Does difference in ICD indication result in a difference in inappropriate shock risk?

Brugada syndrome is a heritable cause of fatal ventricular arrhythmias in people with otherwise structurally normal hearts. It is diagnosed by the identification of a characteristic ECG pattern in association with certain risk factors [1]. Some risk factors are clinical events likely to be precipitated by ventricular arrhythmias, such as syncope and agonal respirations during sleep. Such patients with suspected or documented ventricular arrhythmias have a high risk of recurrent ventricular arrhythmias and meet indications for ICD implantation for secondary prevention [2]. A second population of patients diagnosed with Brugada syndrome had no clinical events, but either have a family history of sudden cardiac death or have inducible ventricular arrhythmias. The best course of management for this second group of patients who are asymptomatic has been difficult to determine.

In making a decision regarding ICD implantation, providers and patients must weigh benefits and burdens of each option. The risk of ventricular fibrillation and sudden cardiac death in asymptomatic patients has been difficult to quantify; the approach to risk stratification in asymptomatic patients with suspected Brugada syndrome remains controversial. Bonny et al. focus on the burdens of ICD implantation, comparing 33 symptomatic and 18 asymptomatic patients implanted with an ICD for Brugada syndrome over a 14 year period [3]. The symptomatic secondary prevention group had 11 patients receive appropriate shocks and 2 patients receive inappropriate shocks. The primary prevention group received no appropriate shocks and 5 patients received inappropriate shocks [3]. This finding is in agreement with prior studies finding low risks for ventricular arrhythmia occurrence in asymptomatic Brugada syndrome patients [4].

This study identifies a trend toward more inappropriate shocks in patients with Brugada syndrome undergoing ICD implantation for primary prevention (27.8% versus 6.1%, p = 0.08). There were 2 patients with inappropriate shocks due to lead malfunction in each group; additionally, the asymptomatic group had 2 patients inappropriately shocked for rapid ventricular rates during atrial fibrillation, and 1 patient inappropriately shocked for T wave oversensing. Other ICD related complications include pocket infection in 2 (4%), endocarditis in 1 (2%), and device-related depression in 2 (4%). One case of depression was determined to be secondary to inappropriate shocks in a patient who was asymptomatic prior to ICD implantation [3].

There were no statistically significant differences among the two groups, as shown in table 1 [3]. Thus, the reason for the difference in inappropriate shock rate between groups is unclear. However, the asymptomatic patients were a mean 3.5 years younger than symptomatic patients and more likely to have a history of atrial fibrillation (16.7% vs. 12.1%, p = 0.42) and less likely to be taking quinidine (22.2% vs. 36.4%, p = 0.36) [3]. Possible reasons for an increased risk of inappropriate shocks in asymptomatic patients can be classified into 3 groups:

1. Patient-related reasons
   Younger patients who had never experienced a clinical event would be less likely to be motivated to refrain from intense physical activity. High intensity physical activity would increase the likelihood of sinus tachycardia treated with inappropriate shocks; possibly, the risk of lead fracture may also be increased.

2. Device-related reasons, which can be further subdivided into:
   a. Programming parameters
      Longer detection times and higher rate thresholds reduce inappropriate shocks in primary prevention patients [5]. Bonny et al. give limited information regarding device programming other than that a single ventricular fibrillation detection zone was used with a threshold above 200–220 beats per minute [3]. The increased rate of inappropriate shocks in the asymptomatic patients may be a chronological phenomenon, in that the majority of patients (77.8%) in the asymptomatic group underwent electrophysiologic studies, 88% of which preceded the FINGER registry results [6]. Therefore, most of the asymptomatic patients received their defibrillators prior to the MADIT-RIT trial [5]. Some inappropriate shocks may have been avoidable with higher rate thresholds, longer detection times, or use of supraventricular tachycardia discriminators.
   b. Lead failure
      One asymptomatic patient had a lead identified to be prone to failure, a Sprint Fidelis (Medtronic, Minneapolis, MN) [7]. The other leads that failed are not described. The same number of lead failures was seen in each group.
   c. Dynamic changes
      The ST segment elevation and angulation between the QRS complex and the T wave in Brugada syndrome can be dynamic, affected by exercise [8], core body temperature [9], and medications [9]. Changes in the ST segments may affect template matching in SVT discrimination and dynamic sensitivity thresholds that prevent T wave oversensing.

3. Coincident atrial arrhythmia and pharmacologic treatment

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Brugada syndrome is a known risk factor for atrial fibrillation, which was implicated in 2 inappropriate shocks in the asymptomatic group. Asymptomatic patients were less likely to be taking quinidine, which would suppress recurrence of atrial fibrillation in addition to suppressing ventricular arrhythmias. Brugada syndrome is associated with an increased incidence of atrial fibrillation in younger patients [10], who would be likely to conduct rapidly and thus receive inappropriate shocks. The frequency of other medications used in this study is not given, but would be relevant to understanding the reasons for inappropriate shocks from atrial fibrillation.

It is also possible that the difference in inappropriate shock rates is less than identified in this study: the probability that the difference between groups is coincidental is 8% as estimated by the p value [3]. These results should be compared with the rate of inappropriate shocks in a larger population of patients with asymptomatic Brugada syndrome. Therefore, the possibility that a difference in ICD indication results in a different risk of inappropriate shocks is suggested by this study, but not confirmed.

Thus, Bonny et al. highlight that the long-term risks of ICD implantation, particularly inappropriate shocks, may be higher among asymptomatic patients than among symptomatic patients [3]. In retrospect, the group of asymptomatic patients appears to have reaped only burdens (inappropriate shocks, depression, and device infections) and no benefits (appropriate shocks for ventricular arrhythmias). Potential reasons may be related to the patients’ young age and activity level; variations in device programming; defibrillation lead propensity to failure; dynamic changes in the patients’ ST segments and T waves; incident atrial fibrillation and treatment with quinidine; and chronologic issues related to changing guidelines for risk stratification, device implantation and programming, and medication therapy. Continued attention to each of these issues will improve the management of patients with this uncommon but potentially life-threatening condition.

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