

Review Article

Risks of Sexual Activity in Elderly and/or Sick People: Review

Ruth Schobert^{1*} and Ursula Gresser^{1,2*}

¹Outpatient Clinic for Internal Medicine and Metabolic Diseases, Oskar-von-Miller-Ring 31, Munich, Germany

²University of Munich, Munich, Germany

Abstract

Study objectives: The review aimed to provide information about risk of sexual activity in elderly and/or sick patients. Is there a condition which reduces or increases the risk of sexuality under these circumstances?

Methods: Extensive search in medical databases PubMed, Medline, Embase, Science Direct and Google Scholar including multimodal search terms on the topic.

Results: In the autopsy studies, coital deaths were <1% and <2%, respectively. Concomitant circumstances, such as partner relationship, spatial environment, or additional stress factors, were found to be important. ECG monitoring studies during sexual activity showed that arrhythmias occurred in a maximum of 56% of patients and cardiac ischemia in 50% related to sexual activity. ECG changes during daily activities showed comparable percentages. Fatal cardiac events were not observed. Physical fitness (≥ 3 x/week physical activity/ ≥ 6 METs) showed a decreased relative risk of myocardial infarction related to sexual activity compared with less physically active patients (≤ 1 x/week physical activity). A lowered odds ratio for fatal coronary heart disease was observed in patients with regular sexual contacts (≥ 2 x/week) compared with patients with lower sexual contacts (< 1 x/month).

Conclusion: Coital deaths should be considered as rare events. In patients with coronary artery disease, arrhythmias during sexual activity were not significantly higher than during other activities of daily

***Corresponding authors:** Ruth Schobert, Outpatient Clinic for Internal Medicine and Metabolic Diseases, Oskar-von-Miller-Ring 31, 80333 Munich, Germany, E-mail: ruthschobert@aol.com

Ursula Gresser, Outpatient Clinic for Internal Medicine and Metabolic Diseases, Oskar-von-Miller-Ring 31, 80333 Munich, Germany, E-mail: ursulagresser@email.de

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living, work, or exercise. Minimization of risk factors includes sexual activity with a steady partner (wife/husband), in a familiar environment without prior excessive alcohol consumption. Physical fitness and an active sexual life before cardiovascular events turned out to be positive factors.

Keywords: Aging; Coital death; Risks; Sexual activity

Introduction

Sexuality is still considered a taboo topic nowadays [1-4], especially in the care of patients with cardiovascular disease [5,6]. According to international statistical data, 40% of patients and 30% of (spouses) partners reported receiving medical counseling on sexuality after cardiovascular events [7]. Review data from Lindau et al., [8] showed that one-third of women and just under half of men received education about post-discharge sexual behaviors. In contrast, in the study by Lunelli et al., [1] only 4% of patients received information about sexuality in cardiovascular events. On the other hand, patients did not address the topic of sexuality themselves due to shame [3,4,5,9,10].

Although there was a continued interest in sexual activity after cardiovascular events in 60% of patients [1], there was a significant decline in sexual activity after hospitalization [11,12]. 35% of patients experienced decreased sexual activity and 35% experienced decreased sexual satisfaction [13]. Even months after cardiovascular events, one-third of patients had not resumed sexual activity [14]. In the cohort of Cohen et al., [15] it was just under half (47%) of patients. Fear of cardiovascular events was cited as an important reason for sexual avoidance behavior [9,10,12,16-19]. (Spousal) partners also expressed fears about re-infarction from sexual activity [10,16,18,20,21]. It has been documented that this also negatively affected their sexuality [22,23].

This article focuses on the question of what risk sexuality has in old age and/or illness. What data were found on this in the scientific literature? Are there positive or negative factors that have an influence on the possible health risk of sexual activity in this setting?

