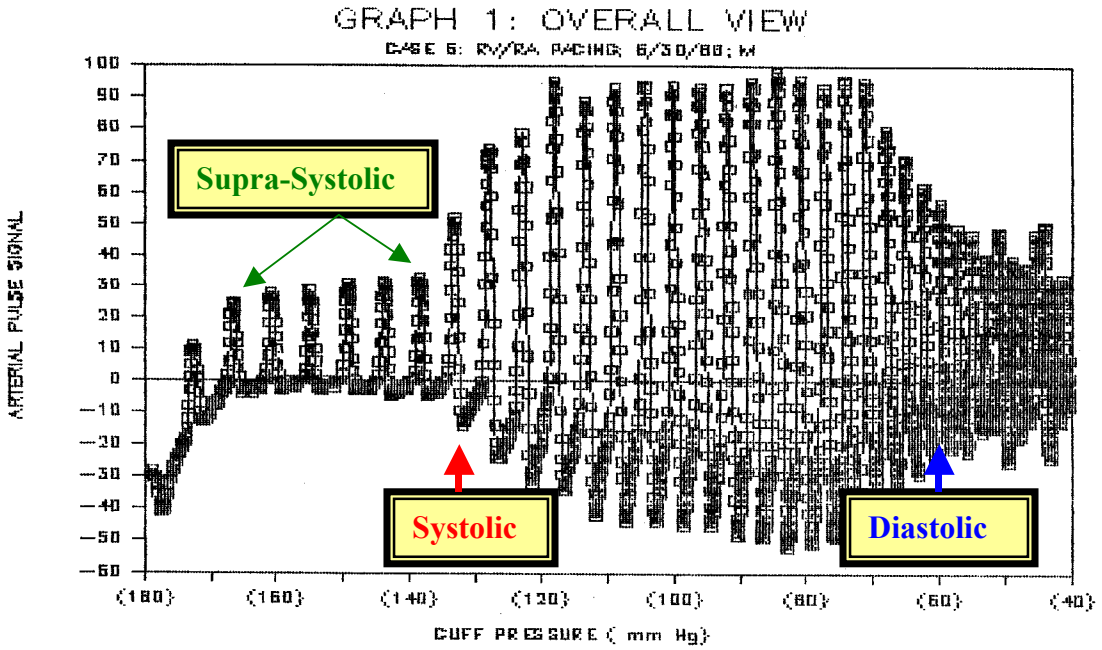
Applying DynaPulse Supra-Systolic Waveform Augmentation Analysis and 24-hour Ambulatory Hemodynamic Profiling in Advanced Management of Hypertension, CVD and Heart Failure

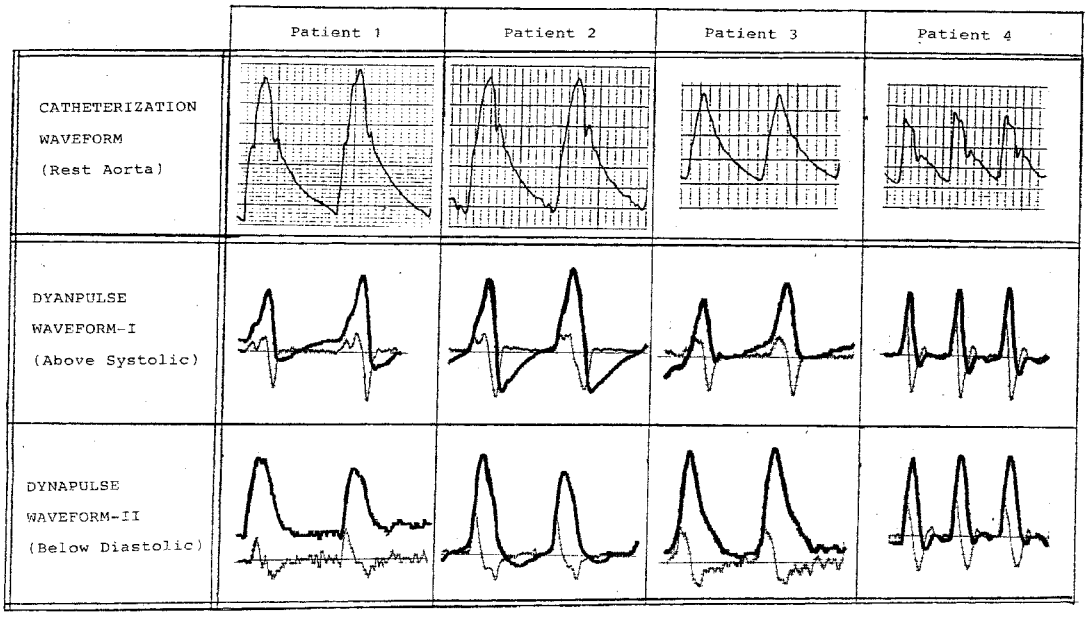
I. DynaPulse Supra-Systolic Wave & Augmentation

