ORIGINAL RESEARCH ARTICLE

Sexual rehabilitation for cardiac patients with erectile dysfunction: a randomised clinical trial

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ABSTRACT

Background Sexual dysfunction is common in patients with either ischaemic heart disease (IHD) or implantable cardioverter defibrillator (ICD) and has a negative impact on quality of life. Non-pharmacological treatment options are lacking. The purpose of this trial was to assess the effect of sexual rehabilitation versus usual care for males with erectile dysfunction and either IHD and/or ICD.

Methods Participants with erectile dysfunction and IHD and/or ICD were randomised to 12 weeks of sexual rehabilitation consisting of physical exercise training, pelvic floor exercise and psychoeducation, or usual care. Primary outcome: sexual function by the International Index of Erectile Function (IIEF). Secondary outcome: sexual function by the Psychosocial Adjustment to Illness Scale. Exploratory outcomes: exercise capacity, pelvic floor strength/endurance, self-reported health and mental health.

Results 154 participants were included, mean age 61.6 years (SD 6.1). Sexual rehabilitation compared with usual care improved sexual function with a mean difference IIEF score of 6.7 (95% CI 3.1 to 10.4, p<0.0003) at 4 months between groups (unadjusted IIEF mean scores 36.4 vs 31.3) and a mean difference of 6.7, 95% CI 3.2 to 10.1 (p<0.0002) at 6 months between groups (unadjusted mean scores IIEF 37.1 vs 32.2). No effects were seen on the secondary outcome. Sexual rehabilitation improved exercise capacity on cycle ergometer measured by Watt max with a mean difference of 10.3, 95% CI 3.6 to 16.9 (p<0.003) and pelvic floor strength (p<0.01). No differences were seen on self-reported health and mental health.

Conclusion Sexual rehabilitation compared with usual care improves sexual function and exercise capacity.

Trial registration NCT01796353; Results.

INTRODUCTION

Males with cardiovascular disease have increased prevalence of sexual dysfunction,[1 2] which has a negative impact on quality of life and well-being. Disorders of male sexual function are categorised in relation to desire, ejaculation, orgasmic and the most common, erectile function.[3] The causes of erectile dysfunction can be classified mainly as organic, with a vascular, hormonal or neurogenic aetiology, or psychogenic where the aetiology is connected to psychiatric disorders, performance anxiety, interpersonal problems or concerns related to somatic disease, or a combination of the above. Furthermore, erectile dysfunction can be due to an adverse effect from medications.[4]

In males with ischaemic heart disease (IHD) erectile dysfunction is prevalent in up to 75% of patients,[5] whereas for males with implantable cardioverter defibrillator (ICD), up to 57% are affected.[6] Despite the fact that international guidelines recommend that health professionals address sexuality in patients with heart disease,[7] this is rarely done in clinical practice.[8] Guidelines and clinical practice on how and where patients with heart disease and sexual dysfunction should be treated are lacking, except for consensus about prescription of phosphodiesterase type 5 (PDE5) inhibitors.[7] Non-pharmacological interventions such as physical exercise including pelvic floor exercise possess a potential in reducing sexual dysfunction.[9 10] However, the available literature was based on studies with high risk of bias, non-randomised designs and the use of non-validated tools for assessment of sexual dysfunction. Pelvic floor exercise interventions have not previously been performed in cardiovascular patients.

A recent Cochrane systematic review identified only three randomised clinical trials including a sexual counselling intervention in patients with a history of heart disease and found a clear need for methodological rigorous adequately powered randomised trials.[11]

As the condition sexual dysfunction often includes both physical and psychological components,[4] the objective of this trial was to investigate the effects of a comprehensive sexual rehabilitation programme, consisting of a physical exercise component, including pelvic floor exercises plus a psychoeducative component on sexual function of male patients with IHD or with ICDs.

METHODS

Study design

The CopenHeart$_{SF}$ trial (SF: sexual function)[12] is a randomised clinical trial comparing sexual rehabilitation versus usual care. The trial complies with the Declaration of Helsinki and was registered at ClinicalTrials.gov (NCT01796353 (results)).

