

# QT Prolongation from Psychiatric Medication: Information for Physicians

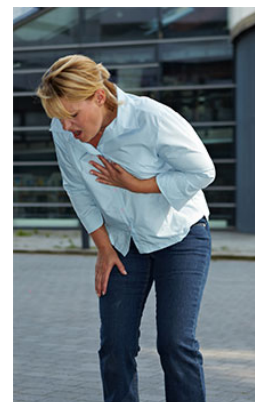


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**Summary:** QT prolongation from psychiatric medications leading to potentially fatal cardiac arrhythmias (such as Torsades de Point) is an uncommon but serious complication. Unfortunately, many psychiatric medications such as antidepressants and antipsychotics have a risk of prolonging QT. For patients at risk of QT prolongation, address modifiable risk factors, use caution with medications that may worsen QT intervals, and consider cardiology consultation. For patients with QT prolongation, stop any offending medications and address modifiable risk factors.

## Case, Part 1

Jan is a middle-aged female in your practice. Several years ago, she had been diagnosed with anxiety, and treated with Citalopram, which she continues to take. A few months ago, the dosage was raised to 40 mg daily. She now presents to you with fainting spells and chest pains. What are you going to do?

## What is a Normal QT Interval?

The QT interval on an ECG:

- Is the beginning of the QRS complex to the end of the T wave, and represents ventricular depolarization and repolarization.
- Varies with heart rate. Various formulas are used to correct the QT interval for heart rate, and once corrected, it is expressed as the QTc ("QT corrected") interval -- **a normal QTc interval is < 440 ms.**

## What is Prolonged QT?

QT prolongation is clinically significant as it is associated with an increased risk of torsades de pointes (TdP), a potentially fatal ventricular arrhythmia.

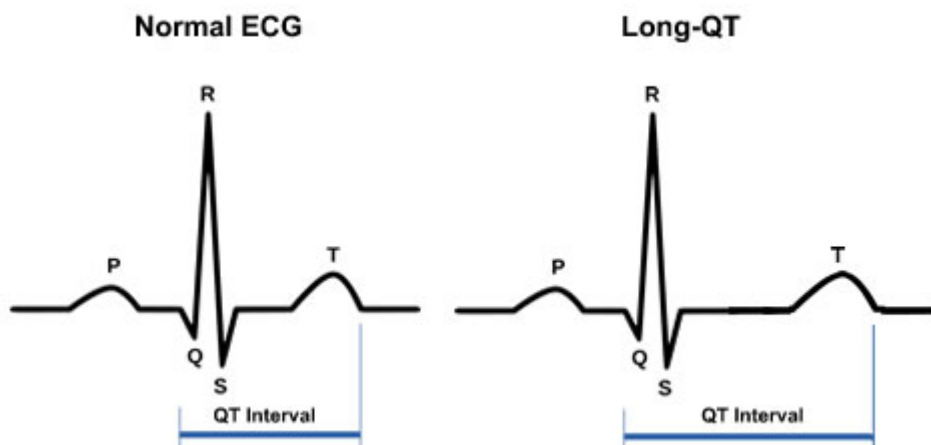
QTc may be

**1. Borderline prolonged >440 ms and <500 ms**

When borderline → Consider reducing the dosage of any QT-prolonging medications or changing to an alternative non QT-prolonging medication.

**2. Prolonged QTc Interval >500 ms**

When prolonged → Stop any medications that prolong the QT interval



## What is a Significant Medication-Induced QTc Prolongation?

- Increase in baseline QTc < 5 ms = Not considered significant
- Increase in baseline QTc > 20 = Concerning
- Increase in baseline QTc > 60 ms = Very concerning
  - With familial long QT syndrome, for every 10 ms increase in QTc, there is a 5% increase in the risk of arrhythmic events.

