Dana-Farber Cancer Institute

QTc Monitoring Tip Sheet

Based on a presentation given on October 16, 2024 by Anju Nohria, MD, MSc

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QT Interval Prolongation in Cancer Care

The QT interval is a measure of the duration of ventricular repolarization, which approximates the time between the initiation of depolarization and the end of repolarization. Many different anti-cancer agents and supportive medications can cause prolongation of the QT interval, which can lead to potentially fatal arrythmias like torsades de pointes. Thus, QT interval monitoring is an essential component of care for many cancer patients. The QT interval changes with heart rate, therefore measurements of the QT interval on ECG must be corrected for heart rate (QTc).[1-4]

Formulas for QTc Monitoring

Historically, five different formulas have been used for this purpose: the Bazett, Fridericia, Framingham, Hodges, and Rautaharju formulas, as shown below.[1]

- Bazett: $QTcB = QT/RR^{1/2}$
- Fridericia: $QTcFri = QT/RR^{1/3}$
- Framingham: $QTcFra = QT + 0.154\ (1 - RR)$
- Hodges: $QTcH = QT + 0.00175\ ([60/RR] - 60)$
- Rautaharju: $QTcR = QT - 0.185\ (RR - 1) + k$ (k = + 0.006 seconds for men and + 0 seconds for women)

This free online tool calculates QTc using any of the five formulas: https://www.mayoclinic.org/medical-professionals/cardiovascular-diseases/calculators/corrected-qt-interval-qtc-calculator/itt-20487211

Prior studies have demonstrated that the Framingham and Fridericia formulas provide the best rate correction in cancer patients.[1,3] The FDA recommends using the Fridericia formula in cancer patients. When calculating QTc it is important to remember the upper limit of normal cutoffs for different ages and sexes, as included below in **TABLE 1**.

TABLE 1. QTc Upper Limit of Normal

Population	QTc Interval
Prepubertal Children	460 milliseconds
Adult Males	470 milliseconds
Adult Females	480 milliseconds

Adapted from presentation by Anju Nohria, MD, MSc

Which Patients Need Cardiac Monitoring?

Patients who are scheduled to receive a potentially cardiotoxic agent should undergo baseline (pre-treatment) ECG screening. Periodic cardiac monitoring is recommended for patients receiving potentially cardiotoxic therapies (**FIGURE 1**).[2]

