Monaldi Arch Chest Dis
2012; 78: 160-166

CASE REPORT

Post-traumatic stress disorder, emotional processing and Inappropriate Implantable Cardioverter-Defibrillator Shocks: clinical consideration by a single case report

Disturbo post-traumatico da stress, profilo cognitivo-emotivo e shocks inappropriati del defibrillatore cardiaco impiantabile: considerazioni cliniche attraverso un single case report

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ABSTRACT: ***Post-traumatic stress disorder, emotional processing and Inappropriate Implantable Cardioverter-Defibrillator Shocks: clinical consideration by a single case report. A. Compare, D. Del Forno, E. Callus, F. Giallauria, A. Vitelli, C. Buccelli, C. Vigorito.***

Introduction. **Even though an overwhelming amount of evidence supports the clinical efficacy and safety of the implantable cardioverter defibrillator (ICD), inappropriate shocks for atrial arrhythmias with rapid ventricular conduction or for abnormal sensing results in multiple adverse effects**

Presentation. **In this study we present the case of a 59-year-old woman who was admitted to hospital for ICD implantation with a past medical history that was positive for non-ischemic dilated cardiomyopathy, congestive heart failure (NYHA class III), atrial fibrillation, essential hypertension and a recent episode of syncope. Since in the 18 months follow-up the patient suffered many inappropriate shocks, we investigated the association of the presence of a PTSD (Post-Traumatic-Stress-Disorder) prior to implantation and a specific profile of cognitive processing emotions, with the effectiveness of the ICD. Emotional distress states and cognitive thoughts preceding ICD shock inappropriate episode were recorded by structured mobile diary (eMotional-ICDiary©). We outlined how the presence of a highly traumatic event which had occurred 6 years previously was related to a recurrence of a combination of moderate distress and cognitive thoughts, associated with episodes of Inappropriate Shock. A psycho-diagnostic examination and the administration of the Emotional Processing Scale (EPS-25) and Emotional Regulation Questionnaire (ERQ) outlined that the patient presented a profile of cognitive processing of emotions characterized by elevated levels of unprocessed emotions, low appraisal and high suppression emotional regulation strategy.**

Conclusion. **The observations gathered in this single case are a good starting point for further research in order to check if the post-traumatic stress disorder and a specific cognitive profile connected to the processing of emotions are associated with the presence of inappropriate ICD shocks. Further larger sample studies are required in this area.**

Keywords: Emotional Regulation, Inappropriate Shocks, Implantable Cardioverter-Defibrillator, Post-traumatic stress disorder.

Monaldi Arch Chest Dis 2012; 78: 160-166.

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Introduction

An overwhelming amount of evidence from prospective randomized controlled trials supports the clinical efficacy and safety of the implantable cardioverter defibrillator (ICD). Although ICD devices are an effective life-saving treatment, however, inappropriate shocks for atrial arrhythmias with rapid ventricular conduction [1, 2] or for abnormal sensing [3-5] results in multiple adverse effects [5-8] including impaired quality of life [9-11], psychiatric disturbances [12], and even provocation of nonfatal [13] or fatal [14] ventricular arrhythmia. Research has indicated that the occurrence of specific fears and psychological symptoms, such anxiety, are the most common psychological symptoms experienced by ICD recipients [15]. Recent findings show as inappropriate shocks is independently associated with an increased risk of all-cause mortality (HR=2.60) [16] in ICD patients followed for 3,2 years after implantation. Although recent studies have shown prognostic importance of distressed (Type D) personality on ICD mortality [16, 17], poorer health status [18-20], psychiatric symptoms [21, 22] and ventricular arrhythmia [23], no study has specifically investigated the prognostic value of

personality for inappropriate shocks in ICD patients. Emotional distress may even arise when possible malfunctioning of an ICD is announced, with a higher risk of serious ventricular arrhythmias and death as a consequence [24-30]. In this single report we present the case of a 59-year-old woman with ICD monitored during 18 months for emotional distress states and cognitive thoughts preceding ICD shock inappropriate episodes.

Case report

A 59-year-old woman was admitted to hospital for ICD implantation with a past medical history that was positive for non-ischemic dilated cardiomyopathy, congestive heart failure (NYHA class III), atrial fibrillation, essential hypertension and recent episode of syncope. No family history of ischemic cardiomyopathy was noted.

