

Sexual Dysfunction in Heart Failure Patients

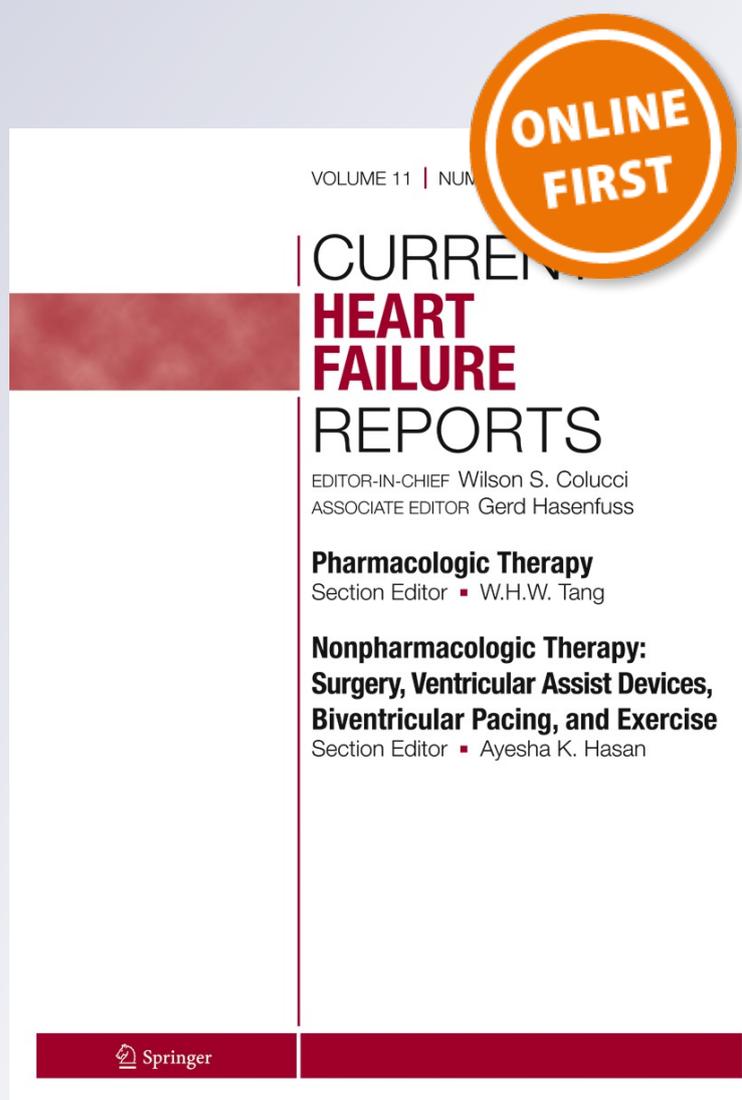
Tiny Jaarsma, Bengt Fridlund & Jan Mårtensson

Current Heart Failure Reports

ISSN 1546-9530

Curr Heart Fail Rep

DOI 10.1007/s11897-014-0202-z



Your article is protected by copyright and all rights are held exclusively by Springer Science +Business Media New York. This e-offprint is for personal use only and shall not be self-archived in electronic repositories. If you wish to self-archive your article, please use the accepted manuscript version for posting on your own website. You may further deposit the accepted manuscript version in any repository, provided it is only made publicly available 12 months after official publication or later and provided acknowledgement is given to the original source of publication and a link is inserted to the published article on Springer's website. The link must be accompanied by the following text: "The final publication is available at link.springer.com".

Sexual Dysfunction in Heart Failure Patients

Tiny Jaarsma · Bengt Fridlund · Jan Mårtensson

© Springer Science+Business Media New York 2014

Abstract Heart failure has a severe impact on different aspects of a patient's life, including sexual function. Sexual problems are common in heart failure (HF) patients, both in men and women, and are not always adequately addressed and treated in the current health care system. Several factors have been described to be related to sexual problems, such as activity intolerance, psychological factors, physiological factors, cardiac medications, recreational habits and comorbidity. The current review summarizes knowledge that can help clinicians treat sexual dysfunction in HF patients. After a good assessment, several steps are advised, including improving HF and co-morbid conditions, discussing psychosocial problems, worries and misunderstandings, managing risk factors and considering PDE-5 inhibitors or other libido enhancing agents.

