Sevoflurane as a Cause of Torsade de Pointes in a Patient with the Long QT Syndrome (LQTS). A Case Report.

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Introduction

Long QT syndrome (LQTS) is a rare condition that can lead to Torsade de Pointes (TdP), a severe cardiac arrhythmia. Although most patients are asymptomatic, LQTS patients can experience symptoms of palpitations, syncope, seizures, cardiac arrest and sudden death. Since a genetic predisposition to LQTS exists, patients with congenital LQTS may have relatives who experienced sudden cardiac death. To date, there are 13 identified mutations that maybe responsible for LQTS.

The QT interval varies with changes in heart rate, time of the day, autonomic nervous system activation and sex. As the heart rate increases, the QT interval decreases. Bazett's formula is currently the most widely used and popular to calculate the corrected QT (QTc) as QT divided by the square root of the RR interval. Many studies have shown that cardiac rhythm disturbances usually do not occur until QTc exceeds 500 ms.

**Bazett's Formula:**

\[ QTc = \frac{QT}{\sqrt{RR}} \]

<table>
<thead>
<tr>
<th>QTc</th>
<th>Male</th>
<th>Female</th>
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<tbody>
<tr>
<td>Borderline prolonged</td>
<td>440-460</td>
<td>450-470</td>
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<tr>
<td>Prolonged</td>
<td>&gt; 460 ms</td>
<td>&gt; 470 ms</td>
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Case Presentation

A 14-year-old Caucasian female with known LQTS and intermittent 2nd degree AV Block presented for an elective pacemaker generator replacement and heart catheterization. The patient was evaluated in the preoperative area by anesthesiologist as an ASA 2 patient. On the morning of surgery, the ECG showed a paced rhythm of 60 bpm with QTc of 540 ms. She was fearful of needles and refused pre-op IV placement. Physical exam was unremarkable. Her only medication was atenolol which was given the morning of surgery. The ECG showed a paced rhythm of 60 bpm with QTc of 540 ms. She was fearful of needles and refused pre-op IV placement. The anesthetic plan was an inhalational induction with sevoflurane for IV start, then maintenance with total intravenous anesthesia. No premedication was given. Monitors were placed and sevoflurane in 25/75 O₂/N₂O was administered. During IV placement, the patient went into ventricular tachycardia (TdP) which was short-lived, lasting only 3 seconds and resolved spontaneously. Sevoflurane was turned off. Fentanyl, vecuronium and propofol were given IV and the trachea was intubated uneventfully. A propofol infusion was used for rest of the case. The patient had an uneventful procedure and recovery.

Discussion

Many conditions and medications are known to prolong the QT interval. Inhalational anesthetics are among them and potentially predispose the patient to the occurrence of TdP. Although studies have shown that sevoflurane is safe for healthy patients [1, 2, 3], the situation is not clear for patients with LQTS. Because LQTS is rare, the few case reports of sevoflurane causing TdP occurred in the presence of other predisposing factors such as older age, slower heart rhythm, hypokalemia, hypomagnesemia, hypocalcemia, and the concomitant use of other QT prolonging medications. In our patient, the stimulation caused solely by an inhalational induction with sevoflurane resulted in V-Tach, albeit self-limited and brief. Many important steps should be followed in the care of a patient with LQTS:

**Pre-op**
- obtain a baseline ECG
- maintain adequate beta-blockade
- consider premedication
- make sure that defibrillator is ready to be used without any delay

**Intra-op**
- general anesthesia is the anesthetic of choice
- decrease sympathetic stimulation from laryngoscopy and tracheal intubation
- induce and maintain anesthesia with propofol, opioid, muscle relaxation
- avoid reversal of muscle relaxation
- avoid hypothermia
- avoid epinephrine in local anesthetic solutions

**Post-op**
- adequate pain control to minimize the sympathetic activation and tachycardia
- avoid medications known to prolong the QT interval (ondansetron, droperidol)
- post-op QTc monitoring

Conclusion

In our case, premedication, IV induction and avoidance of sevoflurane may have prevented brief ventricular tachycardia. Based on this case, we advocate caution with the use of inhaled anesthetics in patients with LQTS.

References

2. Scuderi PE. Sevoflurane and QTc prolongation: an interesting observation, or a clinically significant finding? Anesthesiology. 2010;113(4):772-5.