardiac disease and the most common cause of arrhythmia-related sudden cardiac death in the young,[68] including competitive athletes.[69] Approximately 70% of HCM patients may have left ventricular outflow obstruction either at rest[70] or with physiological provocation,[71] independent of whether limiting symptoms are present. The underlying arrhythmogenic substrate in HCM is unpredictable,[72,73] but a linkage between physical activity and sudden death events attributable to ventricular tachycardia/ventricular fibrillation[69] raises concern that vigorous sexual activity might heighten risk in patients with this disease. However, there are no documented cases of cardiac arrest related to sexual activity in HCM patients. This is consistent with the physical activity recommendations afforded HCM patients that only prohibit participation in intense competitive sports or activities that mimic such forms of exercise.[60]

Cardiovascular Drugs and Sexual Function

Recommendation

1. **Cardiovascular drugs that can improve symptoms and survival should not be withheld because of concerns about the potential impact on sexual function *(Class III: Harm; Level of Evidence C)*.**

Numerous classes of cardiovascular drugs, particularly diuretics and β-blockers, have been implicated in causing erectile dysfunction (ED)[74–79]; however, recent studies and reviews have not found clear relationships between many contemporary cardiovascular drugs and ED.[76–78,80–83] An analysis of 6 studies involving almost 15 000 people found β-blocker therapy increased the annual reported rate of sexual dysfunction by only 5 reports per 1000 patients and the annual reported rate of impotence by only 3 per 1000 patients.[84] In addition, a nocebo effect, in which a patient's knowledge that a drug has been associated with ED, is often at least as important a contributing factor to a patient's ED as any physiological effect, particularly with contemporary β-blockers.[82,85,86] In one of the few studies addressing sexual function in women, antihypertensive therapies did not appear to adversely impact sexual function,[76] although thiazide diuretics and aldosterone may be associated with decreased vaginal lubrication or menstrual irregularities.[79,87]

Cardiovascular drugs that can improve symptoms or survival should not be withheld because of concerns about their adverse impact on sexual function. If a patient being treated with a cardiovascular drug complains of sexual dysfunction, efforts should be made to assess whether the sexual dysfunction is more likely related to underlying vascular or cardiac disease, the nocebo effect, or anxiety or depression, as discussed below. There are no good data to recommend a specific class of cardiovascular drug to improve sexual function or activity in patients with CVD.

In patients who clearly develop ED as a result of thiazide diuretic therapy, it is reasonable to switch to a loop diuretic. Some male patients treated with spironolactone may experience antiandrogen side effects (eg, ED, decreased libido, and gynecomastia) that compromise their sexual function and activity, in which case eplerenone may be a reasonable alternative. In male patients with clearly established β-blocker–induced sexual dysfunction, nebivolol (which has nitric oxide–mediated vasodilating properties and a lower incidence of ED than other β-blockers) may be considered provided the β-blocker is not being administered specifically for survival improvement for the patient with systolic heart failure or after MI.[88,89] Treatment of ED with a phosphodiesterase-5 (PDE5) inhibitor (discussed below) may be a reasonable alternate strategy.

Pharmacotherapy for Sexual Dysfunction

PDE5 Inhibitors

Recommendations

1. **PDE5 inhibitors are useful for the treatment of ED in patients with stable CVD *(Class I; Level of Evidence A)*.[5,46,48,49,90–106]**
2. **The safety of PDE5 inhibitors is unknown in patients with severe aortic stenosis or HCM *(Class IIb; Level of Evidence C)*.**
3. **PDE5 inhibitors should not be used in patients receiving nitrate therapy *(Class III; Level of Evidence B)*.[98,107,108]**
4. **Nitrates should not be administered to patients within 24 hours of sildenafil or vardenafil administration or within 48 hours of tadalafil administration *(Class III; Level of Evidence B)*.[98,107,108]**

PDE5 inhibitors are effective for the treatment of ED.[90–92] PDE5 inhibitors prevent the breakdown of cyclic GMP, thereby result-

ing in increased nitric oxide concentration and vasodilation, which enhances erectile function. Three PDE5 inhibitors are approved for the treatment of ED in the United States: sildenafil, tadalafil, and vardenafil. Sildenafil and tadalafil are also approved for the treatment of pulmonary hypertension. Sildenafil and vardenafil are relatively short-acting, with half-lives of approximately 4 hours; tadalafil is long-acting, with a half-life of 17.5 hours. These agents cause systemic vasodilation and mild reductions in systolic (≤10 mm Hg) and diastolic (≤8 mm Hg) systemic blood pressure.[27,91,93,94,98] These reductions may be greater in patients with underlying CAD and higher baseline blood pressures.[91]

