

## Ventricular Tachycardia During Ajmaline Challenge

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### Case Report

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### Abstract

We report the case of a 63 year old woman who comes to an ajmaline challenge. After 8 minutes of infusion her baseline ECG showed significant QRS complex prolongation and switched over to the typical coved-type ECG. Subsequently a sustained monomorphic ventricular tachycardia was developed, followed by a sustained polymorphic VT onset, which finally degenerated in a hemodynamically non relevant sustained monomorphic VT. Finally, a 200J defibrillation was required to terminate the arrhythmia.

Sustained ventricular arrhythmia (SVA) is infrequent but not an exceptional event (0.1-18%) and ajmaline is considered a valuable drug. In addition, provocation testing must be performed in an appropriate environment with advanced life support facilities. The evidence shows that the occurrence of ajmaline-induced sustained ventricular arrhythmia in patients with BS might not identify a category at higher risk for further arrhythmic events during follow-up.

**Keywords:** Brugada syndrome; Sodium channel blocker Challenge; Ajmaline Challenge; Ventricular arrhythmias; Proarrhythmia

**Abbreviations:** ECG: Electrocardiography; BS: Brugada Syndrome; SCB: Sodium Channel Blockers; VT: Ventricular Tachycardia; SVA: Sustained ventricular arrhythmia

### Case Report

We report the case of a 63 year old woman with arterial hipertensión, who comes to an ajmaline challenge due to a family screening of Brugada syndrome after the recently diagnosis to her 29 year old son.

The patient underwent ajmaline challenge and received 50mg in 10 minutes intravenous infusion, as our protocol requires (body weight 60 kg). Her baseline ECG showed a 118 ms QRS complex (Figure 1). After 8 minutes of

infusion she showed significant QRS complex prolongation (174 ms) and ST elevation in the right precordial leads, which switched over to the typical coved-type ECG (Figure 2). Subsequently short-coupled ventricular extra systoles occurred and a sustained monomorphic ventricular tachycardia was developed, followed by a sustained polymorphic VT onset (Figure 3), which finally degenerated in a hemodynamically non relevant sustained monomorphic VT with RBBB configuration, inferior axis and a cycle duration of 416 ms. The SMVT showed a progressive shortening until reaching a 288ms cycle duration (Figure 4). 20 minutes later, the SMVT persisted despite intravenous isoprenaline administration (2-5mcg/min). Finally, a 200J defibrillation was required to terminate the arrhythmia (Figure 5).

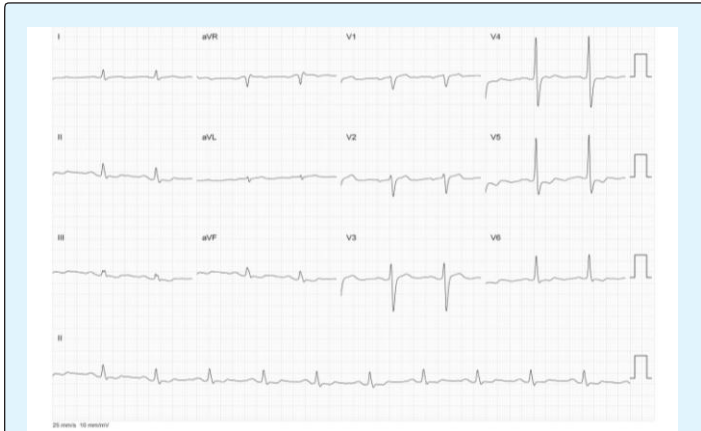


Figure 1: Baseline ECG.

