Background and Introduction

Ventricular pacing by a cardiac pacemaker results in artificial widening of the QRS complex caused by myocyte-to-myocyte propagation of the electrical current, which results in slowing of depolarization (but not repolarization) when compared to a healthy non-paced heart. Because QT-interval appears prolonged (and the QTC is correspondingly prolonged), clinicians may be reluctant to prescribe QT-prolonging medications to patients with cardiac pacemakers, due to concern for the risk of potentially fatal arrhythmias / torsades de pointes. Herein we present two cases illustrating this phenomenon, of patients with cardiac pacemakers and QTc >540ms who were initially denied QT-prolonging (but clinically useful) psychiatric medications. In both cases, consult liaison psychiatrists assisted the patient’s medicine teams in re-calculating the QTc, demonstrating normal QTc when accounting for pacemaker, and allowing the patient to resume their psychiatric medications. In such cases, the JT-interval and JTc may further provide useful information to guide clinical decision making.

Purpose

To present two cases demonstrating the correction of QT-interval and JT-interval in patients with prolonged QT in the setting of cardiac pacemaker and taking QT-prolonging psychiatric medications.

Patient 1, Mr. L

Initial Presentation and History, Patient 1: Mr. L is an 80 yo gentleman with past medical history significant for COPD, CAD s/p multiple PCI, HFrEF, AF (on anticoagulation), HTN, T2DM, hypothyroidism, MDD, BPH, urinary retention, GERD, heart block, CKD (stg 4), chronic neck and back pain, Parsonage Turner syndrome, who was admitted to the WX MICU in setting of hypoxic respiratory failure and sepsis due to PNA, complicated by AKI on CKD and metabolic encephalopathy. Psychiatry was consulted due to worsening restlessness and agitation in the ICU, manifesting as loud outbursts of yelling; the primary team requested assistance in selecting a psychotropic medication, given his EKG findings. Recent EKG findings reviewed at consultation:

- Instrument measured QT = 544ms
- Instrument calculated QTc = 547ms

Manual Measurement of QT, JT, QRS, and RR, Patient 1 (Mr. L):
- QT: 520ms, JT: 330ms, QRS: 200ms, RR: 0.960s
- JTc = (100)/(RRs^(1/3))
- JTc = ((330)/(0.960^(1/3))) = (330/0.98648)
- JTc = 335 ms

Manual Calculation of QTc and JTc

Using Fridericia’s Formula, corrected for cardiac pacemaker:

- JTc = ((450-160-100)/(0.810*(1/3)))
- JTc = (600/0.93217) = (600/0.93217)
- JTc = 437 ms

QTc and JTc to Guide Clinical Decision-Making

For both Patient 1 and Patient 2, the QTc and JTc when calculated manually were found to be non-concerning, and psychiatric medications (including those which prolong QT) could be continued.

Discussion

Cardiac pacemakers falsely prolong QT and can result in clinical concern for the use of QT-prolonging medications, including many psychiatric medications. Here we presented two cases in which the QT was falsely prolonged. We demonstrated the manual measurement of QT-interval and JT-interval, and manually calculated QTc and JTc, demonstrating that doing so can resolve clinical concern for prolonged QT in some patients with cardiac pacemakers, and thereby improve care for these patients.

References


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