Keywords Sexual dysfunction · Heart failure · Sexual problems · Sexual counseling · PDE-5 inhibitors

Introduction

Although sexual function is not one of the first issues that comes to mind when treating heart failure (HF) patients, it is known that a considerable number of HF patients and their

partners have sexual concerns which might cause worries and that can have a negative influence on their quality of life [1, 2]. Furthermore, misunderstandings about sexual dysfunction and misinterpretations of information regarding effects of cardiac medication or of libido-enhancing medication may lead to non-adherence to medication or unsafe use of potency enhancing products [3]. Although most studies on sexual dysfunction address erectile dysfunction (ED), other sexual problems also exist, affecting >80 % of men and women [4, 5]. Tomcsanyi et al. (2007) [6] even describe a takotsubo syndrome induced by sexual activity in women.

Heart failure and sexual dysfunction have common and epidemiologic associations, common risk factors and common underlying pathology. Furthermore, ED has been recognized as an early predictor of cardiovascular events, and might worsen with HF due to symptoms or cardiovascular medications [7].

In stable HF patients sexual activity is generally not contraindicated and sometimes it is even encouraged as a form of moderate-intensity physical exertion [7]. However, others discuss a possible negative relationship between sexual dysfunction and survival. [8]. A significant positive correlation between duration of active sexual life and life expectancy has been found in healthy men [9, 10].

Of course, it should be recognized that sexual activity is not a main topic of concern for all HF patients. However, in a study of 100 patients, 52 % of the men and 38 % of the women reported that sex was important and that sexual problems reduced their quality of life [11].

Sadly, HF patients expressed that physicians rarely discuss potential sexual problems with them [5]. Corresponding figures are found with other health care providers regarding the lack of discussions about sexual activities [12–15]. Clinicians seem reluctant to discuss sexual concerns, even if it concerns a patient's and partner's right to seek fulfilling lives. The purpose of this review was therefore to provide an overview of

T. Jaarsma (✉)

Department of Social and Welfare Studies, Faculty of Health Sciences, University of Linköping, 58183 Linköping, Sweden
e-mail: tiny.jaarsma@liu.se

B. Fridlund

Department of Nursing, School of Health Sciences, Jönköping University, Jönköping, Sweden

J. Mårtensson

Department of Nursing, School of Health Sciences, Jönköping University, Jönköping, Sweden

the knowledge base available regarding sexual activity in HF, common problems and how to approach these problems.

Prevalence of Sexual Dysfunction in HF Patients

Sexual problems are common in both male and female HF patients [5], particularly in younger patients and those with a partner [16, 17]. Sexual problems can include ED, orgasmic difficulties, lack of interest in sex since living with HF, being afraid of having sex, the partner being afraid to have sex or being overprotective [2, 5, 18].

Depending on how sexual problems are measured, around 60 % of HF patients report problems with sexual performance, sexual function, sexual pleasure or satisfaction [16, 17, 18]. Other studies have found that normal sexual activity was observed only in 31 % of patients younger than 70 [1]. Although it is known that in general 52 % of men aged 40–70 report some degree of ED and the prevalence is estimated to be 50 % in 60-year-old men [19], ED is even more prevalent in cardiac patients, particularly in HF patients [1]. ED prevalence is reported in up to 81 % of cardiac patients [20, 21, 22], and is reported across different cultures and ethnic groups [23, 24].

There is not a lot of data available on female sexual dysfunction in the general population or in women with HF, but women with cardiac disease are known to more often have sexual problems compared to women in the general population [5]. In a study of 100 female HF patients it was found that 87 % of the women were diagnosed with female sexual dysfunction with 80 % reporting reduced lubrication, of which 76 % reported frequent unsuccessful intercourse [5]. Women may experience other types of sexual dysfunction than men, including decline in sexual interest or desire, decline in sexual arousal, orgasmic disorder, vaginismus or painful sexual intercourse [25]. These numbers are higher than in a non-HF population in which 27 % of women aged 50–59 reported lack of interest in sexual activity, and 23 % of women were not able to have an orgasm [26].

Perceived difficulties in sexual activity can occur prior to the onset of HF [5] or develop during the course of the disease [2]. Despite several reports on the high prevalence of sexual problems, it is also known that the relationship or the psychosocial aspect of sexuality is not always affected, and that the majority of both patients and partners report no issues related to their sexual relationship [17, 18, 27].

Risk Factors, Related Factors and Underlying Reasons

Several factors have been described to be related to sexual problems (Table 1).

