International Journal of Medical Anesthesiology

E-ISSN: 2664-3774
P-ISSN: 2664-3766
www.anesthesiologypaper.com
IJMA 2025; 8(1): 41-45
Received: 20-12-2024
Accepted: 26-01-2025

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Anaesthetic management in Brugada syndrome: A case report

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DOI: https://www.doi.org/10.33545/26643766.2025.v8.i1a.547

Abstract
Brugada syndrome (BrS), an autosomal dominant condition associated with SCN5A gene mutations, is marked by RBBB (right bundle branch block) as well as ST segment elevation in causes V1-V3, resulting in sudden cardiac mortality or arrhythmias. Treatment focuses on preventing life-threatening arrhythmias, with an ICD being a most effective intervention for patients with a history of VF (ventricular fibrillation). This report discusses the use of perioperative isoprenaline in a 62yr old patient with an ICD undergoing elective surgery, highlighting the importance of preoperative assessment and careful perioperative management to prevent malignant arrhythmias (MA).

Keywords: Brugada syndrome, isoprenaline, implantable cardioverter defibrillator

Introduction
BrS is an autosomal dominant condition that was initially identified in 1992 as a cause of sudden cardiac mortality or "ventricular tachyarrhythmias" [1]. The syndrome was marked by an electrocardiographic pattern of RBBB with persistent ST-segment elevation in right precordial leads (V1-V3), a tendency for arrhythmias, there is no correlation with structural heart disease [1]. Etiology of the syndrome remains undetermined. There is mutation in SCN5A gene, which encodes cardiac sodium ion channels, in approximately 20%-25% of patients with BrS. The inheritance pattern of this gene mutation is autosomal dominant [2]. Genetic mutations have been observed in families, where a history of syncope or sudden death is often present among family members. In general, patients are affected in their late 30s.

The unpredictable onset and duration of arrhythmias make it crucial for clinical management to focus on preventing life-threatening arrhythmias. Treatment options include antiarrhythmic drugs, ablation therapies, as well as implantation of AICD (automated implantable cardioverter defibrillator). AICD implantation has been regarded as most effective preventive measure to reduce the risk of sudden cardiac death in patients with a history of VF or previously aborted sudden cardiac death [17].

This report introduces the novel use of perioperative isoprenaline in a 62 yr old female patient with an ICD in place, undergoing an elective surgical procedure. It highlights the critical role of preoperative assessment as well as perioperative management in patients with BrS. The risk of MA is a major concern for anaesthesiologists, as pharmacological and physiological alterations during the perioperative period can provoke these events and result in cardiac dysfunction.

Case report
A 62 yr old female diagnosed with right-sided invasive ductal carcinoma of breast was scheduled for a Modified Radical Mastectomy. A pre-anaesthetic assessment was conducted to evaluate her medical history and ensure optimal perioperative management. The patient had a 10-year history of hypertension and currently on regular antihypertensive medication. Additionally, she reported experiencing palpitations and syncope around 10 years ago, which resulted in hospitalization. During this episode, her ECG showed a heart rate of 68/min, BP of 128/76 mmHg, as well as RBBB in addition to a coved ST segment in leads V1 as well as V2 (Figure 1). She was diagnosed with BrS and subsequently had ICD (Implantable Cardioverter Defibrillator) implanted. According to ICD records, the device had been activated twice over the past ten years.

