Cardiovascular Risks of Sexual Activity

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Introduction
There is a perception shared by a large portion of our society, including many physicians, that sexual activity, especially at orgasm, is associated with a very significant cardiovascular response. This response would then represent a significant risk to selected individuals, especially those with cardiovascular diseases (clinically known or unknown). Patients and their spouses frequently cease their sexual activity because of this assumption of orgasm-related risk, associated with a perceived near maximal or even “super maximal” cardiac workload. A marked reduction in frequency of sexual activity, in the range of 39% to 70%, has been reported in patients following myocardial infarction (MI) or bypass graft surgery. This high cardiac stress and risk of sexual activity mythology of our culture is often supported, in the minds of patients, by reports of sexual activity-related cardiac deaths of prominent public figures, and story lines in popular television dramas. The data on heart rate and blood pressure response to coitus, reported by Masters and Johnson [1•], and the awareness of physicians that some patients with stable effort angina report chest pain symptoms during or immediately after coitus, reinforced the clinical perception of a high cardiac workload and risk associated with sexual activity. This subject has become increasingly important with the recent availability of sildenafil for erectile dysfunction and the resultant resumption of sexual activity by men with elevated coronary heart disease risk factor profiles, or known cardiovascular disease.

Physiology of Sexual Response
The parasympathetic nervous system is critical to penile erection and overrides the sympathetic tone that maintains the penis in a nonerectile state. In addition to the reduction of sympathetic tone, initiation of erection begins with release of nitric oxide (NO) from nonautonomic, nonadrenergic nerves that cause an initial increase in penile artery blood flow. This initial blood flow activates shear receptors on the penile artery endothelium with a resultant further increase in penile artery dilation and blood flow. The resultant increased blood flow engorges corpus cavernosum sinusoids, and the increased corporal pressure compresses the venous outflow of the corpora with the development and maintenance of penile erection. The alternations in parasympathetic and sympathetic tone may potentially affect the cardiovascular system. Although increased parasympathetic tone may decrease the heart rate, other events associated with arousal may stimulate the cardiovascular system.

Becker et al. [2•] measured, in healthy subjects, the concentration of norepinephrine and epinephrine in peripheral venous and corporal blood during different phases of erection: flaccidity, tumescence, rigidity, and detumescence. There were no changes in peripheral venous blood levels of norepinephrine and heart rates during all phases. Only a mild elevation of plasma epinephrine levels was noted. This may reflect a general systemic response to arousal; however, the overall stress on the cardiovascular system was minimal.

Studies of the physiologic response to coitus have focused in large part on changes in the heart rate, blood pressure, and myocardial oxygen uptake. In this regard, Masters and Johnson [1•], published their findings of heart rates and blood pressure during coitus, in student and faculty couples who were attached to electrocardiographic machines in a private chamber of their laboratory. In this setting, they noted peak coital heart rates of 140 to 180 beats per minute, and a mean increase in blood pressure of 80 mm Hg systolic and 50 mm Hg diastolic.

These data were similar to an earlier small study (three young married couples, ages 22–30 years) by Bartlett [3]. Coitus among couples was performed in a small experimental room with electrocardiograph wires fed through a foam-filled slit in the wall separating the investigators. A handheld button was used to signal the stages of coitus: intromission, orgasm, and withdrawal. In both men and women, peak coital heart rates occurred at orgasm and were similar, 170 beats per minute. A repeat study was done during which couples wore mouthpieces, so that expired air was collected for tidal volume and respiratory rate. Respiratory rate and tidal volume increased significantly in all subjects. In some subjects, respiratory rate...
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exercise-training program. Patients wore 24-hour ambulatory electrocardiograph monitors at home and during
were 47.5 years and their fitness level, as assessed by maximal oxygen consumption testing, was similar to that of urban ambulatory middle-aged normal subjects. The mean peak heart rate at orgasm was 117 beats/min with a range of 90 to 144. Of particular interest was the finding that, in the majority of the 14 subjects, the peak coital heart rate was lower than heart rates achieved with normal daily activity (mean of 120 beats/min).
Hellerstein and Friedman [4••] approximated the blood pressures (which were not measured) during coitus and at orgasm by having the patients perform cycle ergometry exercise to heart rate equivalent to those achieved at orgasm and measuring the blood pressures achieved at these heart rates. The mean blood pressure at coital equivalent heart rate was relatively modest, 162/89 mm Hg. However, this value may underestimate the peak coital blood pressure, as it does not account for the neuroendocrine sympathetic response to arousal and coitus.

