aubert et al and other reports have demonstrated that inappropriate shocks were relatively common.1–7 Recent studies also have demonstrated the association between inappropriate shocks and an increased probability of mortality during follow up.1,8–10 Considering the potential benefits for the quality of life and improvement in mortality, physicians need to make maximum efforts to reduce the occurrence of inappropriate shocks. The reliable recognition and appropriate shock therapy depends on the amplitude and morphology of the electrograms recorded from the sensing electrodes. The aim of this study was to investigate the effects of pacing and high-pass filter settings on the ventricular bipolar electrograms in implantable cardioverter-defibrillator (ICD) systems, and to find out the predictors for T wave oversensing.

**Methods**

**Patient Characteristics**

This study included 13 consecutive patients (male/female: 12/1, age: 48±15 years old) who underwent ICD implantations with a transvenous lead system in the electrophysiology laboratory of the University of the Ryukyu Hospital for the management of sustained life-threatening ventricular tachyarrhythmias; ventricular tachycardia (VT)/ventricular fibrillation (VF). The patient characteristics are summarized in Table 1.

**Conclusions:**

DDD had a significant impact on the R wave amplitude reduction and the T/R ratio during AAI can be predictors of T wave oversensing. These findings have important implications for inappropriate shocks due to T wave oversensing. (Circ J 2011; 75: 2095–2104)

**Key Words:** Brugada syndrome; High-pass filter settings; Implantable cardioverter-defibrillator; Inappropriate shocks; T wave oversensing
### Table 1. Patient Characteristics

<table>
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<tr>
<th>Case number</th>
<th>Gender/Age</th>
<th>LVEF (%)</th>
<th>LV/EF</th>
<th>SHD</th>
<th>Pacing threshold (V)</th>
<th>Lead impedance (Ω)</th>
<th>Events during FU period</th>
<th>Complication</th>
<th>FU</th>
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</table>

**ICD Implantation**

After obtaining written informed consent, patients underwent an ICD implantation. We implanted devices (a Biotronik Lexos DR in 2 patients and Lumax 340 DR-T in 11; Biotronik, Berlin, Germany) using the same transvenous lead system. The ventricular lead system (Linox SD 65/18, Biotronik, Berlin, Germany) had an active fixation, true bipolar sensing capability, and an 11 mm space between the tip and ring electrode. The atrial lead (Guidant Fineline 4470, Boston Scientific Inc, Natick, MA, USA) also had an active fixation lead, with a true bipolar sensing capability, and a 16 mm space between the tip and ring electrode. The ICD systems were inserted through a left precardial subclavian incision. We performed a left subclavian puncture for the lead insertion. The ventricular leads were placed in the right ventricular apex, and the atrial leads were positioned in the right atrial appendage using active fixation. Both the atrial and ventricular leads were dedicated bipolar leads. In all patients, the acceptable pacing and sensing parameters were recorded, and the ventricular defibrillation threshold was tested at the time of the implantation with a 10-J safety margin and high-pass filter setting (1/2) of 20/20Hz.

**Study Protocol**

Each patient underwent an electrophysiological study in the fasting, non-sedated state after written informed consent was obtained. The intracardiac depolarization (R) and repolarization (T) waves detected from the ventricular leads were evaluated with 9 different ranges of the high-pass filter settings (1/2) (40/20, 0.625/40, 20/20, 10/20, 2.5/20, 0.625/20, 5/10, 0.625/10, and 0.625/5Hz) and a fixed low-pass filter setting of 40Hz. The intracardiac electrograms were recorded for at least 30s, respectively, during the baseline conditions (76±11 bpm), AAI mode with full-capture (output of 3.6 V at a pulse width of 0.5 ms, and at a pacing rate of 120 bpm), DDD mode with full-capture (atrial and ventricular output of 3.6 V at a pulse width of 0.5 ms, at a pacing rate of 120 ppm, and an AV delay of 140 ms). The pacing rate was set at 120 bpm, which was a relatively safe rate, because that rate is considered to be physiological. Furthermore, an intravenous isoproterenol (ISO) infusion (2–5 μg/min) was also administered to adjust and maintain the heart rate (HR) at approximately 120 bpm (mean HR during ISO, 128±11 bpm). The surface ECG leads (I, II, and III), wide bipolar electrograms recorded from the coil electrodes located in the right ventricle (distal) and superior vena cava (proximal) expressed as “FF”, and ICD-electrograms recorded from the atrial and ventricular leads were simultaneously recorded using the programmer (Biotronik ICS 300, Biotronik, Berlin, Germany) under all measurement conditions, during baseline, AAI/DDD pacing with full-capture, and at the administration of ISO. All study protocols were performed within 2 weeks after the ICD implantation, except for in 1 patient (number 10). In that patient, we discontinued only the ISO infusion protocol before the HR reached 120 bpm because of chest discomfort.
Follow up
After the implantation, close clinical follow up (1 week, 1 month, and then every 3 months thereafter) was scheduled to obtain a routine check of the surface ECGs and chest x-rays during each follow up. The status of the ICD system and any episodes of ICD therapy were also evaluated at the outpatient pacemaker clinic. To evaluate T wave oversensing during the follow-up period, we routinely checked the ICD electrograms with the high-pass filter setting (1/2) of 10/20 Hz.

