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Vitreoretinal Surgery Under Sub-Tenon's Block and Conscious Sedation in a Patient with Brugada Syndrome: A Case Report and Literature Review

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Abstract

Brugada syndrome (BrS), a type of sudden arrhythmic unexpected death syndrome (SADS), is characterized by specific electrocardiogram (ECG) changes, a structurally normal heart, and susceptibility to life-threatening ventricular arrhythmias. General anesthesia (GA) is usually used for major surgery in patients with BrS due to concerns that some local anesthetic agents may precipitate critical arrhythmias. The majority of ophthalmic surgeries are successfully carried out under regional anesthesia (RA). The literature does not address the use of ophthalmic RA in patients with BrS except one report of peribulbar block for glaucoma surgery. This clinical case report and the liertature review suggests that for BrS patients presenting for vitreoretinal surgery, a sub-tenon block, with or without sedation may safely be used as a primary anaethestic technique.

Keywords: Brugada Syndrome, Ophthalmic Regional Anesthesia, Sub-Tenon's Block, Vitreoretinal Surgery, Lidocaine, Bupivacaine, Conscious Sedation, Arrhythmia

1. Introduction

Brugada syndrome (BrS), also known as sudden arrhythmic unexpected death syndrome (SADS), is characterized by electrocardiogram (ECG) changes in precordial leads, a structurally normal heart, and a susceptibility to life-threatening ventricular arrhythmias (1). BrS is an autosomal dominant genetic disorder with incomplete penetrance and variable expression stemming from various mutations of ion channels in the cardiac conduction system (1, 2). BrS is a cause of concern for the anesthesiologists as routinely used anesthetic drugs can interact with cardiac ion channels and trigger malignant arrhythmias (3, 4).

BrS is more common in people of Asian descent, and males are affected more than females. It has been reported that between 0.01 - 0.3% suffer from BrS (2). Although there are several genotypes of BrS (1), the commonest one is due to mutation of SCN5 gene causing malfunction of cardiac sodium channels. Other variants result from gene mutations causing potassium and calcium channels abnormalities.

The ECG pattern of BrS type 1 is the most specific of all. It has a pronounced J point elevation (2 mm), a gradually descending coved-type ST segment, and an inverted T wave in V1 and V2 precordial leads (1, 2). The Type 2 BrS has a 'Saddleback ST-segment', a 2 mm J point elevation, and biphasic T wave. In Type 3, the 'Saddleback ST segment' shows $<$ 1 mm terminal elevation (1, 2). The type 1 ECG pattern is diagnostic of BrS; However, types 2 and 3 patterns may not be present at rest and sometimes require drug challenges with sodium channel blockers such as flecainide or procainamide for them to be unmasked and converted into type 1.

The condition is increasingly being recognized. Not all patients are symptomatic or diagnosed until late in adult life (2). Since patients are living longer, they are likely to require anesthesia for ophthalmic procedures more often than before.

2. Search Strategy

A literature search was conducted in September 2021 using MEDLINE (Ovid), PubMed, Embase, CINAHL, Google

Scholar, and Cochrane to identify English language articles published during January 1970 and September 2021. The used search keywords included "Brugada Syndrome" in various combinations with "sedation", "ophthalmic surgery", "vitrectomy", "general anesthesia", "local", "regional", "local anesthetic agent", "complications" "anesthesia", and "surgery". The retrieved articles included randomized control trials (RCT), case reports, and citations of key reference articles. After examining their relevance and quality, 24 articles were included in the literature review.

3. Case Presentation

A 69-year-old man presented recently with a history of severe headache, sudden blurring of vision in both eyes, and jaw claudication. His history included right posterior 4 - 7th ribs fractures following a road traffic accident seven years ago when he had a diagnosis of BrS type 2. He had never experienced syncope, dyspnea, or palpitations but had complained of atypical chest pain in the past. On this occasion, the fractures had been managed conservatively. He was incidentally found to have macular hole in the left eye, but he declined corrective surgery. Two years later, he developed bilateral cataracts. He underwent an uneventful left eye cataract extraction under peribulbar block (5 mL, 2% plain lidocaine, and hyaluronidase) administered by the surgeon. Three months later, he had right eye cataract surgery under topical anesthesia (1% tetracaine drops).

On current admission, a magnetic resonance imaging (MRI) was performed, and a space occupying cerebral lesion was ruled out. Other findings included mild atherosclerotic changes of the infrarenal abdominal aorta, as well as temporal arteries with focal stenosis in the right parietal ramus, segmental stenosis of the left main trunk, and distal frontal ramus occlusion. A temporal artery biopsy confirmed the diagnosis of bilateral anterior ischemic optic neuropathy (AION) induced by giant cell arteritis. His visual acuity in the left eye with an untreated macular hole was better than the right eye, which was limited to fingers count. He was prescribed long-term prednisolone, methotrexate, and aspirin. His routine medications had included azathioprine, omeprazole, and calcium.