Participants, setting and recruitment

Males aged ≥18 years with erectile dysfunction and IHD verified by coronary angiography or

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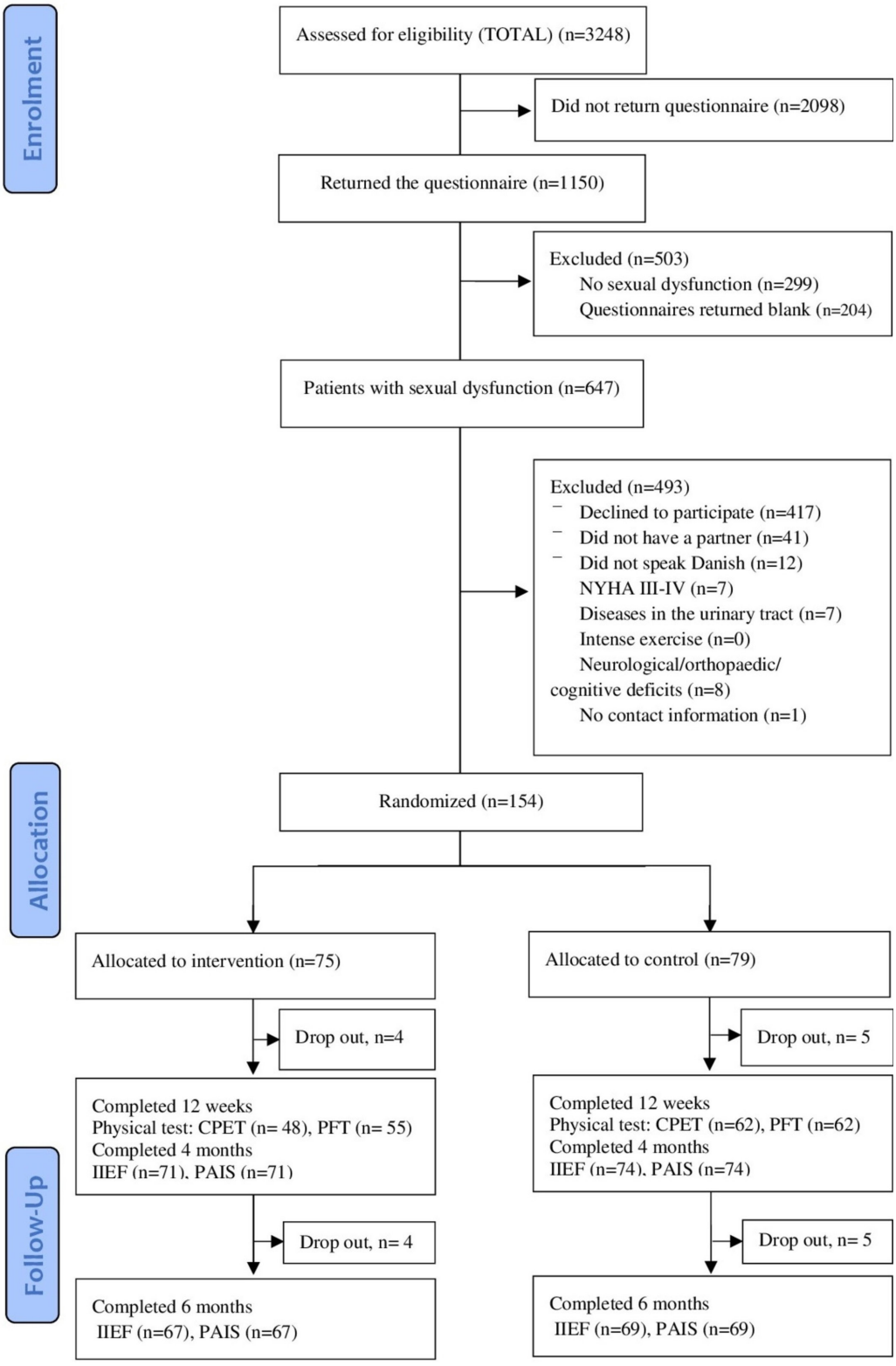

Figure 1 Consolidated Standards of Reporting Trials flow diagram. Flow of patients in the CopenHeart$_{SF}$ (SF: sexual function) trial. The 10 dropouts in the control group and 8 in the intervention group were due to new onset of other disease or withdrawal of consent. CPET, cardiopulmonary exercise testing; IIEF, International Index of Erectile Function; NYHA, New York Heart Association; PAIS, Psychosocial Adjustment to Illiness Scale; PFT, Pelvic Floor test.

an implanted ICD, had a partner, were Danish speaking and provided informed written consent were eligible for the trial. Exclusion criteria: patients with intermediate or high risk in relation to their cardiovascular status according to the Princeton group,[13] and known urinary tract disease. To establish some exercise potential patients performing intense exercise training more than three times weekly, had known neurological or orthopaedic deficit (diseases in the musculoskeletal system) that