Methods

An extensive search in medical databases like PubMed, Medline, Embase, Science Direct, and Google Scholar was performed, including multimodal search terms on the topic. A total of $\geq 20,000$ articles were found, which were analyzed and evaluated for a preselection under various aspects. First, the search was based on the multiple search terms such as “coital death”, “death on coition”, “erotic death”, “cardiac death”, “myocardial infarction after sexual intercourse/activity”, “acute coronary syndrome after sexual intercourse/activity”, “myocardial infarction and sudden cardiac death”, “cardiac arrest after sexual intercourse/activity”, “heart disease and sexual intercourse/activity”, “acute heart failure after sexual intercourse/activity”, “trigger of myocardial infarction/cardiac arrest”, “sex and death”, “sex and heart failure”, “sex and heart insufficiency”, “sexual health”, “sexual counseling”, “sexual rehabilitation”.

Second, the search was extended to study design, combining terms such as “case crossover study”, “prospective study”, “cohort study”, “case report”, “retrospective study”, “autopsies/obductions” in conjunction with “coital death”, “cardiac death”, “sexual intercourse”, “sexual activity” and “sexual health”. Bibliographies of previously searched publications were searched for original papers, and authors or research groups were identified by name and included in an extended search in relation to “sexuality and mental stress/physical activity”, “coital death and mental stress/physical activity”, “extramarital coital death”, “myocardial infarction on coition”.

Results

Original papers

Data mining of the search yielded a total of 42 original papers, including 11 publications as casuistics, 10 autopsy studies, 7 ECG monitoring analyses, and 14 collective studies in retrospective, prospective, and case-crossover analysis. The publications were written over a period from 1932 to 2018 and included a total collective of >180.000 patients or cases.

Selection criteria

The selection criteria varied widely; in some cases, patient data from a heterogeneous collective of diverse study groups, such as the MILIS study [24], MIO study [25], Caerphilly Study [26,27], SHEEP Study [28]; SUDS Study [29,30], or Paris-SDEC Study [31] were recruited and analyzed. In other publications, myocardial infarction [16,17,24,25,28,29,32-39], coronary artery disease [26,27,40], sudden cardiac arrest [30,31], stable angina [41], or documented shock events in patients with ICD-implantation [42] were selection criteria.

Sex distribution

Gender data were found in 2/3 of the publications [16,17,25,26,28,27,30,32,34-53]. In just under half (approximately 43%) of the cases, it was an exclusively male collective. No sex was reported for a total of 5.126 of the cases. Furthermore, the autopsy collective was not included in the analysis of sex distribution because no sex information was available for the overall collective.

Age distribution

The age distribution in the casuistics showed a range of variation from 20-70 years [47]. In some of the collective studies, age range information was found to be 45-59 years [26,27], 35-76 years [17], or 36-70 years [41]. The largest age range was 20-92 years [25]. Data on mean age were partially represented. This ranged from 57 years [37], or 58 years [42] to 60 years [38]. One publication found age-specific data related to prior cardiovascular disease, which was reported as a mean age of 48.5 years for men with atherosclerotic heart disease and 42.5 years for men without prior cardiac disease [40].

In one publication, a group-specific indication of mean age was given: 49.6 years for group A, which included patients with unchanged or increased sexual activity after myocardial infarction, and 52.3 years for group B, which included patients with reduced sexual activity after myocardial infarction [16].

Cardiovascular diseases

Data on previous cardiovascular disease for the total collective were found in 18 publications [24-27,30,35,36,39,42,45,47,49,51,54-57]. These included 5 autopsy studies [54-58] and 3 publications of

case reports [47,49,51]. In both casuistry and autopsy studies, myocardial infarction [47,57] was found more frequently as a presenting condition compared with angina [45,57], hypertension [56], hypertensive heart disease [51], arrhythmias, and heart failure [57], which occurred as isolated cases. In the autopsy collective of Krauland [58], a total of 50% of the 1.722 autopsies found a pre-existing cardiovascular disorder that was not described in detail.