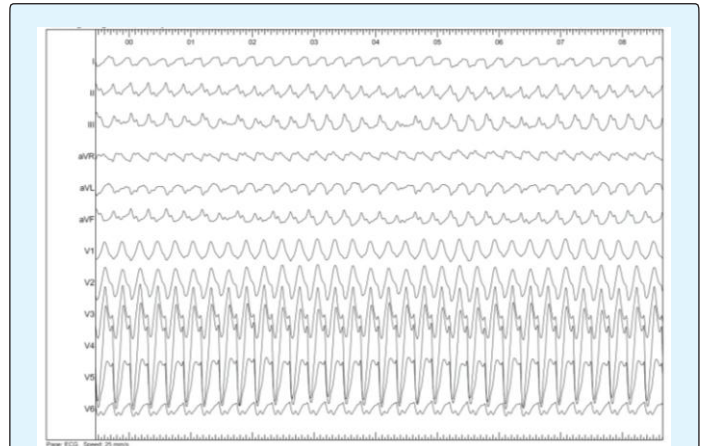


Figure 4: Sustained Monomorphic Ventricular Tachycardia

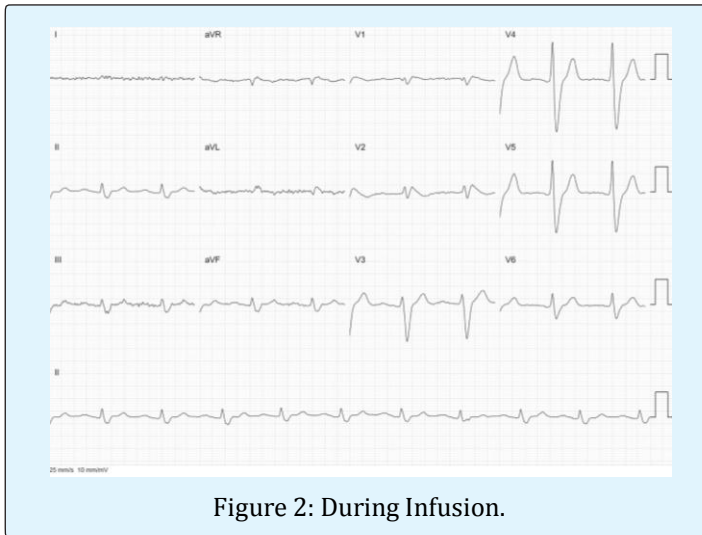


Figure 2: During Infusion.

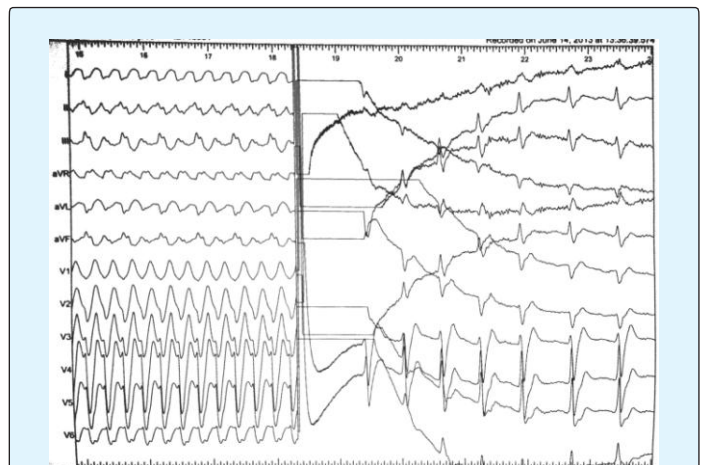


Figure 5: Defibrillation.

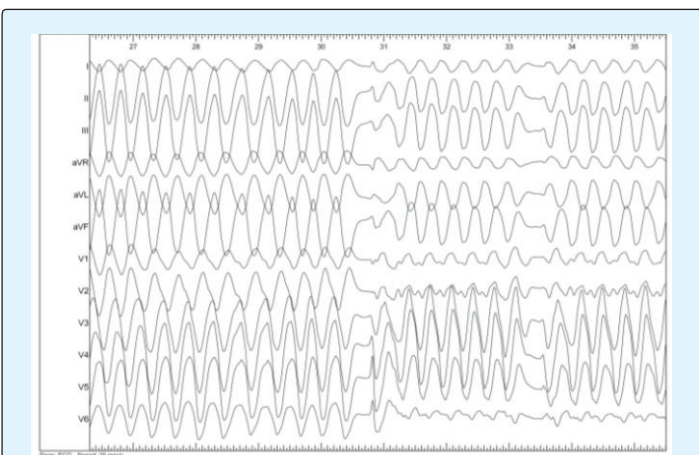


Figure 3: Polymorphic Ventricular Tachycardia.

The event was considered non prognostic of higher risk for further arrhythmic events during follow-up. As a result, an usual management of asymptomatic patients according to Brugada Syndrome guidelines was performed, focused in lifestyle changes.

### Review

Brugada Syndrome (BS) was introduced as a clinical entity in 1992. It is defined by a characteristic electrocardiographic pattern of ST-segment elevation in right precordial leads and a high incidence of sudden death in young individuals with structurally normal hearts, which is most commonly secondary to the development of polymorphic ventricular tachycardia and fibrillation [1]. The prevalence of the disease is estimated to be 5-20 cases/10 000 [2].

