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REVIEW
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Depression and anxiety in patients receiving an implantable cardioverter defibrillator with or without cardiac resynchronization therapy

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ABSTRACT Implantable cardioverter defibrillators (ICDs) represent an established therapeutic strategy for the prevention of sudden cardiac death and reduction of mortality in high-risk patients, while ICDs with cardiac resynchronization therapy defibrillators improve morbidity, quality of life, and mortality in eligible patients with heart failure who are on optimal medical therapy. However, these devices may adversely affect the patients' psychological status after the delivery of shock therapies or even because of the fear of impending therapy. On the other hand, the potential of effective treatment of malignant arrhythmias may provide a 'safety' sensation in most treated patients without significant impairment in the quality of life during periods of clinical stability. During the past few years, an increasing number of reports have investigated psychological distress, including depression and anxiety status in ICD/cardiac resynchronization therapy defibrillator recipients. However, heterogeneous results have been reported while data on the variation of these psychological indexes over time in implanted patients are quite limited. Several intrinsic and extrinsic factors affect the psychological status of these patients while variations of these disturbances in specific populations are evident. Factors that seem to be associated with a greater risk for depression and anxiety in this setting include female gender, younger age, and device shock therapies. Moreover, depression and anxiety may have an adverse impact on patients' clinical outcomes exacerbating heart failure and increasing the arrhythmic risk. In this brief review article, we provide a concise and critical overview of the current literature on this topic, and we also discuss unresolved and conflicting issues delineating future perspectives.

Implantable cardioverter defibrillators (ICDs) represent an established therapeutic strategy for the primary or secondary prevention of sudden cardiac death (SCD) reducing mortality in patients with heart failure (HF) with reduced ejection fraction as well as in high-risk patients with cardiomyopathies or primary arrhythmia syndromes.[1,2] ICDs confer a very effective protection against malignant ventricular arrhythmias but, on the other hand, potential risks such as infections, lead-related problems, and inappropriate ICD shocks may limit the anticipated benefits.[2-4] In addition, cardiac resynchronization therapy (CRT) represents an effective therapy for mortality and morbidity reduction in HF with reduced ejection fraction patients who are on optimal medical therapy having significantly reduced ejection fraction and prolonged QRS interval (electrical desynchrony).[5,6] Most candidates for CRT also have indications for an ICD for primary prevention of SCD and therefore are implanted biventricular pacemakers with a defibrillator capability (CRTDs).

Regarding psychological status, it is reasonable to speculate that ICDs/CRTDs provide a 'safety' sensation in most of the treated patients without significant impairment in the quality of life since there are not many limitations and precautions in the daily activities after implantation. However, this status may be compromised and deranged by their underlying disease(s) as well as by the aforementioned potential complications and uneventful events including appropriate and inappropriate shocks from the device. Moreover, some patients' psychological status and mood may be adversely affected due to the fear of impending device therapy. Also, some patients may experience aesthetic problems or local discomfort in the device pocket area, problems that may affect their psychological status.

The quality of life is much more well-studied in these

populations, especially in CRT patients where marked improvement is usually noted in the responders.[7,8] Also, it should be taken into account that patients with severe congestive HF experience a markedly impaired quality of life that significantly affects their cognitive and psychological well-being. Indeed, several studies have examined quality-of-life measures in ICD and CRT patients.[7-9] Of note, quality of life and other psychological parameters such as depression and anxiety are in general interrelated but there seem to be variations and deviations across different populations.

Even though during the past few years, an increasing number of investigations have examined depression and anxiety in these populations, most of them include a small number of patients and they report heterogeneous results. However, some recent larger studies elucidate more clearly the prevalence and the clinical relevance of depression and anxiety in this setting. Moreover, data on the variation of these psychological disorders over time in patients implanted with ICDs/CRTDs are quite limited. Undoubtedly, psychological distress and mood disorders may have an adverse impact on patients' clinical outcomes exacerbating HF and increasing the arrhythmic risk. In this article, we provide a concise and critical narrative overview of the current literature on this topic, and we also discuss unresolved and conflicting issues delineating future perspectives. We selected studies relevant to the topic giving preference to systematic reviews and/or meta-analyse and large cohort or longitudinal studies. Cross-sectional studies were only included if they were large enough and had reported findings not investigated in longitudinal studies.

