심박간격변이도(RRV) : 연속된 심박동 간 시간간격의 변동
심박변이도(HRV) : 심박간격을 일당 심박동수로 단위변환하여 표현한 것

→ 단위만 다를 뿐 같은 개념임
학술분야에서는 RRV 용어 선호 / 일반·임상 분야에서는 HRV 선호

* 심박간격변이도에서 추출가능한 분석 파라미터

Analysis of short-term recordings (5 min)

5-min total power	msec^2	The variance of NN intervals over the temporal segment	≈ ≤ 0.4 Hz
VLF	msec^2	Power in VLF range	≤ 0.04 Hz
LF	msec^2	Power in LF range	0.04-0.15 Hz
LF norm	nu	LF power in normalized units LF/(total power-VLF)×100	
HF	msec^2	Power in HF range	0.15-0.4 Hz
HF norm	nu	HF power in normalized units HF/(total power VLF)×100	
LF/HF		Ratio LF [ms^2]/HF[ms^2]	

Statistical measures

SDNN	msec	Standard deviation of all NN intervals
SDANN	msec	Standard deviation of the averages of NN intervals in all 5-minute segments of the entire recording
RMSSD	msec	The square root of the mean of the sum of the squares of differences between adjacent NN intervals
SDNN index	msec	Mean of the standard deviations of all NN intervals for all 5-minute segments of the entire recording
SDSD	msec	Standard deviation of differences between adjacent NN intervals
NN50 count		Number of pairs of adjacent NN intervals differing by more than 50 ms in the entire recording; three variants are possible counting all such NN intervals pairs or only pairs in which the first or the second interval is longer
pNN50	%	NN50 count divided by the total number of all NN intervals

Geometric measures

HRV triangular index		Total number of all NN intervals divided by the height of the histogram of all NN intervals measured on a discrete scale with bins of 7.8125 ms (1/128 seconds)
TINN	msec	Baseline width of the minimum square difference triangular interpolation of the highest peak of the histogram of all NN intervals
Differential index	msec	Difference between the widths of the histogram of differences between adjacent NN intervals measured at selected heights (eg, at the levels of 1,000 and 10,000 samples)
Logarithmic index		Coefficient k of the negative exponential curve $k \cdot e^{-k}$, which is the best approximation of the histogram of absolute differences between adjacent NN intervals

→ 스트레스에 민감하게 반응하는 자율신경계(교감과 부교감 신경계)의 활동양상에 많이 의존한다.

$$MeanRRI = \overline{RR} = \sqrt{\frac{1}{N}\sum_{j=1}^{N}(RR_j)}$$

$$SDNN = \sqrt{\frac{1}{N}\sum_{j=1}^{N}(RR_j - \overline{RR})^2}$$

$$rMSSD = \sqrt{\frac{1}{N}\sum_{j=1}^{N}(RR_j - RR_{j-1})^2}$$

$$NN50 = sample\,COUNT(duration(RR) > 50msec)$$

$$pNN50 = \frac{NN50}{N} X100\%$$

*주파수 영역에서 HRV를 분석하려면?

→ HRV 시계열 데이터를 주파수 영역으로 변환

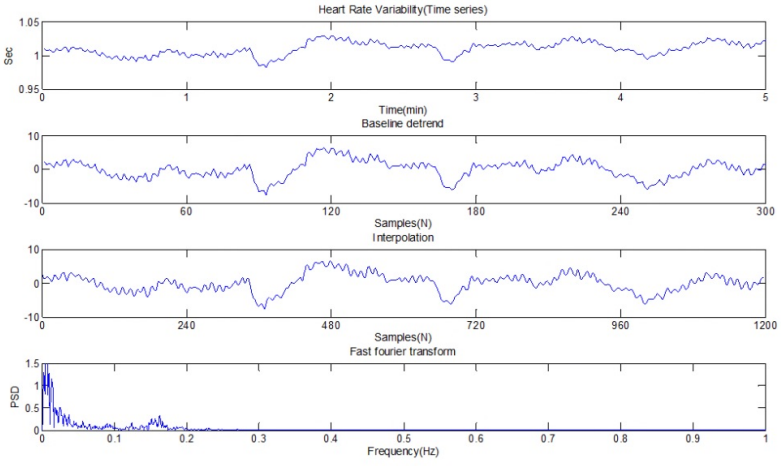

Fig. 5. Power spectrum analysis of heart rate variability.

① R-R간격 수열 데이터의 DC 성분을 제거하기 위한 기저선 보정 (Detrend)

② 주파수 분해능 올리기 (수열데이터 4Hz 보간 : Interpolation)

③ 주파수 누출 효과 약화 (50% overlapped Hamming 윈도우 적용)

④ 고속 푸리에 변환 (Fast Fourier Transform : FFT)

→ 주파수 영역의 특징추출

LF	저주파수영역(0.04~0.15Hz)파워값의 자연로그스케일값(ms^2)	교감 활성도
HF	고주파수영역(0.15~0.4Hz)파워값의 자연로그스케일값(ms^2)	부교감 활성도
LF/HF	HF값에 대한 LF값의 비율	자율신경 균형도