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Considerations for the Deactivation of the Stimulation Function of Pacemakers and Defibrillators in End Stage Disease

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Abstract

Background: The deactivation of anti-tachycardia functions of implantable cardiac devices such as pacemakers and defibrillators in end stage disease becomes clinical routine. Uncertainty exists about the deactivation of the stimulation function.

Methods: To collect information about possible consequences of the deactivation of stimulation we retrospectively analyzed device interrogation data of a total of 363 patients. 244 data stem from consecutive routine ambulatory patients and 119 from patients later died due to their chronic underlying illnesses.

Results: Routinely interrogated and later deceased patients are comparable for age at implantation (76.6 ± 9.4 vs 74 ± 7.7) and sex (females 26% vs 26%). Patients were divided in three groups: group A) no expected sequelae from deactivation (spontaneous heart rate >50/min, 51.5%), group B) expected reduced quality of life (spontaneous heart rate 30-50 or presence of cardiac resynchronization therapy; 34.7%) and group C) expected timely death (spontaneous heart rate<30; 13.8%).

Discussion: According to our results only minorities of device patients (13.8%) are "truly" pacemaker dependent and were expected to die shortly after deactivation of stimulation (Group C). A third of patients may survive, but probably with a reduced quality of life either due to insufficient heart rate or loss of resynchronization (Group B). For more than a half of the patient's deactivation of antibradycardia - stimulation seems to be irrelevant (Group A). We conclude that the deactivation of the stimulation function of cardiac devices in palliative situations may be of lesser importance in the process of dying and may reduce quality of life.

Keywords: Pacemakers; Defibrillators; Loss of resynchronization; Palliative situations; Implanted devices

Background

The presence of cardiac implantable electrical devices such as pacemaker or defibrillators in patients presenting with terminal illness approaches up to 7% [1]. The deactivation of the devices antitachycardia/ defibrillation functions after physicians and / or patient's request becomes a clinical routine to avoid painful shocks in the terminal stages of life. In contrast to that, uncertainty or at least more discussions exist about the deactivation of stimulation functions, especially in pacemaker-dependent patients. It is intuitive that defibrillator shocks have to be avoided in palliative care, because they cause pain and anxiety from repetitive events. A postmortem-analysis of defibrillators showed that approximately 25% of patients in palliative care received shocks immediately prior death [1]. Therefore, consensus guidelines uniformly recommend a deactivation of antitachycardia functions after patient's request [2]. In the case of antibradycardia functions recommendations are less clear, and it is interesting that in contrast to lawyers, medical professionals believe in a higher percentage that this would be physician assisted suicide or euthanasia [3]. Some reports argue pro a liberal deactivation, stressing the patient's right of self-determination [4-7], others are more critical [8,9]. Arguments to avoid a deactivation of antibradycardia stimulation in palliative care are the high likelihood of worsening of life quality by increasing symptoms of heart failure (dyspnea) due the loss of resynchronization therapy [10,11] and repetitive losses of consciousness [12]. Furthermore, the magnitude of the problem is unknown; especially which and how many patients will deteriorate promptly after deactivation and in how many patients a deactivation of pacing is futile.

After an ethical board discussion on a female patient who wanted her pacemaker deactivated after a long stay on the intensive care unit, we were interested to investigate more precisely which and how many patients will theoretically change their clinical course to such an intervention.

Methods

To collect information about consequences of deactivation of stimulation we analyzed retrospectively interrogation data of a total of 363 patients (n=244 consecutive patients without terminal illness and n=119 device patients later died from end-stage illnesses (mostly malignancies).

Data from the device patients with terminal illness stem from our defibrillator database covering the years 2000-2020 containing a total of 2715 device implantations (approved by the ethics committee of Hamburg, Germany (registration number PV5597). We assume that this mixed group is representative for device patients.

Age, sex, duration of implantation, pacing mode, percentage of atrial and ventricular stimulation and especially the presence of an immediate escape rhythm during sensing test was noted. Usually, the sensing test generates a basal rhythm of 30 ipm. Data usually covered the six-month prior the interrogation. All data were anonymously analyzed by a standard statistical software package (WINSTAT R).

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Results

Table 1 showed that device patients with routine follow-up and later deceased patients are comparable for age at implantation (76.6 ± 9.4 vs 74 ± 7.7) and sex (females 26% vs 26%). The duration of device implants was significantly shorter in the later deceased patients compared to routine follow-up (4.6+-3.5 vs 6.1+-5 years, p=0.00009).

Table 2 showed that patients were divided in three groups: group A) no expected sequelae from deactivation (spontaneous heart rate >50/min, 51.5%), group B) expected reduced quality of life (spontaneous heart rate 30-50 and / or presence of CRT; 34.7%) and group C) expected timely death (spontaneous heart rate<30; 13.8%). Much lesser patients of group C had ESD than in group A or B (p<0.0001, Table 1). As expected group C) patients had no measurable escape rhythm and accordingly more AV blocks were present. Resynchronization function was important in group B) patients (with expected deterioration).

Only 9 of the 119 (7,5%) device patients deceased later due to terminal illnesses – as to our knowledge - requested for deactivation of tachycardia functions. Antibradycardia functions were never deactivated, also not in the lady under discussion in the background paragraph. She later died peacefully in our hospice department. A discussion with our palliative team covering the northwest of the Hamburg, Germany region revealed that deactivation of pacing function was only sporadically requested in the last 10 years.