DEPRESSION AND ANXIETY IN PATIENTS WITH IMPLANTABLE DEFIBRILLATORS: OVERVIEW OF THE CURRENT EVIDENCE

Quality of Life in Patients with ICDs

It is reasonable to assume that the quality of life is associated with psychological and mood disorders. Regarding the quality of life in ICD patients, the first reviews and meta-analyses that appeared in the literature showed inconsistent results.[10-12] Remarkably, the meta-analysis by Tomzik, *et al*.[9] studied the quality of life in patients with an ICD including 5 randomized controlled trials with 5138 patients and 10 observational studies with 1513 patients. Their analysis showed inconclusive results; namely, 9 studies, including 3 randomized trials, demonstrated neutral results (no improvement of quality of life in ICD patients compared to controls), while 3 studies showed improvement and 3 other studies deterioration in the quality of life.[9] However, for the patients who experienced ICD shocks, the data indicated an unchanged or poorer quality of life compared to patients who did not suffer shocks. Of note, there were heterogeneous results in the included studies that could be attributed to differences in study designs, control groups, and quality of life assessment, as well as in the inclusion and exclusion criteria.[9]

Depression and Anxiety in ICD Patients and Their Variation Over Time

Regarding depression and anxiety, an early meta-analysis published in 2003 including very small studies, failed to demonstrate differences in the prevalence of anxiety and depression between patients with ICDs and patients treated conservatively with or without antiarrhythmic agents.[12] The same was true regarding differences after the implantation of ICDs.[12] However, this meta-analysis included only ventricular arrhythmias patients not receiving modern HF therapies while patients who were not implanted and ICD were receiving antiarrhythmic drugs that often have adverse events. Analyzing specific data on depression and anxiety, a systematic analysis reported in 2011 which included 45 studies with more than 5000 patients with ICDs showed that the prevalence of these disturbances based on self-reported questionnaires ranged widely.[13] Specifically, the prevalence of depressive symptoms ranged from 10% to 36% and the prevalence of anxiety symptoms ranged from 27% to 63% before ICD implantation.[13] Moreover, this systematic review was not able to determine the changes in the prevalence of depression and anxiety after ICD implantation since there were inconsistent and limited data until this time point.[13] In this context, no firm conclusions were made regarding potential differences between primary and secondary prevention patients. These findings were consistent with another previous viewpoint that reviewed 5 studies and concluded that there are no differences in the quality of life and psychological distress between primary and secondary prevention ICD patients.[14] Of note, the early systematic review by Magyar-Russell, *et al*.[13] showed inconsistent results regarding the effect of ICD shocks on depression and anxiety. However, as discussed later, accumulating evidence sug-

gests that ICD therapies may have a negative impact on these psychological parameters. It should be noted that most of the studies included in this systematic review were small (including < 100 patients) while there was significant heterogeneity regarding patient populations, tools used for the assessment of psychological parameters, study designs, and settings. Presumably, these parameters may account for the wide variation in depression and anxiety rates.

A more recent systematic review and meta-analysis (15 studies with 10,182 patients) showed that almost one-fourth of ICD patients suffer from depression, close to the prevalence of depression in other chronic diseases.[15] Specifically, the subgroup analysis indicated the highest prevalence of depression in studies conducted in Asia and the lowest prevalence in those conducted in Europe.[15] Moreover, a significant variation was observed across different instruments used for the assessment of depression. The most commonly used instrument was the Hospital Anxiety and Depression Scale which is utilized in hospitalized patients and has significant shortcomings and disadvantages compared to other self-reported instruments.[15] Of note, in this meta-analysis, no clear data were provided regarding the variation of depression over time before and after ICD implantation, nor data on the effect of ICD therapies.[15]

