

Distinguishing Acute from Chronic Left Bundle Branch Block Using QRS/T Ratio 3D Voltage-Time-Integrals versus Amplitudes

Nicholas Kettelkamp, DO; Christopher Harvey; Charles Kircher; Seth Sheldon, MD; Madhu Reddy, MD; Rhea C Pimentel, MD; Amit Noheria, MBBS, SM



Background

- Discriminating acute vs. chronic left bundle branch block (LBBB) has important clinical implications.
- Ratio of deepest S to tallest T in precordial leads and 3D QRS/T amplitude ratio have been shown to distinguish new vs. old LBBB.¹

Research Question

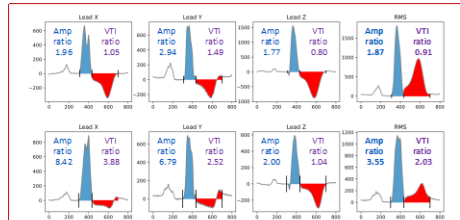
- Is the **ratio of QRS/T** assessed by **voltage-time-integral (VTI)/area** superior to amplitude in distinguishing *acute* from *chronic* LBBB?

Methods

- We compared ECGs of patients with new persistent LBBB within 24 hr post transcatheter aortic valve replacement
 - vs. **control** patients with presumed chronic LBBB (independent sample t tests)
 - vs. their **own ECG** with LBBB persisting at **1 month** post TAVR (pairwise t tests)
- Orthogonal X, Y, Z leads were reconstructed from 12-lead ECG using Kors's matrix.
- X, Y, Z and 3D VTI were obtained from temporal integration of voltage in X, Y, Z and root-mean-squared (RMS/3D) ECGs respectively.

| Variable | Acute post | | Controls with chronic LBBB | 1 month post | |
|------------------------------------|--------------|------------|-------------------------------|--------------|----------------|
| | TAVR N=78 | N=385 | | TAVR N=78 | p [†] |
| Female (%) | 53.3 | 53.5 | 1 | | |
| Age (yrs.) | 77.6±9.6 | 70.6±12.0 | <0.0001 | | |
| QRS duration (ms) | 149.6±12.9 | 155.3±14.1 | 0.001 | 147.9±13.1 | 0.08 |
| Max precordial S/T amplitude ratio | 2.92±0.83 | 3.28±1.34 | 0.02 | 3.23±1.22 | 0.03 |
| 3D QRS/T amplitude ratio | 2.80±0.54 | 3.37±1.27 | 0.0001 | 3.27±1.38 | 0.003 |
| X | 3.29±1.77 | 4.05±2.45 | 0.009 | 3.63±2.26 | 0.3 |
| Y | 5.09±2.85 | 5.01±3.21 | 0.8 | 4.46±2.52 | 0.1 |
| Z | 2.89±0.76 | 3.63±1.60 | <0.0001 | 3.37±1.22 | 0.0003 |
| 3D QRS/T VTI ratio | 1.35±0.22 | 1.59±0.44 | <0.0001 | 1.53±0.32 | <0.0001 |
| X | 1.32±0.71 | 1.72±0.96 | 0.0006 | 1.51±0.87 | 0.1 |
| Y | 1.52±0.73 | 1.76±0.96 | 0.04 | 1.56±0.83 | 0.7 |
| Z | 1.45±0.29 | 1.65±0.60 | 0.002 | 1.61±0.38 | 0.0004 |

Table. Comparisons of acute post TAVR LBBB with chronic LBBB.



Example. X, Y, Z and 3D/RMS QRS/T ratios in acute (top) vs. 1 month old (bottom) LBBB post TAVR.

Results

- Post-TAVR acute LBBB was better distinguished from chronic LBBBs by 3D QRS/T VTI ratio (both comparisons p<0.0001) than by 3D QRS/T amplitude ratio (p=0.0001, 0.003).
- Max precordial S/T amplitude ratio had less significant differences for both comparisons (p=0.02 and 0.03).

Conclusions

- Larger T waves (smaller QRS/T ratio) can distinguish *acute* from *chronic* LBBB.
- 3D VTIs perform better than 3D amplitudes for discrimination.
- Max precordial S/T amplitude ratio is less distinctive.

Reference

Shvilkin A, ... Josephson ME. VCG and ECG criteria to distinguish new and old LBBB. *Heart Rhythm*. 2010 Aug;7(8):1085-92.

Conflicts of Interest - None

Presented at: American Heart Association Scientific Sessions, Philadelphia, PA, November 11-13, 2023