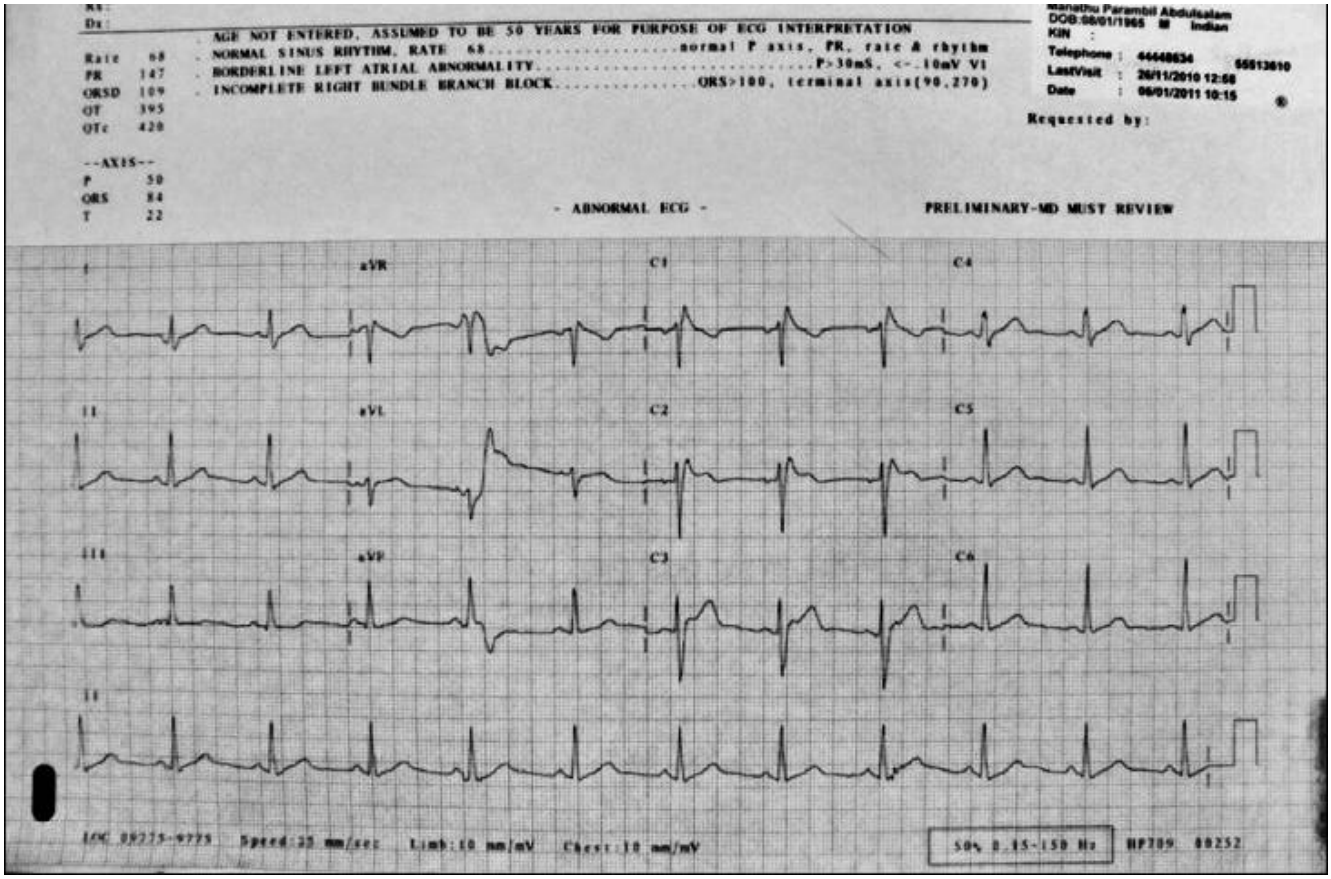

Fig 1: ECG showing RBBB along with coved ST segment in V1, V2, V3 leads (before placement of ICD)

The patient's family history was characterized by the sudden death of her father at the age of 38. The electrocardiogram (ECG) of the patient revealed a heart rate of 83bpm with normal sinus rhythm (Figure2). Echocardiographic imaging (2D ECHO) confirmed the presence of the ICD, but no structural abnormalities were observed (Figure 3). A cardiology consultation was obtained, which categorized her cardiac status as Class II according to the NYHA (New York Heart Association) classification.

