QT Module

A tool for Long QT Syndrome analysis

Introduction

Recently, a lot of attention has been given to the so-called "sudden cardiac death." This is an event that often happens to children and young adults, typically sportsmen. In many cases the disease that is responsible for this sudden death is the so-called "Long QT syndrome" (LQTS). People suffering from this syndrome may suddenly die, although their relatives or neighbors consider them to be perfectly healthy. It has been proved that the appearance of the syndrome is mostly associated with a prolonged QT interval on the ECG waveform. Thus, in order to precisely determine the LQTS, the physician needs a high-quality tool for QT interval measurement. BTL can provide such a tool and we call it the QT module which is implemented within the BTL CardioPoint-ECG and the BTL CardioPoint-Ergo software.

What is the long QT Syndrome?

The Long QT syndrome (LQTS) is a special heart rhythm disorder that may trigger dangerous ventricular arrhythmias leading to sudden seizures, fainting or even death. The patients suffering from this syndrome are always born with it; certain medicines may also make the syndrome even more conspicuous. LQTS is pretty subtle, it may occur in people who seem very healthy even without any clear signs or symptoms. If there are any symptoms, then fainting and arrhythmia appearance during physical activity or emotional excitement or after use of medication are the most common ones.

The most at-risk groups of people that may suffer from LQTS are children and young adults. Family relatives with known LQTS, increases the risk of LQTS as well. Usually those people have to change their lifestyle to prevent future complications. Typically, they should avoid physically-demanding competitive sports, surprise or shock and possibly change their medications. There are also medications (called beta-blockers) that can be used to treat LQTS and sometimes ICD (implantable cardioverter-defibrillator) implantation or surgery (left cardiac sympathetic denervation surgery) can be recommended too.

The most common characteristics of LQTS are a prolonged QT (QTc) interval on the ECG waveform. The prolonged QT itself does not cause any damage, yet it may develop into a ventricular arrhythmia (torsade de pointes or ventricular fibrillation) that endangers the patient's life. Such development occurs only during physical activity or emotional stress. The resting ECG, stress-test (exercise) ECG and sometimes even Holter ECG examinations should be carried out to measure the QT interval and its corrected form – the QTc.
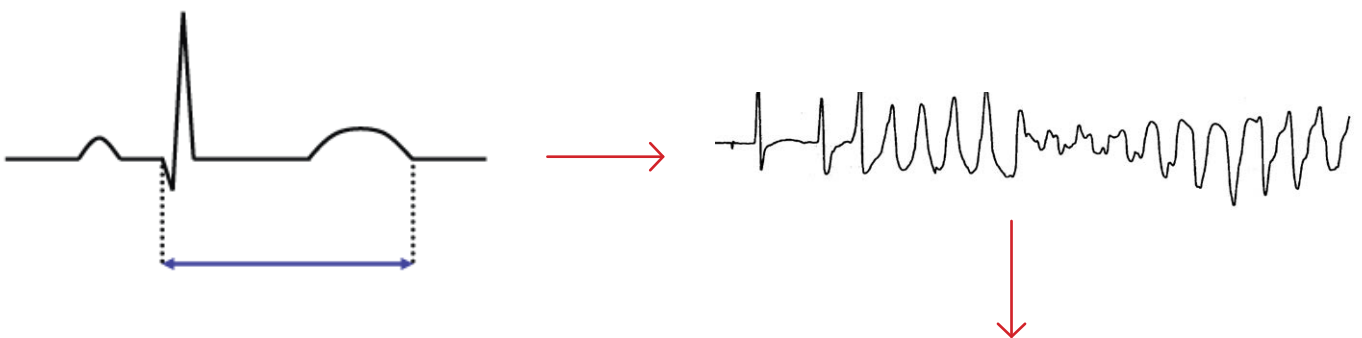
*The prolonged **QTc is diagnosed** when:*
• men: QTc > 470ms
*• women: QTc > 480 ms*
• infants: QTc > 460 ms
The prolonged QT may develop into ventricular arrhythmia during physical or emotional stress (typical examples: A ball hits the person's chest or an alarm-clock awakens the person).