Table 1 Factors/variables related to sexual function in cardiac patients

Activity Intolerance	
Psychological	Depression, type D Performance anxiety Anxiety regarding deterioration or death
Physiological	Endothelial dysfunction Atherosclerotic plaques Anabolic deficiency Andropausal syndrome
Medications	Digoxin Spironolactone Aldosterone antagonist Thiazide diuretics Other medication
Recreational habits	Smoking Overweight Sedentary lifestyle
Co-morbidities	Dislipidemia Hypertension Diabetes Obesity
Other factors	Age Quality of relationship

1. Activity intolerance

Lack of energy and decreased exercise capacity reduce the ability to be sexually active for HF patients. Depending on the severity of their symptoms and the reduction of heart function, HF patients experience various degrees of reduction in exercise tolerance. Furthermore, as a result of a longer disease trajectory, several patients lose physical condition/form during the course of the disease.

The physical effort and related energy expenditure related to sexual activity in cardiac patients can be considered as mild to moderate physical activity in the range of 3 to 5 METS [28]. With regard to blood pressure and sex it was found that blood pressure and heart rate increase mildly during foreplay in normotensive men, with more modest increases occurring transiently during sexual arousal [29]. The greatest increases occur during the 10 to 15 seconds of orgasm, with a rapid return to baseline systemic blood pressure and heart rate (HR) thereafter [28, 30].

Although the highest energy expenditure during sexual activity does not exceed that employed during general housework or when climbing three flights of stairs, during sexual activity (especially during orgasm) HF patients have exhibited increased HR, right ventricular pressure and diastolic pulmonary pressure due to the activation of the sympathetic nervous system [31]. Authors studying a large number of stable male HF patients found that if they had a $VO_2 < 10$ ml/kg/min (i.e.,

2.8 MET) they had a markedly impaired sexual function, indicating that reduced cardiac performance can play a pivotal role in sexual intercourse failure [1]. Patients with decompensated or advanced heart failure (NYHA class III or IV) should wait to engage in sexual activity until their condition is stabilized and optimally managed [7•, 28•]. Although some patients approach their physical limit during sexual activity, patients might still be able to have sex by their partner active ensuring they practice passive sex or sex helped by drugs or implants. Therefore, a low peak VO₂ does not mean that severe HF patients cannot have sex or improve their sexual performance and satisfaction.

2. Psychological factors

Psychosocial problems such as depression, poor mood, type-D and anxiety are common in HF patients and these feelings might have a negative effect on sexual activity or satisfaction [32–34]. Goldstein et al. [33] described the so-called triad of depression, cardiac disease and ED, reflecting on how these conditions can influence each other. Changes in sexual activity after a cardiac event may impair the patients' quality of life, negatively affect psychological health and have an effect on intimate relationships, which in turn may lead to anxiety and depression [33]. Depression is known to be an important contributing cause of sexual problems, causing decreased libido, ED, difficulty with arousal and orgasm, and dyspareunia [33]. Anxiety is another psychological factor related to sexual problems, including both performance anxiety [34] and being afraid of triggering new cardiac events during sexual activity. Patients and their partners might worry that their sexual activity may lead to new cardiac events, a worsening of symptoms during sexual activity or even death [28•].

3. Physiological factors

Endothelial dysfunction is strongly associated with HF and may reduce NO production and vascular dilation, which are fundamental steps throughout the penile erection process [35]. Atherosclerotic plaques can also decrease blood flow to the corpus cavernosum [36].

Metabolic imbalance is often present in HF patients and can lead to increased catabolism and cardiac cachexia [37]. Anabolic deficiency is independently related to exercise tolerance, ED, reduced libido, and is also associated with increased mortality and hospitalization in men with HF [20•]. At the same time low serum testosterone levels are even hypothesized to act as an HF pathogenic factor in men, but evidence supporting this hypothesis is still lacking [20•].

Furthermore, andropausal syndrome, an element of male aging associated with the age-related decline in androgen circulation, is common in male patients with systolic HF

[38]. The prevalence of andropausal syndrome has been reported to be 4 times higher in men with systolic chronic HF aged 40 to 59 years compared with healthy men [38].

4. Medication: HF medication and other medication for related co-morbidities

Most patients with HF are prescribed a lot of medication. In addition to HF medication, other medication is prescribed for co-morbid or underlying conditions. Several HF medications are known to affect sexual performance or libido. Digoxin and aldosterone antagonists are well-known compounds affecting sexual performance or libido [34]. Thiazide diuretics can cause endothelial dysfunction and increased vascular oxidative stress, as well as hyperlipidemia, insulin resistance, a new onset of diabetes mellitus, and stimulation of the sympathetic system and the renin–angiotensin–aldosterone system (RAAS) [34]. Furthermore, the use of beta blockers can reduce sexual function [39]. However, data on 3rd generation beta blockers currently used for HF treatment are inconsistent [5]. Heart failure patients have even reported an improvement of sexual performance with beta blockers, which is likely to be a result of both a reduction of HF severity and the ancillary properties of some of the 3rd generation beta blockers [5].