At the anamnesis, the patient reported, as a traumatic event she experienced, her son's death which had occurred 6 years before the visit; he passed away in a car accident at 25. During the interview with the cardiologist the patient did not manifest signs of clear psychological distress. Furthermore, she did not report symptoms relating to post-traumatic stress disorder in the diagnostic process and she had not been visited by a specialist because of this event.

The ICD therapy was defined as either antitachycardia pacing (ATP) or ICD shock. Two investigators categorized the rhythm prompting ATP or shock using the stored electrocardiograms. An episode's termination was defined by the ICD redetecting sinus rhythm and thus could include more than 1 shock and/or ATP bursts. Any ICD therapy not delivered for VT or VF was deemed inappropriate, and the rhythm triggering therapy categorized as: atrial fibrillation or atrial flutter (AF), supraventricular (including sinus) tachycardia (SVT), or inappropriate sensing using published criteria (9,19). An inappropriate shock episode was defined as an episode during which one or more inappropriate shocks occur. The patient was followed for 18 months after the ICD implantation. During the 18 months the patient was also given a structured mobile diary application (eMotional-ICDiary©) to record the emotional distress state and cognitive thoughts retrospectively for the period 0 to 15 minutes preceding ICD shock. The emotional distress state was rated with the use of a visual analogical scale ranged from 0 (null) to 10 (high).

During the last outpatient visit, after 18 months, the analysis of the diary showed a recurrence of a combination of moderate distress and cognitive thoughts, associated with her deceased son, with episodes of Inappropriate Shock (Table 1). This evidence led to the suspicion of the presence of psychological problems in the patient. For this reason, the patient was subjected to psycho-diagnostic examination by a clinical psychologist who observed the following signs and symptoms in relation to the event of the death of his son:

Re-experiencing the event

- recurrent and intrusive (unwanted) memories of the event
- distressing dreams or nightmares of the event
- acting or feeling as though the event were happening again (flashbacks)
- physiological reactivity (feeling jumpy, startled, or anxious) when reminded of the event

Table 1. - Emotional distress states and cognitive thought recorded by structured mobile diary preceding ICD shock inappropriate episode

N° episode	Inappropriate Shock Type	Cognitive thoughts	Emotional Distress State
1	Atrial fibrillation / Flutter	Son's birthday party	9.1 (acute distress)
2	Atrial fibrillation / Flutter	Day of son's graduation	8.2 (acute distress)
3	SVT	Son's recorded voice	7.2 (moderate distress)
4	SVT	Son's photo	8.7 (acute distress)
5	SVT	Video recording of son	7.1 (moderate distress)
6	SVT	Memories of when she used to help her son do his homework	6.8 (moderate distress)
7	Abnormal sensing	Memories of going on holiday with her son	9.2 (acute distress)
8	Atrial fibrillation / Flutter	Memories of when she gave birth to her son	8.4 (acute distress)
9	Atrial fibrillation / Flutter	Memories of a trip with her son	6.9 (moderate distress)
10	Atrial fibrillation / Flutter	Memories of some calls with her son	8.3 (acute distress)
11	Abnormal sensing	Memories about her son's room	8.5 (acute distress)
12	Abnormal sensing	Memories of having lunch with her son	8.5 (acute distress)
13	Abnormal sensing	Memories of having dinner with her son	9.3 (acute distress)
14	Atrial fibrillation / Flutter	Memories of her son's first exam at university	6.6 (moderate distress)
15	SVT	Memories of attending a party with her son	8.4 (acute distress)
16	SVT	Memories of going for a walk in the park with her son	8.1 (acute distress)

Note: ICD: implantable cardioverter-defibrillator; SVT: supraventricular tachycardia

Persistent avoidance of any reminders of the event

- avoiding activities, places, or people that are reminders of the event
- no memory of an important aspect of the event
- lack of interest and participation in activities (due to wishing to avoid cues of the event)
- feeling detached or estranged from others
- limited range of emotions
- sense that they will not live to graduate college, get married, have kids, etc.

Persistent feelings of anxiety or physical reactivity

- problems paying attention or concentrating
- overly aware of noises or other cues that remind them of the event (smells, visual cues)
- exaggerated startle response

The presence of these signs has led to the diagnosis of post-traumatic stress disorder [31] (PTSD).