## Risk factors for QT prolongation

In cases of torsades de pointes, there are often multiple risk factors present, which include the following main risk factors:

- Potentially Modifiable Risk Factors
  - Electrolyte Disturbances (in particular hypokalaemia, hypomagnesemia and more rarely hypocalcemia).
  - Bradycardia
  - Using more than one medication that prolongs the QT interval
- Non-modifiable
  - Congenital long QT syndrome
  - Cardiac disease (e.g. bradycardia, heart failure, left ventricular hypertrophy, myocardial infarction)
  - Impaired hepatic/renal function (due to effects on medication metabolism)
  - Thyroid disease (more common with hypothyroidism and usually normalizes with treatment)
  - Female sex
  - Age > 65-yo

### Clinical Presentation

- May have no symptoms or present with cardiac symptoms

## Red Flags for ECG Screening

In primary care, there are so many medications that may potentially prolong QT, that it is not practical to do an ECG every time such medication is prescribed.

Consider ECG with the following red flags/risk factors

- For children and youth
  - Any young person with unexplained syncope, unexplained seizures or unexplained cardiac events

- (such as cardiac arrest, or sudden death)
- Family history of
  - Unexplained syncope
  - Unexplained seizures
  - Sudden death in young people
- For adults
  - Age >65
  - Female sex
  - Electrolyte imbalances (specifically low serum potassium and magnesium levels)
  - High or toxic serum levels of the suspected medication
  - Preexisting cardiovascular impairment, such as bradycardia (Washington 2012)
  - Taking two or more medications that may cause QT prolongation
  - Myocardial infarction
  - Heart failure
  - Genetic polymorphism
  - History of QT prolongation
  - Brain injury (Abrishamkar, 2012)

If there are red flags or risk factors

- Do baseline ECG prior to starting potentially QT-prolonging medication
- Repeat ECG when the medication reaches a steady state at the target dose.

## Medication-induced QT Prolongation

### Epidemiology

- **Medication-induced QT prolongation is the most common cause of long QT syndrome**

### Pathophysiology

- Due to taking one or more medications that prolong the QT interval
- Mechanisms of medication-induced QT prolongation
  - Pharmacodynamic Interaction: Using more than one medication that prolongs the QT interval increases the risk of torsades de pointes and ventricular arrhythmia.
  - Pharmacokinetic Interaction: Even medications that do not prolong the QT interval themselves can increase the risk of QT prolongation by inhibiting the metabolism of medications that do prolong the QT interval
    - E.g. macrolide antibiotics and antifungals which inhibit the CYP3A4 enzyme.
    - E.g. antidepressants that may inhibit the CYP2D6 enzyme
  - Effects on Electrolytes: Hypokalaemia and hypomagnesemia can increase the risk of QT prolongation
    - E.g. diuretics can interact with QT-prolonging medications by causing hypokalaemia.
    - E.g. long term proton pump inhibitors may cause hypomagnesemia which can increase the risk for QTc prolongation

## Assessment / History including Medication History

HPI

- Any history of cardiac events or symptoms?
- Any history of disordered eating, vomiting or diarrhea that could cause electrolyte disturbance or bradycardia

