

Heart Rate Variability in Male Breast Cancer

Male breast cancer (BC) constitutes 1% of all the BC cases.^[1] BC has known to be the second most common cause of death after lung cancer.^[2] Electrocardiogram was recorded from 4 male BC patients and 17 healthy controls using an MP45 bioamplifier (Biopac Systems Inc., USA). The heart rate variability (HRV) time, and spectral and nonlinear domain based parameters were extracted from the tachogram obtained from Acknowledge 4.0 software (Biopac Systems Inc., Goleta, USA) using HRV analysis tool (Kubios HRV 2.0, University of Finland, Finland). The study showed that patients had decreased values of mean RR intervals, standard deviation (SD) of normal RR intervals (SDNN), square root of mean of successive differences of RR intervals (RMSSD), normalized unit (nu) of low frequency (LF), ratio of LF to high frequency (LF/HF), SD perpendicular to the line of identity (LOI) (SD1), SD along LOI (SD2), recurrence plots (L_{mean} , L_{max} , and Shannon entropy [ShanEn]), and correlation dimension (CD). Furthermore, it was found that few HRV parameters had increased values, namely, average of heart rate (mHR), SD of heart rate (SDHR), nu of high frequency (HF), LF/HF, ratio of SD1 to SD2 (SD1/SD2), approximate entropy (ApEn), sample entropy (SampEn), and long-term detrended fluctuation ($\alpha 2$). The decreased values of SDNN and RMSSD indicate sympathetic dominance. The increased values of ApEn and SampEn indicate stress and panic disorder. Higher $\alpha 2$ indicates the diseased state. The decreased values of SD1, SD2, L_{max} , ShanEn, and CD indicate the decreased complexity of the signal. Healthy male controls have higher values of HRV measures than patients, which indicates the diseased state of male BC patients.^[3-6] All the values of HRV measures are summarized in Table 1 in the form of mean \pm standard error. To conclude, the decreased values of HRV measures in male BC patients in comparison with healthy male controls prove autonomic dysfunction due to withdrawal of parasympathetic activity.

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Table 1: Heart rate variability measures in breast cancer male patients and healthy male controls

| HRV | mRR | SDNN (ms) | mHR (bpm) | SDHR (bpm) | REC | DET | ShanEn | LF (nu) | HF (nu) | LF/HF | SD1 (ms) | SD2 (ms) |
|---------|--------------------|--------------------|--------------------|------------------|--------------------|--------------------|-------------------|-------------------|-----------------|-------------------|--------------------|----------|
| BC | 800.05 \pm 78.63 | 79.68 \pm 28.53 | 78.08 \pm 7.18 | 7.46 \pm 2.8 | 88.54 \pm 41.97 | 88.54 \pm 41.97 | 55.56 \pm 11.95 | 44.32 \pm 11.92 | 2.17 \pm 1.24 | 62.69 \pm 29.71 | 91.02 \pm 30.29 | |
| Control | 833.36 \pm 43.31 | 112.48 \pm 46.15 | 75.08 \pm 3.02 | 7.36 \pm 1.93 | 113.82 \pm 41.97 | 113.82 \pm 41.97 | 59.39 \pm 5.21 | 40.27 \pm 5.18 | 2.99 \pm 1.42 | 80.66 \pm 32.69 | 120.16 \pm 42.12 | |
| HRV | SD1/SD2 | L_{mean} (beats) | L_{max} (beats) | REC | DET | ShanEn | $\alpha 1$ | $\alpha 2$ | ApEn | SampEn | CD | |
| BC | 0.57 \pm 0.19 | 13.73 \pm 1.29 | 204 \pm 64.68 | 37.49 \pm 2.12 | 98.85 \pm 0.32 | 3.35 \pm 0.09 | 0.99 \pm 0.23 | 0.97 \pm 0.09 | 1.05 \pm 0.05 | 1.48 \pm 0.21 | 1.92 \pm 0.71 | |
| Control | 0.55 \pm 0.57 | 22.99 \pm 7.01 | 248.15 \pm 39.31 | 48.78 \pm 5.94 | 98.75 \pm 0.37 | 3.44 \pm 0.15 | 0.95 \pm 0.09 | 0.83 \pm 0.05 | 0.99 \pm 0.07 | 1.18 \pm 0.15 | 2.07 \pm 0.45 | |

All the values are in mean \pm SE. nu: Normalized unit, HRV: Heart rate variability, mRR: Mean RR interval, SDNN: Standard deviation of normal RR interval, mHR: Maximum heart rate, SDHR: Standard deviation of heart rate, RMSSD: Square root of mean of successive differences of RR interval, SD1: Standard deviation perpendicular to the LOI, SD2: Standard deviation along LOI, LF: Low frequency, HF: High frequency, LOI: Line of identity, ApEn: Approximate entropy, SampEn: Sample entropy, ShanEn: Shannon entropy, SE: Standard error, BC: Breast cancer, CD: Correlation dimension, REC: Recurrence Rate, DET: Determinism

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Conflicts of interest

There are no conflicts of interest.

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