

ORIGINAL ARTICLE

Determinants and trajectory of phobic anxiety in patients living with an implantable cardioverter defibrillator

En-Young Nicole Cho,¹ Roland von Känel,¹ Birgit Marten-Mittag,² Joram Ronel,² Christof Kolb,³ Jens Baumert,⁴ Karl-Heinz Ladwig^{2,4}

¹Division of Psychosomatic Medicine, Department of General Internal Medicine, Inselspital, Bern University Hospital, University of Bern, Bern, Switzerland

²Department of Psychosomatic Medicine and Psychotherapy, University Hospital rechts der Isar, Technische Universität München, Munich, Germany

³Faculty of Medicine, Department of Cardiovascular Diseases and Electrophysiology, Technische Universität München, German Heart Centre Munich, Munich, Germany

⁴Institute of Epidemiology II, Helmholtz Zentrum München, German Research Center for Environmental Health, Neuherberg, Germany

Correspondence to

Professor Karl-Heinz Ladwig, Institute of Epidemiology, Helmholtz Zentrum München, German Research Center for Environmental Health, Ingolstaedter Landstrasse 1, Neuherberg 85764, Germany; ladwig@helmholtz-muenchen.de

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ABSTRACT

Objective The implantable cardioverter defibrillator (ICD) is the gold standard therapy to prevent life-threatening arrhythmias. Phobic anxiety predicts ventricular arrhythmia in coronary heart disease patients, but little is known about phobic anxiety in ICD patients. This study aimed to identify determinants and the course of phobic anxiety in ICD patients.

Patients 140 outpatients living with an ICD (mean age 56±14 years, 66% men).

Main Outcome Measures Phobic anxiety was assessed with the Symptom Checklist-90 Revised at a mean of 27±21 months (range 3–109) post-ICD placement (baseline) and after an average follow-up of 41±18 months (range 10–82). Multivariate linear regression models considered sociodemographic factors, clinical variables and psychological scales as potential determinants of phobic anxiety scores.

Results ICD patients reported more than 10-fold higher levels of phobic anxiety than a previous representative population survey (2.6±3.4 vs 0.2±0.4). Greater age ($p=0.003$), previous shock experience ($p=0.007$), depressed mood ($p<0.001$) and hypochondriasis ($p=0.005$) were associated with higher phobic anxiety scores at baseline. Multimorbidity ($p=0.030$) and higher baseline phobic anxiety ($p<0.001$) determined greater phobic anxiety at follow-up. Younger age ($p=0.029$) and an elevated number of non-cardiac diseases ($p=0.019$) were both associated with an increase in phobic anxiety scores from baseline to follow-up. More patients had high phobic anxiety levels (score >4) at follow-up compared with baseline (31% vs 24%; $p=0.048$).

Conclusions Phobic anxiety was comparably high and persisted over time in ICD patients. Modifiable determinants of phobic anxiety were identified, which may inform tailored interventions to improve ICD patients' distress and perhaps also prognosis.

The implantable cardioverter defibrillator (ICD) is the gold standard therapy to prevent sudden cardiac death due to life-threatening arrhythmias.¹ According to research on psychological adjustment, many ICD patients report a good quality of life,^{2,3} as well as a decrease in anxiety post-implant.³ Nevertheless, in a recent systematic review of 45 studies that assessed over 5000 ICD patients, between 11% and 28% had a depressive disorder and between 11% and 26% had an anxiety disorder when applying a diagnostic interview.⁴ Moreover,

although the data are not straightforward,^{5,6} an increasing number of ICD shocks has been attributed to reduced quality of life and the onset of anticipatory anxiety, with a number of five or more ICD shocks being particularly associated with emotional distress in experimental⁷ and clinical⁸ studies. On a population basis, anxiety disorders are also common, with a 1-year prevalence of 18% found in US adults⁹ and with phobic anxiety being the predominant complaint.¹⁰ In US primary care, 6% of patients had phobic anxiety.¹¹ Epidemiological studies have reported an association between phobic anxiety and an increased risk of fatal cardiac events in community-dwelling men and women without cardiovascular disease.^{12,13} In patients with coronary heart disease, phobic anxiety has been shown to predict ventricular arrhythmia¹⁴ and, in women patients, also cardiac mortality.¹⁵