In the collective studies, a NYHA classification was sometimes given for the collective [35,36,42]. Drory et al., [35] and Drory et al., [36] listed 50 of 88 men (57%) as having NYHA I, 26 men (30%) as having NYHA II, and 12 men (14%) as having NYHA III. Fries et al., [42] classified 28 men as having NYHA I or II and 15 men as having NYHA III. In 3 publications of the collective studies, prior cardiovascular disease was reported in association with sexual frequency [26,27,39]. Smith et al., [26] quantified pre-existing heart disease in 918 patients as prevalence per 100, depending on sexual activity. In the low sexual frequency categories it was 20.5% and in the high sexual frequency category it was 14.1%. Ebrahim et al., [27] reported pre-existing ECG relevant ischemia for 11 of 914 patients with low sexual frequency (<1x/month) and angina for 16 patients. In comparison in the high sexual frequency category ($\geq 2x/week$) there were 5 patients with ECG relevant ischemia and 12 patients with angina. Rothenbacher et al., [39] categorized pre-existing cardiovascular disease in 536 patients according to the graduation of coronary heart disease related to sexual activity. In the category of none/low sexual activity (0/<1x/month) there were 35.2% with a 3-vessel-disease. In comparison in the high sexual frequency category ($\geq 1x/week$), there were 20.3% with a 3-vessel-disease. Toftler et al., [24] listed 204 of 849 patients with angina during the 3 weeks prior to myocardial infarction. Muller et al., [25] identified 192 of 858 sexually active patients as having pre-existing myocardial infarction and 186 patients as having pre-existing angina. Aro et al., [30] reported 34 patients with sexually triggered heart failure, 8 cases of heart failure and 9 cases of coronary artery disease as pre-existing conditions.

Coital incidents

Fatal and nonfatal cardiac/cardiovascular events

Data on fatal events related to sexual activity were found in 19 publications [29-31,43-47,49-55,57-61]. Data came from casuistics [43,44,45,47,49,50-52], autopsy studies [54,55,57-61] and collective studies [29-31,53].

Data on nonfatal events related to sexual activity were found in 17 publications [16,24,25,27,28,31-37,39,40,42,46,48]. The data came from casuistry [46,48], collective studies [16,24,25,27,28,31,37,39,42] or were collected via ECG monitoring [32-36,40,41] of a patient population (Table 1).

Triggers of cardiovascular events associated with sexual activity

As triggers of coital cardiovascular events have been identified physical and emotional stress [45], medical intervention, extreme temperatures, heavy alcohol consumption, toilet use and smoking [24], decreased physical fitness [37], alcohol consumption and stress during long car trips [49], arterial hypertension, obesity, overheating from sun exposure, physical exertion and psychological stress [51], high body mass index and physical or emotional stress [61], physical overexcitation, vascular sclerosis and hypertrophic heart disease combined with alcohol consumption [59], change in familiar environment, extramarital relationship and intense lovemaking and a large age difference [41,56,59], sumptuous meals [58] and additional stress [37].

