International Research Journal of Education and Technology
Peer Reviewed Journal
ISSN 2581-7795

Impact of Chronic obstructive pulmonary disease on heart rate dynamics among clients admitted with cardiac failure in Index Medical College Indore

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Introduction

Patients with both HF and COPD usually have significant decreases in their ability to do daily tasks and their overall quality of life. This is because both conditions involve several organ systems and cause disruptions in autonomic regulation and the operation of various organs and bodily processes, including cardiovascular control at rest and during exercise. Heart rate variability (HRV) analysis is a good way to learn more about the cardiovascular system and the mechanisms that control autonomic adjustments. It is also a reliable way to estimate the likelihood of death or a bad prognosis.

When it comes to the sinus node, those with HF have an imbalance between the sympathetic and vagal tones. Impaired cardiac function is associated with lower vagal tone and increased sympathetic activity, both of which slow down the body's ability to flush out waste and absorb nutrients. Stress in the vagus nerve is a proxy for vagal tone. The central and peripheral chemoreceptors' ability to regulate oxygen consumption may be affected by the chronic hypoxia in the periphery that may be seen in these people.

Significant systemic effects of COPD include decreased heart rate variability (HRV) responses, increased sympathetic activity, and a higher resting heart rate. Extreme parasympathetic airway hyperactivity, vasoconstriction, bronchoconstriction, hypoxia, hypercapnia, and systemic inflammation are all potential triggers for these reactions. Active postural manoeuvres (APMs), as discovered by Sam et al., are associated with poor autonomic modulation and mostly parasympathetic control. Some people may not react to the APM, which is a strong stimulus for increasing sympathetic modulation, because they don't have enough vagal resumption. This may cause sympathetic hyperactivity and may also control the exercise response.

Despite the fact that autonomic imbalances may have a negative impact on static postural adjustments and during respiratory manoeuvres, no studies have looked at APM and the respiratory sinus arrhythmia manoeuvre (RSA-M) in patients with coexisting COPD and HF. We aimed to examine the linear and nonlinear effects of COPD-HF on HRV dynamics by using APM and RSA-M as stimuli. We hypothesised that the elevated sympathetic state at rest in COPD-HF patients compared to HF patients was responsible for the reduced autonomic response observed in this population.

Methodology

All of the participants in this research were drawn from patients at Index Medical College in Indore. The samples were selected for a particular objective. One hundred individuals made up the sample. Patients with pulmonary function test-confirmed COPD and patients with a clinical diagnosis of HF, whereby the LVEF was defined as 50% or less, took part in the study. The left ventricular ejection fraction (LVEF) was lower than 50% in patients with HF. Participants were excluded if they had a history of exacerbations of COPD or HF, musculoskeletal disorders, neurological conditions, or mental health issues; a clinical diagnosis of lung cancer; a history of heavy alcohol use; an abnormal electrocardiogram; or uncontrolled metabolic or cardiac diseases. Diagnostic procedures include heart rate variability (HRV) indices, digital spirometry, electrocardiograms, and Doppler echocardiography. We used SPSS 21 to analyse the data. Parametric tests were performed to ensure the data was consistent. Assuming the data are normally distributed, we use mean values, standard deviations, frequency distributions, and t-tests to explain the results.

Results

Patients with heart failure and COPD-HF were assessed, and we compared their clinical, echocardiographic, and spirometric features. The pulmonary function of patients with COPD and heart failure was lower than that of patients with heart failure alone, but other than that, the two groups were equal. When compared to the supine position, patients with heart failure had lower values for the RR tri-index, iRR, , HF nu , and RMSSD while higher values were seen for the HR, LF/HF nu and LF nu, . The expected autonomic reaction was seen upon

orthostasis. In comparing the supine posture to orthostasis, this was really the case. However, time and frequency indices failed to demonstrate APM's efficacy in patients whose COPD and HF symptoms overlapped. During the transition from the supine to the orthostatic posture, the HR complexity decreased, as measured by the only non-linear metric, sample entropy, whose values decreased after the APM. This was the only metric to show a decline. Patients with COPD and HF coexisting had, a lower LF nu, and a higher LF/HF nu compared to patients with HF in the orthostatic position. When comparing individuals with HF and COPD.

Conclusion

When compared to patients with isolated HF, patients with COPD and concomitant HF demonstrated an autonomic imbalance during vigorous postural shift and regulated breathing. This study adds to the growing body of evidence connecting COPD and poor autonomic cardiac regulation across a spectrum of diagnostic and therapeutic interventions. Clearly, these individuals require corrective therapies, such as regular exercise and breathing exercises, to improve their cardiac autonomic responses.

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