In spite of this literature, surprisingly few attempts have been made to characterise phobic anxiety in ICD patients. These studies suggest that phobic anxiety compromises emotional quality of life¹⁶ and is higher in female than in male ICD patients.¹⁷ The prevalence of phobic anxiety has not previously been estimated systematically in ICD patients. One study administered the phobic anxiety subscale of the Crown-Crisp experiential index to ICD patients and found phobic anxiety levels to be below the clinical threshold.¹⁸ In another study, agoraphobic behaviour was higher in ICD patients than in non-ICD controls, but was only so if ICD patients also had shock-related anxiety.¹⁹

Typically, the patient with phobic anxiety knows that the fear is irrational, but he or she can neither control it nor seek adequate healthcare. The two-process theory of fear and anxiety²⁰ provides a conceptual framework to understand the emergence of phobic anxiety in ICD patients. The first step in establishing fear and avoidance would be classic conditioning of fear triggered by a threatening cardiac event (eg, myocardial infarction; MI), but also by threateningly perceived (eg, painful) ICD shocks. The second step would refer to ICD patients' attempts at removing themselves from fear-eliciting stimuli, whereby such an escape behaviour may eventually become avoidance. In cardiology practice, the ICD patient with phobic anxiety would be expected to feel tense and anxious episodically awaiting to be shocked by the device or that the device is malfunctioning. Patients

may try not to think, talk or have feelings about the device, but nevertheless may become overwhelmed by episodes of fear and horror lasting several minutes to hours. Anxiety may be associated with shock-like bodily sensations or irregular heartbeat, but panic episodes also occur without identifiable context variables. ICD patients' avoidance behaviour may compromise adherence with cardiac therapy.

The aim of our study was to identify determinants of phobic anxiety in patients living with an ICD at two consecutive time points, being, on average, 2 years post-placement of the device (baseline) and 3.5 years later (follow-up). We further investigated the change in phobic anxiety over time and the determinants of this trajectory. The identification of such predictors might ultimately inform tailored behavioural interventions for patients with phobic anxiety to improve their quality of life and perhaps also the course of the cardiac disease.

MATERIALS AND METHODS

Study participants

Data from the Living With an Implantable Cardioverter Defibrillator (LICAD) study had been approved by the ethics committee of the medical faculty of the Technical University of Munich.²¹ All patients attended the cardiology outpatient clinic at the German Heart Center Munich for routine ICD check-up, and were consecutively enrolled after they had provided written informed consent to the study protocol. The baseline assessment for the LICAD study was conducted between January and May 1998 (first survey) and between April and June 2002 (second survey). Because the sample of the first and second survey included only 17.3% female ICD patients, the LICAD study was extended in 2002 and 2003 including only female patients (third survey). Inclusion criteria were treatment with an ICD, time since implantation longer than 3 months (to avoid transitory adaptation reaction), and age 15 years or older, yielding a basic sample of 251 patients. The mean time between the beginning of the ICD treatment and the baseline assessment was 27.1 ± 22.1 months (range 3–142).

Among these 251 patients, a follow-up assessment was carried out between July 2002 and December 2004 (first survey), between June 2004 and December 2004 (second survey) and between June 2004 and April 2005 (third survey) in 165 patients who all took part in the baseline assessment. Of the 86 patients who did not participate in the follow-up assessment, 52 had died, 15 refused to participate, nine were too ill/demented, seven had moved away, and three had had their ICD removed. Among these 165 patients, a number of 161 had completed data for phobic anxiety at the baseline and at the follow-up assessment. An additional 21 were excluded who missed information on covariates used in the present study. Therefore, we report on 140 patients with complete data allowing us to compute a full linear regression approach. None of the patients was subject to a lead or device advisory.

Assessment of phobic anxiety

We assessed phobic anxiety with the subscale from the German version of the Symptom Checklist-90-revised (SCL-90-R).²² Respondents were asked to rate on a 5-point scale (0, 'not at all' to 4, 'extremely') the degree of distress experience due to seven phobic anxiety symptoms in the previous 7 days (overall score between 0 and 28). For the baseline assessment we defined the upper quartile of patients to have high levels of phobic anxiety, corresponding to a phobic anxiety score of 4 or greater. The same cut-off was applied to define high phobic anxiety scores at the

follow-up assessment. Norm values (mean \pm SD) for SCL-90 phobic anxiety levels for the German population are 0.22 ± 0.38 .²³

Assessment of covariates

All covariates were assessed by a standard interview and from patient records at the pacemaker outpatient clinic of the German Heart Center, Munich.