One month later, he developed a retinal detachment in the left eye. Considering the complex nature of the proposed vitreoretinal surgery, he was listed under GA. He was assessed preoperatively by an anesthesiologist. Then, routine blood tests were performed, and a cardiologist examined the patient. He was also advised to avoid drugs that trigger arrythmias (5).

His repeated electrocardiogram (ECG) showed a type 2 pattern BrS (Figure 1). A 2D echocardiography showed a post-stress ejection fraction of 55%, grade 1 diastolic dysfunction, aortic valve sclerosis, but no regional wall motion abnormality. The routine hematological and biochemical tests were unremarkable. Patient was offered flecainide challenge test, which he declined (flecainide: a sodium channel blocker unmasks ECG changes in those patients who have Brugada syndrome).

On the day of the proposed surgery, the patient was found to have rhinorrhea, fever, increased sputum production, and persistent cough. His chest x-ray was normal, and COVID-19 antigen test was negative. He was prescribed amoxicillin clavulanate, and surgery was deferred pending the resolution of these new symptoms.

On relisting after two weeks, the patient requested regional anesthesia (RA) in preference to GA. Following complete discussion and consent, baseline vital sign monitoring was commenced, and intravenous access was obtained. Then, external defibrillators were applied. After obtaining surface anesthesia with tetracaine (1%) and instillation of 5% iodine, inferonasal (equatorial) sub-Tenon's block was performed using a blunt cannula (19G, 2.54cm, Sterimedix Ltd, UK) inserted to a depth of 2 cm. Six milliliters of 2% plain lidocaine with hyaluronidase 10 IU/mL were injected, and ocular compression was applied (Honan balloon) for 5 minutes. Complete akinesia of the globe in four primary directions and lids (two directions) was achieved. The surgery proceeded uneventfully. Monitoring of the vital signs (ECG, blood pressure, oxygen saturation, end-tidal carbon dioxide [($ETCO_2$)]) was continued and remained stable. After 78 minutes, a supplementary sub-Tenon's injection (3 mL of 2% plain lidocaine) was administered by the ophthalmologist. Target-Controlled Infusion (TCI) of propofol (Marsh 0.5 mcg/kg) was commenced to provide conscious sedation. The surgery (vitrectomy, retinal membrane peel, heavy liquid perfluorocarbon instillation, retinotomy, endolaser, and air / gas exchange) lasted for 140 minutes, during which a total of 51 mg of propofol was administered. Postoperatively, the patient was monitored in a high dependency unit as recommended (5) and discharged home the next day. A written informed consent was obtained from the patient.

4. Discussion

There is a paucity of literature on ophthalmic RA in patients with BrS. There are no evidence-based guidelines as the disease has low prevalence, and there are no prospective studies either (3, 4).

BrS, although rare, is a challenging clinical condition due to the high probability of sudden unexpected death (4). Although BrS patients may be asymptomatic, they may develop fatal ventricular tachycardia or ventricular

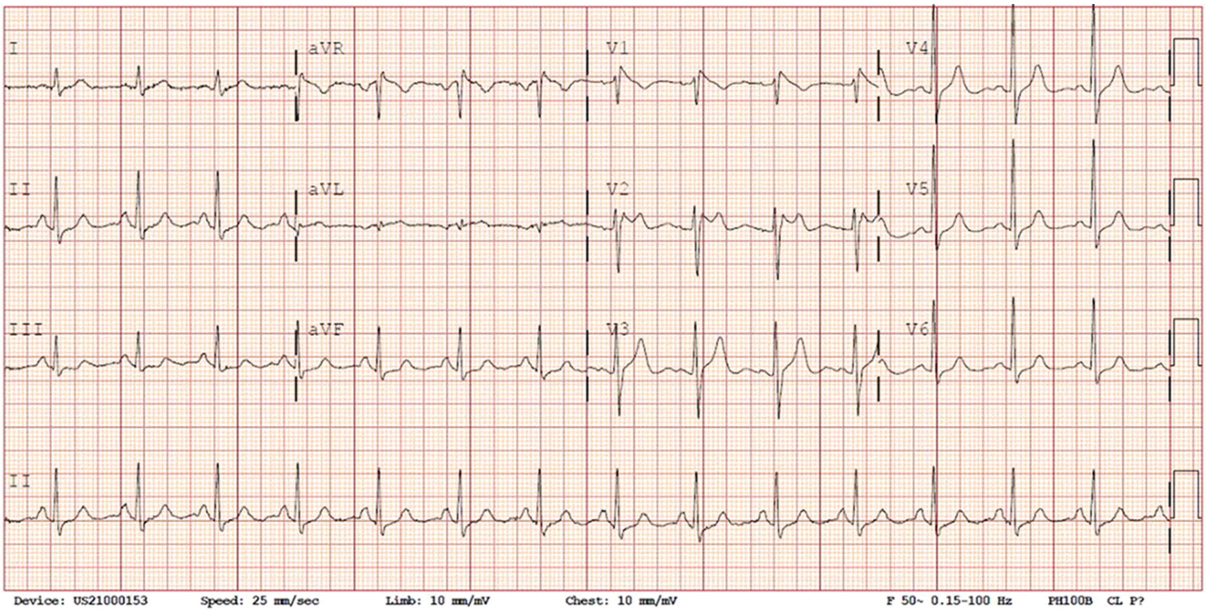

Figure 1. ECG pattern (Brugada syndrome type 2: Saddleback; ST-segment elevated by more than 1 mm and biphasic T wave)