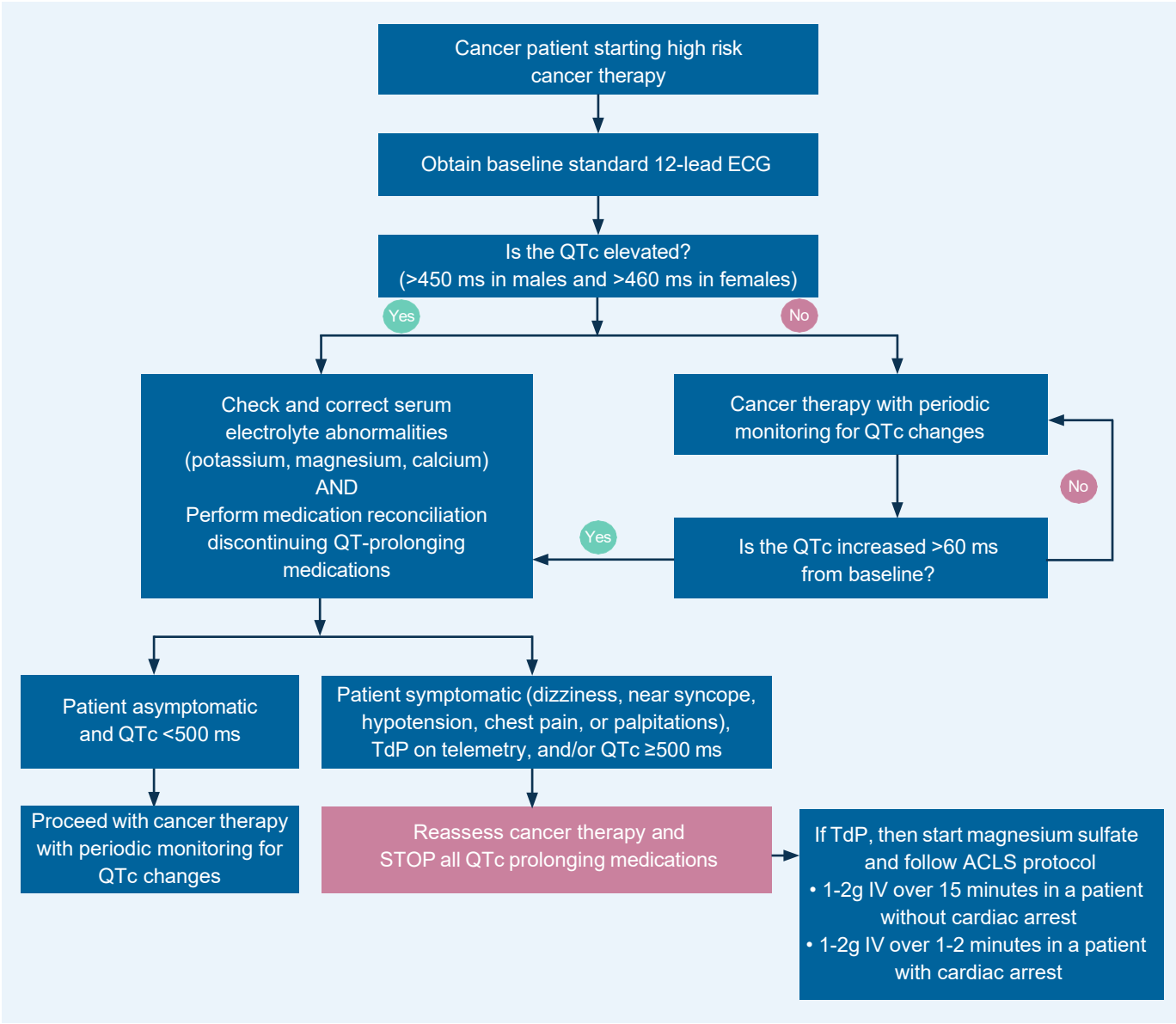

FIGURE 1. Flowchart for monitoring and treating QTc prolongation in cancer patients. Reprinted without changes from Kim et al. 2021[2] under the Creative Commons CC-BY-NC-ND license (https://creativecommons.org/licenses/by-nc-nd/4.0/)

Abbreviations: QTc, QT interval corrected for heart rate; ACLS, advanced cardiovascular life support; ACG, electrocardiogram; IV, intravenous; TdP, torsades de pointes; ms, milliseconds

Treatment of Cardiac Complications

Prompt recognition and treatment of rare, but potentially fatal arrythmias such as torsades de pointes is essential. Treatment guidelines are included in **TABLE 2**.

TABLE 2. Treatment of Torsades de Pointes

Patient Status	Treatment
Hemodynamically Stable	Single Episode: • IV magnesium (2-gram bolus) • Correction of electrolyte abnormalities • Removal of QT-prolonging medications Multiple self-terminating episodes: • IV magnesium (2-gram bolus) • Temporary transvenous overdrive atrial pacing (100-140 bpm) and/or IV isoproterenol infusion (initially 2 microgram/minute, titrated to 100 bpm)
Hemodynamically Unstable	Electrical cardioversion IV magnesium (2-gram bolus)
Pulseless	Defibrillation as per European Resuscitation Council guidelines (consider lidocaine over amiodarone) IV magnesium (2-gram bolus)

Adapted from presentation by Anju Nohria, MD, MSc
Abbreviations: IV, intravenous; bmp, beats per minute

REFERENCES

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3. Richardson DR, Parish PC, Tan X, et al. Association of QTc Formula With the Clinical Management of Patients With Cancer. JAMA Oncol 2022;8(11):1616-1623. DOI: 10.1001/jamaoncol.2022.4194.
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