Sociodemographic variables

We asked the patients about their gender, age and educational level (ie, a measure of socioeconomic status). For statistical purposes, educational level was categorised into two groups of low education (no graduation/primary school) versus high education (secondary school or high school graduation/university degree).

Clinical variables

The following medical and ICD-related variables were used for the present analyses (all coded as yes/no): previous MI, resuscitation, number of non-cardiac diseases (diabetes, stroke, hypertension, renal failure, chronic obstructive pulmonary disease, peripheral arterial disease, hyperuricaemia, ulcer) and experience of shock discharge (yes/no). Patients were also asked whether they had experienced cardiac symptoms (palpitations, tachycardia, racing heart) (yes/no) or chest pain (at rest, during the night, in cold weather) (yes/no) in the last 4 weeks before examinations.

Depression

Depressive symptoms were assessed with the 13-item depression subscale of the German version of the SCL-90-R²² with an overall score between 0 and 52.

Helplessness

Helplessness as characterised by social incompetence and ego weakness in stressful situations was assessed by a German version of a dichotomous six-item scale (0, no; 1, yes), with an overall score between 0 and 6.²⁴ Typical items are 'I often have the feeling to bother other people if I ask them for help' and 'I feel helpless at once'. The questionnaire relies on Seligman's theory of learnt helplessness, which as a consequence of for instance inescapable shocks, may trigger symptoms of depression and anxiety.²⁵

Hypochondriasis

We assessed hypochondriasis using a German version of the somatosensory amplification scale.²⁶ The patients were asked to rate the degree to which each of 10 statements is 'characteristic of you in general', on a scale from 1 to 5 (overall score between 10 and 50; higher score indicates greater hypochondriasis tendency). The items cover a range of uncomfortable bodily sensations (eg, hunger contractions, being too hot or too cold), which do generally not connote serious disease.

Statistical analysis

Data were analysed using PASW statistics V.18.0 with the significance level at $p < 0.05$ (two-tailed). For all psychometric scales, we replaced missing item values by the mean of completed items if at least 70% of the items of that scale were answered. The change score in phobic anxiety from baseline to follow-up was computed by subtracting square root transformed follow-up scores from square root transformed baseline scores (note that a negative change score would mean an

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increase in phobic anxiety over time). Group differences were calculated using Student's *t* test or one-way analysis of variance for continuous variables and Pearson's χ^2 test or Fisher's exact test for categorical variables. Within-group changes were analysed using the paired-samples *t* test and Wilcoxon signed rank test for continuous and categorical data, respectively. We computed three multivariate linear regression models to identify independent determinants of phobic anxiety levels at baseline, phobic anxiety levels at follow-up and the trajectory of phobic anxiety levels over time from baseline to follow-up. We controlled a priori for sociodemographic and clinical variables (model 1) and additionally for psychological scales in the final model (model 2). All covariates were entered into the equation in one block. Results are presented as beta coefficient beta with SE and *p* values; the contribution of each covariate to the model r^2 is expressed by the partial correlation coefficients (partial r^2).

RESULTS

Patient characteristics

The mean \pm SD of phobic anxiety scores across all 140 ICD patients was 2.6 \pm 3.4. Compared with patients with low levels of phobic anxiety (score <4) at baseline, those with high baseline phobic anxiety levels (score \geq 4) had more often experienced shocks and chest pain since implantation of the device. Patients with high phobic anxiety levels also had higher levels of depression and of hypochondriasis than those with low phobic anxiety levels (table 1).

Multivariate relationships with phobic anxiety at baseline

Table 2 shows that greater age, as well as having experienced shock(s), cardiac symptoms and chest pain all between ICD implantation and the baseline assessment were independently associated with greater phobic anxiety levels in model 1 (adjusted for sociodemographic and clinical variables). With additional adjustment for psychological variables in model 2, greater age and shock experience since ICD implantation remained significant correlates of phobic anxiety. Greater levels of depression and of hypochondriasis were also independently associated with greater baseline levels of phobic anxiety.

Multivariate relationships with phobic anxiety at follow-up

Table 2 shows that of sociodemographic and clinical variables (model 1), a greater number of non-cardiac diseases and having experienced cardiac symptoms between ICD implantation and the follow-up assessment were individually associated with greater phobic anxiety levels at follow-up. When psychological scales were also taken into account in model 2, higher phobic anxiety levels at baseline emerged as a strong determinant of elevated phobic anxiety levels at follow-up, while depression, helplessness and hypochondriasis were not significantly associated with levels of phobic anxiety levels at follow-up. A greater number of non-cardiac diseases (but no longer chest pain since ICD implantation) was retained in model 2 as a significant determinant of greater phobic anxiety levels at follow-up (table 3).

