

# End-of-life Decisions in ICD Patients with Malignant Tumors

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**Background:** The results of multiple implantable cardioverter-defibrillator (ICD) studies have demonstrated a survival benefit in specific high-risk populations, leading to the expansion of ICD implantation rates worldwide. Because the ICD reduces the incidence of sudden cardiac death, patients with these devices more often die of nonarrhythmic causes. For those with a malignancy, little is known about their preferences for disabling ICD therapy.

**Methods:** The objective of the present study was to evaluate whether patients with an ICD and a malignant tumor desire deactivation of their ICD in order to have a death without ICD interventions, which are life-prolonging, bothersome, and prevent a peaceful death. All deceased patients having had an ICD implanted at our institution were retrospectively analyzed with respect to whether the option of disabling ICD therapy had been discussed and whether the ICD had been deactivated.

**Results:** Two hundred and seventy-two patients received an ICD at our institution between January 1, 1994, and January 31, 2007. Thirty-six of the patients have died, and of these eight had a malignant tumor. In six of these eight patients (75%) the option of disabling their ICD therapy was discussed extensively; none wished to abandon the possibility of terminating a malignant arrhythmia by the ICD.

**Conclusions:** With the use of ICDs, patients with heart failure are more frequently protected from arrhythmic death, and consequently treating physicians are increasingly confronted with ICD patients presenting with a malignant tumor or other noncardiac terminal disease. In these situations, dialogue between the treating physician and the patient about the possibility of withdrawing ICD therapy is important to terminal care. The physician must be aware that the patient's attitude may contrast with his/her own, and that the patient may be resolute in maintaining ICD protection from arrhythmic death. (PACE 2007; 30:845–849)

**implantable cardioverter defibrillator, terminal care, end-of-life decisions, malignant tumor, cancer**

## Introduction

The use of implantable cardioverter-defibrillators (ICDs) is established as both primary and secondary prophylaxis of sudden cardiac death. As recent studies have shown a survival benefit mainly in patients with a left ventricular ejection fraction less than 35% due to both coronary artery disease and dilated cardiomyopathy, use of ICDs has become frequent in this population.<sup>1–4</sup> This therapy prevents sudden cardiac death, and the patients with ICDs are more likely to survive the cardiac disease and to die from noncardiac causes such as, among others, progressive cancer.

Recently, it was reported that deactivation of the ICD in terminally ill patients is discussed with only a few patients.<sup>5</sup> However, in cases of terminal illness a sudden arrhythmic cardiac death may be desirable to potentially reduce the period of suffering.<sup>6,7</sup> Therefore, if a patient with an ICD is living with fatal illness, dialogue that death from arrhythmia may be a less suffering mode of dying should be conducted with the patient and his family. In

patients with an ICD and a malignant tumor little is known about their personal preference for deactivating the shock therapy.

The aim of our study was to evaluate whether patients with malignant disease wish a withdrawal of ICD shock therapy in order to have the chance of dying without ICD interventions, which are life-prolonging, bothersome, and prevent a peaceful death.

## Methods

### Patients

Between January 1, 1994, and January 31, 2007, 272 patients had an ICD implanted at our institution. Before implantation, every patient was informed about the benefit and the risk of the device. Additionally, the patients were informed about the possibility of withdrawing ICD therapy at any time, should they wish so. Each patient was followed in our device clinic every 3–12 months and as needed. At each visit, an electrophysiologist evaluated the patient, collected the ICD data, and reviewed the patients' history and medical treatment. If a new illness with worse prognosis and most likely a longer duration of suffering and pain (i.e., a malignant tumor) was identified, discussion regarding the option of ICD therapy

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**Table I.**  
Patient Demographics of Patients Who Died

|  | All<br>(N = 36) | Malignancy<br>(N = 8) | No Malignancy<br>(N = 28) | P Value |
|--|-----------------|-----------------------|---------------------------|---------|
| Age at implantation (mean ± SD)                  | 60 ± 9          | 63 ± 7                | 59 ± 9                    | ns      |
| Age at death (mean ± SD)                         | 64 ± 9          | 67 ± 6                | 63 ± 10                   | ns      |
| Male/female                                      | 30/6            | 7/1                   | 23/5                      | ns      |
| Longevity after ICD implant (years, median ± SD) | 2.9 ± 3         | 4.9 ± 2.9             | 2.7 ± 3.0                 | ns      |
| Appropriate ICD therapy                          | 20 (56%)        | 5 (63%)               | 15 (54%)                  | ns      |
| Inappropriate ICD therapy                        | 5 (14%)         | 2 (25%)               | 3 (11%)                   | ns      |
| Occurrence of electrical storm                   | 12 (33%)        | 5 (63%)               | 7 (25%)                   | ns      |
| Ejection fraction at implant (%)                 | 31 ± 10         | 28 ± 11               | 31 ± 12                   | ns      |
| Ejection fraction before death (%)               | 28 ± 11         | 24 ± 10               | 29 ± 11                   | ns      |
| Underlying heart disease                         |                 |                       |                           |         |
| Coronary artery disease                          | 22 (61%)        | 3 (38%)               | 19 (68%)                  | ns      |
| Dilated cardiomyopathy                           | 12 (33%)        | 5 (63%)               | 7 (25%)                   | ns      |
| ARVC/D   | 1 (3%)          | 0 (0%)                | 1 (4%)                    | ns      |
| Valvular heart disease                           | 1 (3%)          | 0 (0%)                | 1 (4%)                    | ns      |
| Indication for ICD                               |                 |                       |                           |         |
| Primary prophylaxis                              | 15 (42%)        | 3 (38%)               | 12 (43%)                  | ns      |
| Secondary prophylaxis                            | 21 (58%)        | 5 (63%)               | 16 (57%)                  | ns      |