5. Recreational habits

Recreational habits, in other words, changeable habits such as alcohol consumption, smoking, an unhealthy diet, and a sedentary lifestyle are all known risk factors with negative impact on cardiac health and ED in HF patients (7). Even though light to moderate alcohol intake is associated with a decreased risk of HF, alcohol intake must be taken into consideration when reviewing causes for sexual dysfunction, since higher levels of alcohol consumption are associated with a negative impact on sexual activity in HF patients [40]. Smoking also has a strong negative impact on sexual activity [41]. Obesity, which is mostly related to an unhealthy diet, can be related to decreased sexual activity in HF patients [42, 43]. Therefore, an improved diet is recommended with an emphasis on the Mediterranean diet [44]. Furthermore, a sedentary lifestyle is known to be related to ED (together with diabetes and the metabolic syndrome) and, therefore, moderate physical exercise is recommended [7•, 43, 45].

6. Co-morbidities

Several co-morbidities in HF patients might be related to sexual dysfunction but most evidence is related to diabetes and anemia [1]. ED and diabetes are a well-established combination regarding sexual activity in male and female HF patients due to damage to nerves and small blood vessels. However, today's treatments mostly prevent sexual

dysfunction [1, 46]. Anemia is reported in a large portion of HF patients [47] and has a significant role in determining an HF patient's sexual activity and other quality of life factors [48].

7. Other factors

Other factors such as age and the quality of the patient's relationship with their partner contribute to sexual function. Heart failure is most often seen in the elderly and reduced sexual activity is often considered to be a result of aging rather than of HF [1]. Although older age is not a direct reason to not have sexual interests or capability, several physiological changes, such as age-associated changes in microvessel function, alternations in NO and associated changes in CAD risk factors influence sexual function [7••]. Furthermore, the quality of the sexual relationship influences sexual function, and daily stressors, hassles or financial worries can be related to sexual problems [49]. These are important to consider since they are often common during a state of chronic disease.

Treatment and Counseling

Recently two main guiding documents of the American Heart Association (AHA) [28••, 50] and a comprehensive review [34] were published that can help clinicians treat sexual dysfunction in HF patients. A good assessment of a patient's sexual activity and satisfaction is needed prior to treatment and counseling [20•, 51, 52]. A variety of factors related to sexual function should be assessed, including responsiveness to treatment, previous medical history, co-morbidity, and the couple's concerns about resuming sexual activity. Assessment instruments and other tools can provide a basis for providing psychosocial support and for addressing a patient's particular concerns or problems [52]. These instruments can be easily used in the practice setting and may provide a starting point for sexual counseling, education, and provision of resources and referrals. After assessment, the following steps are important:

A. Improve HF and co-morbid conditions

As in all HF patients the first priority should be to optimize HF management. Although there is no data published indicating whether optimized HF therapy improves ED or other sexual problems, it is assumed that reduced symptoms and improved exercise capacity contribute to improved sexual activity [20•]. Secondly, drugs with potential sexual dysfunction side effects should be evaluated and replaced if possible. In a recent review it was advised that prior to any use of PDE-5 inhibitors clinicians should try to: (1) avoid digoxin; (2) avoid thiazide diuretics; (3) replace betablockers, for example,

propranolol with either metoprolol or carvedilol (due to their alpha-blocking effects); and, (4) replace spironolactone with eplerenone. The above approach should be considered only if clinically feasible without worsening the patient's function or symptoms and if affordable to the patients [34].

In addition to pharmacologic treatment, other treatment options might lead to improved sexual function. Cardiac resynchronization therapy might result in a significant improvement in libido and erectile function in HF patients. This improvement is related to improvements in the left ventricular ejection fraction (LVEF) and functional capacity [53]. In addition, encouraging patients to attend cardiac rehabilitation, if appropriate, might improve exercise tolerance and be a source of information and support [50, 54].

B. Discuss psychosocial problems, worries and misunderstandings

Health care providers who discuss sexual issues can facilitate an open discussion regarding the patient's and partner's sexual concerns [55].

Patients and partners may have information needs concerning sexuality in several respects, for example in relation to the relationship and symptoms [18, 27]. Some patients might want to know more about medication and psychological factors, but these might not be their first priority [18]. Westlake et al. described that there was no relationship between the level of perceived need for education and counseling and the level of reported sexual problems on the part of both patients and spouses or partners [27]. This highlights the importance of providing sexual education and counseling to all couples regardless of their reported level of sexual problems.