Trajectory in phobic anxiety

For the entire sample the mean time since ICD placement and the follow-up assessment was 68 \pm 28 months (range 12–151) and the mean duration of follow-up since baseline assessment was 41 \pm 18 months (range 10–82). The mean continuous levels of phobic anxiety did not significantly change from baseline to follow-up (2.6 \pm 3.4, range 0–21 vs 3.0 \pm 4.1, range 0–24; *p*=0.55). In patients who had multiple non-cardiac diseases, phobic anxiety scores increased significantly over the observation period (partial r^2 =0.035; *p*=0.032), even when controlling for sociodemographic and clinical variables (model 1). With additional adjustment of psychological scales in model 2, the number of non-cardiac diseases (partial r^2 =0.043; *p*=0.019) and younger age (partial r^2 =0.037; *p*=0.029) were both significantly associated with an increase in phobic anxiety over the observation period. There was an increase of 0.22 \pm 0.09 points on the (square root transformed) phobic anxiety score from baseline to follow-up for an increment in the number of non-cardiac diseases by one. Gender, education, time since ICD implantation, MI, resuscitation, previous shock experience, cardiac symptoms and chest pain both since ICD implantation, depression, helplessness and hypochondriasis were all not significantly associated with the change in phobic anxiety over time (all *p* values >0.09).

Table 1 Baseline characteristics of 140 ICD patients per phobic anxiety level

Variables	Phobic anxiety		p Value
	High (n = 34)	Low (n = 106)	
Female gender (%)	44.1	31.1	0.165
Age (years)	59 \pm 13 (30–77)	56 \pm 14 (15–78)	0.184
Low educational level (%)	47.1	59.4	0.205
Time since ICD implantation (months)	25 \pm 20 (3–65)	27 \pm 21 (3–109)	0.359
Myocardial infarction (%)	47.1	47.2	0.991
Resuscitation (%)	64.7	65.1	0.967
No of non-cardiac diseases	1.4 \pm 1.3 (0–3)	1.4 \pm 1.1 (0–3)	0.781
One or more shock(s) since ICD implantation (%)	52.9	34.0	0.048
Cardiac symptoms since ICD implantation (%)	44.1	28.3	0.086
Chest pain since ICD implantation (%)	50.0	16.0	<0.001
Phobic anxiety (score)	6.9 \pm 3.9 (4–21)	1.2 \pm 1.1 (0–3)	<0.001
Depression (score)	11.0 \pm 7.7 (0–30)	5.0 \pm 5.0 (0–24)	<0.001
Helplessness (score)	3.7 \pm 2.3 (0–9)	2.7 \pm 2.2 (0–10)	0.055
Hypochondriasis (score)	27.7 \pm 6.6 (12–39)	22.7 \pm 6.5 (12–39)	<0.001

High phobic anxiety was defined by a score of 4 or greater (ie, the upper quartile of phobic anxiety scores). Values are given as means \pm SD with range in parentheses or as percentage values.

Statistical analyses used Student's *t* test and Pearson's χ^2 test. ICD, implantable cardioverter defibrillator.

Table 2 Determinants of phobic anxiety level at baseline in multivariate linear regression analysis

Entered variables	Model 1			Model 2		
	Beta (SE)	Partial r ²	p Value	Beta (SE)	Partial r ²	p Value
Sociodemographic variables						
Female gender			NS			NS
Age	0.01 (0.01)	0.032	0.041	0.02 (0.01)	0.070	0.003
Education			NS			NS
Clinical variables						
Time since ICD implantation			NS			NS
Myocardial infarction			NS			NS
Resuscitation			NS			NS
No of non-cardiac diseases			NS			NS
One or more shock(s) since ICD implantation	0.42 (0.16)	0.050	0.010	0.39 (0.14)	0.057	0.007
Cardiac symptoms since ICD implantation	0.47 (0.18)	0.052	0.008			NS
Chest pain since ICD implantation	0.49 (0.19)	0.051	0.010			NS
Psychological scales						
Depression at baseline	—	—	—	0.27 (0.06)	0.133	<0.001
Helplessness	—	—	—			NS
Hypochondriasis	—	—	—	0.03 (0.01)	0.061	0.005
Fit statistics of entire model	F(10,129)=4.03; p<0.01; adjusted R ² =0.179			F(13,126)=7.76; p<0.01; adjusted R ² =0.387		

All covariates were entered into the models in one block.