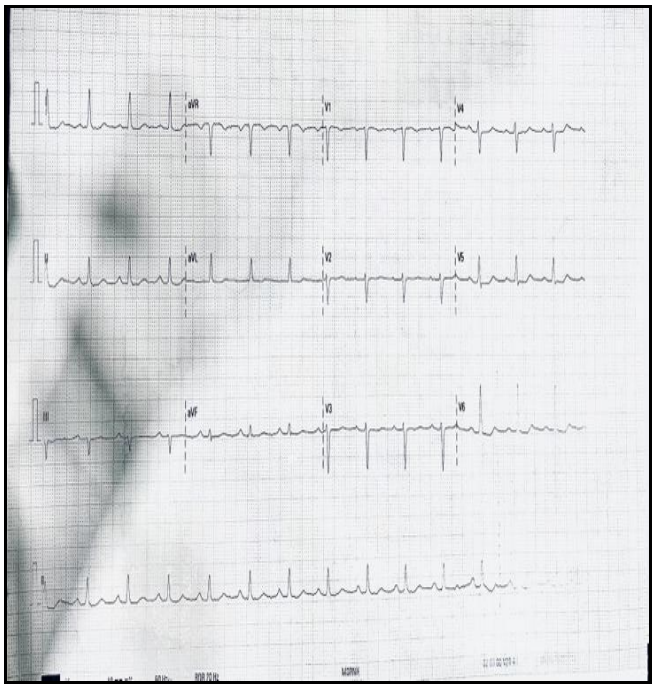

Fig 2: Recent ECG after placement of ICD.

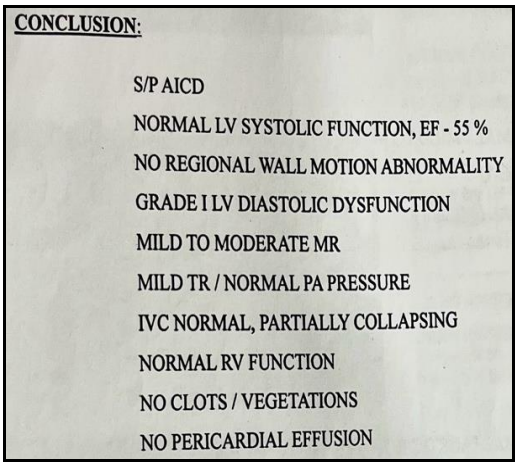

Fig 3: 2D ECHO confirmed the presence of ICD, with no structural abnormalities noted.

After providing written informed consent for anaesthesia and surgery, the patient was prepared for the procedure. Prior to induction of anaesthesia, the patient's Implantable ICD was deactivated. Intraoperative monitoring included a pulse oximeter, a 3-lead ECG, and an invasive blood pressure (BP) monitor to assess beat-to-beat variation. The patient's chest wall was equipped with automatic external defibrillator electrodes to facilitate cardio version in the event of an emergency.

For anaesthetic induction, fentanyl 2 mcg/kg and thiopentone 250 mg were administered intravenously. To facilitate tracheal intubation, atracurium 0.5mg per kg was given intravenously. Anaesthesia maintained with isoflurane 1 MAC in an oxygen-air mixture, with additional doses of atracurium 0.1 mg/kg to ensure muscle relaxation. A

prophylactic continuous infusion of isoprenaline 0.003 mcg/kg/min was started to mitigate any potential vagal stimulation that could lead to dysrhythmias. Throughout the surgery, the patient's hemodynamic parameters were closely monitored the ECG showed normal sinus rhythm, and the heart rate was maintained above 50 bpm.

For perioperative pain management, diclofenac 75 mg and paracetamol 1 g were administered intravenously. The surgery lasted for approximately 2 hours, and no significant intraoperative events were observed. Prior to extubating, the isoprenaline infusion was stopped, and glycopyrrolate 0.005mg/kg and neostigmine 0.05 mg/kg have been supplied intravenously, and successful tracheal extubation performed. The ICD was reactivated and set according to patient's requirements.