Table 1 Baseline characteristics

	Sexual rehabilitation group (n=75)	Control group (n=79)
Age, mean (SD)	62.3 (9.2)	60.9 (9.1)
NYHA I, n (%)	50 (67)	49 (62)
NYHA II, n (%)	25 (33)	28 (38)
Stratification diagnosis		
Ischaemic heart disease, n (%)	39 (49)	40 (51)
Implantable cardioverter defibrillator, n (%)	36 (48)	39 (52)
Heart failure, n (%)	7 (9)	9 (11)
Inherited heart disease*, n (%)	3 (4)	7 (9)
Ischaemic heart disease, n (%)	26 (35)	23 (32)
Implantation indication ICD		
Primary prophylactic indication	23 (64)	20 (51)
Secondary prophylactic indication	13 (36)	19 (49)
Diabetes mellitus, n (%)	15 (20)	16 (20)
Dyslipidemia, n (%)	5 (7)	1 (1)
Sexual dysfunction of physical origin n (%)	71 (95)	75 (95)
Current smoking, n (%)	9 (12)	12 (15)
Body mass index, mean (SD)	27.5 (3.8)	28.3 (4.1)
Longest educational level		
Primary school, n (%)	11 (14.7)	8 (10.1)
High school, n (%)	2 (2.7)	1 (1.3)
Vocational, n (%)	42 (56)	42 (53)
Short/medium higher education, n (%)	6 (8)	16 (15)
Long higher education, n (%)	14 (18)	12 (15)
Occupational status		
Retired, n (%)	42 (56)	43 (54)
Still working, n (%)	33 (44)	36 (46)
Physical activity		
Inactive, n (%)	37 (49)	42 (53)
Performing >1 hour exercise per week	38 (52)	37 (47)
Medication		
PDE5 inhibitors, n (%)	6 (8)	8 (10)
Beta-blockers, n (%)	56 (75)	55 (70)
Amiodarone, n (%)	1 (1)	1 (1)
Calcium antagonists, n (%)	8 (11)	8 (11)
ACE inhibitors, n (%)	41 (55)	34 (43)
Nitrates, n (%)	3 (4)	10 (13)
Vitamin K antagonists, n (%)	5 (8)	4 (5)
Insulin, n (%)	1 (1)	2 (3)
Acetylsalicylic acid, n (%)	59 (79)	57 (72)
Statin, n (%)	64 (85)	66 (84)

*Inherited heart disease includes long QT syndrome and cardiomyopathies.
ICD, implantable cardioverter defibrillator; NYHA, New York Heart Association; PDE5, phosphodiesterase type 5.

prevented patients from participating in the physical exercise intervention or participated in other ongoing research projects were excluded. Eligible patients were initially screened with the International Index of Erectile Function (IIEF) Questionnaire[14] by mail. Participants were identified from hospital records from two university hospitals in Denmark.

Randomisation and blinding

Participants were centrally randomised 1:1 to intervention plus usual care or to a control group by a computer-generated allocation sequence with varying blocks sized 4, 6 and 8, and were stratified according to disease group (IHD or ICD) and age (≤59 or ≥60 years). Allocation of participants, all physical testing, data collection, statistical analyses and drawing of conclusions were performed blinded to allocation group.

Intervention group

The experimental group was offered physical exercise, pelvic floor exercise and psychoeducational consultations for 12 weeks.

Physical exercise

The aim of the physical exercise intervention was to improve exercise capacity. Three weekly sessions of 60 min were offered. A single training protocol was applied to all participants but individualised when needed. Three options were available: 1) supervised training at hospital 2) training at a local study-protocol certified supervised facility and 3) home-based training with contact to a physiotherapist when needed. The training programme consisted of graduated cardiovascular training and strength exercises. The cardiovascular training was based on intensity of the Borg scale[15] and performed as interval training. The strength-related exercises primarily targeted the lower body muscles comprising four exercises. The sessions started with 10 min warm up bicycling followed by 20 min bicycling with increasing intensity (intensity training). This was followed by 20 min strength training and 10 min stretching exercises.

Pelvic floor exercise

The aim of the pelvic floor exercise intervention was to enhance strength and endurance of the pelvic floor. Both the ischiocavernosus and bulbocavernosus muscles are superficial pelvic floor muscles that are active during erection and they enhance rigidity.[9] Patients were instructed to tighten their pelvic floor muscles, three times a day: when lying, when sitting and when standing. The duration of the contraction was 10 s.

To encourage adherence, and monitor compliance, training diaries and pulse watches were used.

The psychoeducational consultations

The aim of the consultations was to guide patients to interpret and react to relevant physical and psychological symptoms compromising participant's sexual health. A patient-centred approach inspired by RR Parse's Human Becoming Practice Methodologies[16] was applied. Consultations were carried out by a specially trained nurse and were conducted as individualised sessions. An inspirational guide consisting of components such as sexological and medical history, psychosocial and psychological concerns was developed, and served as a basis for the consultations.[12] The topics discussed were: causes of sexual dysfunction, sexual concerns, level of sexual activity, types of activities, relationship, sexual problems, comorbidity and medication.

Usual care

All participants followed their usual outpatient visits according to treatment guidelines. Besides usual care both groups were encouraged to contact their general practitioner for prescription of PDE5 inhibitor treatment if indicated.[7] Choice and dose of PDE5 inhibitors were the general practitioners. Type and dose were monitored.