The unstandardised coefficient beta with SE indicates that, for instance, for having at least one shock, there is an increase of 0.39±0.14 points on the (square root transformed) phobic anxiety score, controlling for all other covariates in model 2.

This increase is significant at p=0.007 and uniquely explains 5.7% (partial r²) of the variance in the phobic anxiety score in model 2.

For the non-significant variables, p values were marked 'NS' and beta (SE) and partial r² values were left blank.

ICD, implantable cardioverter defibrillator.

The increase in the absolute number of patients with high versus low levels of phobic anxiety over time reached significance (34 vs 43; p=0.048). Of the initially 34 patients with high phobic anxiety levels, 18 (52.9%) had maintained high phobic anxiety levels at follow-up ('persistent phobic anxiety'), while 16 patients (47.1%) no longer had high phobic anxiety levels ('remitted phobic anxiety'). Of the 43 patients with high phobic anxiety levels at follow-up, 25 (58.1%) had low phobic anxiety levels at baseline ('new phobic anxiety') and 81 patients (57.9%) had low phobic anxiety levels at both assessments ('never phobic anxiety'). The four groups differed from each other in experi-

enced shocks and chest pain since ICD implantation as well as in depression and hypochondriasis (table 4) (Because some cell sizes were small, we did not adjust this analysis for covariates to avoid unstable models.) Patients who newly developed high levels of phobic anxiety had frequently experienced shocks since ICD implantation, and those with persistent high levels of phobic anxiety had frequently experienced chest pain since ICD implantation. Shock and chest pain experience since ICD implantation, as well as depression and hypochondriasis, did not differ between patients with persistent and those with remitted high levels of phobic anxiety (p>0.050).

Table 3 Determinants of phobic anxiety level at follow-up in multivariate linear regression analysis

Entered variables	Model 1			Model 2		
	Beta (SE)	Partial r ²	p Value	Beta (SE)	Partial r ²	p Value
Sociodemographic variables						
Female gender			NS			NS
Age			NS			NS
Education			NS			NS
Clinical variables						
Time since ICD implantation			NS			NS
Myocardial infarction			NS			NS
Resuscitation			NS			NS
No of non-cardiac diseases	0.19 (0.09)	0.031	0.044	0.188	0.037	0.030
One or more shock(s) since ICD implantation			NS			NS
Cardiac symptoms since ICD implantation			NS			NS
Chest pain since ICD implantation	0.47 (0.21)	0.037	0.028			NS
Psychological scales						
Phobic anxiety at baseline	—	—	—	0.512	0.141	<0.001
Depression at baseline	—	—	—			NS
Helplessness	—	—	—			NS
Hypochondriasis	—	—	—			NS
Fit statistics of entire model	F(10,129)=2.32; p=0.015; adjusted R ² =0.086			F(14,125)=4.20; p<0.001; adjusted R ² =0.244		

All covariates were entered into the models in one block.

The unstandardised coefficient beta with SE (SE) indicates that, for instance, for having had chest pain since ICD implantation, there was an increase of 0.47±0.21 points on the (square root transformed) phobic anxiety score, controlling for all other covariates in model 1.

This increase is significant at p=0.028 and uniquely explains 3.7% (partial r²) of the variance in the phobic anxiety score in model 1.

For the non-significant variables, p values were marked 'NS' and beta (SE) and partial r² values were left blank.

ICD, implantable cardioverter defibrillator.

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Table 4 Health characteristics of patient groups with different trajectories in phobic anxiety status

