

Author: Lindsay Schroeder, MD

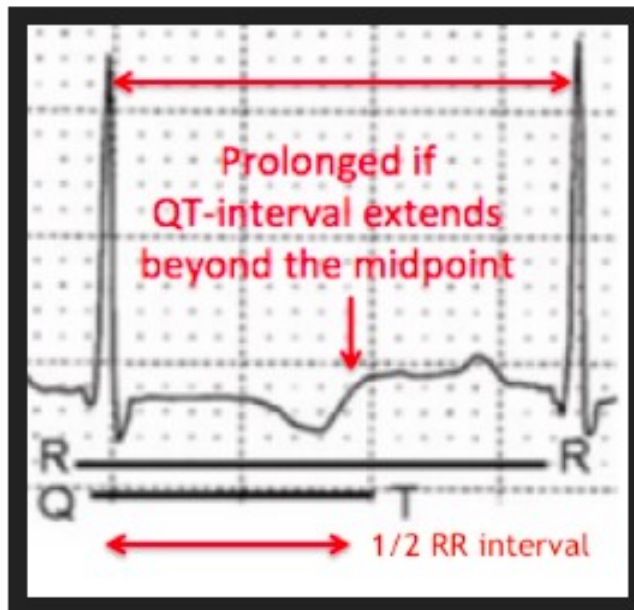
Some 170 drugs are known to prolong QT interval (<https://www.crediblemeds.org/everyone/composite-list-all-qtdrugs/>), 42 of which are known to cause torsades (TDP). Primarily, they do so by inhibiting the repolarizing potassium current (I_{Kr}) necessary for ventricular repolarization or indirectly by inhibiting metabolism through cytochrome P450 3A4. These drugs can act singly to prolong QT or in drug-drug interactions. For example: the nauseated patient with a fever and history of depression – Zofran + Tylenol + escitalopram. Another example: the agitated patient who also has atrial fibrillation and HTN – Haldol + amiodarone + HCTZ. Then, if any of these patients need antibiotics, fluoroquinolones, azithromycin, metronidazole, and bactrim further prolong QT. Combine this with the **risk factors for drug-induced TDP** (namely females, hypokalemia, hypomagnesemia, bradycardia, structural heart disease, reduced drug elimination, digitalis therapy, use of other QT prolonging medications, ion channelopathies, and baseline QTP/congenital long QT syndrome) and you have created a recipe for potential badness. The risk of TDP, and thereby sudden death, goes up with **QTc of >500 msec**. (Remember, normal at **<440 msec in men and <460 msec in women**, and QTc corrects for a HR of 60 so intervals can be compared over time regardless of HR. An image for estimating QT via Amal Mattu is shown below).

In a study by Pickham et al, all patients in a 154-bed ICU at Stanford had continuous QT monitoring with the median values reported every 5 minutes. For the patients with QTc of >500ms sustained for at least 15 minutes, the **length of stay was over twice as long with nearly 3 times the odds ratio for in-hospital mortality** (N = 726, p = 0.0005). There were a total of 41 deaths and proportionally more of these patients had QTP, but only one patient had TDP.

In a study by Haugaa et al, Mayo Clinic retrospectively examined 86,107 EKGs from 52,579 patients over 7 months in all areas of the hospital with an alert for QTc >500 msec. “During the study period, **all-cause mortality** for the 470 patients with ECG isolated QTc of at least 500 msec was 19% (n = 87) and was increased markedly compared with 5% mortality in the 51,434 patients with QTc less than 500 msec (log-rank P < .001) despite being significantly younger (mean ± SD age = 55 ± 24 vs 61 ± 17 years; P < .001; data not shown).” This increased mortality in the QTP group was seen consistently through 6 and 12 months. Furthermore, the study created a pro-QTc score whereby 1 point was given for “female sex, QT-affecting clinical diagnoses and conditions, QT-prolonging electrolyte disturbances, and QT-prolonging medication(s) present on the Arizona CredibleMeds QT drug list.” Patients with a pro-QTc score of 4 or greater predicted mortality with a hazard ratio of 1.72 (P = .02), and the more risk factors patients have, the higher the risk of death (ie, hazard ratio of 1.17 per pro-QTc point; P = .008). The cause of death was determined for 89% of the patients that died, and 7/18 cardiac deaths were sudden. The paper makes no mention of the frequency of TDP but does question whether “drug-induced torsadogenic environments” accelerated non-cardiac causes of mortality.

The above studies are limited for our purposes by study populations outside of the ED. Intuitively, hospitalized and particularly ICU patients may be on more drugs and have more risk factors for QTP/TDP. Thus there are two take-home points if the QTP >500 msec is an incidental finding in the ED. 1.) **Be mindful of which drugs you are giving.** 2.) While TDP seems to be an infrequent event, on the whole **QTc >500 msec is an indicator of increased all-cause mortality at least within the next 12 months.** (Much like the “peri-death” associated with baseline troponin elevation.)

QUICK ESTIMATION OF QT INTERVAL



waves should typically end before the midpoint of the R-R interval. Beware of a prolonged QT-interval when the T-wave ends after the midpoint of the R-R interval (half way between the R-waves).

<http://e kgumem.tumblr.com/search/prolonged+qtc>

<http://e kgumem.tumblr.com/search/prolonged+qtc>

Resources:

- D. Pickham, E. Helfenbein, J.A. Shinn, et al. High prevalence of corrected QT interval prolongation in acutely ill patients is associated with mortality: results of the QT in Practice (QTIP) Study. *Crit Care Med*, 40 (2) (2012), pp. 394–399

- K.H. Haugaa, J.M. Bos, R.F. Tarrell, et al. Institution of wide QT alert system identifies patients with high risk of mortality. *Mayo Clin Proc*, 88 (4) (2013), pp. 315–325

- www.crediblemeds.org