Given that BS is an inherited condition, the mechanisms underlying the syndrome remain to be clarified. Several hypotheses have been proposed involving abnormalities in both repolarization and depolarization, but the same mechanism might not be responsible for the disease in all patients, and several might coexist in a single patient. Inheritance of BS occurs via an autosomal dominant mode of transmission with a low penetrance, but there are sporadic cases as well. Mutations in voltage-gated sodium channels (*SCN5A*), voltage-gated potassium channels (*KCNE3*, *KCNJ8*, *KCND3* and *KCNE*) and in voltage-dependent calcium channels (*CACNA1C*, *CACNB2B* and *CACNA2D1*) have been linked to the syndrome [3,4].

Current clinical guidelines and consensus documents state that BS is diagnosed in patients with ST-segment elevation with type 1 morphology  $\geq 2$ mm in one or more leads among the right precordial leads V1 and/or V2 positioned in the second, third, or fourth intercostal space, occurring either spontaneously or after provocative drug testing with intra-venous administration of sodium-channel blockers. Other ECG patterns are not sufficient for the diagnosis, but the diagnostic ECG pattern can be concealed or can fluctuate between a diagnostic and a non-diagnostic pattern [5,6].

Sodium-channel blockers had been widely used to unmask the diagnostic ECG pattern of BS in case of a non-diagnostic basal ECG, due to its availability, fast action and effectiveness, specially ajmaline, flecainide and procainamide [7]. Ajmaline has been shown to be a potent drug in unmasking the diagnostic ECG pattern of BS and is favoured compared with other sodium-channel blockers because of its short lasting half-life and its electrophysiological effects. In direct comparison with flecainide, ajmaline was superior in unmasking the diagnostic ECG pattern of BS. In a prospective study with 22 patients diagnosed with BS, the responses of the surface ECG to two different intravenously administered sodium-channel blockers (ajmaline and flecainide challenge) were investigated. In 15 of 22 patients (68%) the study revealed concordant results, but in seven patients (32%) intravenous flecainide did not produce the typical ECG changes, and they were only provoked after ajmaline infusion [8].

In a study with 147 individuals, representing 4 large families with *SCN5A* mutations, 104 were determined to be at possible risk for BS and underwent both genetic and electrocardiographic evaluation with ajmaline test. The sensitivity, specificity, positive and negative predictive values of the drug challenge were 80%, 94.4%, 93.3% and

82.9%, respectively [9].

Meregalli performed 160 tests with flecainide in *CN5A*-positive probands and their family members. The sensitivity, specificity, PPV and PNV were 77%, 80%, 96% and 36%, respectively. The greater sensitivity to ajmaline may be attributable to differences in the effectiveness of the two drugs in blocking the sodium-channel current *INa* at the doses used [10].

Ajmaline challenge should be developed by electrocardiography monitoring. The infusion should be discontinued when the diagnostic type I ECG pattern with ST-segment elevation greater than 0.2 mV appears in at least two right pre-cordial leads, the occurrence of PVCs or VT, prolongation of the QRS duration  $>130\%$  or the occurrence of higher degree AV-block. After termination of ajmaline administration, monitoring should be continued for a minimum of 60 seconds until ST elevation returns back to baseline [11].

It is known that ajmaline challenge produces prolongation of PR, QT and QRS duration [12]. On the other hand, sustained ventricular arrhythmia (SVA) is infrequent but not an exceptional event (0.1-18%) and ajmaline is considered a valuable drug [13]. A recently review of articles published from 2000 to 2015 evaluated the incidence and predictors of SVA during sodium channel blockers (SCB) challenge. The weighted average for induction of any VA during sodium blocking challenge was 2.4%; 0.34% for non-sustained ventricular tachycardia (VT) and 0.59% for sustained VT. No fatal cases were reported. Predictors may be young age, conduction disturbance at baseline ECG, and mutations in the *SCN5A* gene [14].

### **We considered our case of special interest based on the rare occurrence of these events, highlighting possible serious complications of an already established diagnostic test**

However, due to the prognostic importance, all patients with aborted sudden death or unexplained syncope without demonstrable structural heart disease and family members of affected individuals should presently undergo drug testing for unmasking BS. It can be questioned whether an SCB challenge is necessary in all asymptomatic patients with a suspicious ECG baseline or a family history of BS, considering the good prognosis of asymptomatic patients, but it seems too simple to conclude that the risk of SCB-induced arrhythmia

outweighs the potential benefits. In addition, provocation testing must necessarily be performed in an appropriate environment in which advanced life support facilities are present [14].

Finally, the evidence shows that the occurrence of ajmaline-induced sustained ventricular arrhythmia in patients with BS might not identify a category at higher risk for further arrhythmic events during follow-up.

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