PDE5 inhibitors are generally safe and effective for the treatment of ED in patients with systemic arterial hypertension, stable CAD, and compensated heart failure.[5,46,48,49,90–106] No studies have shown one agent to be more effective or safer than the others. Despite occasional anecdotal case reports linking PDE5 inhibitors to cardiac events, large trials and meta-analyses suggest that they are not associated with an increase in MI or cardiac events.[91,95,99,103] When administered with cardiovascular drugs that reduce systemic blood pressure, PDE5 inhibitors are associated with small additive reductions in systemic blood pressure but no increase in adverse cardiac events.[93,94,109] In some patients, the concomitant use of PDE5 inhibitors and α-blocking agents may result in symptomatic hypotension.[110] Thus, when both are indicated, the lowest α-blocker dose should be initiated and tolerated by the patient before the patient begins the lowest dose of a PDE5 inhibitor. PDE5 inhibitors should not be administered to treat ED in patients who are already receiving PDE5 inhibitor therapy for pulmonary hypertension. Vardenafil (but not sildenafil or tadalafil) carries a precautionary statement about prolongation of the corrected QT interval and should be avoided in patients with congenital QT prolongation or a history of torsade de pointes and in those taking medications known to prolong the QT interval (eg, class IA or III antiarrhythmic agents).

Organic nitrates (both short-acting forms such as sublingual nitroglycerin and long-acting forms such as isosorbide mononitrate) are nitric oxide donors and remain an absolute contraindication to PDE5 inhibitor use, because this combination may result in unpredictable and precipitous reductions in systemic blood pressure.[107] Patients with chest pain or acute MI should not be administered nitrates until at least 24 hours after the last dose of sildenafil or vardenafil[98] and until 48 hours after the last dose of tadalafil.[108] Healthcare providers should question patients presenting with chest pain about PDE5 inhibitor use before administering nitrates. Other than nitrates, patients with chest pain or an acute coronary syndrome who have taken a PDE5 inhibitor can be treated with all other cardiovascular medications. In patients undergoing chronic nitrate therapy who desire to use PDE5 inhibitors, the need for continued nitrate therapy (or an alternate therapy) should be evaluated, particularly in patients who have undergone complete revascularization.

The writing group is unaware of any reported deaths attributable to PDE5 inhibitor use in patients with left ventricular outflow obstruction (fixed or dynamic). As with all vasodilators, caution is advised when the use of these drugs is considered in patients with severe aortic stenosis or HCM.

PDE5 inhibitor use has been explored in females for treatment of arousal disorders and has largely been shown to be no more effective than placebo.[111] The safety of PDE5 inhibitor use in females with CVD has not been established.

Local and Topical Estrogen Therapy

Recommendation

1. **Nonsystemic (local or topical) estrogen use for the treatment of dyspareunia in women with CVD is reasonable *(Class IIa; Level of Evidence C)*.**

Vaginal dryness and pain with sexual intercourse are prevalent symptoms among sexually active postmenopausal women.[1] Estrogen administered via the vaginal route is an effective and Food and Drug Administration–approved treatment for relief of symptoms of vaginal atrophy typically seen in menopausal and postmenopausal women. Topical estrogen preparations can also be used on the vulva to treat insertional pain at the vaginal introitus. Concerns about estrogen therapy and increased cardiovascular risk were raised by the results of several large trials of women who received oral combination therapy with estrogen and progesterone[112,113]; however, trials with estrogen therapy alone have not reported increased cardiac risk.[114,115] Because systemic absorption with vaginal administration is minimal,[116] and focal vulval application is expected to be even less, topical estrogen therapy is unlikely to pose any cardiac risk in women with CVD.

Herbal Medications

Recommendation

1. **It may be reasonable to caution patients with CVD regarding the potential for adverse events with the use of herbal medications with unknown ingredients that are taken for treatment of sexual dysfunction *(Class IIb; Level of Evidence C)*.**

Numerous herbal medications are advertised to patients for the treatment of sexual dysfunction. Some of these medications may contain drugs, such as PDE5 inhibitors (or chemically similar substances),[117,118] yohimbine,[119] or L-arginine.[120] Such drugs can interact with cardiovascular medications, have vasoactive or sympathomimetic properties, can elevate or reduce systemic blood pressure, or have been associated with adverse outcome in patients with CAD.[98,107,119–122] Therefore, it may be reasonable to caution patients with CVD about the use of herbal medications with unknown ingredients advertised for the treatment of sexual dysfunction.

