

Significance of Detection of Bradycardia in Preterm Infants

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ABOUT THE STUDY

Up to 10% of births globally are premature, occurring before the 37th week of pregnancy. The average preterm birth rate in Europe is 7.3%, while 4.5% to 8% of all deliveries are to infants with low birth weights (less than 2500 g). Due to their undeveloped immunological and cardio-respiratory systems, premature babies and low birth weight newborns are more likely to experience life-threatening illnesses. Additionally, the COVID-19 pandemic and the related Severe Acute Respiratory Syndrome Corona Virus 2 (SARS-CoV-2) strain both mother and kid because there are still many unanswered uncertainties regarding the newborn's long-term development.

Given that multiple studies have linked SARS infections during pregnancy with premature delivery and intrauterine growth limits, it is important to consider the psychological strain on the mother. The newborn intensive care unit's operations are reportedly affected by the epidemic as well (NICUs). Many youngsters are affected by the most recent SARS-CoV-2 virus advances (according to CNN, "Hospitalizations were highest among kids up to 4 and youths aged 12-17. Recently (19 October 2021), Romania also recorded a record number of COVID infections of 18,863 cases, with 486 minors afflicted. One in four of the children who were hospitalized required intensive care.

To better understand the effects of the novel coronavirus, long-term observation of newborns is advised. Remote supervision and automatic diagnosis algorithms are designed to make access to medical care possible when hospitals throughout the world are understaffed and under pressure. Neonatal remote monitoring is a challenging undertaking since newborns are frequently in motion and a variety of interferences contaminate the relevant ECG data. A quick clinical response is made possible by the development of technical technologies that help with medical diagnostics. Another management strategy is giving parents of young children some of the responsibility for their children's medical care through remote home monitoring.

Additionally, because newborns' immune systems are still developing and therefore need close monitoring, infants are susceptible to contracting the coronavirus later in life. Due in part

to apnea and sleep abnormalities, the preterm state is a vulnerable state that is strongly linked to Sudden Infant Death Syndrome (SIDS), necessitating the use of particular sleep techniques to assure an infant's safety. Infants are especially vulnerable to sleep-related cardio-respiratory instability since preterm neonates might sleep for up to 70% to 90% of the day. During the periods of sleep, there is a noticeable danger of cardiovascular instability. Preterm newborns are reportedly more likely to experience breathing pauses (also known as apnea-bradycardia incidents), which are linked to cardiac rhythm problems.

A cardiac event known as bradycardia is described as one in which the heart rate drops to fewer than 100 beats per minute for at least two beats (in terms of RR-peaks, the time difference between the subsequent R-peaks must be greater than 0.6 seconds). Physiological alterations caused by foetal discomfort can be identified by variations in heart rate variability (HRV). Infants with larger root mean square of consecutive RR-interval differences (RMSSD), Standard Deviation of Normal RR-Intervals (SDNN), and Standard Deviation of the Average Normal RR-Intervals (SDANN) demonstrated a better neurological development, according to real-time monitoring of HRV measurements.

Clinicians may find it easier to interpret RMSSD variations if they are aware of the relationship between RMSSD and the infant's vagal activity. The lower the RMSSD, the lesser the modulation by the vagal activity, which worsens the infant's condition. However, a sharp increase in RMSSD values may be a sign of further pathogenic conditions, such as intra-partum hypoxia-ischemia (lower oxygen supply) that causes brain damage. According to the study's findings, the clinical outcome is poorer the more the HRV measures are adjusted (leading to brain injury or even SIDS). Clinical diagnosis should be aided by personalized and automated diagnostic algorithms, which should reduce medical stress. Bradycardia and COVID-19 have been combined in recent studies, with an increased incidence of cardiovascular symptoms in patients (both adults and children) being documented. Some studies link cardiac arrhythmias (such bradycardia) with clinical post-symptoms of COVID.

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An automatic surveillance system therefore has a useful medical use (for NICU or home monitoring). Future aims include developing a prototype for a portable neonatal monitoring system

based on Arduino and applying the software algorithms to a hardware device in order to do more clinical research on the prevalence and consequences of baby cardiac arrhythmias.