Medication history	<p>Any psychiatric medications that may prolong QT, which includes (but are not limited to):</p> <p>TCA's such as</p> <ul style="list-style-type: none"> <li>• Amitriptyline</li> <li>• Maprotiline</li> <li>• Desipramine</li> <li>• Nortriptyline</li> </ul> <p>SSRIs such as</p> <ul style="list-style-type: none"> <li>• Citalopram &gt; 40 mg daily (Washington, 2012)</li> <li>• Escitalopram</li> <li>• Fluoxetine</li> <li>• Venlafaxine &gt; 300 mg daily (Washington, 2012)</li> </ul> <p>• Note: <b>All SSRIs</b> at plasma concentration <b>above therapeutic level</b> are associated with QT prolongation</p> <p>First-generation antipsychotics</p> <ul style="list-style-type: none"> <li>• Thioridazine (Mellaril)</li> <li>• Mesoridazine (Serenil)</li> <li>• Chlorpromazine (Thorazine)</li> <li>• Haloperidol (Haldol)</li> </ul> <p>Newer antipsychotics</p> <ul style="list-style-type: none"> <li>• Ziprasidone (Zeldox in Canada / Geodon in USA) (most compared to other newer antipsychotics)</li> <li>• Risperidone (Risperdal)</li> <li>• Olanzapine (Zyprexa)</li> <li>• Quetiapine (Seroquel)</li> </ul> <p>• Note: Aripiprazole may shorten, rather than prolong QTc interval</p> <p>Are there drug interactions that can increase the level of a QT prolonging medication?</p> <p>Any medications that can alter serum electrolytes?</p> <p>What is the dose intensity of the QT prolonging medications?</p>
Past Medical History	<p>Risk factors for drug-induced TdP</p> <ul style="list-style-type: none"> <li>• Any congenital long QT syndrome?</li> <li>• Any previous TdP</li> </ul>

## Diagnosis of Medication-Induced QT Prolongation

Is the following present?

- Presence of QT prolongation, plus
- Presence of QT prolonging medications

If so, then:

- Make a presumptive diagnosis of medication-induced QT prolongation.
- Stop QT prolonging medications

Does the ECG normalize after this step?

- If so, this confirms the diagnosis of medication-induced QT prolongation.

## Differential Diagnosis (DDx) of Medication-Induced QT Prolongation

Other conditions that may also cause QT prolongation are:

- Congenital/familial long QT syndrome
  - Patients with prolonged QT in absence of secondary causes for QT prolongation such as medication-induced (European Society of Cardiology, 2006)
  - Epidemiology

- Rare; about 1 in every 7,000.
- Presentation may be:
  - Asymptomatic with no symptoms suggesting that they have QT prolongation, OR
  - Symptomatic with cardiac symptoms such as
    - Syncope (the most common symptoms), often triggered by exertion or sound; usually the rhythm returns to normal within a minute, and the patient regains consciousness without disorientation.
    - Generalized seizure: When the long QT syndrome dysrhythmia persists longer, it may present with a generalized seizure.
    - Sudden death: In a small minority, the rhythm degenerates further into torsades de pointes and ventricular fibrillation, and unfortunately, some patients will present with sudden death as the first indication of QT prolongation.
  - Triggers include exercise, swimming or emotion, or simply sleeping at night
- Red flags for long QT syndrome
  - Any factors that may indicate a congenital (familial) form of long QT syndrome, such as:
    - Hearing loss deficit?
    - Family history of cardiac arrest and sudden death at early age
- Does long QT persist despite stopping medications causing prolonged QT?
  - If so, then suspect possibility of congenital long QT syndrome
- QT prolongation may also be seen in other conditions such as:
  - Myocardial infarction
  - Cerebral hemorrhage

## Physical Exam

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There are no pathognomonic findings on physical exam to indicate QT prolongation. Nonetheless, physical exam is useful to rule out other potential reasons for arrhythmic and syncopal events in otherwise healthy people such as:

- Heart murmurs caused by hypertrophic cardiomyopathy
- Valve defects

Some patients may show:

- Excessive bradycardia for their age
- Hearing loss (congenital deafness), indicating the possibility of JLN syndrome.
- Skeletal abnormalities, such as short stature and scoliosis are seen in LQT7 (Andersen syndrome)
- Congenital heart diseases, cognitive and behavioral problems, musculoskeletal diseases, and immune dysfunction may be seen in those with LQT8 (Timothy syndrome)

## Investigations

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When there is suspicion, consider the following:

- ECG of the patient and family members
- Serum potassium and magnesium levels
- Thyroid function tests
- Genetic testing of the patient and family members