Why does the automatic QT measurement often fail?

Nowadays, the QT interval and its corrected form, the QTc, can be automatically measured and calculated by most electrocardiograph devices available on the market. Although the automatic measurement brings an obvious comfort to ECG evaluation, it may also result in certain inaccuracies, especially under extreme conditions such as a noisy signal, higher heart rates (both typical for stress-test examination),

the T wave does not return to baseline, the T wave has two peaks, there is the U wave in the signal, etc. Also, the automatic diagnostics measures the QT on an averaged beat and that causes other inaccuracies (the T wave end can become distorted). As a result, the automatic QT measurement can be often considered as unreliable and improper to use.
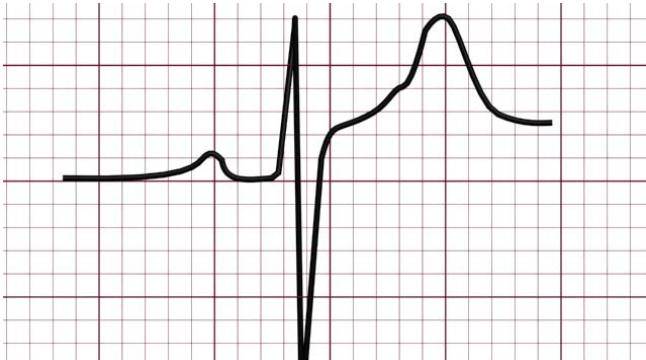
The T wave does not return to baseline.
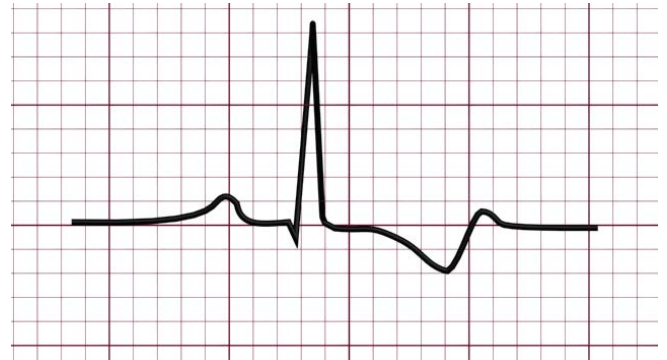
The T wave has two peaks.

# How does the QT Module work?

The QT module offers a manual QT measurement using the tangent method. Since this method is rather robust, it is perfectly suitable to handle all the previously-mentioned extreme conditions.

Even more interesting the QT measurement is reEEvealed when analyzing the stress-test ECG record. Some patients may exhibit a normal (unextended) QT at rest; however the QT does not become any shorter during the stress-test. In other words, the QT does not adapt to the increasing heart rate and that clearly identifies a QT abnormality. The BTL CardioPoint-Ergo presents the results of QT measurement in a graph which shows the dependence of QT on heart rate (RR interval). This means that the graph shows the survival probability of the patient.

The basic principle of the tangent method lies in creating a tangent to the steepest part of the T wave. The end of the QT interval can be found where the tangent meets the baseline. This example shows how the P wave follows the T wave making it very difficult to determine the T wave end.

Time	RR [ms]	QT [ms]	QTc [ms]
E 02:42...	526	319	439
E 05:55...	429	288	439
E 08:55...	325	239	419
E 10:24...	398	259	410
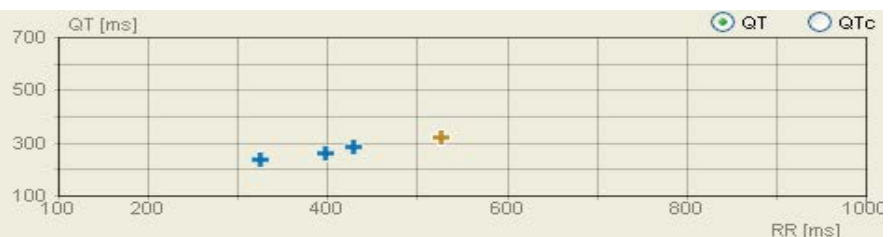
The upward trend in the graph represents the QT interval adapting to the heart rate. The higher heart rate, the shorter QT.