Postoperatively, patient has been monitored in PACU (post-anaesthetic care unit) for 6hrs. During this time, her hemodynamic status remained stable, and the ECG showed no changes. The patient was then transferred to the ward, where she continued to recover. She was discharged from the hospital 4 days post-surgery, with no further complications.

Discussion

BrS is classified as a "channelopathy." These conditions are result of changes “to transmembrane ion channels, which are responsible for the action potential of cells and increase the body's susceptibility to arrhythmias [5]. In absence of structural cardiac disease, it is distinguished by a unique ECG pattern of ST elevation in right precordial leads. The mechanism of ST-segment elevation with BrS is a discrepancy in action potential gradients between the right ventricular endocardial and epicardial cells [3]. Three distinct repolarization patterns are identified (Figure 4). In the event of a negative T wave”, coved “ST segment elevation greater than 2 mm in more than one right precordial lead (V1-3), and at least one clinical criterion from the following, a definitive diagnosis (Type 1 abnormality) is rendered(Figure 5)(4). Nevertheless, this definition may be altered in light of recent evidence, which indicates that a Type 1 ECG can be linked to sudden cardiac mortality in the absence of additional clinical criteria [5]. In addition to clinical criteria, other patterns (Type 2 and 3) that transition to a Type 1 ECG following sodium channel blockade could also function as diagnostic” signals [4].

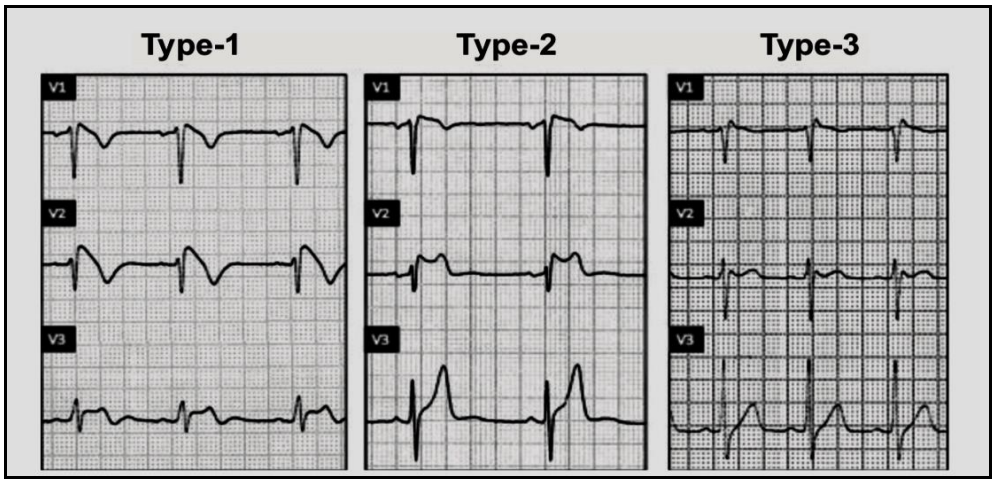

Fig 4: Patients “with BrS frequently exhibit three distinct ECG patterns. Type 1: coved type pattern. Type 2: saddleback pattern. Type 3: morphology with ST <1mm, either coved or saddleback. Progress in Cardiovascular Diseases has granted permission for this” reprint [6].

Documented ventricular fibrillation
Polymorphic ventricular tachycardia
Family history of sudden cardiac death at <45 years old
Coved-type ECGs in family members
Inducibility of VT with programmed electrical stimulation
Syncope
Nocturnal agonal respiration

Fig 5: Clinical criteria included in the diagnosis of BrS [4] ECG=electrocardiogram, VT=ventricular tachycardia.