Variables	Phobic anxiety status				p Value
	Persistent (n=18)	Remitted (n=16)	New (n=25)	Never (n=81)	
Female gender (%)	55.6	31.3	36.0	29.6	0.213
Age (years)	62±11 (38–77)	56±13 (30–77)	54±18 (15–75)	56±13 (23–78)	0.335
Low educational level (%)	61.1	31.3	72.0	55.6	0.079
Time since ICD implantation	67±27 (12–114)	69±31 (17–124)	62±28 (17–137)	70±27 (19–151)	0.693
Myocardial infarction	44.4	50.0	44.0	48.1	0.971
Resuscitation	61.1	68.8	76.0	61.7	0.587
No of non-cardiac diseases	1.7±1.4 (0–3)	1.2±1.0 (0–3)	1.6±1.0 (0–3)	1.3±1.2 (0–3)	0.511
One or more shock(s) since ICD implantation	50.0	81.3	80.0*	51.9	0.017
Cardiac symptoms since ICD implantation	66.7	56.3	56.0	38.3	0.085
Chest pain since ICD implantation	77.8†	56.3	36.0	23.5	<0.001
Depression at baseline	11.8±8.1 (0–30)‡	10.1±7.3 (0–24)§	6.1±4.6 (0–18)	4.6±5.1 (0–24)	<0.001
Helplessness	2.5 (0–9)	2.1 (0–6)	2.2 (0–9)	2.2 (0–10)	0.177
Hypochondriasis	27.3±6.8 (15–39)¶	28.1±6.6 (12–39)**	22.3±5.5 (14–39)	22.8±6.8 (12–39)	0.003

Values are given as means±SD with range in parentheses or as percentage values.

Statistical analyses used one-way analysis of variance and Pearson's χ^2 test or Fisher's exact test.

*More frequent than in 'persistent' group ($p=0.049$) and 'never' group ($p=0.013$).

†More frequent than in 'new' group ($p=0.014$) and 'never' group ($p<0.001$).

‡Higher than in 'new' group ($p=0.014$) and 'never' group ($p<0.001$).

§Higher than in 'never' group ($p=0.001$).

¶Higher than in 'new' group ($p=0.016$) and 'never' group ($p=0.011$).

**Higher than in 'new' group ($p=0.004$) and 'never' group ($p=0.006$).

ICD, implantable cardioverter defibrillator.

DISCUSSION

The average level of phobic anxiety in our 140 ICD patients was more than 10 times higher than the previously observed phobic anxiety level in a representative German population sample (2.6 ± 3.4 vs 0.2 ± 0.4).²³ This supports the notion that phobic anxiety is clinically relevant in ICD patients. We found that greater age, previous shock experience, increased depressive symptoms and greater hypochondriac tendency were all associated with greater phobic anxiety scores at baseline. We expected an association between hypochondriasis and phobic anxiety because illness worries might contribute to avoidance and distrust in the ICD patient.²⁷

Interestingly, when depression and hypochondriasis were not considered as covariates, cardiac symptoms and chest pain were also associated with baseline phobic anxiety scores, suggesting that depressive processing of and worries about the heart condition might better account for phobic anxiety than heart-related symptoms per se. This concurs with the notion that taking into account the psychological profile of ICD patients is important because factors such as type D personality,²⁸ depressive coping²⁹ and lack of optimism³⁰ may all predict adjustment problems. Patients with a high-risk psychological profile may have a tendency to interpret ICD shocks as relatively more malignant, suggesting that it is not the actual shock that leads to distress but more the patient's appraisal and interpretation of the shock.³¹ This association of the presence of any shock is consistent with an earlier study dealing with leads under advisory,³² which was not the case for our ICD patients.

Greater phobic anxiety scores at follow-up were determined by a greater number of non-cardiac diseases and also by greater phobic anxiety baseline scores. In addition to younger age, a greater number of non-cardiac diseases was also predictive of an increase in phobic anxiety scores during the follow-up period. Despite the observation that phobic anxiety scores did not significantly change over time among all patients, we found that those with a greater number of non-cardiac diseases and relatively younger patients showed an increase in phobic anxiety scores over time. Younger individuals are less prepared to live with an ICD and attribute, particularly in the context of medical

comorbidity, more impairment in daily functioning to the device compared with older individuals.³³

The proportion of patients with high levels of phobic anxiety was significantly greater at follow-up than at baseline. Chest pain and shocks, both experienced since ICD implantation, seemed to play particularly important roles for, respectively, the persistence and the development of high levels of phobic anxiety during the follow-up period. The association between high levels of phobic anxiety and chest pain may indicate high degrees of emotional disability in our ICD patients. Long-acting chest pain regardless of an ischaemic or functional origin triggers substantial amounts of emotional distress and chest pain at rest is also a major source of anxiety, depression and subsequent somatic preoccupation.³⁴ The importance of shock experience for anxiety has also been emphasised. Anxiety is the most important psychological side effect of ICD therapy, attributable to the device being able to provide an uncontrollable shock.³⁵