Psychological Issues of Sexual Activity and CVD

Recommendation

1. **Anxiety and depression regarding sexual activity should be assessed in patients with CVD *(Class I; Level of Evidence B)*.[2,3]**

Psychological distress[123] and decreased sexual function or activity[2,3] are associated[124] and are common in patients with CVD. In patients with CAD,[2,3] heart failure,[51] CHD,[67] recent MI,[125] CABG,[126] ICD implantation,[64] or cardiac transplantation,[127] sexual activity frequency and satisfaction often decline because of anxiety on the part of the patient or partner that sexual activity will worsen the underlying cardiac condition or cause death.[3,128] Changes in sexual activity after a cardiac event may impair the patient's quality of life, negatively affect psychological health, and strain marital or other important intimate relationships,[67,125,127] which in turn may lead to depression and anxiety. The resultant depression may be an important contributing cause of ED in men and of female sexual problems, including decreased libido, difficulty with arousal and orgasm, and dyspareunia.[2,67,124,129]

Patient and Partner Counseling

Recommendation

1. **Patient and spouse/partner counseling by healthcare providers is useful to assist in resumption of sexual activity after an acute cardiac event, new CVD diagnosis, or ICD implantation *(Class I; Level of Evidence B)*.**[130–134]

Although sexual counseling of patients and partners with CVD is an important component of recovery, it is rarely provided.[135–138] Potential reasons for this include the provider's lack of experience or comfort discussing sexual issues, inadequate knowledge on issues regarding sexual activity and CVD, and limited time.[135–138] Studies show that most CVD patients (and their partners) believe they have been inadequately educated on this topic by healthcare providers[139,140] and desire more information on how to resume their normal sexual activity.[140–142] Partners of patients with CVD often have considerable anxiety about sexual activity, which may adversely impact the sexual activity of the couple.[62,143,144] When information on sexual activity is provided to the patient, it is more likely to be provided in written form than verbally, more likely to be provided to men than to women, and rarely provided to the partner.[145]

A discussion about sexual activity is appropriate for men and women of all ages who have CVD. Initiation of a discussion of sexual issues by the healthcare provider can facilitate an open discussion of the patient's and partner's sexual concerns.[146] Questionnaires can be used to facilitate a discussion of sexual issues.[147] General suggestions to the patient may include being well rested at the time of sexual activity, avoiding unfamiliar surroundings and partners to minimize stress during sexual activity, avoiding heavy meals or alcohol before sexual activity, and using a position that does not restrict respiration.[79,130,142,148] The achievement of orgasm may require a greater degree of exertion and may not be a realistic initial goal in some patients. Randomized trials have demonstrated that sexual counseling in patients with CVD results in increased knowledge, a higher likelihood of return to sexual activity, improved sexual desire and satisfaction, and increased confidence and reduced fear in resuming sexual activity.[130–134]

Summary

Sexual activity is an important component of patient and partner quality of life, and it is reasonable for most patients with CVD to engage in sexual activity. It is reasonable that patients with CVD who wish to engage in sexual activity undergo a comprehensive history and physical examination beforehand. Those with stable symptoms and good functional capacity generally have a low risk of adverse cardiovascular events with sexual activity. Patients with unstable or severe symptoms should first be treated and stabilized before engaging in sexual activity. Exercise testing can provide additional information as to the safety of sexual activity in patients with indeterminate or unclear risk.

Cardiovascular medications are uncommonly the true cause of ED, and those that can improve symptoms and survival should not be withheld because of concerns about the potential impact on sexual function. PDE5 inhibitors have proved safe and effective in many patients with stable CVD; however, nitrate use is an absolute contraindication for PDE5 inhibitor administration.

Anxiety and depression are important considerations in patients with CVD and can contribute to reduced or impaired sexual activity. Sexual counseling of CVD patients and their partners is an important component of recovery; unfortunately, it is rarely provided.

Further research is needed on sexual activity in specific cardiovascular conditions, particularly with regard to the effects of sexual activity in females and in older adults. When possible, pharmacotherapy, device and surgical intervention, registries, and longitudinal studies of patients with CVD should specifically include data on sexual activity and function. Future studies of interventions to improve sexual activity in the context of CVD, including sexual counseling, should address sexual concerns and activity of both men and women, young and old, and both patients and partners.