Relatively few studies have examined the variation of mood disorders comparing their prevalence before and after the device implantation while the effect of ICD therapies is not clearly reported on several occasions. Amiaz, *et al*.[16] reported that ICD contributed little if any, additional depressive, or anxiety symptoms after implantation. It was demonstrated that the overall attitude towards the device was positive and that shocks and phantom shocks were related to depressive symptoms. Another study included patients undergoing ICD implantation and examined the symptomatology and anxiety at baseline and after a 12-month follow-up. It was demonstrated that patients with younger age, increased depression score at baseline, and type D personality were especially prone to experience post-traumatic stress disorder and anxiety symptomatology at 12 months follow-up.[17]

The largest and most recent systematic review and meta-analysis on the burden of mood disorders and symptoms before and after ICD (without CRT) implantation included 109 studies with almost 40,000 patients (mean age: 64 years, 91% males).[18] The overall prevalence of a diagnosis or clinically relevant symptomatology of anxiety post-implantation was 22.6%. Interestingly, the prevalence of anxiety was 30.4% before discharge from the hospital, initially increased during the first 5 months after implantation (32.3%), and then gradually decreased beyond 12 months post-implantation at the level of 22.4%. Regarding diagnosis or clinically relevant symptomatology depression, the overall prevalence post-implantation was 15.4%.[18] The prevalence of depression was 16.8% before discharge from the hospital, initially increased during the first 5 months after implantation (22.6%), and then gradually decreased beyond 12 months post-implantation at the level of 13.6%.[18] Subgroup analyses showed that female ICD patients exhibited significantly higher symptoms of anxiety compared to males after ICD implantation. However, no gender differences were evident in the pre-implantation period, nor for the depressive symptoms.[18] Also, no differences in mood symptoms were evident between primary and secondary indications post-ICD implantation. Interestingly, 27/109 included studies reported continuous data for ICD patients across at least one timepoint comparison. It was indicated that symptoms of depression decreased significantly from pre- to post-ICD implantation and from pre-discharge for ICD implantation to up to 6 months post-ICD.[18] In the same line, symptoms of anxiety also significantly decreased from up to 6 months post-ICD implantation compared to 6–12 months post-ICD.[18] Table 1 presents a concise overview of the published systematic reviews and meta-analyses regarding depression and anxiety in ICD patients.

Very recently, Frydensberg, *et al*.[19] in a large prospective cohort study (1496 patients, 18% women) examined the prevalence of depression and anxiety in ICD and CRTD patients as well as their association with the indication of implantation and sex with up to 24 months follow-up. It was demonstrated that patients with an ICD indication for secondary prevention, especially women, reported higher anxiety and depression scores compared to patients with a primary prevention indication.[19] Interestingly, the anxiety scores decreased over time during the follow-up, both in primary and secondary prevention groups. Concerning depression, only women exhibited decreased scores during the follow-up. Moreover, women reported greater anxiety compared to men at all time points while they reported more depression than men only at baseline. However, it should be noted that CRTD implantation was much more prevalent in primary prevention patients compared to secondary prevention

Table 1 Concise overview of the published systematic reviews and meta-analyses regarding depression and anxiety in ICD patients.

Meta-analysis	Included studies, number of patients	Patient characteristics	Main findings	Limitations and shortcomings
Burke JL, *et al*[12]	20 studies 490 patients	Patients with ventricular arrhythmias treated with ICDs or conservatively with or without antiarrhythmics	No significant difference in depression and anxiety: • ICD and conservative treatment • Before and after ICD implantation • Shock *vs.* no shock	• Small studies included • No data on clinical characteristics • Wide variation of time of assessment of psychological outcomes after implantation • Different tools to assess psychological factors
Magyar-Russell G, *et al*[13]	45 studies 5140 patients	Patients who implanted an ICD for secondary or primary prevention of sudden cardiac death	Inconsistent results regarding differences in depression and anxiety: • After ICD implantation • After shock • Between primary and secondary prevention	• Small studies included • Most patients were white men and implanted for secondary prevention • Different populations • Different follow-up periods • Different tools to assess psychological factors
Oshvandi K, *et al*[15]	15 studies 10,182 patients	Patients who implanted an ICD for secondary or primary prevention of sudden cardiac death	• One-fourth of ICD patients suffer from depression • Prevalence of depression was higher in middle-aged patients compared to elderly • Highest prevalence of depression in Asian studies • Significant variation across different instruments used for the assessment of depression	• Only depression was studied, no data on anxiety • Different populations • Different tools to assess depression
Ghezzi ES, *et al*[18]	109 studies 39,954 patients	Patients who implanted an ICD (no CRT devices were included) compared to non-ICD group. Data on mood disorders at > 1 timepoint (pre-ICD and post-ICD)	• Depression in 15.4% and anxiety 22.6% before discharge (after ICD implantation) • Depression decreases 5 months after post-ICD and anxiety at 6 months • Higher anxiety in females • Higher depression after shock therapy • No differences between primary and secondary prevention	• Limited clinical data in control groups • Males overrepresented • Different tools to assess psychological factors