Outcomes

Both groups underwent outcome assessment at baseline, after 12 weeks (physical tests), plus at 4 months and 6 months (questionnaire-based data).

Table 2 Primary and secondary outcomes; mean differences between groups reported

		Follow-up at 4 months* (primary and secondary outcome)				Follow- up at 6 months*				
	N	Mean difference (95% CI)	P values	SD†	Cohen's d	N	Mean difference (95% CI)	P values	SD†	Cohen's d
IIEF total score	145	6.7 (3.1 to 10.3)	**0.0003**	19.0	0.4	146	6.7 (3.2 to 10.1)	**0.0002**	19.1	0.4
PAIS score	145	−0.5 (−1.2 to 0.2)	0.17	3.3	−0.2	146	−0.4 (−1.0 to 0.3)	0.26	3.2	0.1

*Main effect of intervention adjusted for age (binary), disease group and baseline value of the outcome. Significant p values in bold.
†SD of the unadjusted mean.
IIEF, International Index of Erectile Function; PAIS, Psychosocial Adjustment to Illness Scale, Self/reported version.

Primary outcome

Sexual function was measured by the total IIEF score at baseline, at 4 months (primary outcome) and at 6 months. The IIEF questionnaire consists of five domains of sexual function: erectile function, orgasmic function, sexual desire, intercourse satisfaction and overall satisfaction. A high score indicates a better function. The summary score ranges from 5 to 75 points. On the erectile function domain, a sum score of 25 or less indicated erectile dysfunction. The IIEF meets psychometric criteria[14] and is considered the gold standard instrument for efficacy assessment in clinical trials of sexual dysfunction.[14]

Secondary outcome

Sexual adjustment to illness was measured by the Psychosocial Adjustment to Illness Scale (PAIS), sexual relationship domain at baseline and at 4 months (secondary outcome) and 6 months. The PAIS meets psychometric criteria.[17] It consists of six items and the total score ranges from 0 to 18 points. Low score indicates good adjustment. No cut-off score exists.[17]

Exploratory outcomes

The explorative physical outcomes were pelvic floor strength and endurance by the Danish version of the Modified Oxford Grading Scheme[18] and peak VO_2, heart rate (beats per minute), blood pressure, Watt max, anaerobic threshold and VE/VCO_2 slope measured by cardiopulmonary exercise testing, at baseline and at 12 weeks. The questionnaire-based outcomes are the IIEF domains[14] representing erectile function, orgasmic function, desire, intercourse and overall satisfaction. Self-reported health by the Short Form-36 (SF-36),[19] anxiety and depression by the Hospital Anxiety and Depression Scale[20] and quality of life by the EQ-5D-5L[21] assessed at baseline, at 4 months and at 6 months. The 'Sex after ICD' questionnaire[6] was evaluated in patients with ICD at the same time.

Statistical analyses

We planned a trial of the continuous variable IIEF[14] with one control per experimental participant. In a previous trial, the IIEF was normally distributed, SD 6 points.[22] If the true difference was 3.5 points, we needed to include 77 experimental participants and 77 control participants (total 154 participants) to obtain a power of 95% (β=5%) and a type 1 error probability of 5%.

The analyses followed the intention-to-treat principle with two-sided significance test at the 5% level using the SAS V.9.3 and R V.3.1.2 for the analyses. Continuous outcomes followed the same procedure as described in the following for the primary outcome. The primary model for assessing the effect of intervention was the general linear model with outcomes measured 4 months after randomisation comparing the intervention group with the control group. In this model disease groups, baseline value of the outcome and age were included. The secondary model included follow-up data using a mixed model because of repeated outcome measures. In this model, the baseline value of