No evidence has been found that explicitly states reduced sexual activity negatively impacts the partner relationship [56]. As sexuality includes individual psychological, environmental, and physical aspects, and not only the specific act of intercourse, the impact on the partner relationship may be more implicit in nature. Reasons for less sexual intimacy, which could negatively influence the partner relationship, may be general depressive symptoms, such as anxiety, lowered self-esteem and fatigue. Also, the partner may adopt the role of a caregiver rather than an intimate lover or the patients and partners experience fear and apprehension in resuming sexual activity [56]. Cultural and personal differences need to be taken into account in discussing sex with patients and their spouses. People might regard sex as private and talking about sex can be regarded as taboo or unnecessary in some cultures [57].

C. Risk factor management

ED carries an independent risk for cardiovascular events. A considerable number of studies have examined the ability of

ED to predict the risk of future fatal and non-fatal cardiovascular events (e.g., myocardial infarction, stroke, revascularization) and total mortality in the general population and in high CV risk patients, as well as in diabetes and heart failure patients [45].

Risk factor management is a cornerstone in the management of sexual dysfunction. This includes regular exercise, smoking cessation, blood pressure control and diabetes control.

D. Pharmacological intervention.

PDE-5 inhibitors are a safe and effective therapy for ED in patients with mild to moderate HF who are at low cardiac risk. PDE-5 inhibitors should be used with caution in cases of intermediate cardiac risk and should be avoided in patients with high cardiac risk or patients who are concurrently being treated with nitrates [58]. Studies show that the PDE-5 inhibitor sildenafil is effective and safe for treating ED in patients with HF [58–60]. The mechanism by which PDE-5 inhibitors improve HF may be multifactorial. Studies have revealed that sildenafil has similar effects on preload and afterload as classic HF medications. Furthermore, PDE-5 inhibitors appear to have an intrinsic effect on diseased myocardium by increasing contractility as well as inhibiting and even reversing cardiac hypertrophy [58–60].

A special word of caution is required in relation to herbal medications. The AHA consensus on sexual activity is that cardiac patients should be cautious regarding the use of herbal medications with unknown ingredients that are taken as treatment for sexual dysfunction [28••]. These herbs are (often online) advertised to patients for treatment of sexual dysfunction. Some of these medications may contain drugs that can interact with cardiovascular medications or that have been associated with adverse outcome in cardiac patients [28••].

Other second-line therapies include a vacuum constrictor device and transurethral or intracavernosal prostaglandin E1 [61]. Even though clinical trial data are limited in the general population, current practice guidelines recommend testosterone replacement therapy for symptomatic men with low testosterone levels in order to improve SD [62]. However, testosterone replacement is not recommended in patients with untreated obstructive sleep apnea or severe decompensated HF as there is a potential for acute mild fluid retention at the initiation of treatment [63].

For women estrogen therapy is sometimes considered effective treatment for relief of vaginal atrophy symptoms [28••]. Trials with estrogen therapy alone have not reported increased cardiac risk for women [28••].

Concluding Remarks and Areas for Future Study

Sexual function can be reduced by HF symptoms and treatment or by co-morbidities that commonly occur in HF

patients. Obstacles to appropriate sexual counseling have been documented in the literature but the current review is aimed to give the readers knowledge and insight in order to optimally manage an HF patient's sexual problems. Although several reviews exist that summarize the knowledge on HF and sexual dysfunction, there is still a lack of original research in this patient population. Underrepresented populations include patients with congenital heart disease, patients with left ventricular assist devices and women. Further research is also needed to better understand sexual needs and concerns of those living with HF in a variety of practice settings.

Compliance with Ethics Guidelines

Conflict of Interest Tiny Jaarsma, Bengt Fridlund, and Jan Mårtensson declare that they have no conflict of interest.

Human and Animal Rights and Informed Consent This article does not contain any studies with human or animal subjects performed by any of the authors.