Statistical Analysis
All parametric data are expressed as the mean±SD. Continu-
ous variables were analyzed by an ANOVA with a Bonferroni correction for multiple comparisons of 4 conditions when appropriate. Comparisons between Brugada and non-Brugada syndrome were analyzed by a Mann-Whitney U-test. Categorical data were analyzed by a chi-square test with Yates corrections or the Fisher’s exact 2-tailed test. The receiver-operating characteristic (ROC) curve was used to find the best cutoff value for predicting those patients with and those without T wave oversensing. A P<0.05 was considered to be statistically significant.

**Results**

**Effects of the High-Pass Filter Settings on the R and T Wave Amplitudes During the Different Conditions**

We evaluated the effects of the high-pass filter settings on the R and T wave amplitudes (peak-to-peak amplitudes of the bipolar electrograms) during baseline, AAI pacing at 120 bpm (AAI), DDD pacing at 120 bpm (DDD), and ISO loading (ISO) with 9 different high-pass filter settings, as shown in Figure 1. The mean R wave amplitude during baseline, AAI, DDD, and ISO with high-pass filter settings (1/2) of 40/20, 10/20, and 2.5/20 Hz were as follows: baseline (8.0±2.99, 14.1±6.24, and 15.6±7.87), AAI (8.12±2.94, 14.77±6.01, and 16.07±7.98), DDD (2.04±2.08, 3.56±3.38, and 3.82±3.95), and ISO (7.83±3.09, 13.80±6.42, and 16.19±8.29) (mV). There was no significant difference in the R wave amplitude during baseline, AAI, and DDD (baseline vs. AAI, P=0.868; and baseline vs. DDD, P=0.883). Only the R wave amplitude during DDD was significantly lower than that at the other conditions (baseline vs. DDD, P<0.001) (Figure 1A). In the multiple comparisons between the R wave amplitude with each different high-pass filter setting during baseline and DDD, there were significant differences in all high-pass filter settings (baseline vs. DDD, P<0.0001).

The mean T wave amplitude during baseline, AAI, DDD, and ISO with high-pass filter settings (1/2) of 40/20, 10/20, and 2.5/20 Hz, respectively, were as follows: baseline (0.20±0.19, 0.69±0.55, and 1.05±0.78), AAI (0.25±0.18, 1.15±0.57, and 1.15±0.51), DDD (0.36±0.36, 0.83±0.79, and 1.50±1.28), and ISO (0.38±0.38, 1.35±0.98, and 2.45±1.66) (mV). There was no significant difference in the T wave amplitude during baseline, AAI, and DDD (baseline vs. AAI, P=0.644; and baseline vs. DDD, P=0.464). Only the T wave amplitude during ISO was significantly higher than that at baseline (baseline vs. ISO, P<0.05) (Figure 1B). In the multiple comparisons between the T wave amplitude for each different high-pass filter setting during baseline and ISO, there were significant differences in the following high-pass filter settings (1/2): (baseline vs. ISO, P<0.05 in 0.625/40; P<0.01 in 0.5/10; P<0.001 in 2.5/20, 0.625/20, 5/10, 0.625/10, and 0.625/5Hz). Figure 2 demonstrates a representation of the effects of the high-pass filter settings on the R and T wave amplitudes during baseline, AAI pacing at 120 bpm, DDD pacing at 120 bpm, and ISO loading with these 3 different ranges of high-pass filter settings in Case number 8. The R wave amplitude during DDD was lower than that during the other conditions for each high-pass filter setting. The T wave amplitude during DDD pacing exhibited no significant difference from that during baseline and AAI pacing. In contrast, the T wave amplitude during ISO loading was higher than that during the other conditions. Both the R and T wave amplitudes gradually decreased as the value of the high-pass filter setting 1 became higher.