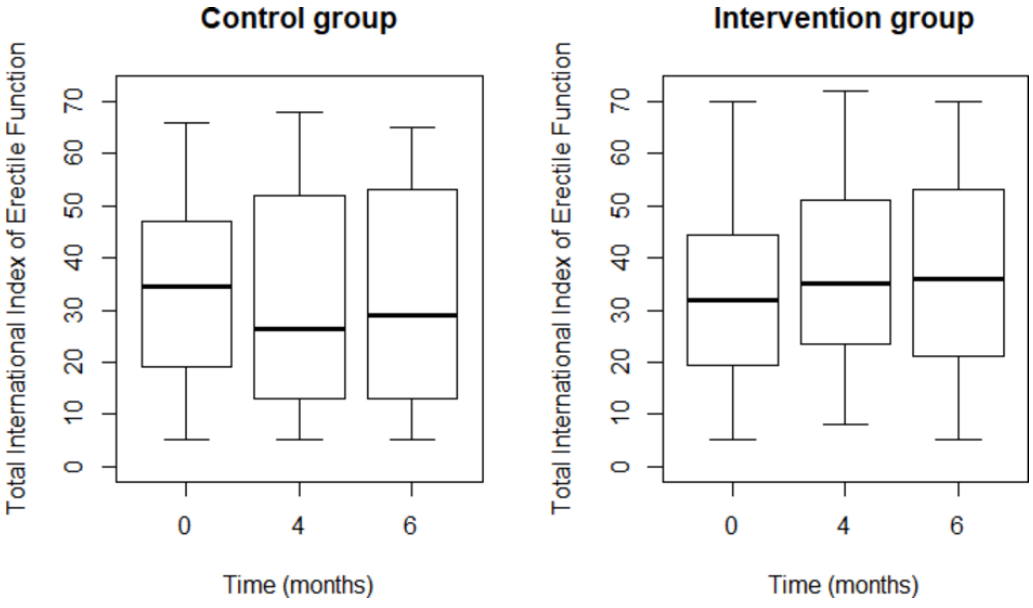

Figure 2 Total International Index of Erectile Function (IIEF) for groups by allocation group. Summary primary outcome (total IIEF) mean score of groups by allocation group by time in months.

Table 3 Mean scores at all times in both groups (questionnaire-based data)

	Sexual rehabilitation group						Usual care group					
	Baseline		4 months		6 months		Baseline		4 months		6 months	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Total IIEF	32.2	16.7	36.4	17.2	37.1	20.0	33.7	17.1	31.1	20.7	32.2	20.0
Erectile function domain	11.2	8.0	14.5	8.5	14.3	9.6	12.3	8.4	11.5	9.7	12.2	9.6
Orgasmic function domain	5.6	3.8	5.8	3.7	5.9	4.0	6.0	3.8	4.8	4.2	5.1	4.0
Sexual desire domain	6.1	2.3	6.1	2.1	6.4	2.3	5.9	2.1	5.6	2.3	5.4	2.3
Intercourse satisfaction domain	4.4	4.7	4.9	4.8	5.3	4.6	5.0	4.5	4.5	4.9	4.8	4.6
Overall satisfaction domain	4.9	2.1	5.2	2.0	5.2	2.0	4.6	1.8	4.7	3.1	4.8	2.0
PAIS	6.3	3.4	6.1	3.4	6.3	3.9	6.5	3.3	6.9	3.2	6.9	3.3
SF-36 Physical Component Scale	45.3	10.3	45.6	9.3	47.8	8.8	46.7	9.1	47.0	9.1	47.0	8.8
SF-36 Mental Component Scale	51.7	9.8	51.0	10.6	51.7	10.9	51.8	10.2	50.9	11.3	51.0	10.9
HADS A	3.8	3.8	4.3	4.3	3.9	4.0	4.2	3.8	4.0	4.0	4.0	4.0
HADS D	2.6	2.9	2.9	2.9	2.7	3.7	3.0	3.2	3.0	3.6	3.1	3.7
EQ-5D index	0.8	.2	0.8	0.8	0.8	0.2	0.8	0.2	0.8	0.2	0.8	0.2

EQ5D, EuroQol; HADS A, Hospital Anxiety and Depression Scale Anxiety scores; HADS D, Hospital Anxiety and Depression Scale Depression scores; IIEF, International Index of Erectile Function; PAIS, Psychosocial Adjustment to Illness Scale; SF-36, Short Form-36.

the outcome, time, intervention indicator (I), disease group (G), the interaction between I and G and stratification variable (aged above and below 60 years) and time were included. Subgroup analyses, secondary and exploratory outcomes were considered hypothesis generating. If missing values of outcomes were above 15% multiple imputation techniques were used. The intervention effect of the primary analysis is shown in online supplementary file with worst/best case analyses. The standardised difference between the means of each continuous measure was assessed using Cohen's d.[23]

RESULTS

Between March 2013 and June 2016, 3248 patients were identified for questionnaire prescreening. Of these, 647 male patients were identified with sexual dysfunction of whom 154 (24%) were included and randomised (figure 1). Demographic and clinical characteristics are presented in table 1. Groups were well balanced except for a three times larger nitrate intake in the control group. Furthermore, twice as many had a short/medium-higher education in the control group.