CRT: cardiac resynchronization therapy; ICD: implantable cardioverter defibrillator.

patients.[19] Also, secondary prevention patients suffered more device shocks during the follow-up. Unfortunately, the authors did not report subgroup analyses to clarify the potential effects of CRT during the follow-up.[19] Interestingly, a sub-analysis of this study showed that during the 24-month follow-up, 14.5% of patients developed new-onset anxiety and 11.3 % developed new-onset depression, indicating that regular psychological assessment is needed after ICD implantation.[20] Remarkably, some limited data indicate that depression and anxiety are also highly prevalent in the partners and relatives of ICD patients.[18,21,22]

Of note, data on other contemporary devices such as subcutaneous ICDs (S-ICDs) are sparse. S-ICDs are devices much bigger in size than conventional intravascular ICDs and deliver only shock therapies. A recent case-control study revealed equal or even better physical well-being of patients with the S-ICD.[23] In this context, an analysis of a matched cohort of S-ICD and transvenous ICD patients enrolled in the EFFORTLESS study indicated that the quality of life and depression levels were similar in patients with an S-ICD and a transvenous ICD up to 12 months follow-up, while S-ICD patients reported lower anxiety levels and a greater reduction in depression over time.[24]

Impact of Patient Characteristics and Comorbidities on Depression and Anxiety

Interestingly, a large cross-sectional study including 3067 ICD recipients reported that the probability of symptoms of symptoms of anxiety and depression was associated with younger age, living alone, female gender, and a previous history of myocardial infarction or HF.[25] An interesting finding in the meta-analysis by Oshvandi, *et al*.[15] was that the prevalence of depression was higher in middle-aged patients compared to elderly patients

possibly reflecting the negative perception of ICD therapy in younger patients. In this context, other data indicate that ICD patients who are older people (≥ aged 60 years) and more self-care-dependent perceive higher depression with no significant factor associated with anxiety.[26] It has been indicated that social factors such as isolation, and other comorbidities are highly prevalent in the elderly and may aggravate depression.[26]

Impact of ICD Shocks on Depression and Anxiety

The adverse effects of ICD shock(s) on anxiety have been well documented and validated using established tools such as the Florida Shock Anxiety Scale.[27] The most significant predictors of shock-related anxiety include the occurrence and number of shocks (appropriate and inappropriate). Interestingly, in the MADIT-RIT study ≥ 2 appropriate or inappropriate ICD shocks and ≥ 2 appropriate antitachycardia pacing therapies were associated with more anxiety at 9-month follow-up despite no significant changes in the assessment of the global quality of life.[28] The increased anxiety linked to antitachycardia pacing therapies indicates that shock anxiety increases even in the absence of actual shock but in the presence of increased awareness of shock possibility.[28] Even though older small meta-analyses showed inconsistent results (Table 1), a subgroup analysis of the large recent meta-analysis by Ghezzi, *et al.*[18] (Table 1) demonstrated that shock therapies post-ICD implantation were associated with higher rates of clinically relevant depression and anxiety as well as with higher depression symptom severity. Notably, a recently published sub-analysis of the DEFIB-WOMEN study indicated that device shocks during follow-up were associated with depression, anxiety, and ICD concerns.[29]