| Original papers | Number of cases | Period | Coital cardiovascular events/deaths |
|---------------------------------|-------------------------------|-----------|--|
| 11 Publications with casuistics | 21 cases 15 men 6 women | 1932-2018 | Coital events Vlay [46] 1/1 bilateral mitral valve prolapse Safi et al., [48] 1/1 sinus tachycardia and ventricular tachycardia Coital deaths Schrader [43] 2/3 syphilitic vascular changes Vergano [44] 2/2 myocardial infarctions Malik [45] 2/2 coronary heart diseases Anders & Tsokos [47] 3/7 recurrent myocardial infarctions 1/7 acute left heart failure in CMP and post-ICD implantation 1/7 arrhythmia in reactivated myocarditis 1/7 pericardial tamponade during aortic valve replacement in Marfan-syndrome Zack & Rummel [49] 1/1 fibromuscular dysplasia of the AV-nodal artery Bardale & Dhawane [50] 1/1 vasovagal response to pain Gips et al., [51] 1/1 acute cardiac failure in hypertensive CMP De-Giorgio et al., [52] 1/1 rupture aortic aneurysm in coarctation. Mondello et al., [53] 1/1 arrhythmogenic right ventricular CMP |
| 10 Autopsy studies | 103141 autopsies | 1965-2017 | Coital deaths Ueno [59] 15/67 acute heart failures, 9/67 CHD 5/67 dilated CMP, 5/67 syphilitic aortic stenosis 2/67 pericardial tamponades Krauland [58] 13/30 coronary stenoses, 11/30 coronary thromboses 3/30 coronary artery ruptures, 2/30 heart failures 1/30 mesaortitis luica Missliwetz & Kmen [60] 6/30 CHD, 5/30 acute myocardial infarctions, 5/30 re-infarctions 7/30 calluses in old infarctions, 4/30 cardiac hypertrophy/cardiac fibrosis Lecomte et al., [62] 3/43 cardiovascular, unspecified Lee et al., [56] 6/14 CHD, 2/14 fibromuscular dysplasias of the AV-nodal artery Reiter [63] 15/1400 sudden cardiac deaths, unspecified Parzeller et al., [54] 12/39 CHD, 10/39 re-infarctions, 11/39 myocardial infarctions, 3/39 CMP, 1/39 aneurysm dissecans, 1/39 myocarditis Parzeller et al., [55] 13/48 CHD, 13/48 re-infarctions, 12/48 myocardial infarctions, 4/48 CMP, 1/48 aneurysm dissecans, 1/48 myocarditis Parzeller et al., [57] 20/68 CHD, 15/68 re-infarctions, 13/68 myocardial infarctions, 7/68 CMP, 4/68 aneurysm dissecans, 1/68 myocarditis Lange et al., [61] 28/99 CHD, 21/99 myocardial infarctions, 17/99 re-infarctions, 8/99 CMP, 8/99 aortic aneurysm ruptures 2/99 acute heart failures, 1/99 cardiac arrest, 1/99 myocarditis, 1/99 post-myocardial infarction + cocaine intoxication |

| | | | |
|---|--|------------------|--|
| <p>7 Studies ECG monitoring</p> | <p>319 patients 232 men 18 women 69 cases gender not defined</p> | <p>1970-1996</p> | <p>Coital events Hellerstein & Friedman [40] 13/48 tachycardia 9/48 angina pectoris 4/48 tachycardia + AP 4/14 ST depression + AP 2/14 VES 1/14 VES + SVES Johnston & Fletcher [32] 4/24 occasional VES 1/24 occasional SVES 1/24 occasional VES + SVES 1/24 occasional VES + couplets 1/24 frequent VES 1/24 frequent VES + couplets 1/24 constant ventricular bigeminus, couplets, frequent VES 1/24 fusion beats 1/24 WPW Paolillo et al., [33] higher grade VES, unspecified. Jackson [41] 19/35 angina pectoris 4/19 palpitations 2/4 SVT, 2/4 sinus tachycardia Garcia-Barreto et al., [34] 1/23 VES in decreasing frequency 3/23 SVES in decreasing frequency Drory et al., [35] 21/88 silent cardiac ischemia 6/88 symptomatic cardiac ischemia Drory et al., [36] 49/88 VES 11/88 complex VES</p> |
| <p>14 Collective studies - retrospective - prospective - case-crossover</p> | <p>14569 patients 6859 men 2653 women 5057 patients gender not defined</p> | <p>1977-2018</p> | <p>Coital events Kavanagh & Shephard [16] 20/81 angina pectoris, 6/81 VES Gupta & Singh [17] 11/150 tachycardia, 10/150 AP, 4/150 tachycardia + AP 3/150 dyspnea, 3/150 AP + dyspnea 6/150 hyperventilation, 2/150 tachycardia + hyperventilation Tofler et al., [24] <7.8% acute myocardial infarction Muller et al., [25] 27/858 myocardial infarctions 2 hrs after SA Smith et al., [26] OR = 1.0 CHD with high SA (age-adjusted) OR = 2.2 CHD with low SA (age-adjusted) Ebrahim et al., [27] OR = 1.0 fatal CHD with high SA (age-adjusted) OR = 1.69 fatal CHD with low SA (age-adjusted) Möller et al., [28] 5/399 myocardial infarctions 2 hrs after SA Fries et al., [42] 2/43 tachyarrhythmias Baylin et al., [37] 8/470 myocardial infarctions 2 hrs after SA Masoomi et al., [38] 17/198 chest pain/chest tightness Reddy et al., [29] 7/304 cardiac arrests Aro et al., [30] 25/4557 tachycardia + ventricular fibrillation Rothenbacher et al., [39] 3/438 cardiac events 1 hr after SA Sharifzadehgan et al., [31] 17/3028 cardiac arrests</p> |