Our use of the broader, nuanced definition of palliative care has several consequences. First, according to this definition, health care may sometimes be simultaneously curative and palliative. Second, the broader definition affirms that palliative care is not the exclusive purview of palliative care specialists. All health care providers, including those focused on curative care, can and do frequently provide palliative care. On the other hand, it is important that providers who are not palliative care specialists as well as the general public are aware of the unique competencies that palliative care specialists beneficially apply within their scope of advanced training and practice. Third, every patient should be viewed as a possible candidate for palliative care. The legitimacy of this assertion can be better understood by examining the possible applications of palliative care. Fourth, palliative care can be provided in the context of hospice or pre-hospice care, but palliative care is not synonymous with either of these forms of care—or with "end-of-life" care or "terminal care." Fifth, the provision of palliative

	Routine follow-up patients	Patients deceased in follow-up
N=	244	119
Females (%)	25,8	26
Age (years)	76,6 ± 9,4	74 ± 7,7
Implantation Duration (years)	6,1 ± 5	4.6 ± 3.5*
VVI (%)	29	28.5
DDD (%)	50	23.5*
CRT (%)	20,5	47.9*
Defibrillator Function (%)	48	100
Atrial Pacing (%)	29.7 ± 36	24.2 ± 29
Ventricular Pacing (%)	46.9 ± 45	49.8 ± 46
Atrial Fibrillation (%)	28,3	29.4
AV Block (%)	29	11.7
Escape Rhythm (bpm)	55.5 ± 28	66.2 ± 24
Group A (%)	51.2	52,2
Group B (%)	30.7	42.8
Group C (%)	18.1	5*
*P<0.01 CIED vs CIED & end stage		

Table 1: Patients characteristics: Routine follow-up versus later deceased patients (n=363).

Characteristics	GROUP A: No expected con- sequences Spontaneous heart rate > 50/min	GROUP B: Expected Deterioration Spontaneous heart rate 30-50/min and / or presence of CRT	GROUP C: Expected Death Spontaneous heart rate < 30/min
N (%)	187 (51.5)	126 (34.7)	50 (13.8)
Females (%)	24,6	28,6	24
Age (years)	74.9 ± 9	76.3 ± 8	77.4 ± 9.8
Implant duration (years)	5.5 ± 4.5	5.2 ± 5	7.3 ± 4.8
Single Chamber (%)	41*	13	22
Dual Chamber (%)	58	14*	48
CRT (%)	1	73*	30
AV-Block 3rd (%)	11	28	96*
Atrial Fibrillation (%)	25	32	36
Atrial Pacing (%)	21	24	33
Ventricular Pacing (%)	9*	90	96
Spontaneous Rate /min	72.4 ± 14	56.9 ± 18	0*
*P<0.000001 vs others			

Table 2: Characteristics of groups A) – C) as described in the methods section.

care is not restricted to hospitals; rather, palliative care is provided in a broad range of venues, including both clinical and community settings. The uses of palliative care in diverse settings can be understood by considering the broad scope of this special form of care.

Discussion

According to our results only a minority of device patients (13.8%) are "truly" pacemaker dependent and were expected to die shortly after deactivation of stimulation (Table 2; Group C). A third of patients (34.7%) may survive, but with a reduced quality of life either due to insufficient heart rate or loss of CRT (Table 2; Group B). For more than a half of the patient's, a deactivation of antibradycardia - stimulation seems to be irrelevant (Table 2; Group A). Whether group C patients really come to death within minutes could not be securely deduced from our data. According to a study of Lelakowski et al. forcing spontaneous heart rate for a longer time, this cohort may comprise only a minority of 2-3% [13]. This would fit to the data of Buchhalter et al. [14] where out of 32 patients who underwent deactivation of bradycardia therapy only 4% were pacemaker dependent. Therefore, most patients will survive stimulation deactivation of devices due to a sufficient spontaneous basal heart rate, but this for the cost of a reduced quality of life in the remaining life span. In this regard the loss of resynchronization function may play an important role. In our mind it is counterproductive in terminal illnesses to withdraw such palliative support [15].

When a patient calls for deactivation of antibradycardia function, individual pros and cons have to be discussed under these aspects with full information of patients and relatives. The deactivation of the stimulation function of cardiac implantable electronic devices is much different from the deactivation of antitachycardia functions [16]. In our means withdrawal of this palliative support is not an active ending of life but results in a limitation of patient's last capabilities [17]. The course of device patients towards death seems to be lesser influenced from stimulation than usually thought, in other words it is possible to die "normally" with a pacemaker [18]. We conclude that deactivation of antibradycardia functions in terminal illness will not accelerate the process of dying in the most but may reduce life quality in many. In this regard in a patient with a cardiac resynchronization therapy with defibrillation and antitachycardia pacing capabilities who is also PM-dependent it would be wise to discontinue only defibrillation and antitachycardia function and leave CRT and bradycardia-stimulation intact [14]. Physicians should be aware of these facts, because due to a liberalization of the end-of-life jurisdiction in many countries [19], a deactivation of stimulation will be more and more requested in the future. In the case of the presence of a cardiac device, patient decrees should contain separate advices about brady- and tachycardia function of the devices.

Limitations

Our conclusions presented here are extrapolated from device interrogation data. However from ethical reasons it seems to be very unlikely that controlled or even randomized studies can ever be performed on this topic. As this is a retrospective study some information on terminal deactivation of stimulation function may have been missed. Our view is supported from device interrogations of a timely distance from death. Rate of pacemaker dependency in end-stage disease may be different from what we found.

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