In addition, during the psycho-diagnostic examination of the patient, the mental processing of emotions was evaluated by the Emotional Processing Scale (EPS) [32, 33], which incorporates Rachman's conceptualization of emotional processing [34], and by Emotion Regulation Questionnaire (ERQ) [35]. Emotional processing is defined as a process whereby emotional disturbances are absorbed and decline to the extent that other experiences and behavior can proceed without disruption [34]. He noted that on rare occasions people are not successful in emotionally processing the overwhelming majority of disturbing events that occur in their life. The schematic model of emotional processing was first depicted in the study by Baker [33] in which there was the development of the emotional processing scale. In this model, there three main phases (input, experience and expression of emotion) are described and in each phase there can be various types of disruption. A negative event is regarded as an input that needs to be registered consciously or unconsciously, as a prerequisite for an emotional experience. The severity of the event or the series of events is relative and in the first phase, it is hypothesized that cognitive appraisal processes unconsciously and rapidly shape the nature of the emotion experienced. In the central phase there is the experience of the emotions and finally, in the last phase, the expression of the emotion is seen as an output.

The revised version of the Emotional Processing scale (EPS-25) has been utilized in this study [36]. This instrument has 25 items which are categorized under the following 5 subscales; Suppression, Unregulated emotion, Impoverished emotional experience, Signs of unprocessed emotions and Avoidance. Internal reliability was moderate to high for all five factors. The psychometric properties of this revised scale appear promising, especially when it comes to the detection of differences between diagnostic groups.

ERQ is a ten items (1-7 Likert scale) measure of the habitual use expressive suppression (5-items) and cognitive reappraisal (5-items). *Emotional Appraisal*: Antecedent-focused regulation, in which intervention occurs early and is focused on altering the effect of emotion-generating cues [37]. This strategy modulates emotional response tendencies early on, before they give rise to full-fledged responses [38]. Cognitive reappraisal is an antecedent-focused strategy and involves construing a potentially emotion-eliciting situation in a way that changes its emotional impact. *Emotional Suppression*: Response-focused regulation, which acts late in the process and is focused on altering emotional output (e.g., action and expression) [37]. This strategy modulates the emotional responses themselves later on, once they have arisen.

The examination outlined that the patient has a profile of cognitive processing of emotions characterized by elevated levels of unprocessed emotions (Emotional reactions lasted more than a day, Thinking about same emotion again and again, Unwanted feelings kept intruding, Repeatedly experienced the same emotion, Overwhelmed by emotions) and Suppression (Kept quiet about feelings, Bottled up emotions, Tried not to show feelings, Could not express feelings, Smothered feelings) (see Figure 1 and Table 2). Moreover patient showed an high level in suppression style (score=32) and a low level in reappraisal style (score=13) (see Table 2).