Table 1: Chronological presentation of cardiac/cardiovascular events or deaths from the casuistics, autopsy studies, ECG monitoring studies and collective studies.

Listing of the number of publications, gender-related presentation of cases or collective, if available. Presentation of published studies indicating the time period.

Coital incidents were subdivided into coital events, with numerical listing of the type of events and presentation of coital deaths.

Protective factors and modifying triggers

Protective factors of coital cardiovascular events have been identified as physical conditioning [25,28,37,40] high sexual frequency [26,27,39], prophylactic use of nitroglycerin or/and β -blockers [40], warmed up bedrooms, preheated bed sheets, avoidance of sexual intercourse immediately after eating or bathing [41]. For example, in physically fit patients (≥ 3 x/week physical activity/ ≥ 6 METs), there is a 2.5-fold decreased relative risk of myocardial infarction associated with sexual activity compared with less physically active patients (≤ 1 x/week physical activity) [25]. In patients with regular sexual contact (≥ 2 x/week), up to a 2.2-fold lower odds ratio for fatal coronary heart disease is outlined compared with patients with lower sexual contact (< 1 x/month) [26].

Other triggers of cardiovascular events

Other triggers of cardiovascular events have been cited in isolated cases as walking, activities at work, sedentary office work, driving, domestic quarrels and dinner with family [40]. Furthermore, physical activity [16,24,29,31,38,42,63], occupational activity [40,63], gardening [63], athletic activity [31,63], rest [31], sleep [29,34], emotional stress [24,29,38], sleep deprivation, excessive food intake [24], ergometric testing [35,36], opium use, cigarette use, cold environment, receiving bad news [38], verbal argument, physical altercation, extreme anxiety, police interrogation situation [62] were indicated.

Accompanying circumstances of cardiovascular events associated with sexual activity

Casuistics included data on heterosexual activity by men [43-45,47,49,50] and women [43,51-53]. Men's sexual contacts were mostly with prostitutes [43,44,47,50] and in isolated cases with their steady life partner or wife [47]. Women's sexual contact was mostly with their steady life partner or husband [43,45,49,53] and in isolated cases with their lover [51]. Autoeroticism [45,47] or zoophilia [47] were described in one case each among the men. In the autopsy studies, the majority of deaths occurred during extramarital sexual contact: 41/67 cases [59], 23/30 cases [58], 21/30 cases [60], 10/14 cases [56], 29/68 cases [57], 41/99 cases [61].

Less common death events included masturbation: 4/67 cases [59], 1/30 cases [58], 3/30 cases [60], 10/68 cases [57]. Lange et al., [61] reported causes of death related to autoerotic activities in nearly 1/3 of cases (30/99). Evidence here was pornographic magazines next to the body. Also rare were oral sexual practices: 1/30 cases [60], 3/68 cases [57], 3/99 cases [61] and homosexual contacts: 4/30 cases [58], 3/43 cases [62], 3/48 cases [55], 5/99 cases [61]. Collective studies assessed data from patients with conjugal heterosexual interaction [16,35,36,40]. Percentage status data were listed in 2 publications: married was 78.2% [28], and 67.2% [38] of sexually active patients, respectively.

Data on masturbation were described in one case. Johnston & Fletcher [32] reported a woman who developed cardiac arrhythmias from masturbating twice with a vibrator.

