Cardiac Monitoring and QTc Assessment Guidelines  
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Many of the treatments used for COVID-19 patients have QTc-prolonging potential – these treatments include hydroxychloroquine (Plaquenil) or chloroquine, azithromycin (Zithromax), and lopinavir/ritonavir (Kaletra). When used in combination, or with any other known QTc prolonging agents (e.g. amiodarone, sotalol, haloperidol, etc.), these agents can have additive QTc-prolonging effects and therefore, increased associated risk of arrhythmic death.

A risk score for drug-associated QTc prolongation has been derived and validated by Tisdale and colleagues for prediction of drug-associated QT prolongation among cardiac care unit-hospitalized patients (Table 1). A Tisdale score of ≤ 6 predicts low risk, 7-10 medium risk, and ≥ 11 high risk of drug-associated QT prolongation (Table 2).

**Table 1. Risk Score For Drug-Associated QTc Prolongation**

<table>
<thead>
<tr>
<th>Risk Factors</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age ≥68 y</td>
<td>1</td>
</tr>
<tr>
<td>Female sex</td>
<td>1</td>
</tr>
<tr>
<td>Loop diuretic</td>
<td>1</td>
</tr>
<tr>
<td>Serum K⁺ ≤3.5 mEq/L</td>
<td>2</td>
</tr>
<tr>
<td>Admission QTc ≥450 ms</td>
<td>2</td>
</tr>
<tr>
<td>Acute MI</td>
<td>2</td>
</tr>
<tr>
<td>≥2 QTc-prolonging drugs</td>
<td>3</td>
</tr>
<tr>
<td>sepsis</td>
<td>3</td>
</tr>
<tr>
<td>Heart failure</td>
<td>3</td>
</tr>
<tr>
<td>One QTc-prolonging drug</td>
<td>3</td>
</tr>
<tr>
<td>Maximum Risk Score</td>
<td>21</td>
</tr>
<tr>
<td>K⁺ indicates potassium; and MI, myocardial infarction.</td>
<td></td>
</tr>
</tbody>
</table>

A Tisdale score of ≤ 6 predicts low risk, 7-10 medium risk, and ≥ 11 high risk of drug-associated QT prolongation (Table 2).

**Table 2. Risk Levels For Drug-Associated QT Prolongation**

<table>
<thead>
<tr>
<th>Risk Level</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low risk</td>
<td>≤6</td>
</tr>
<tr>
<td>Moderate risk</td>
<td>7-10</td>
</tr>
<tr>
<td>High-risk</td>
<td>≥11</td>
</tr>
</tbody>
</table>

**Suggested Monitoring for Inpatient Clinical Use**

Patients admitted with COVID-19 are likely to have longer baseline QTc and have higher potential arrhythmic risks as a result of the metabolic and physiologic sequelae of their illness, and a typically greater burden of comorbid disease. However, given the severity of illness, hospitalized and critically ill patients may also derive the most benefit from potentially effective therapies. The goal of QTc screening in this setting is not to identify patients whom are not candidates for therapy, but to identify those who are at increased risk for torsades de pointes so aggressive countermeasures may be implemented.

- **EKG/Telemetry:**
  - To minimize healthcare associate exposure and PPE usage:
    - EKGs can be done by either the ECG technician (if available) or the bedside nurse during the normal course of patient care. ECGs may be performed to coincide with "clustered" care between 2 and 4 hours after dosing.
To further reduce exposure or save PPE resources, QTc monitoring may be performed using surrogates for 12-lead ECG assessment, including QTc monitoring via inpatient telemetry.

Standard protocol will be followed to decontaminate EKG equipment following their use in COVID+ patients (i.e., same protocol used in patients positive for MRSA or C. difficile).

