Heart Rate Variability of preterm infants changes in the hours prior to Late-Onset Sepsis

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Background

Late-onset sepsis (LOS, onset >72 hours after birth) is a major cause of mortality and morbidity among preterm infants.

Prior studies have shown heart rate variability (HRV) may hold potential to act as an early predictor of sepsis.

Our aim is to characterize changes in various features of HRV in the hours leading up to LOS.

Methods

Study population: retrospective cohort study in infants <32 weeks gestational age with LOS (n=42), proven by a positive blood culture (July 2016-February 2018).

The **CRASH-moment** was defined as the start-time of antibiotics and served as an anchor point for analysis of four HRV-features:

- RR-interval (RR)
- Standard deviation of normal-to-normal intervals (SDNN)
- percentage of heart rate decelerations (pDec)
- Severity of heart rate decelerations (SDDec)

HRV-features were calculated every 3 hours using a moving-average window of 6 hours. Mean values (standard deviation) of the HRV-features are graphically displayed in figure 2.

Figure 1: CRASH-moment (Cultures, Resuscitation & Antibiotics Started Here)

Results

Traditional HRV features such as RR intervals, SDNN and pNN50 are insensitive to the development of sepsis.

pDec and SDDec show prominent changes prior to the CRASH-moment.

pDec reduces from 45% to 40% while SDDec increases by more than 50% compared to baseline.

Figure 2: Time-series analysis of 4 HRV features (RR, SDNN, pDec and SDDec). CRASH indicated by red horizontal line. Mean and confidence intervals (horizontal bars) are shown.

Note that from T=-12 pDec gradually decreases and at T=-3 and T=0 below the lower limits of SD values. From T=-12 SDDec is above the upper limits of SD values.

Conclusion

Between 6-12 hours prior to CRASH, preterm infants show a decrease in the percentage of heart rate decelerations but an increase in the severity of decelerations. In effect these features capture a storm of transient bradycardias that may not be severe enough or last long enough to result in clinical alarms.

Tailored features of HRV may prove useful for the predictive monitoring of sepsis by enabling the earlier detection of sub-acute clinical decelerations.