ICD = implantable cardioverter-defibrillator; ARVC/D = arrhythmogenic right ventricular cardiomyopathy/dysplasia.

withdrawal was initiated by the cardiologist, whenever possible.

A retrospective review of all deceased ICD patients was performed. The following data were recorded: demographics, indication for the defibrillator, implant date, appropriate ICD therapies, inappropriate ICD therapies, date of death, cause of death, malignant diseases, programmed ICD parameters, at last visit preceding death. Further, it was determined whether discussion about ICD deactivation had been conducted, and the patients' decision was recorded.

### Statistics

Results are expressed as mean values ± standard deviations (SD), median and range or numbers and percentages, as appropriate. For comparison of categorical variables *t*-test for unpaired data or Fisher's exact test was performed, as appropriate. All statistics were performed by using STATVIEW 5.0™ (SAS Institute, Cary, NC, USA).

### Results

Of the 272 patients who received ICDs at our institution, 36 (13%) died between January 1, 1998, and January 31, 2007 (median follow-up after ICD implantation  $2.7 \pm 2.5$  years;  $n = 267$ ). Mean age at time of ICD implantation was 60 years; mean age at death was 64 years. Four (1.5%) of the patients underwent heart transplantation in the

follow-up after ICD implantation. Five (1.8%) patients were lost during follow-up. The annual mortality rate after ICD implantation was 5%. Demographics of patients who died are listed in Table I. In eight of these 36 patients (22.2%) a malignant tumor had been diagnosed, and cause of death in the majority (six of the eight patients) was the malignant disorder or immediate sequels of the malignancy (Table II). In three patients the diagnosis of a cancer was made before the ICD implantation. The decision not to abandon ICD implantation in these three patients was taken because life expectancies of over five years were estimated by the oncologists. In the other five patients the malignant tumor was diagnosed 0.2–6.1 years after ICD implantation. Two of the eight patients requested ICD replacement at the time of elective replacement, despite an incurable situation.

In six of the eight patients (75%) with a malignant tumor the option of withdrawal of ICD therapy was discussed extensively. The treating cardiologist explained that therapy withdrawal would not result in an immediate sudden death but would rather allow a natural history with eventually less suffering and a shorter period of dying. In five of these six patients appropriate ICD therapy had occurred in the past. At least one electrical storm was documented in all five patients with appropriate ICD therapy; electrical storm has been defined as three or more ventricular tachycardia/fibrillation

**Table II.**  
Patients with Malignant Tumor

| Patient No. | Type of Malignancy     | Time from ICD Implant to Diagnosis (Years) | Longevity after Malignancy Diagnosis (Years) | Grading          | Pain Due to Tumor | Discussion of withdrawing ICD Therapy | Status of ICD Therapy at Time of Death | Cause of Death                    |
|-------------|------------------------|--|--|------------------|-------------------|---------------------------------------|--|-----------------------------------|
| 1           | Urothel carcinoma      | -7.4                                       | 12.0   | cT1 cN0 cM0      | No                | Yes                                   | On                                     | Heart failure                     |
| 2           | Prostate carcinoma     | -2.9                                       | 4.6  | pT3, cN0, cM0 G2 | No                | Yes                                   | On                                     | Heart failure                     |
| 3           | Malignant lymphoma     | -0.1                                       | 0.7  | Ann-Arbor IIIA   | Yes               | Yes                                   | On                                     | Malignancy                        |
| 4           | Urothel carcinoma      | 6.1  | 3.0  | pT2a pN1 M0      | Yes               | Yes                                   | On                                     | Malignancy                        |
|             | Prostate carcinoma     |  |  | pT2 pN0 M0       |                   |                                       |  |                                   |
|             | Malignant lymphoma     |  |  | Ann-Arbor IIA    |                   |                                       |  |                                   |
| 5           | Rectosigmoid carcinoma | 5.1  | 0.7  | pT1 G1 cM1       | Yes               | Yes                                   | On                                     | Malignancy                        |
| 6           | Rectal carcinoma       | 5.0  | 0.5  | pT1 G2 cM1       | Yes               | Yes                                   | On                                     | Malignancy                        |
| 7           | Bronchial carcinoma    | 0.2  | 0.1  | cT2 cN3 cM1      | Yes               | No                                    | On                                     | Malignancy/<br>pulmonary embolism |
| 8           | Bronchial carcinoma    | 4.4  | 0.7  | pT2 pN2 G3 cM1   | No                | No                                    | ICD explanted                          | Malignancy                        |
| All         |                        | 1.3 ± 4.4                                  | 2.8 ± 3.8                                    |                  | 63% Yes           | 75% Yes                               | 88% On                                 | 75% Malignancy, 25% heart failure |