From 1991, the DynaPulse blood pressure and pulse waveform recording system became available. Since then, many physicians and researchers have observed and reported interesting "augmentation" in DynaPulse supra-systolic waveforms that are associated to hypertension and cardiovascular complications in patients. Most recently, Dr. Antonio Delgado and his team at the Hypertension Research Unit, University of Carabobo Medical School, Valencia Venezuela, further categorized the DynaPulse supra-systolic waveforms into four **hypertension phenotypes** in their research and development of the advanced managements for hypertension, CVD and heart failure patients. Some sample supra-systolic pulse augmentations are provided in section III (Examples in PDF). Here, we summarize our experiences and understanding of the physics of DynaPulse supra-systolic waveform morphology, and referenced a recently review paper on **phenotypes in hypertension**, and hope it will provide further reference to those interested in applying DynaPulse for hypertension and cardiovascular disease evaluation and/or studies.

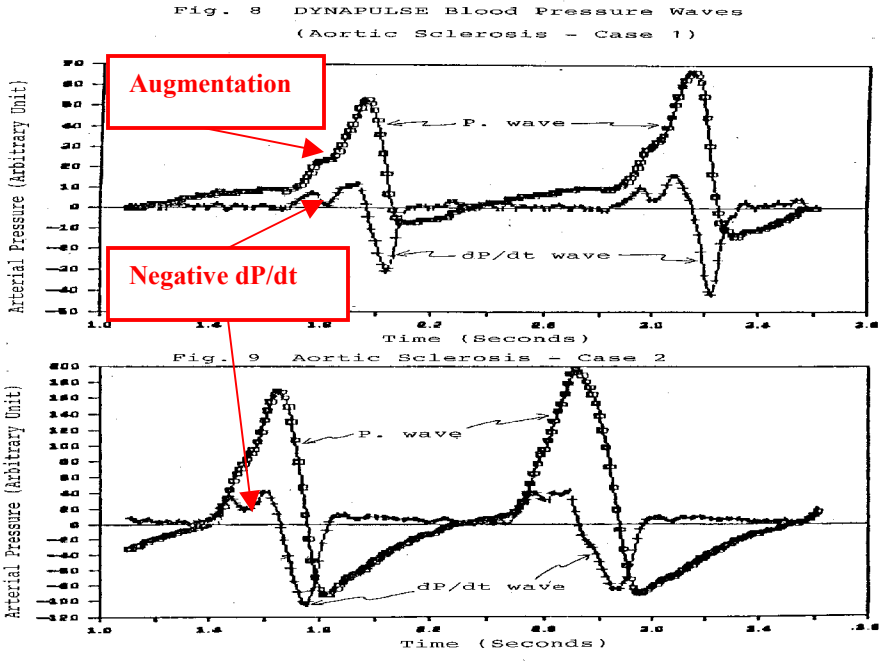
During 1988, Dr. Shiu-Shin Chio observed the pulse waveform recorded by the first DynaPulse prototype, as in Graph-1 shown below. He immediately noted that the waveforms from above the systolic point area (Supra-Systolic), in between systolic and diastolic, and below diastolic areas, were very different and contained further information of the arterial system obtained via the inflated cuff.