**Comparisons of the R and T Wave Amplitudes Between Patients With Brugada and Those With Non-Brugada Syndrome**

We evaluated the comparisons of the R and T wave ampli-
Figure 3. Comparisons of the distribution of the T and R wave amplitude ratio (T/R ratio) during baseline, AAI pacing, DDD pacing, and isoproterenol loading (ISO) with the 9 different high-pass filter settings with 4 different ranges of the T/R ratio: (A) <0.25, (B) 0.25–0.50, (C) 0.50–0.75, and (D) >0.75. Only DDD pacing had a significant difference in the distribution of the T/R ratio of more than 0.25 and less than 0.25 compared to that of the other conditions, respectively.
tudes between patients with Brugada syndrome (group B) (n=5) and those without Brugada syndrome (non-Brugada) (group NB) (n=8) during all 4 conditions. There was no significant difference in the R wave amplitude with the 9 different high-pass filter settings (peak-to-peak amplitudes) between group B and NB during all 4 conditions (B vs. NB, baseline: P=0.996; AAI: P=0.842; DDD: P=0.199; and ISO: P=0.619). The mean R wave amplitude in group B and NB during baseline, AAI, DDD, and ISO with a high-pass filter setting (1/2) of 10/20 Hz were as follows; baseline (B vs. NB: 13.94±6.37 and 14.34±6.60 mV, P=0.769), AAI (14.24±6.60 and 15.10±6.06, P=0.712), DDD (3.32±1.66 and 3.70±4.23, P=0.558), and ISO (14.24±6.55 and 13.49±6.84, P=0.871). In contrast, the T wave amplitude with the 9 different high-pass filter settings in group B was significantly higher than that in group NB (B vs. NB, baseline: P<0.0001; AAI: P<0.01; DDD: P<0.0001; and ISO: P<0.01). The mean T wave amplitude in group B and NB during baseline, AAI, DDD, and ISO with a high-pass filter setting (1/2) of 10/20 Hz were as follows; baseline (B vs. NB: 1.04±0.73 and 0.48±0.27 mV, P=0.092), AAI (1.54±0.67 and 0.82±0.40, P<0.020), DDD (1.38±0.79 and 0.48±0.51, P=0.033), and ISO (2.10±1.06 and 0.81±0.44, P=0.041).

Comparisons of the Distributions of the T and R Wave Amplitude Ratio (T/R Ratio) During Different Conditions With the 9 Different High-Pass Filter Settings With 4 Different Ranges of the T/R Ratio

For comparisons of the distribution of the T/R ratio during baseline, AAI pacing at 120bpm, DDD pacing at 120bpm, and ISO loading with the 9 different high-pass filter settings (Figures 3A–D), the T/R ratio was divided into 4 ranges: (A) <0.25; (B) 0.25–0.50; (C) 0.50–0.75; and (D) >0.75. There was no significant difference in the distribution of the T/R ratio between baseline, AAI, and ISO. DDD had a significantly larger number of patients with a T/R ratio of more than 0.25, and a smaller number of patients with a T/R ratio of less than 0.25 compared with baseline and AAI in all 9 high-pass filter settings (vs. baseline, P<0.05; vs. AAI, P<0.05). Furthermore, DDD had a significantly larger number of patients with a T/R ratio of more than 0.25 compared with baseline and AAI in all 9 high-pass filter settings (vs. baseline, P<0.05; vs. AAI, P<0.05). Further, the T wave amplitude with the 9 different high-pass filter settings during the study protocol. Fifty-two percent (26 out of a total 50 episodes) of the T wave oversensing episodes were observed during DDD pacing in this study population. Even with the nominal setting of the high-pass filter of 10/20 Hz, 3 patients (23.1%) (Case numbers 2, 3, and 12) with Brugada syndrome had T wave oversensing. In contrast, no patient had T wave oversensing with a high-pass filter setting of 20/20 Hz.