There had also been concern regarding the use of sexual position during sexual intercourse, man-on-top versus man-on-bottom. Initial assumptions were that man-on-top position would be a more stressful to cardiovascular system due to enhanced physical movement and the use of his arms to support himself above his partner. This, it was postulated, would result in isometric arm exercise causing significant elevation in his blood pressure. Namec et al. [5], from the University of Washington in Seattle, addressed this issue in 10 male subjects having coitus with their spouses in their own homes. There were no differences in peak coital heart rates, blood pressures, and double products (heat rate and systolic blood pressure) for male subjects in regard to man-on-top or woman-on-top position. This study indicated that there is no physiologic basis for men with coronary heart disease to use the woman-on-top position during sexual activity.

The training effect of an endurance exercise program would be expected to produce lower post-training heart rates at a given submaximal workloads with activities using the same muscle groups as the training program. Stein [6•] studied peak coital heart rates in 16 patients after MI, who

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exceeded 60 breaths/min and peak minute volumes achieved were comparable with moderately severe physical exertion.

In 1970, Hellerstein and Friedman [4••] published the first data on sexual activity in middle-aged men with
coronary artery disease. Unlike the earlier studies using the laboratory setting, their study utilized 24-hour ambulatory electrocardiographic monitors with married couples engaging in sexual activity in their usual private setting, position, and time. Of 91 participants who responded to a questionnaire about sexual activity and wore ambulatory electrocardiographic monitors, 14 subjects with atherosclerotic heart disease engaged in conjugal sexual activity during the 24 to 48 consecutive hours of electrocardiographic monitoring. The mean age of the subjects was 47.5 years and their fitness level, as assessed by maximal oxygen consumption testing, was similar to that of urban ambulatory middle-aged normal subjects. The mean peak heart rate at orgasm was 117 beats/min with a range of 90 to 144. Of particular interest was the finding that, in the majority of the 14 subjects, the peak coital heart rate was lower than heart rates achieved with normal daily activity (mean of 120 beats/min).

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exercise-training program. Patients wore 24-hour ambulatory electrocardiograph monitors at home and during coitus with their spouses on two occasions before and two occasions after completion of a 16-week bicycle-training program. Six patients comprised a control group (without exercise training) for the 16-week period. The mean peak coital heart rate before training was 127 beats/min (120–130). After training, it fell significantly, to 120 beats/min (115–122). Exercise training maximal oxygen consumption (VO2max) increased a mean of 11.5% in this training group. There was no change in the control group in regard to their peak coital heart rates and VO2max. This study suggested the potential value of exercise training in reducing the myocardial oxygen requirement, as reflected by reduced heart rates, in patients with coronary heart disease during sexual activity.

Sanderson et al. [7], from the University of Minnesota in Minneapolis, studied heart rate changes during masturbation. Eleven men (mean age of 28.5 years) and 11 women (mean age of 28.2 years) were enrolled in the study. Heart rates increased, from a mean resting level of 68 beats/min, by 29% (to 88 beats/min) during stimulation, by 57% (to 107 beats/min) during orgasm, and by 74% (118 beats/min) at peak values. There were no statistically significant gender-related differences.

Bohlen et al. [8••] comprehensively evaluated sexual activity-related cardiac and metabolic responses in the male partners of 10 young (mean age 33.2 years), healthy married couples in a laboratory setting. The male subjects were characterized by a high level of physical fitness as reflected by their mean maximal oxygen consumption of 54 ml O2/kg/min, representing 15.5 METS (metabolic equivalent of oxygen consumption). The men were evaluated during four sexual activities (coitus with husband on top, coitus with wife on top, noncoital stimulation of husband by wife, and self-stimulation by the husband when alone). Measurements included heart rate (from a continuous electrocardiograph recording), blood pressure, and VO2 (minute oxygen consumption from a face mask worn by the man throughout the sexual activity with hook-up to metabolic cart) during the 4th minute of each 5-minute stage and orgasm. The 5-minute stages of sexual activity included baseline resting, foreplay, stimulation, orgasm, and resolution. A handheld button was used to signal orgasm.

The investigators noted a modest increase in heart rates with each stage of sexual activity, with peak heart rates occurring at orgasm. The average heart rate increased 4 to 8 beats/min during foreplay, to as much as 29 beats/min for man-on-top coitus during orgasm. Rate-pressure product peak values were noted at orgasm and represented an approximate doubling of the baseline value. These were not significantly different for the two coital positions, or in fact, for any of the four activities. Minute oxygen consumption (VO2) expressed as METS (1 MET = 3.5 mL O2/kg/min) was modestly elevated during self- and partner-stimulation (1.7