Effects of Depression and Anxiety on Patients' Outcomes

The psychosomatic effects of depression and anxiety in various clinical settings are considerable. It has been demonstrated that psychosomatic instability and impaired psychological status such as depression and anxiety may increase the risk of arrhythmias and SCD.[30,31] However, the most robust evidence concerns the link between depression and SCD/ventricular arrhythmias.[30] The main underlying mechanisms include autonomic dysregulation causing increased sympathetic tone and reduced parasympathetic tone as well as associated neuroendocrine abnormalities related to activation of the hypothalamic-pituitary-adrenocortical axis.[30] In this context, it has been demonstrated that depression and anxiety in ICD patients are associated with reduced parasympathetic control.[32] Also, it should be acknowledged that depression is often related to an unhealthy lifestyle, including less physical activity, smoking, alcoholism, irritability, obesity, and poor drug adherence whereas several antidepressant medications may have proarrhythmic effects.[30]

In a large cohort study of more than 3800 veterans who received an ICD (22.6% had a CRTD) who had a follow-up of 2.7 years, depression was independently associated with the combined endpoint of HF hospitalization or mortality.[33] Even though there are some inconsistent results most data in the literature indicate the adverse effect of depression on mortality in ICD patients. A small study of outpatients who were stratified in some sites that participated in the SCDHeFT study showed that depression and social isolation predicted mortality independent of demographic and clinical status in HF outpatients.[34] On the other hand, Tzeis, *et al.*[35] in a cohort of 236 ICD patients indicated that depression was not an independent predictor of mortality. Notably, recent data from the long-term follow-up of the MIDAS cohort indicates that ICD patients with depression have a greater risk of mortality, whereas anxiety only shows a trend.[36] Furthermore, this study showed that neither anxiety nor depression is associated with ventricular arrhythmias during follow-up.[36]

In a cohort of 430 consecutive patients with a first-time ICD, it was shown that depression at the time of implant is not associated with time to first appropriate ICD therapy but almost doubled the risk for all-cause mortality in patients with an ICD.[37] On the other hand, in this study anxiety was not a predictor of mortality.[37] Moreover, patients with persistent depression during the first 3 months after implantation appear to have the greatest risk of dying.[43] Only limited evidence indicates that anxiety is associated with an increased risk of ventricular arrhythmias and mortality 1 year after ICD implantation, independent of demographic and clinical covariates.[38]

It has also been demonstrated that more severe symptoms of depression predict shocks for VT/VF among ICD patients even after controlling for multiple confounders.[45] Furthermore, among the coronary artery disease patients, the association between time to first shock and all shocks remained.[39]

THE EFFECT OF CARDIAC RESYNCHRONIZATION THERAPY ON DEPRESSION AND ANXIETY IN PATIENTS WITH AN ICD

Bearing in mind that CRT improves cardiac performance, including left ventricular ejection fraction, and ameliorates mitral regurgitation and arrhythmias in responders it would be sensible to speculate that it favorably affects psychological distress. It is well known that CRT improves exercise capacity and NYHA class.[6-8] On the other hand, it has been demonstrated that ICD implantation in patients with systolic HF does not significantly alter the health-related quality of life compared with patients randomized to usual clinical care.[40] This is consistent with older data showing that symptomatic HF is the most important predictor of impaired quality of life, depression, and anxiety in patients with ICDs.[41] The anticipated benefit of CRT in HF patients in terms of improvement of quality of life and NYHA class may have implications in the prevalence of mood disorders and their variation over time. Indeed, an increasing body of evidence indicates that general anxiety and quality of life improve after CRTD implantation.[42] Even in the long term, CRT improves the quality of life, and this effect appears to be sustained and even greater over time during long a follow-up period.[43]