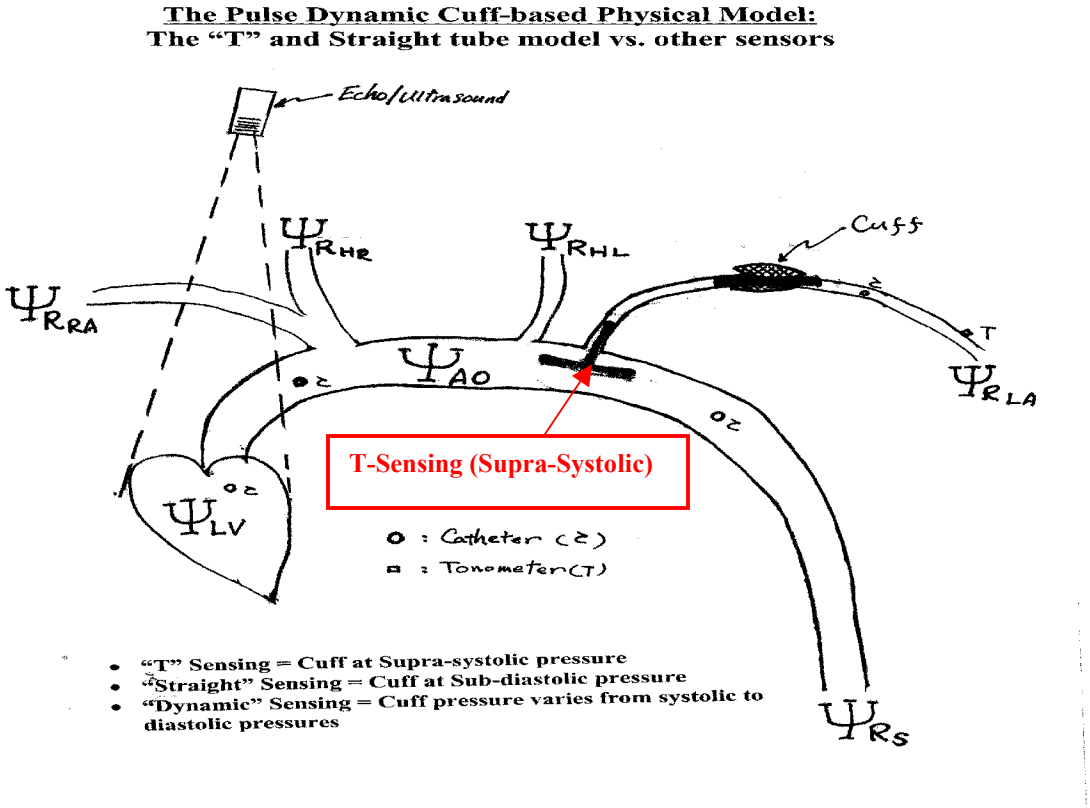
Further investigation into the DynaPulse waveform was completed, including discussions with Dr. Tom Muller, Chief Cardiologist at St. Francis Hospital, Indianapolis, Indiana. With his support and guidance, we compared the DynaPulse supra-systolic and sub-diastolic waveforms to catheterization resting aortic pressure waveform. Data from four subjects, illustrated below, clearly showed that supra-systolic waveform resembled the up-stroke of aortic wave and sub-diastolic waveform, following the down-stroke aortic wave, and "augmentation" or "shoulder" at upstroke waves of subject 1 to 3 were shown in both aortic waves and supra-systolic waves.



Performed dP/dt on the DynaPulse supra-systolic waveform of Case-1 and Case-2, subjects diagnosed with aortic sclerosis and the aortic pressure waveform showing augmentation and "Negative dP/dt", confirmed that the DynaPulse supra-systolic waveform carried the same information of aortic characteristics, illustrated below.