ICD = implantable cardioverter-defibrillator.

episodes with appropriate ICD shocks within 24 hours.<sup>8-12</sup> A possible explanation for the relatively frequent ICD shocks is that our patients with cancer did not die from heart failure and had a longer follow-up, during which time various factors, i.e., shifting of electrolytes, may have led to electrical destabilization of the heart. However, none of the patients wished to have the ICD deactivated in order to have the chance of dying from an arrhythmic death. All six patients with whom withdrawal of antitachycardia therapy was discussed expressed the opinion that an active withdrawal would mean that both themselves and the cardiologist had given up even a minimal hope for some eventual curative option. All were relieved to have been given the individual right to continue ICD therapy.

The two patients with whom therapy withdrawal was never discussed had bronchial carcinoma. One of these had a biventricular ICD (indication for ICD implantation primary prophylaxis) and showed an improvement of the left ventricular ejection fraction from 25 to 50%. However, because he never had appropriate shocks and his bronchial carcinoma was progressive, the ICD was substituted by a biventricular pacemaker at the time of battery depletion. Additionally, because his left ventricular ejection fraction had normalized, from the electrophysiological view the indication for the ICD therapy was no longer present. The other patient presented shortly after ICD implantation with a newly diagnosed, rapidly progressive bronchial carcinoma and died before discussion on disabling the ICD could have been initiated; diagnosis of the carcinoma was made only four days before death when the patient presented with pain from metastasis in the vertebral column.

### Discussion

Cancer places an enormous toll on patients and in terminally ill patients a sudden arrhythmic cardiac death may be desirable to reduce time of suffering. Our study addressed the question as to whether patients with ICD and terminal cancer disease might be willing to abandon the opportunity of terminating ventricular arrhythmia by the ICD. Of the 272 patients who had received an ICD at our institution, 36 died during follow-up. In eight of these 36 patients a malignant tumor had been diagnosed, and cause of death in the majority (six of the eight patients) was the malignant disorder or immediate sequels of the malignancy. In six of these eight patients the option of ICD therapy withdrawal was extensively discussed; however, and although all six patients had previously suffered from an appropriate or inappropriate ICD shock, none approved deactivation of their ICD. The rel-

atively low mortality rate of 5% per year in our ICD population may be attributed to the fact that before the year 2001 patients with severe heart failure and short life expectancy were not evaluated for an ICD implantation.

As a lifesaving device, the ICD is one of the most remarkable therapeutic advances in modern medicine. The results of multiple studies have demonstrated a survival benefit in specific high-risk populations, leading to the expansion of ICD implantation rates worldwide.<sup>3,4,13</sup> Because the ICD reduces the incidence of sudden cardiac death, patients with these devices more often die of nonarrhythmic causes. In 1999, Braun et al. formulated that deactivation of an ICD may be appropriate in situations in which the device is believed to be prolonging patient suffering.<sup>14</sup> In 2004, Goldstein et al. reported that clinicians discussed deactivating ICDs in critically ill patients only in a few cases (27%), even though there is psychological harm and physical pain when ICDs deliver shocks.<sup>5</sup> Berger recently discussed the bioethical considerations of disabling ICDs.<sup>15</sup> He noted that "physicians must be extremely cautious in making futility assessments for patients because quality-of-life judgments vary widely among physicians and are often influenced by their personal values, such as religious and cultural beliefs."<sup>15</sup> This statement reflects our findings as we expected that some of our patients with an ICD and terminal cancer would have wished for a deactivation of their ICD.

In cases of ICD patients presenting with a malignant tumor or other noncardiac terminal disease, discussion between the treating physician and the patient about the possibility of withdrawing ICD therapy is important for terminal care. The physician must be aware that the patient's attitude may contrast with his/her own, and that the patient may be resolute in wishing for continued ICD protection from arrhythmic death.

### Limitations

This study had no standardized protocol for decision making among physicians and the patients, who may respond differently depending on the wording and tone of the conversation. In our center the treating electrophysiologist was familiar with all the patients who, before ICD implantation, were informed of the possibility of disabling ICD therapy in the follow-up. Therefore, in subsequent discussions with terminally ill patients the treating cardiologist was able to circumspectly introduce the idea of ICD deactivation being a mode of terminal care. Patients were already informed about the possibilities of treating the malignancy and the probable prognosis at the time their personal decision with respect to disabling their ICDs

was discussed. In the three patients in whom a tumor was diagnosed before ICD implantation a good prognosis was deemed by the oncologist. Nevertheless, in one of these cases the malignancy subsequently led to the death of the patient, underscoring the need for a careful follow-up with adequate conversions concerning both the heart and the tumor disease.

The findings are further limited by the retrospective nature of the study and the relatively small sample. However, because the indications for ICD implantation have expanded over the last years, physicians will be more frequently confronted with the problem of cancer in ICD patients. Further studies are needed to show the best way to approach these patients.

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