Place of death

Casuistics reported the locations of death as the hotel room [43,49], the prostitute's house [44,47,50], one's home [45,47,53], the stable building of one's yard property [47], one's car [45,51]. In the autopsy studies, the places of death were the hotel in 34/67 cases [59], 9/30 cases [60], 10/14 cases [56], 3/68 cases [57], 4/99 cases [61], the

brothel in 8/30 cases [58], 1/14 cases [56], 21/68 cases [57], 31/99 cases [61], the lover's house in 6/67 cases [59], 2/14 cases [56], 5/68 cases [57], the prostitute's house 6/68 cases [57]. Lange et al., [61] reported the prostitute's or lover's home as the location of finding in 6/99 cases.

Coital deaths occurred in the prostitute's house: 24/67 cases [59], 15/30 cases [58], 12/30 cases [60], 1/14 cases [56], 16/68 cases [57]. Less frequently, the car was reported 1/30 cases [58], 2/30 cases [60], 1/99 cases [61], the forest 1/30 cases [58], or outdoors 2/30 cases [60]. Other rare locations were the porn cinema 3/43 cases [62], the parking lot 4/99 cases [61], building or garage in 2/99 cases [61], the massage parlor in 1/99 cases [61], or the ambulance in 1/99 cases [61].

Discussion

The risk of sexual activity for cardiovascular events showed a dependence on diverse concomitant factors such as activity of sexual life, physical fitness and psychological stress. In available publications, physical fitness or active sex life are shown to be positive in risk assessment. For both qualities, an > 2 -fold reduced risk for cardiovascular events was shown. Stressful situations such as emotional upset [24], anxiety [62], psychological stress [42], or receiving bad news [38] were listed as higher risk for cardiovascular events compared with sexual activity. Consistent with the data from the original papers, various reviews showed an association between psychological stressors and cardiovascular disease risk [64-68]. Depressive episodes, anxiety, hopelessness, social isolation, chronic stress [64], acute stress [66], and negative emotions and anger [67] were important triggers. Both healthy individuals and cardiovascularly predisposed patients with depression or in angry, argumentative situations showed an increased risk of cardiovascular events [64]. Psychological stress was listed as a higher risk factor for cardiovascular events such as diabetes, obesity and smoking [65].

Conclusion

In the medical care of patients of advanced age or with severe diseases, especially cardiovascular diseases, patients also ask whether sexual activity is associated with an increased health risk for them or is still possible without risk. In the scientific search, 42 publications were found that dealt with the topic and in which the data collection was published. 31% of the papers dealt exclusively with men. Women and men were included in 55% of the papers. In the ECG studies, cardiac monitoring occurred during sexual activity. Arrhythmias during sexual activity were observed in 7.4% to 56% of patients. Nearly half of the patients had arrhythmias during activities of daily living. Evidence of cardiac ischemia during sexual activity was found in 31% to 50% of patients. Among the 50% of patients, 64.3% were found to have cardiac ischemia during work. Fatal cardiac events were not observed.

In the autopsy studies, coital deaths were reported at $< 1\%$ and $< 2\%$, respectively. Nearly 2/3 of the cases occurred during extramarital sexual activity, 43% of which involved prostitutes. Accompanying circumstances, such as partnership relationship, environment, and/or various other stress factors, were found to be significant in triggering coital death. Furthermore, pre-existing conditions, lifestyle, physical and sexual activity, and psychological stress influence the risk of coital cardiovascular events. Those who wish to be sexually active and minimize the risk should refrain from sexual activity with

lovers, prostitutes, in unfamiliar surroundings. The lowest risk occurs when practicing sexuality with regularity, with a spouse, in familiar surroundings, after a light meal with little alcohol and in a pleasantly tempered place of action.

Limitations

A total of only 42 published studies with original data were found. The study design was very different throughout, no systematic studies on the topic were found.

Contribution

Ruth Schobert designed the study, contributed to and revised critically. Ursula Gresser supervised the project. All authors read and approved the final manuscript.

Competing Interests

All authors declare that they have no competing interests. All authors contribute and approved the manuscript. All authors declare no financial support and no conflicts of interests.

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