Besides the aforementioned considerations, it is not clear whether CRT added to ICD confers improved psychological distress. A small comparative study showed that patients with CRTD exhibit higher levels of depressive symptoms and psychological distress at baseline and during the 6-month follow-up compared to ICD patients.[44] The authors suggested that psychological burden seems to persist irrespective of the physical improvement after CRT.[44] On the other hand, a controlled clinical trial that enrolled 74 patients demonstrated the beneficial effects of CRTD on psycho-cognitive performance, including depression, compared to ICD, in conjunction with improved cardiac function and hemodynamics.[45]

Of note, limited data are available regarding the prevalence of depression in CRTD patients. In a large observational study with 3862 veterans who received an ICD (22.6% had CRTD) a high prevalence of depression (30%) at baseline was reported with no difference between ICD and CRTD patients.[46] At the same time, depression was independently associated with the advanced NYHA class.[46] The prevalence of depression was in the order of 43% in young females. However, no data on the prevalence of depression after implantation were provided.[46] In a small cohort study, Ford, *et al*.[47] examined the effect of the addition of CRT to the ICD on psychological functioning and showed that anxiety was elevated in both groups but dropped significantly after 9 months only in CRTD patients and not in ICD patients. On the other hand, depressive symptoms were high at baseline in both groups and dropped significantly during the follow-up.[47] As mentioned before the large cohort study by Frydensberg, *et al*.[19] which included a large proportion of patients who received a CRTD did not provide any particular data on this subpopulation.

Heart-focused anxiety (HFA) represents a specific form of anxiety including heart-related sensations, specific attention to cardiac symptoms, and the avoidance of physical exercise and sexual activities. Recently, Kindermann, *et al*.[42] prospectively studied ICD and CRTD patients and assessed psychological parameters, including HFA, at baseline and at regular time intervals until 24 months post-implantation. It was demonstrated that total HFA significantly improves after implantation while no difference was noted between age groups or between patients with ICDs and patients with CRTDs.[42] The mean scores of general anxiety and quality of life decreased significantly after implantation while depression did not change during the follow-up.[42] Interestingly, subgroup analyses showed that general anxiety improved in older participants, patients with CRTD and without shock/anti-tachycardia pacing, and men, but not in younger participants, patients with ICD and shock/anti-tachycardia pacing, or women.[42] The quality of life improved significantly only in CRTD patients and in ICD patients without device therapies. Notably, depression scores did not change in any of the subgroups after implantation.[42]

TREATMENT OF DEPRESSION AND ANXIETY IN ICD PATIENTS

The role of pharmacological, nursing, psychosocial, cognitive, and behavioral therapies in ICD recipients has not been well studied. Remarkably, no study has investigated the effectiveness of known pharmacological treatments for depression and anxiety (antidepressants, sedatives) on the outcomes of patients with ICDs.

Concerning non-pharmacological interventions, some data indicate the beneficial effects of counseling, and behavioral therapies in this setting.[48,49] Of note, a random-

ized clinical trial showed that a specific cognitive-behavioral therapy intervention in ICD patients who suffer from posttraumatic stress disorder produces a significant improvement in symptoms to usual cardiac care.[50] In keeping with these findings, a recent small randomized clinical trial showed that a web-based intervention resulted in reduced depression and anxiety scores compared to usual care after ICD implantation.[51] This specific intervention included information on medical, technical, and psychosocial issues associated with having an ICD, self-help interventions based on cognitive behavior therapy, a virtual self-help group, and on-demand support by a trained clinical psychologist.[51] Given the heterogeneity of patients' characteristics and comorbidities in the ICD population, tailored interventions seem to be the most appropriate approach in this setting.

DISCUSSION

Depression and anxiety seem to be highly prevalent in patients with ICDs with or without CRT and cause distress to the patients. Specifically, anxiety seems to be more prevalent than depression within the ICD population. Also, as mentioned before, specific patient groups such as women, younger persons, isolated individuals as well as patients with comorbidities seem to be more susceptible to anxiety and depressive disorders. Also, patients receiving defibrillator shocks report increased anxiety symptoms. The addition of CRT to ICD therapy seems to improve the quality of life while it ameliorates anxiety with no significant improvement in depression. A schematic presentation of key patient characteristics and risk factors associated with the increased prevalence of depression and anxiety is provided in Figure 1.