Outcomes

Primary and secondary outcomes

Sexual rehabilitation compared with usual care had a beneficial effect on sexual function with a between-group mean difference IIEF score of 6.7, 95% CI 3.1 to 10.4 ($p<0.0003$) in favour of the sexual rehabilitation group after 4 months (primary outcome) (table 2, figure 2). The Cohen's d was 0.4, indicating a small-to-moderate clinical effect.[23] Results persisted at 6 months with a between-group mean difference IIEF score of 6.7, 95% CI 3.2 to 10.1 ($p<0.0002$). The mean scores at all times are presented in table 3. Best-worst case scenario analysis showed a mean difference of 9.9, 95% CI 5.7 to 14.0 ($p<0.0001$), and for worst-best case scenario a mean difference of 2.5, 95% CI −2.0 to 6.9 ($p=0.28$). Tests for interaction between intervention group and

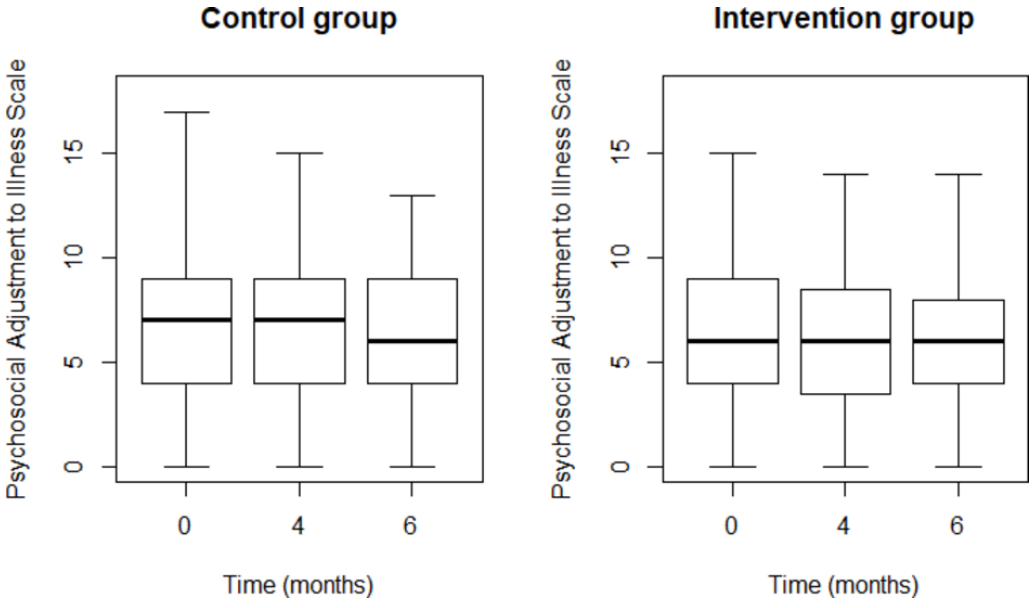

Figure 3 Psychosocial Adjustment to Illness Scale - Self-Reported (PAIS)-SR for groups by allocation group. Summary secondary outcome (PAIS-SR) mean score of groups by allocation group by time in months.

Table 4 Exploratory outcomes at 4 and 6 months (questionnaire-based data), mean differences between groups reported

	Follow-up at 4 months*					Follow-up at 6 months*				
	N	Mean difference (95% CI)	P values	SD†	Cohen's d	N	Mean difference (95% CI)	P values	SD†	Cohen's d
Exploratory outcomes										
Erectile function domain	145	3.9 (2.1 to 5.6)	**<0.0001**	9.2	0.4	146	3.5 (1.8 to 5.3)	**<0.0001**	9.2	0.4
Orgasmic function domain	145	1.2 (0.3 to 2.2)	**0.01**	4.0	0.3	146	1.2 (0.3 to 2.1)	**0.01**	3.9	0.3
Sexual desire domain	145	0.4 (–0.03 to 0.8)	0.07	2.3	0.2	146	0.6 (0.2 to 1.0)	**0.002**	2.3	0.3
Intercourse satisfaction domain	145	0.9 (–0.1 to 2.0)	0.08	4.8	0.2	146	1.0 (0.0 to 1.9)	**0.0499**	4.8	0.2
Overall satisfaction domain	145	0.2 (–0.3 to 0.7)	0.38	2.1	0.1	146	0.2 (–0.3 to 0.6)	0.40	2.1	0.1
SF-36-PCS	154	–0.5 (–2.4 to 1.5)	0.64	9.2	–0.1	146	0.3 (–1.5 to 2.1)	0.74	8.8	0.0
SF-36-MCS	154	–0.3 (–2.3 to 2.3)	0.83	11.2	–0.0	146	0.0 (–2.3 to 2.3)	0.99	10.5	0.0
EQ-5D index	154	0.01 (–0.04 to 0.1)	0.74	0.2	0.0	146	0.01 (–0.03 to 0.06)	0.54	0.2	0.1

Where n=154 multiple imputation was used, all others were available cases. Significant p values in bold.
*Main effect of intervention adjusted for age (binary), disease group and baseline value.
†SD of the unadjusted mean.
EQ-5D, EuroQol; IIEF, International Index of Erectile Function; SF-36-PCS, Short Form-36, Physical Component Score; SF-36-MCS, Short Form-36 Mental Component Score.

disease groups, intervention group and time as well as intervention group, time and disease group were all non-significant.

