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Introduction

Recent studies suggest that (T_{peak}-T_{end})/QT ratio is a relatively constant value regardless of QT interval in patients who have structurally normal hearts, and is higher than 0.3 for patients at arrhythmogenic risk. Therefore, this ratio may serve as an applicable arrhythmogenic risk index. This study examines the properties of this index and compares its stability to QT_c using automatic measurements in a large database of patient monitoring ECG recordings.

Study Population

Several databases were used in our test.

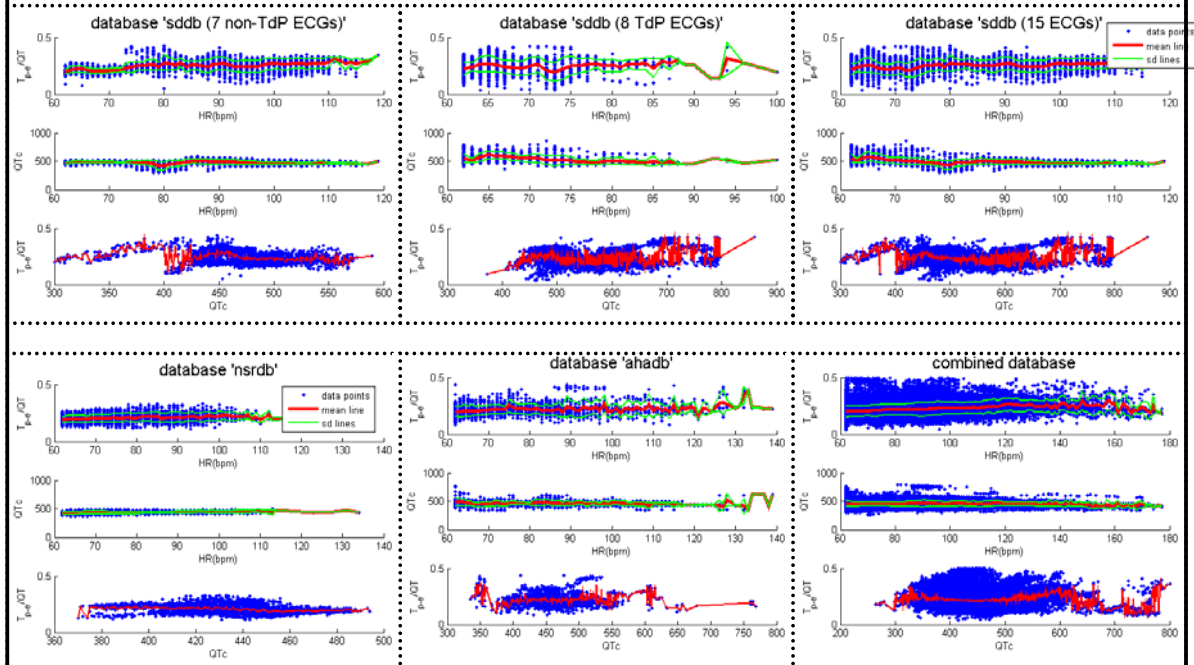
database	No of Patients	Length (hours)
MIT-BIH Sudden Cardiac Death (sddb) without ventricular pacing, with documented sustained tachycardia (VT) or ventricular fibrillation (VF)	15	270 (4~25)
sddb Torsade de Pointes (TdP)	8	154 (4~25)
sddb non-TdP	7	116 (4~25)
MIT-BIH Normal Sinus Rhythm (nsrdb)	18	437 (23~26)
AHA	80	240 (3)
Combined monitoring ECGs from a number of sources	1085	11229 (0.5~77)

Method

ECGs were processed using a computer program to generate one set of Tp-e, and QT_c (Bazett) measurements at five minute intervals. Excluded were ECGs with flat T and individual measurement outliers (i.e., Tp-e or QT_c more than 1.5 times the interquartile range away from the 25th or 75th percentiles). The coefficient of variation (CV) was calculated on each ECG recording as the ratio of the standard deviation (SD) to the mean for both Tp-e/QT and QT_c. In each dataset, we calculated the mean and SD of CV.

Results

	Measurement Value mean±SD (range)		Coefficient of Variation% mean±SD (range)	
	QT _c	Tp-e/QT	QT _c	Tp-e/QT
sddb (15 ECGs)	511±66 (435~642)	0.24±0.04 (0.16~0.32)	6.2±5.6 (2.1~18.6)	17.3±11.0 (6.4~45.4)
sddb (8 TdP)	551±66 (460~642)	0.23±0.04 (0.16~0.28)	7.2±5.4 (2.9~15.9)	19.9±12.2 (7.4~45.4)
sddb (7 non-TdP)	466±26 (435~507)	0.24±0.05 (0.20~0.32)	5.0±6.0 (2.1~18.6)	14.2±9.5 (6.4~28.7)
nsrdb	431±21 (388~472)	0.20±0.03 (0.15~0.28)	2.2±0.7 (1.3~3.9)	9.8±3.3 (5.3~14.9)
ahadb	468±58 (314~762)	0.22±0.05 (0.13~0.41)	2.8±2.3 (0.4~12.3)	10.4±6.9 (2.3~33.4)
combined	457±50 (273~767)	0.22±0.05 (0.10~0.55)	2.5±2.5 (0.0~37.7)	9.2±7.0 (0.0~50.1)



Discussion

As shown above, the mean value of the Tp-e/QT ratio is approximately 0.2 as others have found, and has a much higher variation than QT_c (by more than a factor of three). Some variation may be due to automated measurement error, but would not explain the higher variation of the ratio compared to QT_c. We also observed that the mean Tp-e/QT ratio slightly increased for longer QT_c (>530 ms). High variation of this ratio made it difficult to draw a conclusion.

Conclusion

Distribution of Tp-e/QT has more variation than QT_c based on computer measurements (not explained by measurement error). In clinical studies, Tp-e/QT appears to contain useful information and to be a potential risk indicator. More research and refinement of the methodology is necessary to make it a practical tool.