

# Chapter 8

## Effect of Age on Heart Rate Variability Analysis in Breast Cancer Patients:

### Heart Rate Variability in Breast Cancer

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#### ABSTRACT

*Breast Cancer (BC) is the leading cause of death in women, worldwide. The Eastern Cooperative Oncology Group (ECOG) Performance Status (PS) of BC can be studied using HRV measures. The main purpose of this chapter is to give an insight to clinicians via HRV measures with respect to age to make them understand the PS of patients. Data from 114 BC patients was segregated into two age groups, G1 (20 to 40 years) and G2 (41 to 75 years). The 5-minute electrocardiogram of the subjects was taken and HRV measures were extracted. One-way ANOVA with Posthoc Tukeys' HSD test was done. Triangular Index, Ratio of standard deviation of poincare plot perpendicular to the line of identity to the standard deviation along line of identity, Detrended Fluctuation Analysis descriptors, Approximate Entropy,*

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*Sample Entropy and Correlation Dimension significantly decreased from ECOG0 to 4 and from G1 to G2. The sympathetic activity increased with vagal withdrawal as age advanced.*

## **INTRODUCTION**

Cancer belongs to various classes of diseases which occurs due to the uncontrolled growth of cells. The type of cancer is solely dependent on the cell type or organ from which they evolve. Due to invasion, tumor spreads in various parts of the body (Hanahan & Weinberg, 2000). Human breast cancer (BC) is one such type which arises due to variation in genes of somatic cells but is mostly found to acquire from their ancestors found mainly in woman (Hall et al., 1990). Several factors leading to BC includes 5% to 10% due to family history, hormonal, full term pregnancy after 30 years of age, breast density of more than 75%, exposure to ionizing radiation etc. (King et al., 2013). The screening mammography or magnetic resonance imaging (MRI) and then confirmed findings from biopsy or fine needle aspiration leads to final diagnosis of BC (Berry et al., 2005; de la Rochefordiere et al., 1992). Several types of BC includes ductal carcinoma in situ, lobular neoplasia, Paget's disease of nipple and metastatic breast cancer (DeVita et al., 2015). The staging of the BC is given in Table 1a and Table 1b, respectively. Various optimized options are chosen to provide quality improvement in the treatment of BC patients (Giuliano et al., 2017; NCCN, 2003). The age has been considered a confounder while giving the treatment (Silliman et. al., 1989).

Heart Rate Variability (HRV) studies have been done in BC survivors and has been found to be of decreased value with more fatigue (Meersman, 1993). Performance Status (PS) evaluation using Eastern Cooperative Oncology Group (ECOG) Scale is commonly used in treating cancer patients which is explained in detail in Table 2 (Shukla and Aggarwal, 2018e; Blagden et al., 2003). Age and sex factors in analyzing HRV time, frequency and nonlinear analysis were not significant in patients with cardiac disorder and depression (Stapelberg et al., 2017). The HRV analysis of hypertensive patient was done by segmenting the overnight electrocardiogram (ECG) into various scales and extracting HRV features and then reducing feature dimensions using the temporal pyramid pooling method (Hratmann et al., 2019). In HRV biofeedback, patients can observe their HRV on computer screen and attempt to increase HRV and restore autonomic balance (Rourke et al., 2017). The HRV measures decreased in male BC patients as compared to their female counterparts which proves autonomic dysfunction (Shukla and Aggarwal, 2017). Heart rate

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