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Topic: Spectral Analysis and Modeling

Spectral Analysis of Respiratory Activity Provides a Second Autonomic Measure Associated With Spectral Analysis of Heart Rate Variability

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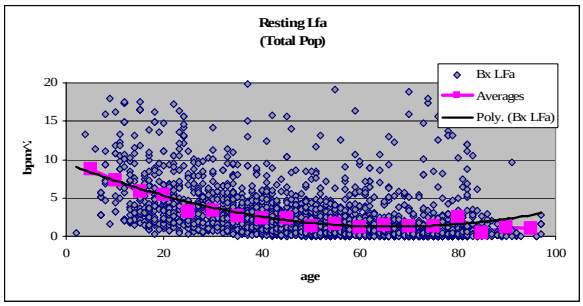
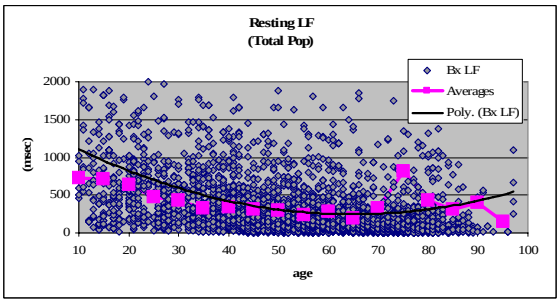
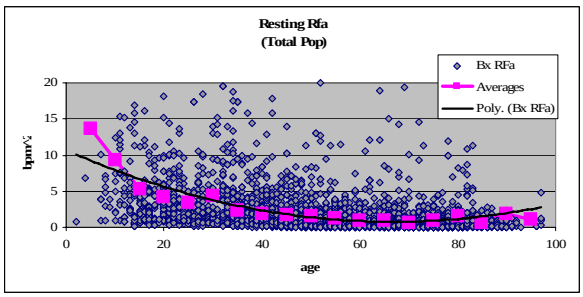
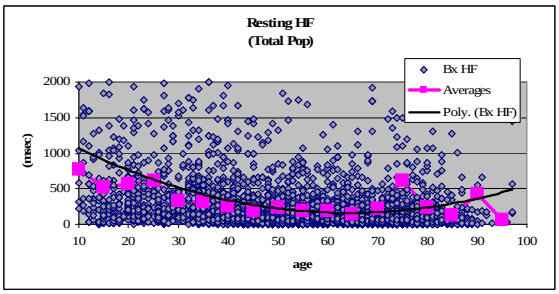
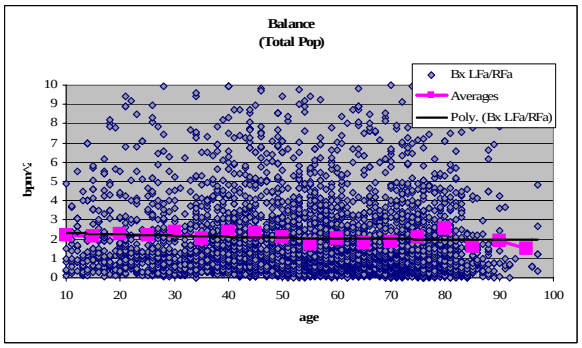
Spectral analysis of heart rate variability as standardized in the 1996 Circulation Special Report provides three measures of autonomic function: low frequency, high frequency, and L/H ratio. The Special Report states that LF is a measure of sympathetic activity as modulated by parasympathetic activity. HF is a broad-band fixed measure of parasympathetic activity when the respiratory frequency is within the frequency band. L/H ratio is an empirical measure of change in sympathetic activity. Theoretically it is a more pure sympathetic measure, resulting from the parasympathetics being divided out. SA of respiratory activity in conjunction with SAHRV, according to the MIT approach provides subtly, but significantly differing correlates. This method starts with two independent, but concurrent signals, RA (by impedance plethysmography in the ANX-3.0, Ansar, Inc., Philadelphia, PA) and EKG. The EKG is processed and spectrally analyzed according to the standard established in the Special Report. The concurrent RA activity undergoes the same spectral analysis, independently. From the RA spectrum, the peak mode is determined (this is called the fundamental respiratory frequency, FRF). The FRF is associated with Vagally mediated respiratory sinus arrhythmia. The FRF is then located in the HRV spectrum and, according to the MIT approach, a narrow frequency band is centered on the FRF. The area under the HRV spectral curve around the FRF is computed as the respiratory frequency area (RFa). The RFa was found by the MIT group to be a measure of parasympathetic activity. Then the area under the HRV spectral curve in the (remaining) low frequency range according to the Special Report is computed as the LF area (LFa). LFa was found by the MIT group to be a measure of sympathetic activity (alone). The ratio, LFa/RFa, is then by definition sympathovagal balance. Peer-reviewed published reports indicate that RA analysis is necessary to isolate parasympathetic from sympathetic activity. Our recent studies have borne this out and have shown that the MIT-based technique, (including RA spectral analysis) provides more specific and sensitive autonomic indices.

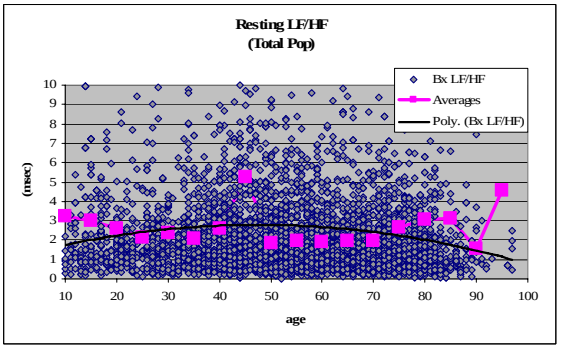

Resting Lfa
(Total Pop)
Bx LFa
Averages
Poly. (Bx LFa)
bpm^2
age


Resting LF
(Total Pop)
Bx LF
Averages
Poly. (Bx LF)
(msec)
age


Resting Rfa
(Total Pop)
Bx RFa
Averages
Poly. (Bx RFa)
bpm^2
age


Resting HF
(Total Pop)
Bx HF
Averages
Poly. (Bx HF)
(msec)
age


Balance
(Total Pop)
Bx LFa/RFa
Averages
Poly. (Bx LFa/RFa)
bpm^2
age


Resting LF/HF
(Total Pop)
Bx LF/HF
Averages
Poly. (Bx LF/HF)
(msec)
age