Incidence of T Wave Oversensing With the Different High-Pass Filter Settings During the Study Protocol and the Follow-up Period

The incidence of T wave oversensing with the different high-pass filter settings during the study protocol is summarized in Table 2. Nine patients (69.2%), excluding Case numbers 9, 10, 11, and 13, had T wave oversensing with a wide range of high-pass filter settings during the study protocol. Fifty-two percent (26 out of a total 50 episodes) of the T wave oversensing episodes were observed during DDD pacing in this study population. Even with the nominal setting of the high-pass filter of 10/20 Hz, 3 patients (23.1%) (Case numbers 2, 3, and 12) with Brugada syndrome had T wave oversensing. In contrast, no patient had T wave oversensing with a high-pass filter setting of 20/20 Hz. During the follow-up period, a total 5 patients (Case numbers 2, 3, 5, 8, and 12) showed T wave oversensing with the high-pass filter setting (1/2) of 10/20 Hz. Case numbers 2, 5, 8, and 12 showed T wave oversensing only during DDD pacing. Case number 3 showed T wave oversensing during sinus rhythm and DDD pacing. All of those 5 patients had Brugada syndrome.

Follow-up Results

In all patients (n=13), the intravenous ICD system was successfully implanted without any complications (Table 1). There were no significant differences in the pacing threshold, wave amplitude, or lead impedance of the atrial and ventricular leads initially, 1 month after, and 3 months after the ICD implantation (only the initial data are shown in Table 1). During a mean follow-up period of 27.5±6.3 months, 4 patients (30.8%) received ICD therapies. Case numbers 2 and 11 received appropriate therapy for sustained ventricular tachyarrhythmias. Case number 2 demonstrated 1 episode of VF, which was successfully converted to sinus rhythm by 1 DC
Pacing and High-Pass Filter on ICD Electrograms

shock at 30J 16 months after the implantation. Case number 11 demonstrated frequent episodes of VT successfully terminated with antifibrillation pacing and DC shocks. During the hospitalization at 1 and 4 months after the implantation, the VTs were suppressed by intravenous nifekalant and lidocaine.

Case numbers 3 and 5 received DC shock therapy for VF after T wave oversensing during a lead impedance measurement (Figure S2). That function usually detects the R wave and inserts ventricular stimulation at a timing triggered by the R wave to measure the lead impedance for the early detection of any lead malfunctions. The ICD systems oversensed the T wave because of relatively high amplitude repolarization electrograms, and insertion of the ventricular stimulation timing with the T wave induced VF. In those 2 patients, we deactivated the lead impedance monitoring function and also changed the high-pass filter setting (1/2) from 10/20 to 20/20 Hz to prevent any T wave oversensing. After changing the high-pass filter setting, the T wave oversensing disappeared during the follow-up period. Case number 8 with LQT3-Brugada also had sick sinus syndrome and PR prolongation. Changing the high-pass filter setting could not prevent T wave oversensing during brady-DDD pacing. Therefore, we changed the mode from DDD to AAI in this case.

**Prediction of T Wave Oversensing During the Follow-up Period Using the T/R Ratio During the Different Conditions**

The existence of Brugada syndrome had a sensitivity of 100% and a specificity of 100% for differentiating between patients with or without T wave oversensing during the follow-up period. The dot diagram showing the T/R ratio distribution of the peak-to-peak voltage (Figure 4A) and peak positive voltage (Figure 4B) during AAI pacing with a high-pass filter setting of 10/20 Hz is demonstrated. The ROC analysis found that a cutoff point of >0.071 for the T/R ratio using the peak-to-peak voltage had a sensitivity (Sens) of 100% and specificity (Spec) of 100%, and a cutoff point of >0.030 for the T/R ratio using the peak positive voltage had a sensitivity (Sens) of 100% and specificity (Spec) of 75% for differentiating between patients with and without T wave oversensing during the follow-up period.

**Discussion**

**Major Findings**

The major findings of the present study were: (1) the R wave amplitude during DDD pacing was significantly lower than that for the other conditions; (2) in contrast, the T wave amplitude during DDD pacing had no significant difference compared to that with the other conditions; (3) DDD pacing had a significantly higher incidence of a T/R ratio of more
than 0.25 compared to that with the other conditions; (4) T wave amplitude with the 9 different high-pass filter settings in patients with Brugada syndrome was significantly higher than that in non-Brugada syndrome patients, and (5) the existence of Brugada syndrome and the T/R ratio during AAI pacing provided an excellent prediction of T wave oversensing in the follow-up period. To the best of our knowledge, this is the first study demonstrating the impact of pacing and high-pass filter settings on the R and T wave amplitudes, and the prediction of T wave oversensing using the value of the T/R ratio during AAI pacing utilizing the ICD electrograms.