References

Papers of particular interest, published recently, have been highlighted as:

- Of importance
- Of major importance

1. Apostolo A, Vignati C, Brusoni D, Cattadori G, Contini M, Veglia F, et al. Erectile dysfunction in heart failure: correlation with severity, exercise performance, comorbidities, and heart failure treatment. *J Sex Med.* 2009;6(10):2795–805.
2. Hoekstra T, Jaarsma T, Sanderman R, van Veldhuisen DJ, Lesman-Leege I. Perceived sexual difficulties and associated factors in patients with heart failure. *Am Heart J.* 2012;163(2):246–51. *Study in a large group of chronic heart failure patients describing changes of time in sexual difficulties during recovery.*
3. Kiowski W, Brunner H, Schalcher C. Sex, the heart and heart failure. *Semin Cardiothorac Vasc Anesth.* 2006;10(3):256–8.
4. Steinke EE, Mosack V, Wright DW, Chung ML, Moser DK. Risk factors as predictors of sexual activity in heart failure. *Dimens Crit Care Nurs.* 2009;28(3):123–9.
5. Schwarz ER, Kapur V, Bionat S, Rastogi S, Gupta R, Rosanio S. The prevalence and clinical relevance of sexual dysfunction in women and men with chronic heart failure. *Int J Impot Res.* 2008;20(1):85–91.
6. Tomcsanyi J, Marosi A, Arabadzisz K, Zsoldos A, Bozsik B. Takotsubo syndrome associated with sexual intercourse. *Int J Cardiol.* 2007;121(3):e28–9.
7. Alberti L, Torlasco C, Lauretta L, Loffi M, Maranta F, Salonia A, et al. Erectile dysfunction in heart failure patients: a critical reappraisal. *Andrology.* 2013;1(2):177–91. *A comprehensive literature review to examine the pathophysiological mechanisms behind the association of erectile dysfunction and HF, the potential therapeutic approaches and the eventual indications for sexual activity in HF patients. They also plead for encouragement of sexual activity as a form of moderate-intensity physical exertion. Nice table with risk factors, other conditions and markers.*