Notably, these mood disorders may adversely affect patients' outcomes, quality of life, HF hospitalizations, and mortality.[18,52] Moreover, there seems to be a wide discrepancy in the incidence and prevalence of these disorders across different populations. Indeed, ethnic, racial, social, geographical, and economic parameters may partially explain these discrepancies. Apart from differences in populations' characteristics, the inconsistent results published in the literature could also be explained by small sample sizes, as well as by differences in methodology, different psychological measures/tools for diagnosis and screening, variation in underlying heart diseases and comorbidities, etc.

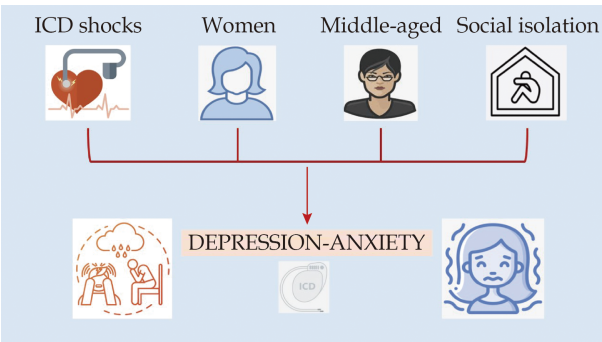

Figure 1 Risk factors for depression and anxiety in patients with ICDs. ICD: implantable cardioverter defibrillator.

It should be noted that many of the published studies do not address the variation of depression and anxiety status before and after the implantation of ICDs as well as their variation in the long term. Importantly, the vast majority of the reported data does not exclude patients who suffer ICD shocks. However, an accumulating body of evidence indicates that appropriate and inappropriate ICD shocks adversely affect the quality of life and depression and anxiety in these patients.

In addition, more studies are needed to elucidate the impact of depressive and anxiety symptoms in subgroups of patients not well represented in the current studies. These include women, ethnic minorities, young adults, and very elderly patients. Moreover, mixed results have been published regarding ICD indication; namely primary versus secondary SCD prevention. Although CRT improves the quality of life equally in men and women,[53] the relative impact of CRTD on depression and anxiety in men and women has not been studied.

It must be underlined that the relative value of different questionnaires and tools used for the assessment of depression and anxiety status needs further investigation in order to establish the best-validated method. In addition, further data are needed to elucidate the exact prognostic factors associated with a greater risk for the development of depression and anxiety after ICD therapy. Also, the exact burden and impact of depression and anxiety on the family members and partners of ICD patients need further clarification.

Bearing in mind the considerations mentioned above it should be stressed that mood disorders should be recognized and treated in device clinics where patients with ICDs perform their regular follow-ups. Despite the patient volume overload of these clinics, a sole device interrogation is not sufficient for appropriately managing these patients. Routine communication, recording of patients' concerns, activities, mental health, lifestyle beha-

viors, and dietary patterns, as well as regular specialized interviews and psychological assessments using validated tools by healthcare providers, seem to be essential procedures for the holistic management of ICD/CRTD recipients. Finally, the exact role and clinical implications of drug treatments and cognitive-behavioral interventions in ICD patients should be further investigated in future studies.

CONCLUSION

Depression and anxiety are highly prevalent in the population of patients with an ICD with or without CRT. Psychological distress and especially depression adversely affect arrhythmic events, mortality, and outcomes in ICD patients. Although in some patients, these mood disorders are ameliorated after device implantation; in some others, no significant variation is observed. Undoubtedly, several intrinsic and extrinsic factors affect the psychological status of these patients and further studies in specific populations are needed to elucidate particular risk factors as well as the exact impact of these disturbances. Factors that seem to be associated with a greater risk for depression and anxiety in this setting include female gender, younger age, and device shock therapies. It would be sensible to speculate that the prevention and management of depression and anxiety in ICD recipients may have a significant impact on patients' outcomes. Therefore, meticulous screening for psychological distress and related disorders could be a beneficial strategy for the effective and holistic management of patients with ICDs.

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