fibrillation (3, 4). Critical arrhythmias typically occur during rest or sleep when vagal activity predominates. Electrolytes or fluid imbalance, perioperative drug-induced heart rate variations, fever, alcohol, and several other drugs may precipitate lethal arrhythmias (6). Therefore, in these patients, a multidisciplinary approach is considered mandatory (3, 4).

Symptomatic patients sometimes have implantable cardioverter-defibrillators (ICD), but their routine usage is controversial and usually made after weighing the individual risk of potential arrhythmic events (7). Current knowledge suggests that during GA, the ICD should be deactivated, and all patients should have external defibrillator pads applied continuously throughout the perioperative period (3). GA remains the primary technique for patients who are considered unsuitable for the topical/regional technique (8).

Concerning RA technique, drugs with sodium channel blocking properties need attention. Some of these (eg, class 1B) may cause adverse events in patients with BrS (4). Bupivacaine (9) is generally cautioned because it has the potential to induce serious arrhythmias. However, the literature shows successful usage of 0.5% bupivacaine for spinal RA (9), and epidural with lidocaine (10) in BrS patients. Duque et al. (10) reported anesthetic management of 31 BrS patients for various surgical procedures, of whom 25 were performed under local and regional anesthesia. While lidocaine was used safely in most cases, ropivacaine was used in some of them. Three cataract extractions were reported under topical anesthesia using oxybuprocaine eye drops. Moreover, 2% lidocaine gel has been used effectively during phacoemulsification cataract surgery (11). Lidocaine in patients with BrS has been shown to be safe during local dental anesthesia, even when combined with adrenaline. The use of sympathomimetics in ophthalmic RA injectate may not be considered, and this opinion is backed by a study in which lidocaine with or without adrenaline was shown to significantly decrease the retinal thickness (12).

Vitrectomy surgery is one of the commonest ophthalmic procedures performed across the world under both general and local anesthesia, including retrobulbar, peribulbar, sub-Tenon's blocks as well as topical anaesthesia. The choice of anesthesia depends on several factors, including patient suitability (medical condition), surgical procedures, and preference of the patient, surgeon, or anesthesiologist. There is no clear evidence on which type of anesthesia is best in reducing harm and providing the best surgical conditions and optimal outcomes for patients (13-17). Our patient preferred RA over GA. The literature search did not reveal the use of RA for vitreoretinal surgery in patients with BrS, except the use of peribulbar block (5 mL of 2% lidocaine) for trabeculectomy (18) offered some guidance.

Sub-Tenon's block is a well-recognized technique for vitreoretinal surgery as the duration of anesthesia can be easily extended (19). We used lidocaine electively in preference to bupivacaine, although the latter would have been first choice in a non-BrS patient as it provides longer duration of action.

Both non-pharmacological and pharmacological techniques are used to calm and relax the patients undergoing ophthalmic surgery. Bensons relaxation technique is shown to reduce the need for sedative such as propofol during ophthalmic surgery (20). Pharmacological agents (not in the order of preference) include etomidate, propofol, and midazolam fentanyl, remifentanil, ketamine, dexmedetomidine, and many others either alone or combined (21). A recent literature review suggests that dexmedetomidine sedation for ophthalmic surgery under local / regional anesthesia is potentially useful, but its role may be limited due to logistical difficulties in administering the recommended dose (22). There is not much difference among the groups, but propofol appears superior to the other two agents (23). Generally, routine sedation is considered undesirable in patients undergoing eye surgery because it is associated with adverse events (21). It has been suggested that propofol should be avoided in patients with BrS due to its arrhythmogenic potential (4). However, it has been safely used for sedation during the implantation of an ICD (24). In our case, low-dose propofol was successfully used when the patient became a little restless halfway through surgery. It was fortunate that the surgery had been amenable to an RA and conscious sedation. Our patient did not have an implanted defibrillator, but an external defibrillator was in place, and cardiology support was available if required.

4.1. Conclusions

In conclusion, given the unpredictable nature of the disease, it is imperative that RA technique with or without sedative should be used cautiously, and patients need to be monitored closely for 24 hours. This case report and the literature review highlighted how a multidisciplinary approach and close collaboration between ophthalmologists, anesthesiologists, and cardiologists can achieve a favorable outcome for patients with Brugada syndrome undergoing major ophthalmic surgery.

Footnotes

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