8. Wong HT, Clark AL. Impact of reported sexual dysfunction on outcome in patients with chronic heart failure. *Int J Cardiol.* 2013;170(2):e48–50.
9. Lindau ST, Gavrilova N. Sex, health and years of sexually active live gained due to good health: evidence from two US population based cross sectional surveys of ageing. *BMJ.* 2010;9:c810.
10. Corona G, Lee DM, Forti G, O'Connor DB, Maggi M, O'Neill TW, et al. Age-related changes in general and sexual health in middle-aged and older men: results from the European Male Ageing Study (EMAS). *J Sex Med.* 2010;7:1362–80.
11. Schwarz ER, Rodriguez J. Sex and the heart. *Int J Impot Res.* 2005;17:S4–6.
12. Riegel B, Moser DK, Powell M, Rector TS, Havranek EP. Non-pharmacologic care by heart failure experts. *J Card Fail.* 2006;12(2):149–53.
13. Byrne M, Doherty S, Murphy AW, McGee HM, Jaarsma T. Communicating about sexual concerns within cardiac health services: do service providers and service users agree? *Patient Educ Couns.* 2013;92(3):398–403.
14. Jaarsma T, Strömberg A, Fridlund B, De Geest S, Mårtensson J, Moons P, et al. Sexual counselling of cardiac patients: nurses' perception of practice, responsibility and confidence. *Eur J Cardiovasc Nurs.* 2010;9:24–9.
15. Hoekstra T, Lesman-Leege I, Couperus MF, Sanderman R, Jaarsma T. What keeps nurses from the sexual counseling of patients with heart failure? *Heart Lung.* 2012;41(5):492–9.
16. Hoekstra T, Lesman-Leege I, Luttik ML, Sanderman R, van Veldhuisen DJ, Jaarsma T. Sexual problems in elderly male and female patients with heart failure. *Heart.* 2012;98(22):1647–52.
17. Driel AG, de Hosson MJ, Gamel C. Sexuality of patients with chronic heart failure and their spouses and the need for information regarding sexuality. *Eur J Cardiovasc Nurs.* 2013. doi:10.1177/1474515113485521. *Although the study is rather small, it is a will performed study of information needs concerning sexuality in HF patients with and partners. The researchers developed an instrument to measure information needs that possibly is interesting to use in clinical practice.*
18. Jaarsma T. Sexual problems in heart failure patients. *Eur J Cardiovasc Nurs.* 2002;1:61–7.
19. Kostis. Sexual Dysfunction and Cardiac Risk — The Second Princeton Consensus Conference. *Am J Card.* 2005;96:85–93.
20. Giagulli VA, Moghetti P, Kaufman JM, Guastamacchia E, Iacoviello M, Triggiani V. Managing erectile dysfunction in heart failure. *Drug Targets.* 2013;13:125–34. *A review on medication to manage erectile dysfunction in men with HF. Contains a good table on the comparison of PDE5 inhibitors.*
21. Chew KK, Bremner A, Stuckey B, Earle C, Jamrozik K. Sex life after 65: how does erectile dysfunction affect ageing and elderly men? *Aging Male.* 2009;12:41–6.
22. Schwarz ER, Rastogi S, Kapur V, Sulemanjee N, Rodriguez JJ. Erectile dysfunction in heart failure patients. *J Am Coll Cardiol.* 2006;48:1111–9.
23. Hebert K, Lopez B, Castellanos J, Palacio A, Tamariz L, Arcement LM. The prevalence of erectile dysfunction in heart failure patients by race and ethnicity. *Int J Impot Res.* 2008;20:507–11.
24. Zeighami Mohammadi S, Shahparian M, Fahidy F, Fallah E. Sexual dysfunction in males with systolic heart failure and associated factors. *ARYA Atheroscler.* 2012;8(2):63–9.
25. Steinke EE. Sexual dysfunction in women with cardiovascular disease: what do we know? *J Cardiovasc Nurs.* 2010;25(2):151–8.
26. Laumann EO, Paik A, Rosen RG. Sexual dysfunction in the United States. *JAMA.* 1999;281(6):537–49.
27. Westlake C, Dracup K, Walden JA, et al. Sexuality of patients with advanced heart failure and their spouses or partners. *J Heart Lung Transplant.* 1999;18:1133–8.
28. Levine GN, Steinke EE, Bakaeen FG, Bozkurt B, Cheitlin MD, Conti JB, et al. Sexual activity and cardiovascular disease: a scientific statement from the American Heart Association. *Circulation.* 2012;125(8):1058–72. *Recommendation on sexual activity and cardiovascular disease, with clear summary of evidence.*
29. Hellerstein HK, Friedman EH. Sexual activity and the post-coronary patient. *Arch Intern Med.* 1970;125(6):987–99.
30. Bohlen JG, Held JP, Sanderson MO, Patterson RP. Heart rate, rate-pressure product, and VO2 were measured in. *Arch Intern Med.* 1984;144:1745–8.
31. Cremers B, Kjellstrom B, Sudkamp M, Bohm M. Hemodynamic monitoring during sexual intercourse and physical exercise in a patient with chronic heart failure and pulmonary hypertension. *Am J Med.* 2002;112:428–30.
32. Mols F, Denollet J. Type D personality ... Health Quality of Life Outcomes. Type D personality in the general population: a systematic review of health status, mechanisms of disease, and work-related problems. *Health Qual Life Outcomes.* 2010;8:9.
33. Goldstein I. The mutually reinforcing triad of depressive symptoms, cardiovascular disease, and erectile dysfunction. *Am J Cardiol.* 2000;86:41F–5F.
34. Rastogi S, Rodriguez JJ, Kapur V, et al. Why do patients with heart failure suffer from erectile dysfunction? A critical review and suggestions on how to approach this problem. *Int J Impot Res.* 2005;17:S25–36.
35. Costa C, Virag R. The endothelial–erectile dysfunction connection: an essential update. *J Sex Med.* 2009;6:2390–404.
36. Hodges LD, Kirby M, Solanki J, O'Donnell J, Brodie DA. The temporal relationship between erectile dysfunction and cardiovascular disease. *Int J Clin Pract.* 2007;61(12):2019–25.
37. Anker SD, Chua TP, Ponikowski P, Harrington D, Swan JW, Kox WJ, et al. Hormonal changes and catabolic/anabolic imbalance in chronic heart failure and their importance for cardiac cachexia. *Circulation.* 2007;96:526–34.
38. Tkaczyszyn M, Nega K, Łopuszańska M, Szklarska A, Mędraś M, Ponikowska B, et al. Andropausal syndrome in men with systolic heart failure. *Pol Arch Med Wewn.* 2013;123(4):156–69.
39. Ko DT, Hebert PR, Coffey CS, Sedrakyan A, Curtis JP, Krumholz HM. Beta-blocker therapy and symptoms of depression, fatigue, and sexual dysfunction. *JAMA.* 2002;288(3):351–7.
40. O'Keefe B, Bajwa, et al. Alcohol and Cardiovascular Health: The Dose Makes the Poison...or the Remedy. *Mayo Clin Proc.* 2014;89(3):382–93.
41. Wu C, Zhang H, Gao Y, Tan A, Yang X, Lu Z, et al. The association of smoking and erectile dysfunction: results from the Fangchenggang area male health and examination survey (FAMHES). *J Androl.* 2012;33(1):59–65.
42. Johannes CB, Araujo AB, Feldman HA, et al. Incidence of erectile dysfunction in men 40 to 69 years old: longitudinal results from the Massachusetts Male Aging Study. *J Urol.* 2000;163:460–3.
43. Esposito K, Giugliano F, Di Palo C, Giugliano G, Marfella R, D'Andrea F, et al. Effect of lifestyle changes on erectile dysfunction Effect of Lifestyle Changes on Erectile Dysfunction in Obese Men A Randomized Controlled Trial. *JAMA.* 2004;291(24):2978–84.
44. Gupta BP, Murad MH, Clifton MM, Prokop A, Nehra A, Kopecky SL. The effect of lifestyle modification and cardiovascular risk factor reduction on erectile dysfunction: a systematic review and meta-analysis. *Arch Intern Med.* 2011;171(20):1797–803.
45. Vlachopoulos C, Jackson G, Stefanadis C, Montorsi P. Erectile dysfunction in the cardiovascular patient. *Eur Heart J.* 2013;34(27):2034–46.
46. Braunwald E. Heart failure. *JACC.* 2013;1(1):1–20.
47. Groenveld HF, Januzzi JL, Damman K, et al. Anemia and mortality in heart failure patients, a meta-analysis. *JACC.* 2008;52:818–27.
48. Kraai IH, Luttik ML, Johansson P, De Jong RM, Van Veldhuisen DJ, Hillege HL, et al. Health-related quality of life and anemia in

