

## VARIABILITY OF HEART RATE IN NEWBORN INFANTS: A LITERATURE REVIEW

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**Abstract:** One of the parameters for understanding the body's homeostasis is through the interaction between the cardiovascular and nervous systems, whose functioning is more dynamic in neonates. This article seeks to analyze heart rate variability in newborns, through previous studies related to the theme. It appears that the analysis of heart rate variation can be presented as a valid tool for monitoring the evolution of the autonomous system of neonates.

**Keywords:** Variability, Heart rate, newborns, autonomic nervous system.

## INTRODUCTION

The human organism has complex systems and mechanisms of interaction with the environment in which it operates and its conditions in order to maintain homeostasis, guaranteeing the internal balance of the organs, notably due to the relationship of mutuality and feedback between heart and brain, whose activation of the autonomic nervous system is reflected in the oscillation of the chronotropic behavior of cardiac contractility ( PIKKUJÄMSÄ et al, 1999).

Faced with this well-known and intricate interaction, several researchers have dedicated themselves to observing and defining how the analysis of cardiac activity can help in the evaluation of the functionality and response of the nervous system to stimuli and external conditions, be they more subtle changes or under greater stress. One of the most widely used non-invasive technologies for recording and evaluating cardiac function is the electrocardiogram, due to its wide availability and accurate recording of the electrical activity of the heart. Thus, this tool proved to be very useful in terms of determining heart rate variability, whose oscillation may reflect on the dynamics of the heart-brain binomial and, therefore, on the body's autonomic response.

In view of this scenario, the knowledge

that younger and healthier individuals have a greater capacity to maintain the dynamic balance of the body, therefore, bearers of a sympathetic and parasympathetic system capable of adapting to the slightest variations of a certain environment. Although this fact has been explored more frequently during the assessment of adults, little has been studied about the context in the pediatric population, especially in individuals in the neonatal period, whose observed concepts were commonly extrapolated to this population rather than investigated in greater detail.

Given the scenario presented, the main purpose of the following work is to discuss the main aspects of heart rate variability in newborns through an exploration of findings in the medical literature, in order to discuss implications and particularities linked to these individuals who may elucidate how this primordial mechanism works in the maintenance of homeostasis in the context of the neonatal population.

## MATERIAL AND METHODS

This study is an exploratory bibliographic review. For the elaboration of this work, the bibliographic survey was compiled in order to understand how the autonomic nervous system interacts with the behavior of cardiac activity in neonates, looking for published theoretical references that deal with the subject, including sources such as articles through a search on the MEDLINE and PubMed platforms, the descriptors were organized with the following search strategy: heart rate variability; newborns; autonomic nervous system. After the bibliographic survey of the most relevant points in relation to the theme, a secondary analysis was carried out on the listed articles.

## RESULTS AND DISCUSSION

The complex performance of body self-regulation mechanisms through the activity of the sympathetic and parasympathetic nervous system on cardiac activity presents even more particularities when the individual's age variable is introduced, in which an attenuation in the body's ability to respond to stress is observed., observed through a trend towards linearity in the behavior of heart rate variability, as described by Dos Santos et al. (2014).

In that same work, the researchers proposed to use statistical tools, such as the recurrence quantification analysis, to accurately determine the physiological changes associated with the dynamics of heart rate variability, as well as to verify the possibility of stratification of different age groups from the information obtained by analyzing the electrical activity of the heart. The outcome of this study revealed that, through the methods adopted by the researchers, there is a significant difference in heart rate variability with age, with a positive correlation of this variable in relation to the degree of slowing of the autonomic response, being even more distinct between individuals of older age in years, when comparing different age subsets such as full-term neonates (mean: 8 days), premature neonates (mean  $\pm$  27.4 days), healthy young adults (mean: 20.7  $\pm$  1.6 years) and adults (mean: 58.4 $\pm$ 10.2 years).

Another piece of information derived from this work, however, is that during the comparative analysis of the analysis of heart rate variability between the subgroups of term neonates and premature neonates, few differences were observed, establishing a more preponderant age-dependent aspect with regard to this variable, despite the particularities regarding the neurological development of premature children, who tend to present a more immature and developing homeostatic response system despite a shorter

time to develop it in relation to full-term newborns, as highlighted by Finley, Hugent and Hellenbrand (1987). Other factors that may interfere with this aspect were also listed by these researchers, such as a greater decline in sympathetic activity with age in relation to parasympathetic activity, in addition to an increase in cardiac volume, although this is more pronounced after five years of life., as described by Henry et al. (apud Finley, Hugent & Hellenbrand, 1987, p. 2052).

From an even more specific perspective regarding the characterization of the sample, Selig et al. (2011) performed an analysis of the heart rate variability of 48 premature newborns and 78 healthy newborns, in order to monitor the evolution of the autonomic nervous system of these patients., as well as observing differences in the behavior of heart rate variation between preterm and full-term neonates. This study, in turn, found that in all parameters associated with the mean RR intervals, which determines the duration of each heartbeat, there were statistically significant differences between the preterm and full-term subgroups, such as a higher mean RR in newborns healthy, as well as the SDNN, a variable that compares the average with the fluctuations in the records, thus quantifying the frequency oscillations that occurred during the evaluation.

## CONCLUSION

The interconnections between the nervous and cardiovascular systems and the hemodynamic repercussions are highly complex events that are difficult to assess in neonates, although consequences of such interactions are reflected in cardiac electrical activity, through the measurement of heart rate variability, one of the most important parameters validated to understand the dynamics of this system.

It is thus observed that, based on the

knowledge already obtained regarding this topic in the literature available to date, using the analysis of heart rate variability can be

quite useful as a tool for prognostic evaluation of the development of the autonomic nervous system of individuals, especially in neonates.

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