**QTc Pearls for Initiation and Monitoring of AAD**

Durham VA EP
Last updated 11/2025

The AHA scientific statement on ECG monitoring in hospital settings emphasizes that all clinicians responsible for QTc monitoring must share a consistent method and procedure, which should explicitly define: measurement equipment, lead selection criteria, method to identify QRS onset and T-wave offset, QT correction formula, frequency of measurement, and documentation procedure.

1. **Lead Selection**
   - Choose a lead with T-wave amplitude of at least 2 mm and a well-defined T-wave end
   - Lead II shows the best correlation between AF and sinus rhythm QTc across most correction formulae
   - Use the same lead for the same patient over time and document it

2. **QT Measurement Technique**
   - Manual measurement remains essential
   - Measure from onset of QRS to end of T wave
   - For difficult T-wave endpoints: draw a tangent from the T-wave peak along the steepest downslope; the intersection with the isoelectric baseline defines the T-wave end
   - Do not include discrete U waves (those occurring after the T wave returns to baseline)

3. **QT Correction for Heart Rate - Formula Selection**
   - Bazett ($QT/\sqrt{RR}$): most widely used but overestimates QTc at heart rates above 100 bpm; produces the most variable serial measurements
   - Fridericia ($QT/RR^{(1/3)}$): superior rate correction and better prediction of 30-day mortality; recommended across cardiology, cardio-oncology, and regulatory (ICH E14) settings
   - Framingham ($QT + 154 \times (1 - RR)$): also performs well as an alternative
   - Note  Bazett available for reference since most drug label thresholds (including dofetilide) were developed using Bazett
   - Document which formula is used: **www.mdcalc.com/calc/48/corrected-qt-interval-qtc**

4. **QTc Measurement in Atrial Fibrillation**
   - Bazett significantly overestimates QTc during AF (approximately 19 ms overestimation in one dofetilide study, leading to unnecessary dose reductions in 33% of patients)
   - Fridericia most closely approximates AF QTc to sinus rhythm QTc; Framingham also performs well
   - Average QT over at least 5 beats (options: average QTc from longest and shortest RR intervals, or average 10 consecutive beat-by-beat QTc values)
   - Quick screen: if R-wave to T-wave peak interval exceeds 50% of the RR interval on a long rhythm strip, QTc is likely above 500 ms
   - Protocol recommendation: use Fridericia with a multi-beat average (at least 5 beats) from a consistent lead; document the method

5. **QRS Width Considerations - JT Interval vs. Modified QT**

When QRS is prolonged (bundle branch block, ventricular pacing, or AAD-induced widening), the QT is prolonged by the conduction delay itself, not necessarily by repolarization changes. Two approaches are endorsed:

- Subtract the excess QRS duration: Modified QT = QT − (QRS wide − QRS baseline). This requires a baseline narrow QRS for comparison.
- Use the JT interval: JT = QT − QRS. This eliminates the QRS entirely. Normal JT standards should be applied (JTc prolongation threshold is generally approximately 330–340 ms for men, 340–350 ms for women, though these are less well-validated than QTc thresholds).
- Bogossian formula (for BBB): QT corrected = QRS/2 + JT. When combined with the Hodges formula for heart rate correction, this showed the most accurate QTc estimation in bifascicular block.

Protocol recommendation: For QRS greater than 120 ms, use either the JT interval or the Bogossian formula, and apply this consistently for that patient over time. The dofetilide label uses a threshold of QTc greater than 550 ms (rather than 500 ms) in patients with ventricular conduction abnormalities.

6. **Drug-Specific Monitoring Protocols**

**Dofetilide**

- Initiation setting: At least 3-day inpatient with continuous telemetry
- QTc monitoring during load: 12-lead ECG 2–3 hours after each dose (doses 1–5)
- Ongoing monitoring: 12-lead ECG plus K/Mg/Cr every 3–6 months
- Key thresholds: Dose reduce if QTc increases more than 15% or exceeds 500 ms (550 ms if wide QRS); discontinue if QTc remains above 500 ms after dose 2

**Sotalol**

- Initiation setting: At least 3-day inpatient (or IV loading protocol)
- QTc monitoring during load: 12-lead ECG 2–4 hours after each dose during initiation/titration
- Ongoing monitoring: 12-lead ECG plus K/Mg/Cr every 3–6 months
- Key thresholds: Discontinue or reduce if QTc reaches or exceeds 500 ms

**Ibutilide**

- Initiation setting: Inpatient with continuous telemetry
- QTc monitoring during load: Continuous monitoring at least 4 hours post-infusion or until QTc returns to baseline
- Ongoing monitoring: N/A (single-use IV)
- Key thresholds: Correct K/Mg before infusion; watch for TdP

**Procainamide**

- Initiation setting: Inpatient with continuous telemetry
- QTc monitoring during load: Continuous ECG monitoring of rhythm, QRS width, and QTc during infusion plus BP monitoring
- Ongoing monitoring: Per clinical context
- Key thresholds: Monitor QRS widening (stop if greater than 50% increase) and QTc

7. **Risk Stratification**
   The Tisdale Risk Score can be used to identify hospitalized patients at highest risk for drug-induced QTc prolongation. Variables include age 68 or older, female sex, loop diuretic use, K+ 3.5 or below, admission QTc 450 ms or above, acute MI, sepsis, heart failure, and number of QTc-prolonging drugs. Scores of 11 or above indicate high risk, with 46% of high-risk patients developing QTc prolongation in one study. This can be integrated into clinical decision support to trigger enhanced monitoring.

8. **Action Thresholds and Notification Criteria**
   - QTc above 500 ms (or above 550 ms with ventricular conduction abnormalities): highest risk for TdP - hold/discontinue offending drug, correct electrolytes, obtain 12-lead ECG
   - QTc increase of 60 ms or more from baseline: significant prolongation warranting drug review
   - QTc increase of 25% or more from baseline during Class III AAD loading: notify prescriber
   - Maintain K+ above 4.0 mEq/L and Mg2+ above 2.0 mg/dL throughout AAD therapy

**Summary Protocol Elements for Standardization**

1. Designate a consistent lead per patient (prefer Lead II; document it)
2. Adopt Fridericia as the institutional default correction formula
3. In AF, average at least 5 beats; use Fridericia (not Bazett)
4. For wide QRS (above 120 ms), use JT interval or Bogossian formula; apply the dofetilide 550 ms threshold
5. Obtain 12-lead ECG 2–3 hours after each dose during inpatient loading
6. Document the lead, formula, rhythm, QRS width, and method at each measurement
7. Establish clear notification thresholds (QTc above 500 ms, change of 60 ms or more, or 15% or more increase for dofetilide)

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