

## Semantic Confusion: The Case of Early Repolarization and the J Point

Early repolarization and J point are classic electrocardiographic terms that have been co-opted.<sup>1</sup> Although we agree with Surawicz and Macfarlane<sup>2</sup> that these terms require standardization, the major commercial electrocardiography programs currently measure ST elevation at the traditional J

point or QRS end and do not classify J waves or slurring for the statement of nonspecific ST elevation or “early repolarization.”<sup>3-7</sup> Furthermore, although J waves or slurs have been noted to occur along with ST elevation as part of classic early repolarization,<sup>8</sup> the clinical focus has been on ST elevation because it also can be confused with myocardial injury or ischemia and pericarditis (Figure).

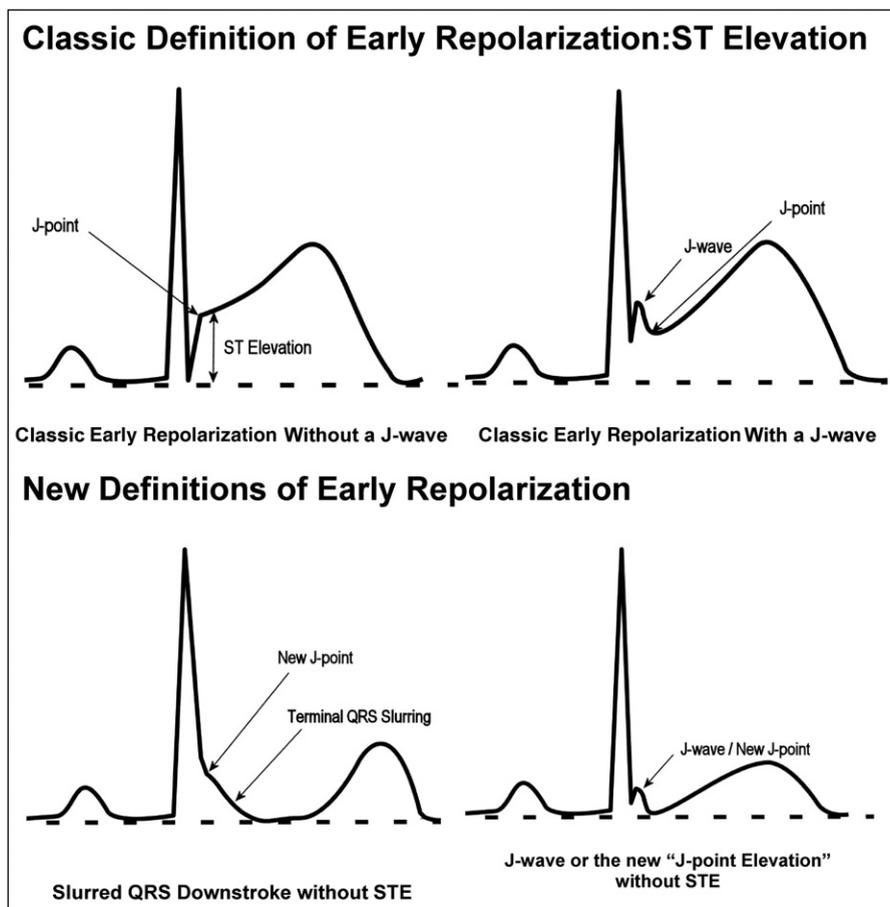
The semantic confusion can be traced back to 2 articles in *The New England Journal of Medicine*<sup>9,10</sup> from 2009. The authors were allowed to co-opt these old and respected terms with good intent, armed with hypotheses, elegant

**Funding:** None.

**Conflict of Interest:** None.

**Authorship:** All authors had access to the data and played a role in writing this manuscript.

Requests for reprints should be addressed to Victor F. Froelicher, MD, 1028 Ringwood Ave, Menlo Park, CA 94025.



**Figure** Examples of the classic and new definitions of early repolarization and J point.

cellular physiology studies, and cardiac mapping. They disregarded the key feature of early repolarization, ST elevation, and focused on J waves and R-wave downstroke notching or slurring. Although new research supporting the concern with J waves and notching/slurring are compelling,<sup>11</sup> their new semantics have caused much confusion.

Specifically in regard to the J point, although cellular physiologists and electrophysiologists are concerned with which portions of the heart are depolarized or repolarized, those of us interpreting surface electrocardiograms are comfortable with established criteria for QRS end. Previously, the J point or QRS end was neither the top of the J wave nor the top of the slur; rather it has been where the high-frequency components of the QRS complex transition to the low-frequency ST segment. Modern computerized electrocardiogram analyses and QRS duration norms are based on this definition.