Impact of Pacing on the R and T Wave Amplitudes in Relation to T Wave Oversensing

Geelen et al reported that approximately 20% of ICD recipients required bradycardia pacing, and 80% of those patients received dual-chamber pacing. Kapa et al reported that T wave oversensing due to depolarization-repolarization mismatch was observed. Barold et al also demonstrated that T wave oversensing occurs more often after paced ventricular beats than after spontaneous beats. In our present study, the R wave amplitude during DDD pacing was significantly lower than that during the other conditions. In contrast, the T wave amplitude during DDD pacing had no significant difference compared to the other conditions. The possible reasons for the lower amplitude of the R wave during DDD pacing compared to that during the other conditions can be explained by the use of a true bipolar lead system and the eccentric propagation pattern during right ventricular apex pacing. The sensed signal is the voltage difference between the 2 intracardiac electrodes, and the bipolar electrograms depend on both the amplitude and timing difference of the signals from each of the 2 intracardiac electrodes. Therefore, if the difference in the electrogram amplitudes detected by the tip and ring electrodes is not high enough or the wavefront from the pacing stimulus advances nearly perpendicular to the axis of the sensing electrodes, it is possible to generate a relatively low amplitude bipolar electrogram.

The R wave amplitude is an important factor for both R wave undersensing and T wave oversensing. Watanabe et al reported the frequency of inappropriate therapy in the follow-up results from 115 consecutive patients. They demonstrated that the frequency of low R waves and also inappropriate therapy was high in arrhythmogenic right ventricular cardiomyopathy (ARVC) (38%), sarcoidosis (33%), and DCM (17%). Wichter et al also suggested that particular attention should be paid to the progressive loss of the R wave amplitude during follow up in patients with ARVC. Bramanti et al also reported that ARVC patients with pacemakers or ICDs should be closely followed in order to avoid any further undersensing due to the extremely prolonged ventricular depolarization. Washizuka et al reported that double counting due to T wave oversensing, due to a decreased R wave amplitude and increased T wave amplitude, led to inappropriate ICD discharges in patients with sarcoidosis. Previous reports by Hsu et al and Porres et al also suggested the importance of the R/T ratio in an inappropriate therapy. In our present study, we demonstrated that DDD pacing had a significantly higher incidence of a T/R ratio of more than 0.25 compared with that during the other conditions. From previous reports and our data, T wave oversensing can easily occur during ventricular pacing compared with sinus rhythm and AAI pacing, particularly in patients with a high T wave amplitude.

Previous Reports of the Limitations of Algorithms for Preventing T Wave Oversensing

To prevent T wave oversensing, an automatic sensitivity adjustment in relation to the amplitude of the preceding R wave has been developed. However, Hsu et al and Baranchuk et al reported that the T wave double counting caused by a transient reduction in the R wave amplitude without a change in the T wave amplitude resulted in inappropriate ICD therapy. Jaoudé et al reported that the automatic adjustment of the sensing threshold caused the undersensing of premature ectopic beats, and led to an inappropriate anti-bradycardia stimulation, which gave rise to ectopic beats on the T wave inducing VF storms. In our present study, we also experienced T wave oversensing by the automatic measurement of the lead impedance-induced VF requiring ICD shock therapy in 2 patients (Case numbers 3 and 5) with LQT3-Brugada syndrome. In those 2 cases and Case numbers 2, 8, and 12, the automatic sensitivity adjustment function could not avoid T wave oversensing. Furthermore, several investigators have reported the efficacy of the function of a so called “decay delay”, which possesses a programmable timing of decreasing the sensitivity threshold from the starting value, and this function can be useful in preventing T wave oversensing. However, Michaud et al reported that this function was aborted because of undersensing of polymorphic ventricular tachycardia in secondary LQT syndrome in DCM patients. Similar phenomena were reported in the case of congenital LQT syndrome by Cohen et al, and in the case of Brugada syndrome by Porres et al. Du et al reported the limitation of the electrogram width criterion using a detection enhancement algorithm intended to avoid T wave oversensing. Because the application of this criterion to prevent T wave oversensing is rate-dependent, this function can work only within the VT detection zone. Therefore, double counting during sinus tachycardia might result in inappropriate VF detection.