## Management: Prevention of Medication-Induced QT Prolongation

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<b>Assess modifiable risk factors for QT prolongation</b>	<p>Potentially modifiable risk factors</p> <ul style="list-style-type: none"> <li>• Bradycardia</li> <li>• Hypokalaemia <ul style="list-style-type: none"> <li>◦ Avoid medications that reduce serum potassium</li> <li>◦ Correct potassium deficiency</li> </ul> </li> <li>• Hypomagnesaemia</li> <li>• Avoid medications that reduce magnesium level</li> <li>• Correct magnesium deficiency</li> <li>• Hypocalcaemia</li> <li>• Drugs that induce QT interval prolongation</li> </ul>
<b>Reduce risk factors</b>	<ul style="list-style-type: none"> <li>• Where possible use alternative agents that do not prolong QT interval such as <ul style="list-style-type: none"> <li>◦ Lorazepam (Ativan)</li> <li>◦ Loxapine (Loxapac)</li> <li>◦ Lurasidone (Latuda)</li> <li>◦ Bupropion (Wellbutrin)</li> <li>◦ Vortioxetine (Trintellix)</li> </ul> </li> <li>• If QT interval prolonging medications are required, use lowest effective dose</li> <li>• Correct underlying causes of electrolyte abnormalities or medication-induced bradycardia</li> </ul>
<b>Monitor</b>	<p>Consider ECG:</p> <ul style="list-style-type: none"> <li>• At baseline prior to initiation or dose increase of QT interval prolonging medication</li> <li>• Once QT interval prolonging medication reaches steady state (5 half-lives)</li> <li>• Every month for 6 months, then every 6-12 months thereafter</li> </ul>
<b>Educate the patient</b>	<p>Educate the patient to seek medical help if s/he has any of the following:</p> <ul style="list-style-type: none"> <li>• Palpitations</li> <li>• Lightheadedness</li> <li>• Dizziness</li> <li>• Syncope</li> </ul> <p>Educate the patient to inform any other healthcare professionals if they:</p> <ul style="list-style-type: none"> <li>• Have congenital long QT syndrome</li> <li>• Have a previous history of medication-induced QT prolongation</li> </ul>
<b>When and how to modify therapy</b>	<p>Where a patient has risk factors and is to be prescribed a QT prolonging medication, consider</p> <ul style="list-style-type: none"> <li>• Changing to an alternative medication that is not known to prolong the QT interval if possible</li> </ul> <p>If baseline ECG shows QTc of 480 ms</p> <ul style="list-style-type: none"> <li>• Consider an alternative medication that does not cause QT prolongation</li> <li>• Correct electrolyte imbalances</li> </ul> <p>If follow-up ECG shows QTc <math>\geq 500</math> ms and/or absolute increase in QTc <math>\geq 60</math> ms</p> <ul style="list-style-type: none"> <li>• Discontinue QT prolonging medication</li> <li>• Correct electrolyte imbalances</li> <li>• Refer to cardiologist</li> </ul>

Reference: Trinkley, 2013; National Medicines Information Centre, 2015; NHS Greater Glasgow and Clyde Medicines Information Service, 2012

## When to Refer

- Emergency Department assessment
  - Refer for assessment in the Emergency Department if patients have risk factors for QT prolongation

- and experience a cardiac event (e.g. syncope, cardiac arrest)
- If a patient has taken an overdose of a QT-prolonging medication (such as an SSRI), consider close cardiac monitoring post-overdose
- Cardiology
  - Should long QT persist despite cessation of offending medications, then consider referring to cardiology to consider other causes (such as familial long QT syndrome)
  - Consider referring pediatric patients with high risk for QTc prolongation to cardiology prior to initiating any psychotropic meds with a known side effects of QTc

## Case, Part 2

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Jan is a middle-aged female in your practice. Several years ago, she had been diagnosed with anxiety and treated with Citalopram, which she continues to take. A few months ago, the dosage was raised to 40 mg daily. She now presents to you with fainting spells and chest pains. What are you going to do?  
ECG shows QTc prolongation. You taper her Citalopram down to 10 mg daily, and you recommend counselling/therapy to ensure that he has non-medication strategies for her anxiety.