The prevalence is estimated to be 5 per 10,000 individuals [6]. This renders it most significant cause of young male’s sudden death as well as has been referred to as “sudden unexplained nocturnal death syndrome” [7]. Men are clinically afflicted at a rate that is 8-10 times greater than that of women [8]. Approximately 20-25 percent of individuals have been found to have mutations in SCN5A gene, which was responsible for α-subunit of cardiac sodium channel [8].

ST segment elevations are associated with certain anaesthetic agents, which can lead to an elevated risk of ventricular arrhythmias. A list of medications that are not advised for use in patients with BrS to prevent cardiac mortality is available at www.brugadadrugs.org. For example, propofol must be avoided [9]. Additionally, numerous investigations had conducted on the safety of thiopental. Kloesel *et al.* [10] conducted a review and case-series on Brs patients. It observed that ST elevation might occur after the administration of ketamine; Nevertheless, thiopental didn’t induce comparable effect. The other substances that should be avoided are tramadol and ketamine. Fentanyl is the most frequently prescribed opioid for patients with BrS [15]. Ahn and Kim [16] reported successful administration of remifentanil. Postema *et al.* [9] reported that inhalational anaesthetics, atropine, neuromuscular blockers, neostigmine, opioids, as well as glycopyrrolate were safe to use without any adverse effects. Nevertheless, the vagotonic effect of neostigmine may result in the elevation of the ST-segment being dose-dependent, while atropine may decrease it. Subsequently, it may be

prudent to avoid the consumption of neostigmine [11]. Several reports have been published regarding successful administration of neostigmine without any complications [12, 13]. In our case, neostigmine did not induce any abnormalities. Sugammadex can be safely and effectively used to antagonize neuromuscular block [14]. Antiemetics, such as ondansetron, granisetron as well as dexamethasone, might be utilized; however, phenothiazine should be avoided [9].

The use of perioperative isoproterenol infusion to prevent malignant ventricular arrhythmias has not been documented in previous studies. In the case of our patient, a low-dose infusion of isoproterenol was able to temporarily alleviate ST segment abnormalities. While anaesthesia is typically regarded as relatively safe for patients with BrS, this novel approach of low-dose isoproterenol infusion could potentially provide an added layer of safety for those with uncontrolled BrS who are undergoing urgent procedures. However, "further research is needed to determine whether this method effectively prevents ventricular" arrhythmias [18].

Present case, patient had an AICD implant after experiencing an arrhythmogenic syncopal event, with the device having been activated twice over the past decade. The use of electrocautery during surgery can cause electromagnetic interference, potentially leading to impulses that are not appropriate for AICD patients. The incidence of electromagnetic interference is lower in bipolar cautery, whereas monopolar cautery was identified as a risk factor for interference like this [19]. In our patient, planned surgery was a right-sided modified radical mastectomy, which was close to the ICD on the left side. Surgeon opted to utilize only bipolar cautery for haemostasis during procedure. Given utilization of bipolar cautery, the surgical site's proximity to the ICD, and the high-risk nature of the procedure, the decision was made to temporarily disable the anti-tachyarrhythmia mode of the ICD. External defibrillator pads were placed on patient in an anteroposterior position to avoid direct contact with ICD.

Before external defibrillator electrodes are removed, the device must be reactivated for any patient with an ICD immediately. Continuous ECG monitoring with ST segment analysis should be implemented for a maximum of 36hrs in order to prevent the occurrence of postoperative arrhythmias.

Conclusion

Managing patients with implantable cardiac devices presents significant challenges for anaesthesiologists. Effective management depends on comprehensive preoperative preparation, the careful choice of anaesthesia methods, and the appropriate administration of drugs. These strategies play a vital role in reducing or preventing serious cardiac complications during the perioperative phase.

Conflict of Interest

Not available

Financial Support

Not available

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How to Cite This Article
Vanshika S, Mane R, Kedareshvara KS. Anaesthetic management in Brugada syndrome: A case report. International Journal of Medical Anesthesiology. 2025;8(1):41-45.