The above observation led to further development of the Pulse Dynamics methodology by Dr. Chio, and the "T-tube" physical model (illustrated below) to explain the ability of DynaPulse supra-systolic waveform to monitor aortic pressure wave.



Also, as described in another DynaPulse reference, "**DynaPulse central aortic blood pressure and waveform: *Validation with catheterization - The Pulse Dynamic noninvasive method***" (DynaPulse education doc. 031308A1), at supra-systolic pressure, the cuff signal allows measurement of central aortic pressure as well as estimation of LV contractility and cardiac output from DynaPulse Pulse Waveform Analysis (PWA) method.

II. DynaPulse 24-hour Ambulatory Hemodynamic Monitoring

In 1996, "**A New Technology to Determine Circadian Blood Pressure and Arterial Compliance Variations During Ambulatory Monitoring**", Brinton TJ, Neutel JM, Walls ED, Chio S-S, Smith DHG, Franklin SS, Weber MA, UCI, Orange, CA, and Pulse Metric, Inc., San Diego, CA., was presented at the Italian Society of Chronobiology Scientific Meetings. Since then, many researchers have applied the unique DynaPulse 24-hour blood pressure and hemodynamic profiles monitoring in their studies on hypertension, drug therapy and risk factors of cardiovascular and heart diseases. References and abstracts are available at "Pulse Dynamics" booklet supplied with DynaPulse monitor software CD.

Just as the DynaPulse waveform provides visual identification of artifacts and irregular heartbeats, along with aortic properties, such as augmentation due to aortic sclerosis, the DynaPulse 24-hour ambulatory hemodynamic monitoring provides much more information than traditional ambulatory blood pressure monitor (ABPM). It allows physicians and researchers to further evaluate the complicated cardiovascular circulation problems and develop advanced treatments and management of associated diseases.

DynaPulse is a non-invasive, easy-to-use, cuff-based blood pressure, pulse waveform and hemodynamic profiles monitoring system. It utilizes the power of the personal computer and internet, not only providing the most advanced technology available today, but also the most cost effective way for patients and their doctors to manage and assist in the prevention of hypertension, known as the "silent killer", and other associated cardiovascular diseases, including stroke, heart failure, and diabetes.

III. Examples of DynaPulse Supra-Systolic Waveform Augmentation and 24-hour Ambulatory Hemodynamics in Heart Failure - from Dr. Antonio Delgado's Clinical Studies

At the VI Venezuelan & II Latin-American Congress on Heart Failure, held March 3-6, 2010 in Valencia, Venezuela, Dr. Antonio Delgado L. of the Hypertension Research Unit, University of Carabobo Medical School, Valencia Venezuela, presented studies on hypertension phenotypes applying the DynaPulse supra-systolic waveform, and DynaPulse 24-hour Ambulatory hemodynamics in heart failure (Examples in PDF). For more information, please contact Professor Antonio Delgado-Almeida, MD, FAHA at admin@hypertensionresearch.org.

Other Reference: *Phenotypes in Hypertension* - *J Clin Hypertens (Feb. 16, 2010)*

Link: http://www3.interscience.wiley.com/cgi-bin/fulltext/123286845/PDFSTART

Review Paper

Hypothesis: It Is Time to Reconsider Phenotypes in Hypertension

Marcelo Orias, MD; Aldo H. Tabares, MD; Aldo J. Peixoto, MD

Abstract

The study of genes and mechanisms associated with hypertension is hampered by the heterogeneity of hypertensive patients. Refining the definition of hypertension is a potential means of improving the clarity of mechanistic studies, but the lack of intermediate phenotypes hinders the assessment of causal relationships. Looking at younger individuals and hemodynamic subsets of hypertension is one such refinement. The authors argue that the separate analysis of patients with isolated diastolic hypertension, predominantly diastolic hypertension, and isolated systolic hypertension in the young in combination with common biomarkers may be an initial step to decrease heterogeneity within patient subsets, thus providing new avenues for genetic and pathophysiological studies.