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Writing Group Disclosures

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Glenn N. Levine	Baylor College of Medicine	None	None	None	None	None	None	None
Faisal G. Bakaeen	Michael Debakey VA Medical Center/Baylor College of Medicine	Veterans Affairs Cooperative Studies Program*	None	None	None	None	None	None
Biykem Bozkurt	Michael Debakey VA Medical Center/Baylor College of Medicine	Amgen†; Corthera†; NIH†; Novartis†	None	None	None	None	None	None
Melvin D. Cheitlin	University of California, San Francisco	None	None	None	None	None	None	None
Jamie Beth Conti	University of Florida	None	None	None	None	None	None	None
Elyse Foster	UCSF Medical Center	Boston Scientific†; EBR Systems†; EDS, Inc†; Evalve, Inc†	None	None	None	None	Actelion*	Adult Congenital Heart Disease Board of Directors*
Tiny Jaarsma	Linkoping University	None	None	None	None	None	None	None
Robert A. Kloner	Heart Institute Good Samaritan Hospital	None	None	Pfizer*	None	None	Pfizer*	None
Richard A. Lange	University of Texas	None	None	None	None	None	None	None
Stacy Tessler Lindau	University of Chicago	NIH/NIA 1K23AG032870-01A1†; NIH/NIA 5P30 AG 012857 (CCBAR)†	None	None	None	None	None	None
Barry J. Maron	Minneapolis Heart Institute Foundation	Medtronic*	None	None	None	None	Gene DX*	None
Debra K. Moser	University of Kentucky	None	None	None	None	None	None	None
E. Magnus Ohman	Duke University Medical Center	Daiichi Sankyo†; Eli Lilly†; MAQUET†	None	Boehringer Ingelheim†; Gilead†	None	None	AstraZeneca*; Boehringer Ingelheim*; Bristol-Myers Squibb*; Gilead†; LipoScience*; Merck*; POZEN*; Sanofi-Aventis*; The Medicines Co*; WebMD†	None
Allen D. Seftel	Cooper University Hospital	Auxilium†; Eli Lilly†	None	None	None	None	Abbott*; Auxilium*; Eli Lilly*; Endo*; Pfizer*	*Journal of Urology* Editorial Board*
Elaine E. Steinke	Wichita State University	None	None	Wichita State University, Regional Institute on Aging*	None	None	None	None
William J. Stewart	Cleveland Clinic	None	None	None	None	None	None	None

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*Modest.

†Significant.

Reviewer Disclosures

Reviewer	Employment	Research Grant	Other Research Support	Speakers' Bureau/ Honoraria	Expert Witness	Ownership Interest	Consultant/Advisory Board	Other
Cesar Alberte-Lista	University of Wisconsin Hospital	None	None	None	None	None	None	None
Nancy C. Berg	Park Nicollet Medical Services	None	None	None	None	None	None	None
James Blankenship	Geisinger Medical Center	Boston Scientific*; Astra-Zeneca*; Schering-Plough*; Abiomed*; Kai Pharmaceuticals*; Novartis*; Conor Medsystems*	None	None	None	None	None	None
Blase A. Carabello	Houston VA Medical Center	None	None	None	None	None	None	None
Christine Chiu-Man	Hospital for Sick Children (Toronto)	None	None	Medtronic*; St Jude*	None	None	None	None
J. Quentin Clemens	University of Michigan Urology Center	None	None	None	None	Merck†	Pfizer*; Lilly*; Afferent Pharmaceuticals, Inc*; United BioSource Corp*	None
Carole Decker	St Luke's Hospital	University of Chicago: research grant with Stacy Tessler Lindau*	None	None	None	None	None	None
Kathleen Dracup	University of California San Francisco	None	None	None	None	None	None	None
N.A. Mark Estes	New England Medical Center	None	None	None	None	None	None	None
Stephan D. Fihn	VA Puget Sound Health Care System	None	None	None	None	None	None	None
Jeffrey Kaufman	Self	None	None	None	None	HealthTronics Lithotripsy†	American Urological Association Board of Directors*; American Association of Clinical Urologists Board of Directors*	
Frederick G. Kushner	Tulane University Medical Center	None	None	None	None	None	None	None
Rachel J. Lampert	Yale School of Medicine	Medtronic†; Boston Scientific†; St Jude Medical†	None	Medtronic*; Boston Scientific*	None	None	None	None
Kevin McVary	Northwestern Medical Faculty Foundation	Allergan*; NeoTract*; NIDDK*; Lilly*	None	GlaxoSmithKline*	None	None	Lilly/ICOS*; Watson*	None
Wayne L. Miller	Mayo Clinic	None	None	None	None	None	None	None
Martin Miner	Brown University	None	None	None	None	None	None	None
Steven Nakada	University of Wisconsin	None	None	None	None	None	None	None
Brian Olshansky	University of Iowa Hospitals	Boston Scientific*	None	None	None	None	Boehringer Ingelheim*	Sanofi DSMB*
Gurusher Panjrath	Johns Hopkins University	None	None	None	None	None	None	None
J. Brantley Thrasher	University of Kansas	Investigator, NIH grant*	None	None	None	None	Editorial Board, *Urology Times**	Oakstone Publishing (Editor, *Practical Reviews in Urology*)†
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*Modest.

†Significant.

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KEY WORDS: AHA Scientific Statements ■ cardiovascular disease