A repeat ECG shows no further QTc prolongation, thus confirming that her Citalopram may have been the cause of her QTc prolongation.

## Patient Handouts

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Acquired Long QT Syndrome

<http://www.nhs.uk/conditions/long-qt-syndrome/documents/acquired-lqt-brochure06.pdf>

## Primary Care Reviews

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Grindrod K, Nagge J: Simplifying QT prolongation for busy clinicians, Canadian Family Physician April 2019, 65(4) 268-270. Retrieved Apr 20, 2019 from <http://www.cfp.ca/content/65/4/268>

## Practice Guidelines

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ACC/AHA/ESC 2006 Guidelines for Management of Patients With Ventricular Arrhythmias and the Prevention of Sudden Cardiac Death: a report of the American College of Cardiology/American Heart Association Task Force and the European Society of Cardiology Committee for Practice Guidelines. Retrieved Dec 29, 2016 from <http://reference.medscape.com/medline/abstract/16935995>

The Task Force for the Management of Patients with Ventricular Arrhythmias and the Prevention of Sudden Cardiac Death of the European Society of Cardiology (ESC), 2015 ESC guidelines for the management of patients with ventricular arrhythmias and the prevention of sudden cardiac death, European Heart Journal 2015;36(41):2793-2867

References

Abrishamkar S, Abbasi Fard S, Momeni A: QT Interval Changes in Moderate and Severe Brain Injuries, Neurosurgery Quarterly 2012 May; 22(2): 123-125.

NHS Greater Glasgow and Clyde Medicines Information Service: medication-induced QT Prolongation, PostScriptExtra, Issue 21, Dec 2012. Retrieved Dec 29, 2016 from [http://www.ggcprescribing.org.uk/media/home/ementalhealth/ementalhealth.ca/frontend/uploads/ps\\_extra/pse\\_21.pdf](http://www.ggcprescribing.org.uk/media/home/ementalhealth/ementalhealth.ca/frontend/uploads/ps_extra/pse_21.pdf)

Trinkley K et al, QT interval prolongation and the risk of torsades de pointes: Essentials for clinicians, Current Medical Research and Opinion 2013;29(12):1719- 1726

The Task Force for the Management of Patients with Ventricular Arrhythmias and the Prevention of Sudden Cardiac Death of the European Society of Cardiology (ESC), 2015 ESC guidelines for the management of patients with ventricular arrhythmias and the prevention of sudden cardiac death, *European Heart Journal* 2015;36(41):2793-2867

St. James's Hospital, medication-induced QT Interval Prolongation, *National Medicines Information Centre* (www.nmic.ie), Vol 21 Number 6, 2015. Retrieved Dec 29, 2016 from [http://www.stjames.ie/GPsHealthcareProfessionals/Newsletters/NMICBulletins/NMICBulletins2015/NMIC%20Bulletin%20February%202016%20-%20Drug-Induced%20QT%20Interval%20Prolongation%20\(3\).pdf](http://www.stjames.ie/GPsHealthcareProfessionals/Newsletters/NMICBulletins/NMICBulletins2015/NMIC%20Bulletin%20February%202016%20-%20Drug-Induced%20QT%20Interval%20Prolongation%20(3).pdf)

Washington N: Which psychotropics carry the greatest risk of QTc prolongation, *Current Psychiatry*. 2012 October; 11(10): 36-39. Retrieved Dec 13, 2016 from <http://www.mdedge.com/currentpsychiatry/article/64870/anxiety-disorders/which-psychotropics-carry-greatest-risk-qtc>

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## Recommended Websites

### Credible Meds

Up-to-date listings of medications that affect QT, including a downloadable app.

<http://crediblemeds.org>

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## About this Document

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## Disclosures

The authors report no financial relationship with any company whose products are mentioned in this article or with manufacturers of competing products.

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