Because phobic anxiety seems to persist naturally, effective interventions are sorely needed. We identified several potentially modifiable determinants of phobic anxiety scores, which might inform such interventions, particularly those relating to patients' psychological status (eg, hypochondriac tendency, depression). Specific subgroups of patients, for example, younger ones and those with higher co-morbidity, might also benefit from interventions. A brief cognitive behavioural preimplantation and rehabilitation programme for patients receiving an ICD previously improved physical health and reduced psychological morbidity and unplanned readmissions.³⁶

Apparently, it would also be crucial to treat phobic anxiety in itself, as it emerged as a strong predictor of the severity of phobic anxiety later in the disease course. Phobic anxiety is accompanied by avoidance behaviours, a sedentary lifestyle, sexual problems and poor quality of life, and it may also increase the risk of life-threatening arrhythmias and mortality. Breaking this vicious cycle seems the ultimate aim of the comprehensive treatment of ICD patients. Prevention of phobic anxiety is also an important goal and could be facilitated by reducing shock rates and by supporting patients' coping resources. Therefore, psychological symptoms and maladaptive personality traits or

Table 5 Key associations with increased phobic anxiety levels holding true in multivariate analyses

Phobic anxiety	Greater age	Previous shock experience	No of non-cardiac diseases
At baseline	×	×	
At follow-up			×
Change over time			×

coping strategies should be identified as early in the course of the heart disease as possible, preferably even before ICD placement. The evidence for a benefit of behavioural interventions in ICD patients is, as yet, most convincing for symptoms of anxiety and exercise capacity, but less so for depressive symptoms, quality of life and shocks, but this is still a nascent area of research.³

Our study has its limitations. The sample size precluded the inclusion of additional covariates into multivariate models (eg, personality traits, coping strategies and social support), as well as the identification of multivariate determinants in the categorical analysis of differences between patient groups with different trajectories in high levels of phobic anxiety. The inclusion of shock anxiety scales and the degree of ICD acceptance might have revealed additionally important correlates of phobic anxiety,³⁷ as patients' acceptance of the device was negatively correlated with trait anxiety in a previous study.³⁸ It would also have been interesting to perform stratified analysis in terms of subgroups, particularly with regard to gender effects and to patients with a cut-off of at least five experienced ICD shocks and primary versus secondary indication for ICD therapy. However, less than 15% of patients reported five or more shocks and less than 20% had ICD indication for primary prevention, yielding subgroups too small for statistically reliable analysis. The first patients of the presented cohort were included in the study more than a decade ago. Despite this, they have received an individual device programming that still meets current standards. In detail, focus was routinely taken to avoid shock therapy by activating anti-tachycardia pacing for rapid ventricular tachycardia, which was later described to be highly effective,³⁹ and discriminators to avoid inappropriate therapies due to supraventricular tachyarrhythmias were routinely applied in a similar way as currently recommended.⁴⁰ The bulk of patients had a one-chamber device implanted but a certain inhomogeneity with regard to the device may make results difficult to extrapolate to other patient samples. The first assessment of phobic anxiety took place at 2 years post-implant. Earlier data capture might have implications for better screening and possibly earlier intervention in this at-risk population.

In summary, we found that symptoms of phobic anxiety persist in patients with an ICD for many years after the place-

ment of the device. Screening of ICD patients for particularly elevated levels of phobic anxiety seems warranted. Several key associations with elevated phobic anxiety scores across the different assessments emerged from both multivariate models (table 5), thereby pointing to potential clinical aspects worthy of greater scrutiny in future studies. The identified modifiable determinants of phobic anxiety may inform tailored interventions with the focus of possible improvement in quality of life and perhaps the prognosis of ICD patients.

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Key messages

- ▶ Phobic anxiety is substantially increased in patients living with an ICD when compared with the prevalence of phobic anxiety in the general population.
- ▶ Phobic anxiety in ICD patients shows persistence between 2 and 5.5 years after ICD implantation.
- ▶ Several of the identified determinants of phobic anxiety are modifiable and might inform tailored interventions to alleviate phobic anxiety in ICD recipients possibly to improve quality of life and prognosis.

Heart rhythm disorders

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Heart

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En-Young Nicole Cho, Roland von Känel, Birgit Marten-Mittag, Joram Ronel, Christof Kolb, Jens Baumert and Karl-Heinz Ladwig

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