It is difficult to sort through the new and exciting data regarding these new findings when standard definitions are not applied. Far be it from us to propose new terminology for the brilliant investigators who have made these important new observations. But please give us back the old and trusted definition of early repolarization, which focuses on elevation at the end of the surface QRS complex or J point! They should take the initiative of creating new names; perhaps terminal QRS delay, H-waves, B-slur, and A-point would be appropriate for R-wave downstroke notching or slurring. They know who did what and can provide the appropriate names and letters.

Although we approach this issue of semantics with a humorous tone, there is a serious consequence of the resulting confusion for clinicians. There are millions of interpretive electrocardiogram machines that cannot recognize J waves and slurs, yet frequently output the diagnostic statement of “early repolarization.” Their algorithms for this statement are based on the ST level and not phenomena on the downslope of the R wave. Replacing or altering these electrocardiogram machines has staggering economic consequences even if there were convincing data to do so. The implication that every healthy individual with an electrocardiogram reading early repolarization needs further evalua-

tion creates liability issues. Perhaps this semantic confusion is not so humorous after all.

Marco V. Perez, MD

Karen Friday, MD

Victor Froelicher, MD

*Division of Cardiovascular Medicine*

*Stanford University*

*Stanford, Calif*

*VA Palo Alto Health Care System*

*Palo Alto, Calif*

*E-mail address: vicmdatg@gmail.com*

## References

1. Gussak I, Antzelevitch C. Early repolarization syndrome: clinical characteristics and possible cellular and ionic mechanisms. *J Electrocardiol.* 2000;33:299-309.
2. Surawicz B, Macfarlane PW. Inappropriate and confusing electrocardiographic terms: J-wave syndromes and early repolarization. *J Am Coll Cardiol.* 2011;57:1584-1586.
3. Welch Allyn. Physician's Guide. 2009. Available at: [http://www.welchallyn.com/documents/Cardiopulmonary/Electrocardiographs/CP300/PhysicianGuide\\_20090916\\_CP300.pdf](http://www.welchallyn.com/documents/Cardiopulmonary/Electrocardiographs/CP300/PhysicianGuide_20090916_CP300.pdf). Accessed October 3, 2011.
4. GE Healthcare. Diagnostic ECG Algorithms. 2010. Available at: [http://www.gehealthcare.com/euen/cardiology/products/diagnostic\\_ecg/algorithms/index.html](http://www.gehealthcare.com/euen/cardiology/products/diagnostic_ecg/algorithms/index.html). Accessed September 27, 2011.
5. Burdick. ECG Physician's Guide. 2006. Available at: <http://www.cardiacscience.com/assets/003/5265.pdf>. Accessed September 27, 2011.
6. Philips. 12 Lead ECG Algorithm Physicians Guide. 2005. Available at: [http://incenter.medical.philips.com/doclib/enc/fetch/2000/4504/577242/577243/577245/577817/577818/12-Lead\\_Algorithm\\_Physicians\\_Guide\\_for\\_Algorithm\\_Version\\_PH080A%2c\\_\(ENG\).pdf%3fnodeid%3d3325283%26vernum%3d1](http://incenter.medical.philips.com/doclib/enc/fetch/2000/4504/577242/577243/577245/577817/577818/12-Lead_Algorithm_Physicians_Guide_for_Algorithm_Version_PH080A%2c_(ENG).pdf%3fnodeid%3d3325283%26vernum%3d1). Accessed September 27, 2011.
7. Mortara Instruments. Physicians Guide Veritas 12 Lead Interpretative Program. 2005. Available at: [www.documark.com/Documents/ng/9515-001-60.pdf](http://www.documark.com/Documents/ng/9515-001-60.pdf). Accessed September 27, 2011.
8. Kambara H, Phillips J. Long-term evaluation of early repolarization syndrome (normal variant RS-T segment elevation). *Am J Cardiol.* 1976;38:157-156.
9. Tikkanen JT, Anttonen O, Junttila MJ, et al. Long-term outcome associated with early repolarization on electrocardiography. *N Engl J Med.* 2009;361:2529-2537.
10. Haissaguerre M, Derval N, Sacher F, et al. Sudden cardiac arrest associated with early repolarization. *N Engl J Med.* 2008;358:2016-2023.
11. Boineau JP. The early repolarization variant—normal or a marker of heart disease in certain subjects. *J Electrocardiol.* 2007;40:3.e11-16.