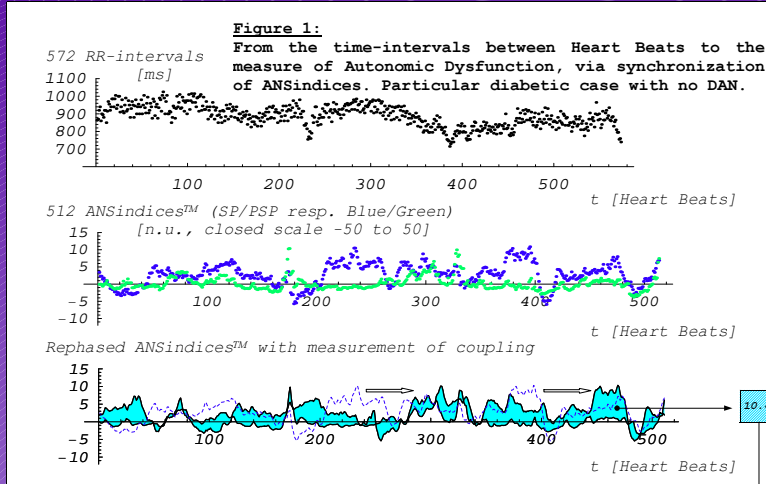


500 Heart Beats for assessing Diabetic Autonomic Neuropathy

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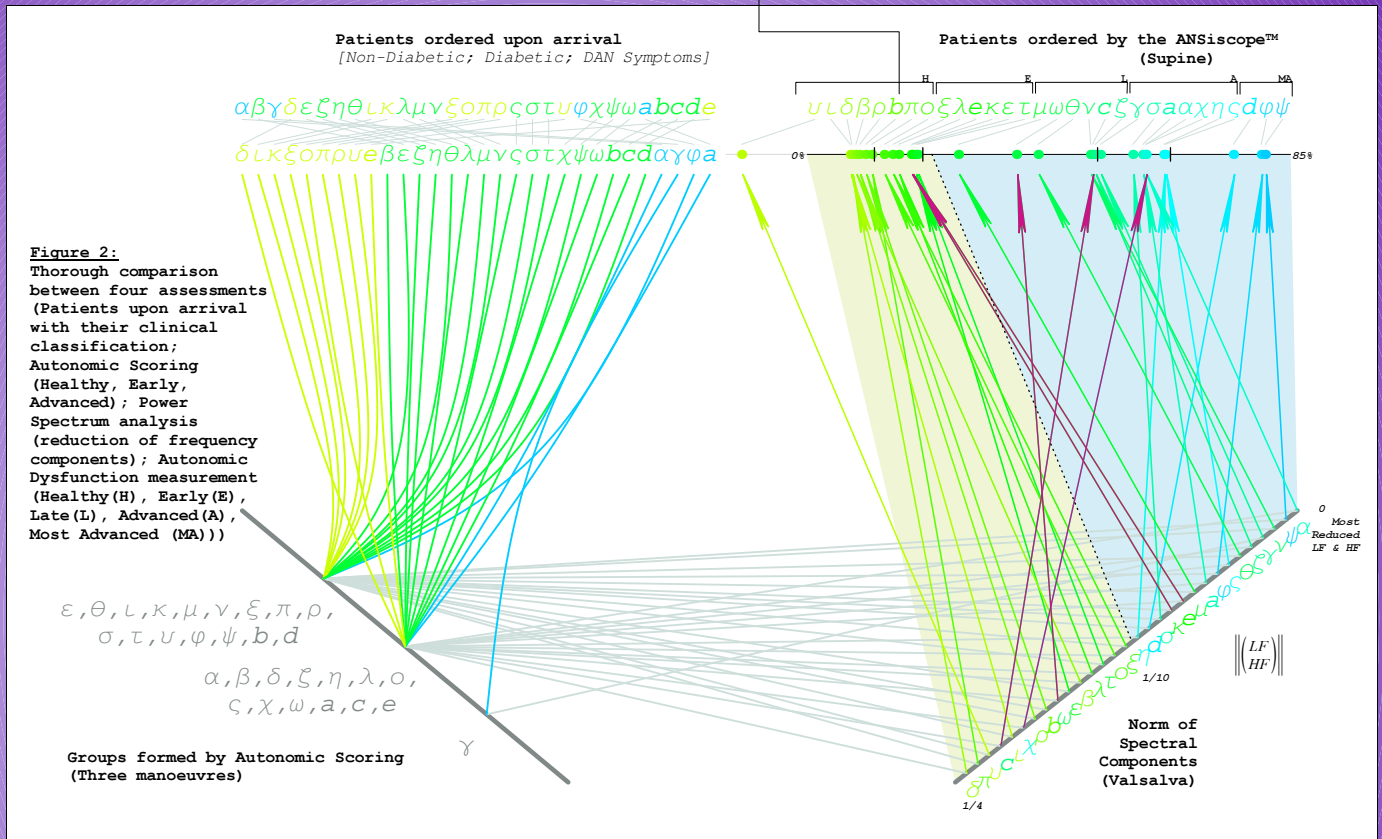
Introduction :

Based on scale covariance physics, a new mathematical method, implemented in the ANSiscope™ device, extracts beat-by-beat information on the sympathetic and parasympathetic subsystems of the Autonomic Nervous System, from the R-R time-intervals of the ECG. Calculated indices give activity-degrees of subsystems locally. The lack of coupling of these indices then defines autonomic dysfunction as a percentage over the time period considered. (See figure 1)

Aim: Investigation of this definition's usage towards assessing Diabetic Autonomic Neuropathy (DAN).

Method: 21 diabetic patients and 9 healthy volunteers (mean age: 47+/-10 years) with enlightened consent were enrolled in the study. Valsalva Manoeuvre, Tilt test, Respiratory sinus arrhythmia (3000 HB) and 10 minutes in supine condition were performed by each patient. 3 techniques for DAN assessment were applied for the purpose of comparison:

- Autonomic scoring following the procedure of Bellavere et al.
- Parametric estimation of the Spectrum (Yule-Walker autoregressive model) during a Valsalva manoeuvre (results are expressed in normalized global reduction of LF and HF components)
- ANSiscope measurement in supine condition during 572 RR intervals



Results(see figure 2) & Conclusion:

While the groups formed by Autonomic Scoring do not correspond to the stratification of patients given by the reading of the ANSiscope™ (and require more than 3000 heart beats for assessment), the presence and absence of reduced LF&HF components of the Power Spectrum during a Valsalva manoeuvre are corroborated (respective agreement of 13/15 and 4/5) by the distinction between Healthy/Early and Late/Advanced groups given by the ANSiscope™ under supine condition. Five groups are formed through the attendance of four aggregations of autonomic dysfunction percentage values, which none-the-less divide the space of neuropathy into two distinct planes. Extreme cases are classified in rather equivalent groups between the different assessments. Non-diabetic volunteers can be classified as Early DAN but Late & Advanced DAN Groups only contain diabetic patients. One healthy case with a vagal tonus was found, the parasympathetic predominance was expressed as a negative measurement. This distinction between autonomic failures is not possible through the sole consideration of autonomic dysfunction as a reduction in activity (e.g. spectral analysis); this is not the case with the ANSiscope™. In summary, the autonomic dysfunction readings given by the ANSiscope™ in supine position provide a strict order between patients which, while being finer and more accurate, does not contradict the reduction in spectral components (the LF/HF ratio is here of no help) during a Valsalva manoeuvre, and just requires a little more than 500 heart beats, 5-7 minutes !