- hospitalized patients with heart failure. *Int J Cardiol.* 2012;161:151–5.
49. Hamilton LD, Julian AM. The relationship between daily hassles and sexual function in men and women. *J Sex Marital Ther.* 2014;2014:20. doi:10.1080/0092623X.2013.864364.
 50. Steinke EE, Jaarsma T, Barnason SA, Byrne M, Doherty S, Dougherty CM, et al. Sexual counselling for individuals with cardiovascular disease and their partners: a consensus document from the American Heart Association and the ESC Council on Cardiovascular Nursing and Allied Professions (CCNAP). *Eur Heart J.* 2013;34(41):3217–35.
 51. Medina M, Walker C, Steinke EE, Wright DW, Mosack V, Farhoud MH. Sexual concerns and sexual counseling in heart failure. *Prog Cardiovasc Nurs.* 2009;24(4):141–8.
 52. Jaarsma T, Steinke EE, Gianotten WL. Sexual problems in cardiac patients: how to assess, when to refer. *J Cardiovasc Nurs.* 2010;25:159–64.
 53. Vural A, Agacdiken A, Celikyurt U, Culha M, Kahraman G, Kozdag G, et al. Effect of cardiac resynchronization therapy on libido and erectile dysfunction. *Clin Cardiol.* 2011;34(7):437–41.
 54. Belardinelli R, Lacalaprice F, Faccenda E, Purcaro A, Perna G. Effects of short-term moderate exercise training on sexual function in male patients with chronic stable heart failure. *Int J Cardiol.* 2005;101:83–90.
 55. Hardin SR. Cardiac disease and sexuality: implications for research and practice. *Nurs Clin North Am.* 2007;42:593–603.
 56. Dalteg T, Benzein E, Fridlund B, Malm D. Cardiac disease and its consequences on the partner relationship: a systematic review. *Eur J Cardiovasc Nurs.* 2011;10:140–9.
 57. Altioik M, Yilmaz M. Opinions of individuals who have had myocardial infarction about sex. *Sex Disabil.* 2011;29:263–73.
 58. Al-Ameri H, Kloner RA. Erectile dysfunction and heart failure: the role of phosphodiesterase type 5 inhibitors. *Int J Impot Res.* 2009;21(3):149–57.
 59. Rosano GM, Aversa A, Vitale C, Fabbri A, Fini M, Spera G. Chronic treatment with tadalafil improves endothelial function in men with increased cardiovascular risk. *Eur Urol.* 2005;47:214–20.
 60. Mazo E, Gamidov S, Iremashvili V. The effect of vardenafil on endothelial function of brachial and cavernous arteries. *Int J Impot Res.* 2006;18:464–9.
 61. Archer SL, Gragasin FS, Webster L, Bochinski D, Michelakis ED. Aetiology and management of male erectile dysfunction and female sexual dysfunction in patients with cardiovascular disease. *Drugs Aging.* 2005;22(10):823–44.
 62. Naghi JJ, Philip KJ, DiLibero D, Willix R, Schwarz ER. Review: testosterone therapy: treatment of metabolic disturbances in heart failure. *J Cardiovasc Pharmacol Ther.* 2011;16(1):14–23.
 63. Kazi M, Geraci SA, Koch CA. Considerations for the diagnosis and treatment of testosterone deficiency in elderly men. *Am J Med.* 2007;120:835–40.