abnormal, and manual verification is recommended. In this clinical practice update we provide practical tips about measurement of the QT interval, diagnosis, and management of congenital long QT syndrome and acquired prolongation of the QT interval. For congenital long QT syndrome, certain β-adrenergic-blocking drugs are highly effective, and implantable defibrillators are infrequently required. Many commonly prescribed drugs such as antidepressants and antibiotics can prolong the QT interval, and recommendations are provided on their safe use.

inexacte, surtout lorsque l'électrocardiogramme de référence est anormal; une vérification manuelle est donc recommandée. Dans cette mise à jour de pratique clinique, nous proposons des conseils pratiques pour mesurer l'intervalle QT, pour poser un diagnostic de syndrome du QT long congénital ou d'allongement acquis de l'intervalle QT et pour prendre en charge ces affections. Dans le cas du syndrome du QT long congénital, certains médicaments bêta-bloquants adrénergiques sont très efficaces, et les défibrillateurs internes sont rarement nécessaires. De nombreux médicaments couramment prescrits, comme les antidépresseurs et les antibiotiques, peuvent allonger l'intervalle QT; nous émettons donc des recommandations sur leur utilisation sécuritaire.

Method

This Clinical Practice Update is a consensus document that provides practical information for the general clinician. It is not meant to replace existing literature reviews and evidence-based recommendations about LQTS intended for a subspecialist audience, such as those published by the Canadian Cardiovascular Society (CCS)/Canadian Heart Rhythm Society,[1] the American College of Cardiology/American Heart Association/Heart Rhythm Society,[2] and the European Society of Cardiology.[3] This document emphasizes important diagnostic and therapeutic features of managing patients with a prolonged QT interval. It was prepared by a panel composed of cardiologists (general and subspecialty electrophysiologists) and internists with expertise in pharmacology, as well as consultants experienced in education and preparation of guideline documents. Representatives of the CCS (R.A.D., V.B.L., M.S.G., J.J., A.D.K., M.S.M., J.D.R., T.M.R., S.S., C.S., and C.M.), Canadian Heart Rhythm Society (V.B.L., M.S.G., J.J., A.D.K., J.D.R., T.M.R., S.S., C.S., and C.M.), the Canadian Society of Internal Medicine (D.N.J.), and the Canadian Pediatric Cardiology Association (S.S.) formed the primary writing panel. The primary panel wrote the report, followed by review and approval by the CCS Guidelines Committee.

Physiology and Measurement of the QT Interval

What is the QT interval?

The QT interval on the electrocardiogram (ECG) represents the time from the onset of ventricular depolarization to the end of repolarization, thereby reflecting the duration of the ventricular action potential (Fig. 1).[4] At the cellular level, the myocardial action potential is characterized by sequential orchestration of different ion channels. Physiological influences on the QT interval include heart rate, age, sex, circulating catecholamines, and autonomic tone. Variations of the latter are also responsible for the normal diurnal fluctuations of the QT interval.[5]

Measurement of the QT interval

Because automated measurement of the QT interval is universal and easy to use, the question is when manual measurement should be used instead. Computerized measurements of the absolute QT interval and the QT interval corrected for heart rate (QTc) can be inaccurate, especially with baseline artifact, a rapid or irregular rhythm, a widened QRS, or an abnormal ST-T wave configuration.

The American Heart Association Electrocardiography and Arrhythmias Committee Council on Clinical Cardiology, the American College of Cardiology Foundation, and the Heart Rhythm Society made recommendations for the standardization and interpretation of the ECG, including the ST segment, T and U waves, and the QT interval.[6] The QT interval extends from the onset of the QRS complex to the end of the T wave. As explained below in the section on measurement of the QT interval, the QT interval is not actually measured to the end of the T wave but rather to the tangent intersection of the T wave with the baseline. Problems with measuring the QT interval include identifying the onset of the QRS (for example, in preexcitation) and the end of the T wave, selecting the best lead to measure the QT interval, and correcting for differences in rate, QRS duration, sex, and time of day. Current ECG machines use automated digital technology to record all leads simultaneously. The onset of the QRS and the end of the T wave appear different in various ECG leads. Consequently, automatically measured QT intervals are often longer than the QT interval measured in an individual lead. The most common formula to adjust the QT interval for heart rate is Bazett's formula, but this can be inaccurate with increased R-R variability as seen with sinus arrhythmia and atrial fibrillation. In this situation, it is important to use a representative R-R interval rather than the longest QT interval and shortest R-R interval, because this will lead to overestimation of the QTc.

The computer-measured QT interval might be inaccurate when it cannot differentiate the end of the T wave from the start of the TP segment. Also, because the QT interval includes the QRS complex, an adjustment needs to be made when the QRS is widened. The computer does not adjust normal limits for the QT interval on the basis of sex, being longer for young and middle-aged women. Neither automatic nor manual measurements of the QT interval account for diurnal variation or when no QT prolongation is present in a patient with cLQTS (concealed phenotype). The automatically measured QT interval can also vary depending on the ECG device and algorithms used; therefore, serial automated measurements of the QT interval should be performed using the same machine and in a quiet environment with the patient at rest. Consumer products such as smart watches or phones