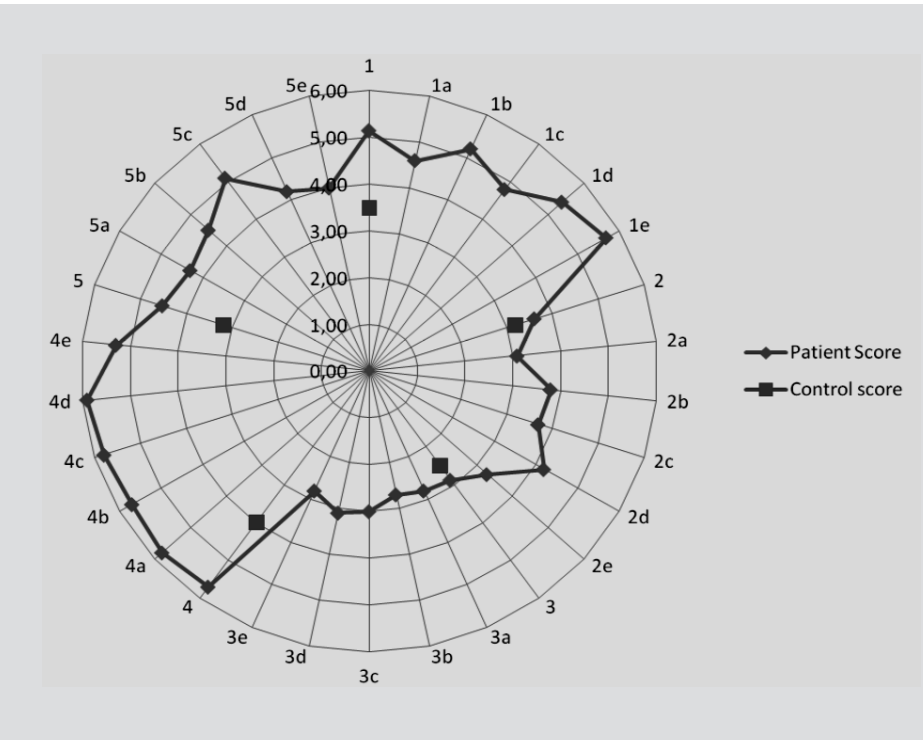

Figure 1. - Emotional Processing Scale profile.
Emotional Processing Scale dimensions: 1. Suppression; 2. Unregulated emotion; 3. Impoverished emotional experience; 4. Signs of unprocessed emotions; 5. Avoidance.

Table 2. - Emotional Processing Scale assessment profile

Emotional Processing Scale (EPS-25) scales and sub-scales		*Control score*	*Patient Score*
1	**Suppression**	***3,50***	**5,14**
1a	Kept quiet about feelings		4,60
1b	Bottled up emotions		5,20
1c	Tried not to show feelings		4,80
1d	Could not express feelings		5,40
1e	Smothered feelings		5,70
2	**Unregulated emotion**	***3,20***	**3,62**
2a	When upset difficult to control what I said		3,10
2b	Felt urge to smash something		3,80
2c	Reacted too much to what people said or did		3,70
2d	Wanted to get own back on someone		4,20
2e	Hard to wind down		3,30
3	**Impoverished emotional experience**	***2,50***	**2,88**
3a	Seemed to be a big blank in feelings		2,80
3b	Emotions felt blunt/dull		2,70
3c	Hard to work out if I felt ill or emotional		3,00
3d	Strong feelings but not sure if emotions		3,10
3e	Feelings did not seem to belong to me		2,80
4	**Signs of unprocessed emotions**	***4,00***	**5,70**
4a	Emotional reactions lasted more than a day		5,80
4b	Thinking about same emotion again and again		5,70
4c	Unwanted feelings kept intruding		5,80
4d	Repeatedly experienced the same emotion		5,90
4e	Overwhelmed by emotions		5,30
5	**Avoidance**	***3,20***	**4,53**
5a	Tried to talk only about pleasant things		4,30
5b	Tried to avoid things that might make me upset		4,50
5c	Could not tolerate unpleasant feelings		5,10
5d	Avoided looking at unpleasant things		4,20
5e	Talking about negative feelings made them worse		4,00
Emotional Regulation Questionnaire (ERQ)			
	Suppression	***20.00***	32.00
	Reappraisal	***20.00***	13.00

Discussion

In this single case report was presented for the first time the observations about the monitoring of the emotional distress states and cognitive thoughts preceding inappropriate ICD shock episode in a patient with ICD, in association with the presence of a PTSD and cognitive processing emotions profile assessed prior to implantation.

Studies on the prognostic value of personality in patients with ICD have highlighted the significant role of personality type D. Studies show the prognostic importance of Type-D personality on ICD mortality [16, 17], poorer health status [18-20, 39-41], psychiatric symptoms [21, 22] and ventricular arrhythmia [23]. These results lead to the hypothesis as the Type-D personality has an important role in fostering inappropriate shocks. Nevertheless, lack specific results to support this hypothesis. The results of the Multicentre ICD study (PANORAMIC) [42] will help to give a specific answer to this.

Many researchers have studied the psychological effects of ICD shocks, highlighting the correlation with PTSD [43-47], but no research has investigated whether the presence of PTSD prior to implantation, associated with a specific profile of cognitive processing emotions, may reduce the effectiveness of the ICD increasing the number of inappropriate shocks.