No statistically significant differences were found on the secondary outcome PAIS (table 2, figure 3).

Exploratory outcomes

Sexual rehabilitation group significantly improved erectile function, orgasmic function, sexual desire and intercourse satisfaction (table 4).

For the PDE5 inhibitor intake at 4 months, 7 (9%) participants in the intervention group reported taking PDE5 inhibitors, whereas there were 15 (19%) in the control group (p=0.09). At baseline, 23% of patients in the intervention groups reported being sexually active within the last 4 weeks compared with 29% in the control group, p=0.39. At 4 months more patients, 32% in the intervention group were sexually active compared with controls 28%, although not statistically significant different, p=0.13. On the physical outcomes, the intervention showed a difference on pelvic floor strength with more participants in the sexual rehabilitation group in the highest category 45% vs 23% in the control group, p=0.01, but we found no effect on pelvic floor strength (continuous) and endurance (table 5). Results from the cardiopulmonary test showed a mean difference between groups on Watt max but no difference on VO_2 peak (table 5). On the 'Sex after ICD questionnaire', statistically fewer patients in the sexual rehabilitation group experienced problems with erectile function and overprotectiveness from the partner compared with control.

Safety

One serious adverse event occurred in the intervention group. Due to angina pectoris during exercise training, one participant was admitted to hospital, discharged after 4 hours of observation and remained in the trial.

Adherence to intervention

A total of 64 (85%) patients participated in the exercise intervention with an average of 25.3 training sessions, and 64 (85%) participated in the sexual consultations with an average of 2.4 sessions during the trial. When adherence was defined as participating in at least 50% of the sessions, 39 patients (75%) were adherent. Participants received between one to four psycho-educational consultations.

DISCUSSION

The results show a beneficial effect of sexual rehabilitation on the primary outcome, IIEF. Furthermore, beneficial effects on the exploratory outcomes: erectile function, orgasmic function, pelvic floor strength and maximum exercise capacity were found. We found no effect on sexual adjustment to illness and mental outcomes. The intervention appeared safe.

Previous trials show conflicting evidence regarding the effect of exercise training on erectile function[10] and the present trial add to the evidence in favour of exercise.

The pelvic floor exercise intervention plus lifestyle advice has been investigated previously and shown to significantly improve the erectile function domain of the IIEF.[9] This trial supports our findings. We found an improvement in strength of the pelvic floor muscles, but not on endurance which is in accordance with findings from a randomised trial in poststroke patients also evaluating a 12-week pelvic floor training intervention.[18] Results from that trial showed no differences on endurance after 12 weeks between groups but found a late response after follow-up (6 months) indicating that the effect on endurance might be delayed compared with strength.

We did not find the expected effect on self-reported health and mental health, probably because there is no such effect in our patients. Our patients had a relatively high self-reported health with baseline scores of 51.7 and 51.8 on the Mental Component Scale of the SF-36, and 45.3 and 46.7 on the Physical Component Scale, which are higher compared with other cardiac disease populations entering a comprehensive rehabilitation intervention.[24 25] The same trends are seen in regard to anxiety, where mean scores of 3.8 and 4.2, and in relation to depression with scores of 2.6 and 3.0 reflecting a relative small burden of anxiety and depression compared with other rehabilitation studies[24 25] and in a large epidemiological study.[26]

Within the screened patients, 24% accepted participating in the present trial. This is similar to inclusion in a study by Steinke, a study concerning sexual matters,[6] which included 21%, although a lower inclusion rate compared with the Copenhagen Outpatient ProgrammE (COPE-ICD) trial[27] a comprehensive rehabilitation trial, which included 33%. This trial recruited patients face-to-face, which is presumed to increase inclusion compared with patient recruitment by mail and questionnaires. We believe that 24% reflects that sexuality is a delicate subject, and that further sexual rehabilitation interventions are needed.

Table 5 Exploratory outcomes at baseline week 12 (physical data), mean values and mean differences between groups reported

