This investigation documented a distinct pattern of change in the systolic time intervals in left ventricular decompensation. The ease with which these measures can be obtained prompted their use as quantitative noninvasive measures of cardiac performance in man. [The SCP indicates that this paper has been cited over 385 times since 1969.]

Arnold M. Weissler
Department of Medicine
Wayne State University
Detroit, MI 48201

February 9, 1981

"During the 1960s cardiac catheterization emerged as the dominant, and in the minds of many, the only definitive diagnostic modality in cardiovascular medicine. Technology had advanced to the point that virtually every hemodynamic measure characterizing the performance of the cardiac chambers could now be determined. So readily available and specific was the physiologic data that few cardiologists raised objection to the inconvenience, discomfort, risk, and expense imposed upon our patients by cardiac catheterization. It was in this setting that I introduced the view that valid quantitative physiologic measures of cardiac performance could be derived from recordings of potentials and pulsations at the body's surface. Such an approach could offer many unique clinical advantages and could potentially augment or replace some cardiac catheterization methods.

"It was at this time that I discovered that of the various measures of cardiac performance the one most often neglected was the determination of the duration of the events of the cardiac cycle. Since the studies of Carl Ludwig, the performance characteristics of the heart had been described relative to a constant time base. Time remained the independent variable relative to which measures of pressure, volume, and flow were determined. I hypothesized that in order to maintain adequate performance through a wide range of heart rate and loading conditions, the heart, a reciprocating pump, must have time to fill and to empty. Thus, just as alterations in chamber pressure, contractile volume, and blood flow occur in left ventricular decompensation, the time intervals of the contractile cycle might change as well. That such changes may reflect alterations in cardiac performance was postulated by earlier investigators including Bowen, Lombard and Cope, Katz and Feil, and Blumberger. It had not been established, however, that changes in the temporal dynamics of the cardiac cycle paralleled other hemodynamic consequences of left ventricular decompensation or retained any quantitative relationship to ventricular performance.

"The present paper was based on our previous studies documenting that prolongation of the ejection phase (PEP) and shortening of the ejection time (LVET) in cardiac decompensation was closely related to abnormalities in other measures of cardiac performance. In this work my colleagues Willard S. Harris, Clyde D. Schoenfeld, and I proposed the use of the ratio PEP/LVET, as a convenient quantitative expression of the overall changes in systolic intervals accompanying left ventricular decompensation. This PEP/LVET ratio is now the most commonly applied measure of systolic time intervals for the evaluation of global left ventricular function in man. It was in this paper, too, that we coined the currently popular term 'noninvasive' as a general expression of this diagnostic concept. This paper prompted several later investigations which verified the close relationship between the systolic time intervals and altered ventricular performance obtained by cardiac catheterization.

"In perspective, the systolic time intervals constitute an initial attempt to quantitate altered ventricular performance in cardiovascular disease by noninvasive technics. Almost simultaneously with their development, the echocardiographic approach to noninvasive diagnosis emerged and, soon thereafter, nuclear methods for defining altered ventricular contractile performance were introduced. These three independent approaches now stand as prototypes for the development of the new discipline of noninvasive cardiovascular medicine, one which promises to add significantly to our knowledge of the physiologic disorders which accompany cardiovascular disease and will lend a more scientific and critical approach to the clinical management of cardiovascular disease. I published a more recent review of the subject in the New England Journal of Medicine."