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Contribution ID: **313** Type: **Withdrawn**

Heart Rate Variability in Breast Cancer: Influence of Hormone Receptor and HER2 Status and Host-Related Factors

Thursday 23 July 2026 14:55 (20 minutes)

Background: Breast cancer (BC) is the most common malignancy among women worldwide and evidence indicates that the autonomic nervous system modulates tumor biology and the tumor microenvironment. Heart rate variability (HRV), a non-invasive marker of autonomic balance, is influenced by age, menopausal status, body composition, and physical fitness. Although reduced HRV has been associated with poor cancer outcomes, it remains unclear whether BC tumor characteristics—such as hormone receptor (HR) and HER2 status—together with host-related factors jointly shape autonomic regulation. Purpose: To compare HRV across BC groups defined by HR and HER2 status and to examine the influence of host-related factors on cardiac autonomic function. Methods: Thirty-nine women with histologically confirmed BC were evaluated before treatment initiation. Tumors were classified by immunohistochemistry as HR-positive/HER2-negative, HER2-positive (irrespective of HR status), or triple-negative. HRV was derived from 15-minute resting R–R interval recordings and analyzed using Kubios software, including time-domain and frequency-domain indices. Host-related factors (age, menopausal status, VO_2peak, muscular strength, body fat, lean mass) were included as covariates. Results: HRV indices did not differ significantly across tumor groups (Pillai's Trace = 0.851, p = 0.398). Age emerged as the strongest determinant, showing inverse associations with SDNN and RMSSD ($p < 0.05$). A significant Tumor Group × Age interaction (Pillai's Trace = 1.013, p = 0.015) indicated that HRV declined with age in the HR-positive/HER2-negative group but remained relatively stable in the triple-negative group. Functional and body composition variables showed no independent associations with HRV. Conclusions: Autonomic function in BC appears to be primarily influenced by age, with age-related trajectories differing according to HR and HER2 status. Functional and body composition characteristics did not independently predict HRV, suggesting that aging and tumor-related biological features exert stronger effects on autonomic regulation. Longitudinal studies are warranted to clarify underlying mechanisms and prognostic implications.

Keywords

Heart rate variability; Hormone receptor status; HER2; Aging.

Conflict of Interest & Ethical Approval

yes

Abstract submitters declaration

yes

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Session Classification: Poster Session