	Sexual rehabilitation				Usual care group						
Exploratory outcomes	**N**	**Baseline ***	**N**	**Week 12***	**N**	**Baseline ***	**N**	**Week 12 ***	**N**	**Mean difference† (95% CI)**	**P values**	**SD‡**	**Cohen's d**
Pelvic floor endurance (s)	73	9.3	55	12.1	72	11.2	62	11.5	154	1.5 (−0.5 to 3.4)	0.13	7.5	0.2
Pelvic floor strength (cmH_2O)	70	131.1	53	150.4	68	128.8	62	128.1	154	11.0 (−8.4 to 30.4)	0.27	74.6	0.2
Peak VO_2	67	20.7	48	21.9	74	21.5	62	20.1	154	1.6 (−0.2 to 3.4)	0.09	7.3	0.2
Heart rate—rest (bpm)	72	66.7	53	64.1	75	63.0	63	64.6	154	−1.0 (−4.2 to 2.2)	0.53	11.7	−0.1
Heart rate—max (bpm)	72	131.4	53	134.8	75	152.5	63	130.0	154	6.3 (−1.8 to 14.3)	0.12	11.7	0.5
Blood pressure—rest	72	135.6	53	137.3	75	138.9	63	136.7	154	2.1 (−3.6 to 7.8)	0.46	11.7	0.2
Blood pressure—max	72	186.9	53	186.7	75	193.1	63	193.2	154	−1.9 (−8.5 to 4.6)	0.56	31.0	−0.1
Watt max	72	149.6	53	160.4	75	159.5	63	154.3	154	10.3 (3.6 to 16.9)	**0.003**	50.0	0.2
Anaerobic threshold	67	1.6	45	1.7	72	1.8	60	1.7	154	0.1 (−0.01 to 0.3)	0.07	0.6	0.2
VE/VCO_2 slope	67	27.8	45	28.1	72	26.8	60	26.6	154	0.2 (−0.8 to 1.3)	0.66	5.4	0.0

Where n=154 multiple imputation was used, all others were available cases. Significant p values in bold.
*Mean values.
†Mean differences between groups at week 12.
‡SD of the unadjusted mean.
IIEF, International Index of Erectile Function; SF-36-PCS, Short Form-36, Physical Component Score; SF-36-MCS, Short Form-36 Mental Component Score.

Adherence was high in our trial, 75% of participants completed >50% of the sessions. Adherence to cardiac rehabilitation has proven to be a challenge and several studies show that only around 30% of eligible patients continue in these programmes,[28] indicating a meaningful and workable design of the $CopenHeart_{SF}$ trial.

A Minimal Clinically Important Difference score on the erectile function domain has been established and found to be 4, with variation ranging according to baseline severity.[29] The mean difference found in our study of 3.8 on the erectile function domain indicates a clinically relevant effect, which is supported by a calculation of the Cohen's d effect size of 0.4 indicating a small-to-moderate clinical effect.

The effect gained was a result of a complex intervention with several components. When doing complex interventions, the premise always includes a risk that one component could be more efficient than others, and therefore there is a chance that it may be the simple exercise or the consultations alone that has the dominant effect on the outcomes.

Strengths and limitations

The trial was designed with central stratified randomisation, which secures against selection bias, and all physical tests as well as statistical analysis was assessed blinded to intervention group, which reduced detection and interpretation bias.[30] Self-reported outcomes, such as questionnaires, are by nature subjective and potentially biased with a risk of recall bias. Nevertheless, validated questionnaires were distributed electronically and independently from the researchers and all analyses were performed by a blinded trial statistician according to the intention to treat.

We did not investigate weight loss, and therefore we were not able to adjust for any associations between improvement in

Key messages

What is already known on this subject?

- A large proportion of patients with ischaemic heart disease (IHD) and patients with implantable cardioverter defibrillator (ICD) suffer from sexual dysfunction.
- Physical training, pelvic floor exercise and sexual counselling have been tested as single components with positive outcomes in relation to sexual dysfunction.
- A combined approach has not been evaluated.

What might this study add?

- This randomised clinical trial investigates the effect of sexual rehabilitation in male patients with sexual dysfunction and IHD and/or ICD.
- Results show statistically significant superiority in favour of sexual rehabilitation compared with usual care in terms of sexual function and physical capacity at 4 and 6 months, but no effect on sexual adjustment to illness and on mental health.
- The mean difference between groups on the primary outcome, the International Index of Erectile Function was 6.7 points after 4 months.

How might this impact on clinical practice?

- This trial demonstrates that sexual rehabilitation improves sexual function significantly and results persist over time.
- The intervention is associated with a relatively high adherence and appears to be safe.

erectile function and weight loss, which is a limitation. Furthermore, the 'Female Assessment of Male Erectile Function' questionnaire was distributed for patients to have their partners fill out. Since <10% of partners answered the questionnaire, the results are not reported and the potential validation from the partners are missing. Due to the large proportion of patients initially screened, there is a risk that the sample is not representative of the study population.

CONCLUSION

The CopenHeart$_{SF}$ trial demonstrated that compared with usual care, sexual rehabilitation improved sexual function significantly and results persisted over time. The intervention was associated with a relatively high adherence and appeared safe.

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Contributors PP, SKB and A-DOZ conceived the idea for the study. All designed the study. LCT performed the statistical analyses. PP wrote the first draft of the manuscript. All revised the manuscript critically. All have given their final approval of the version to be published.

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