Efficacy of the Changeable High-Pass Filter Settings in the Sensing Algorithm

There were several reports that evaluated the effects of the high-pass filter settings on the intracardiac potentials during the electrophysiological study. Tuzcu et al reported the efficacy of the changeable high-pass filter function as one of the methods to avoid sensing failure. In this study, we demonstrated the excellent predictors for T wave oversensing using the existence of Brugada syndrome and the T/R ratio during AAI pacing by the Biotronik ICDs. Furthermore, we also demonstrated that the changeable high-pass filter could reduce the incidence of T wave oversensing for the prevention of inappropriate ICD therapy. In the present study, we successfully prevented T wave oversensing during spontaneous beats and ventricular pacing by simply changing the high-pass filter setting from 10/20 to 20/20Hz without applying an extension of the ventricular blanking period or changing the lead sensitivity. Considering the issue of safety, care must be taken regarding the risk of undersensing after changing the high-pass filter settings. In this study, we performed a ventricular defibrillation threshold test using a high-pass filter setting (1/2) of 20/20Hz at the time of the implantation. To the best of our knowledge, there have been no previous studies demonstrating the effects of a wide range of high-pass filter settings on the intracardiac potentials from ventricular leads of ICDs. In all currently available systems, except for the Biotronik ICDs, the range of high-pass filter settings is fixed, and is not changeable. The main frequency
component of the R wave is within 20–50 Hz, and that of the T wave is less than 10 Hz. Therefore, the high-pass filter is usually set at approximately 10–20 Hz to decrease the frequency component of the T wave. However, it is difficult to completely remove the T wave component when the T wave amplitude is relatively high. In such a case, an ICD with a variable double high-pass filter function, as used in the present study, can filter out and decrease the T wave amplitude. The purpose of the band-pass filter was to correctly sense the R wave during VT/VF electrograms and to remove any unnecessary electrical activity including the T wave, environmental noise, and the electromyogram.

Clinical Implications
Considering the non-invasiveness and cost performance, the change of the high-pass filter settings used in our study has some benefits compared to the above strategies. Therefore, the novel concepts proposed by the present study in regard to the impact of pacing and high-pass filter settings on the R and T wave amplitude and the prediction of T wave oversensing using the T/R ratio might contribute to the prevention of unnecessary ICD therapies and an improvement in the QOL and mortality rate in patients that are at a high risk for inappropriate ICD therapy, especially in patients with Brugada syndrome.

Study Limitations
Currently available ICD systems, including the device used in this study, cannot store the intra-cardiac electrograms in the ICD memory when episodes of T wave oversensing occur without detecting VT or VF. Therefore, the possibility of T wave oversensing during the period between the ICD checks needs to be considered. Although, we did not observe any obvious change in the morphology of the intra-cardiac electrograms, and also any statistical difference in any of the lead parameters during the follow-up period, an unpredictable morphological alteration of intra-cardiac electrograms could be observed when the follow-up periods are longer and closer together. We provided the comparison data between the patients with and without Brugada syndrome in consecutive patients. For a statistical comparison of patients with Brugada syndrome, a uniform arrhythmic background of the patients without Brugada syndrome might be more appropriate. Furthermore, a larger number of patients and longer follow-up periods are needed to ensure the hypothesis proposed by our study. Although we demonstrated an excellent prediction of T wave oversensing during the follow-up period, results and cut-off values might be affected by the sensing properties of each manufacturer’s product. Although, this study demonstrated the high incidence of T wave oversensing during DDD pacing in patients with Brugada syndrome, a possible reason for the high T/R ratio of the electrograms from the ICD lead observed in this study and previous reports still remains unknown. Depolarization and/or repolarization disorders due to channelopathies in the right ventricle might contribute to a depolarization–repolarization mismatch of the electrograms recorded from the ICD lead. The real clinical importance of an exchangeable high-pass filter function during ICD treatment still requires further investigation.

Conclusions
To the best of the authors’ knowledge, this is the first report to demonstrate the excellent predictive value for T wave oversensing in the follow-up period by the existence of Brugada syndrome and the value of the T/R ratio during AAI pacing using bipolar electrograms from an ICD system. These findings have important implications for inappropriate therapy due to T wave oversensing.

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References


Supplemental Files

Supplemental File 1

Methods

Figure S1. A representative example of successful prevention of the T wave oversensing by changing the high-pass filter settings in Case number 3.

Figure S2. A representative example of T wave oversensing during DDD pacing with a high-pass filter setting (1/2) of 10/20 Hz in Case number 5. Pacing for automatic lead impedance measurement by the ICD system triggered by T wave oversensing induced spike on T followed by VF.

Please find supplemental file(s);