The observation of this single case show that the cognitive profile of the patient is characterized by an unprocessed emotions. This finding is consistent with research that confirm the prognostic role of Type-D personality in patients with ICDs, taking

into account the social inhibition Type-D sub-component indicatives of difficulty of share and express emotions with other people. The assessment of Type-D personality in the patient studied could have add a further contribution to the knowledge of the personality factors that predispose to chronic distress, as evidenced by studies on stress cardiomyopathy [48] and those that point out that the Type-D personality has a prognostic value for anxiety and depression in patients with ICD [21, 22].

Moreover our observation can suggest assumptions with respect to the mental processes involved in PTSD and the functioning of the ICD. Recent research suggests a strong link between PTSD and the activation of the adrenergic system [49-52]. In fact an associated hyper-adrenergic state may trigger malignant ventricular arrhythmias repeatedly treated by ICD shocks, entertaining a "vicious circle" which is often difficult to interrupt [53].

Furthermore, some longitudinal studies pointed out the normal psychological adjustment process to ICD implantation: patients usually show the highest psychological distress prior to ICD implantation, which decreases during the initial postoperative months and stabilizes when they had passed the first year of their illness [54, 55].

To achieve the full benefits of the defibrillators, patients have to maintain their quality of life, which is influenced by their psychological status. The recent guidelines for cardiac pacing and cardiac resynchronization therapy [56] point out that the psychological support of the patient is one of the main components of successful pacing therapy. Furthermore, also for the pacemaker clinic, the provision of psychological education and support to the paced patient is one of the most important goals.

The observations of this single case are consistent with the extensive research that support as vulnerability to chronic psychological distress, as defined by the Type D construct, has incremental prognostic value above and beyond clinical characteristics and ICD shocks. Furthermore, and in addition to researches on the Type-D personality [57-60] these single case observations suggest emotional processing as a crucial aspects within the mechanism that trigger inappropriate ICD shocks. Further large samples research are needed in order to establish if a post-traumatic stress disorder and a specific cognitive profile connected to the processing of emotions may have a prognostic value for inappropriate ICD shocks.

Riassunto

Introduzione. Nonostante l'efficacia clinica associata all'utilizzo del defibrillatore cardiaco impiantabile (ICD) sia stata ampiamente dimostrata, la presenza di shock inappropriati per l'aritmia atriale con conduzione ventricolare rapida o per delle sensazioni anormali, rimane una questione irrisolta che comporta conseguenze avverse multiple.

Presentazione. In questo studio presentiamo il caso di una donna di 59 anni, ricoverata in ospedale per l'impianto di ICD, che presentava in anamnesi medica una cardiomiopatia dilatativa non-ischemica associata a insufficienza cardiaca congenita (NYHA classe III), fibrillazione atriale, ipertensione essenziale e un recente episodio di sincope. A causa delle presenza di molti shock inappropriati alla visita di fullow-up al diciottesimo mese, è stata analizzata l'associazione tra la presenza di disturbo post-traumatico da stress (PTSD), dovuto ad un evento traumatico precedente all'impianto dell'ICD, e il profilo cognitivo-emotivo associato all'elaborazione delle emozioni e gli episodi di shock inappropriato dell'ICD. L'esame psicodiagnostico è stato condotto attraverso l'utilizzo dell'Emotional Processing Scale (EPS-25) e dell'Emotional Regulation Questionnaire (ERQ). Inoltre sono stati rilevati, attraverso la compilazione di un diario informatizzato, i pensieri e le emozioni che hanno preceduto associati ad ogni episodio di scarica inappropriata dell'ICD. L'analisi del diario ha evidenziato come gli episodi di scarica inappropriata dell'ICD erano associati ad emozioni e pensieri collegati all'evento emotivo traumatico subito dalla paziente 6 anni prima del impianto di ICD. L'esame psicodiagnostico ha evidenziato un profilo caratterizzato da ridotta elaborazione mentale delle emozioni e, a livello di regolazione emotiva, da elevata inibizione espressiva e ridotta capacità di analisi delle emozioni.

Conclusione. Le osservazioni raccolte in questo caso singolo sono un punto di partenza per ulteriori ricerche finalizzate a verificare se il disturbo post-traumatico da stress ed un profilo cognitivo di elaborazione e regolazione delle emozioni siano associate alla presenza di scariche inappropriate dell'ICD. Studi su campioni grande più ampi sono necessari per verificare queste ipotesi.

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