- **Indications for Telemetry:**
  - Elevation in biomarkers of cardiac injury (TNI > 0.03)
  - ICU Status and institutional standard indications for telemetry monitoring

- **General Principles for Initiating Patients on Hydroxychloroquine (with or without Azithromycin):**
  - Given the growing evidence of myocarditis and arrhythmias with COVID, hydroxychloroquine should be used with caution in this group of patients. Both hydroxychloroquine and azithromycin are known QT prolonging drugs – when given in combination, QT prolongation risk is higher.
  - **BEFORE Initiating COVID-19 Treatments (e.g. hydroxychloroquine/chloroquine, azithromycin, etc.):**
    - Discontinue and avoid all other non-critical QT-prolonging agents (a complete list of QT prolonging agents is available at: [https://www.crediblemeds.org/](https://www.crediblemeds.org/))
    - Assess baseline ECG, renal function, hepatic function, serum potassium and magnesium levels.
    - Assess baseline risk of QT prolongation using the Tisdale Risk Score (seen above or online at [https://www.mdcalc.com/tisdale-risk-score-qt-prolongation](https://www.mdcalc.com/tisdale-risk-score-qt-prolongation))
    - When possible, have an experienced cardiologist/electrophysiologist measure QTc, and seek pharmacist input in the setting of acute renal or hepatic failure.

- **Relative Contraindications (consider consulting Cardiology):**
  - History of long QT syndrome
  - Baseline QTc > 500 msec (or > 550 msec in patient with QRS > 120 msec)
  - Tisdale score ≥ 11 points
  - The flow chart below provides recommendations for evaluation of QTc at baseline as well as follow-up monitoring

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**Check baseline EKG**

- **QRS ≤ 120**
  - **QTc > 500** (Tisdale ≥ 11)
    - Consult Cardiology
  - **QTc 470-500** (Tisdale 7-10)
    - Start, but use caution
  - **QTc < 470** (Tisdale ≤ 6)
    - Start

- **QRS > 120**
  - **QTc > 550** (Tisdale ≥ 11)
    - Consult Cardiology
  - **QTc 520-550** (Tisdale 7-10)
    - Start, but use caution
  - **QTc < 520** (Tisdale ≤ 6)
    - Start

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### Check QTc 2-4 hours after 2nd dose

- **If on Tele:** Check QTc daily
- **If NOT on Tele:**
  - If QTc #2 was optimal – Get pre-discharge EKG
  - If QTc #2 was NOT optimal – Get daily EKGs

### If QTc increases by > 60 msec OR if absolute QTc > 500 msec, Consult Cardiology

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### Any evidence of Torsades on Telemetry – Discontinue Hydroxychloroquine regardless of QT interval
- **Ongoing Monitoring, Regimen Adjustment and Drug Discontinuation**
  - Monitor and optimize serum potassium and magnesium daily
  - Review active medication list and discontinue and avoid all other non-critical QT-prolonging agents (a complete list of QT prolonging agents is available at: [https://www.crediblemeds.org/](https://www.crediblemeds.org/))
  - Monitor QTc interval (QT correction can be calculated at [https://www.qtccalculator.org/](https://www.qtccalculator.org/) or [https://www.mdcalc.com/corrected-qt-interval-qtc](https://www.mdcalc.com/corrected-qt-interval-qtc))
  - **Acquire an ECG 2-4 hours after the second dose of hydroxychloroquine**
    - **What is optimal?** – QTc increase is < 60 msec from baseline AND absolute QTc < 500msec (< 550 msec if QRS >120 msec)
    - **What is NOT optimal?** – QTc increase is > 60 msec from baseline OR absolute QTc > 500 msec (or > 550msec if QRS >120 msec)
      - Consider Cardiology Consult
      - EKG/ Tele monitoring recommended daily
      - Discontinue azithromycin (if used) – if on hydroxychloroquine monotherapy, assess risk vs. benefit for continuation of therapy
  - **If on Tele - QTc should be checked daily and documented in the chart**
  - **If not on Tele AND:**
    - **QTc #2 is < 500 msec (or < 550 msec if QRS > 120) and/or increase < 60 msec from baseline**
      - Get pre-discharge EKG
    - **QTc#2 is > 500 msec (550 if QRS>120) (or increase > 60 msec from baseline)** – Get Daily EKG for QT check
      - If QTc remains increased > 60 msec and/or absolute QTc > 500 msec (or > 550 msec if QRS > 120 msec), reevaluate the risk/benefit of ongoing therapy, consider consultation with a cardiologist or EP, and consider discontinuation of hydroxychloroquine

**References:**