Once the QT interval has been measured, the corrected value (QTc) is calculated using any one of following formulas: Bazett, Hodges, Fridericia or Framingham.

How are the measurement results represented in the final report?
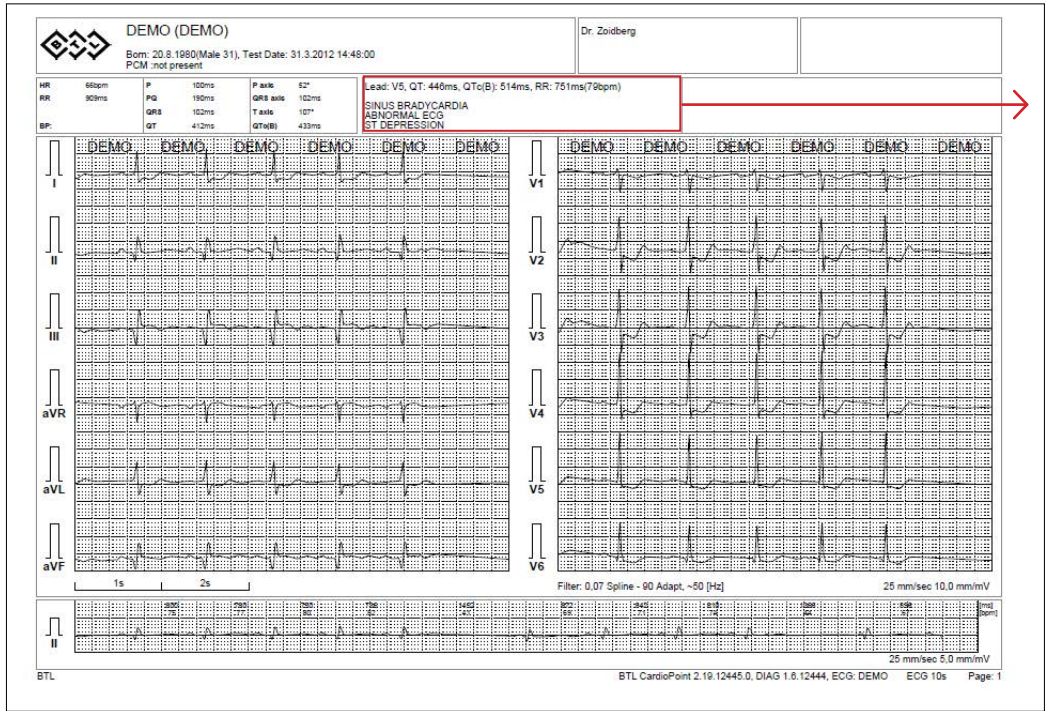
In the BTL CardioPoint-ECG, the measured results automatically become part of the medical conclusion.

In the BTL CardioPoint-Ergo, a special "QT page" containing all the measured QT and QTc values becomes part of the complete report.

LITERATURE:

1 N. W. Taggart et al.: Diagnostic Miscues in Congenital Long-QT Syndrome
2 I. Goldenberg, MD et al.: Risk factors for Aborted Cardiac Arrest and Sudden Cardiac death in Children With the Congenital Long-QT Syndrome
3 Peter J. Schwartz, MD et al.: Prevalence of the Congenital Long-QT Syndrome

About BTL CardioPoint

The BTL CardioPoint is a versatile software solution integrating ECG, Stress test, Holter, ABPM and Spirometry into one unified platform with one patient database and the same logic of controls for each module. The software has a fully customizable interface, and its layout and work steps can be easily adapted. The operator is allowed to arbitrarily add or move tables, ECG strips and other windows. Fast and intuitive work is ensured by an ergonomically optimized user interface with shortened mouse tracks and hotkeys. Colour schemes are designed for both dark and light ambience. The BTL CardioPoint can be used as a stand-alone cardiology system, or it can be seamlessly integrated into an existing ambulatory or hospital system. The BTL CardioPoint is software that adapts to the user, instead of the user having to adapt to the software.