Respiration Signal as a Promising Diagnostic Tool for Late Onset Sepsis in Premature Newborns

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The diagnosis of late onset sepsis in premature infants (PI) remains difficult because clinical signs are subtle and non-specific and none of the laboratory tests have high predictive accuracy. This lack of reliability of laboratory tests often results in anticipatory antimicrobial treatment. Heart rate variability (HRV) analysis emerges as a promising diagnostic tool. Entropy and long-range fractal correlation are decreased in PI with proven sepsis and presenting frequent and severe bradycardias. We shown last year that respiration and its relationship to HRV can participate as a diagnosis tool. As apneas and bradycardias are more severe and recurrent when a systemic infection is present in the PI, we investigated here only the respiratory signal. It has been analyzed using statistical, signal processing and chaos techniques in order to nd any relationships between the breathing pattern and infection. The tests were performed on a cohort study of 13 septic and 13 non septic infants (post-menstrual age $<$33 weeks and chronological age $>$72 hours), hospitalized in the neonatal intensive care unit at the university Hospital of Rennes who presented severe (need of bag and mask to resuscitate) or frequent (more than 1 per hour) bradycardias. From the respiratory signal, the statistical analysis reported some signicance in the ratio between the inspiratory ti and expiratory te times (p value=0,002), while the other parameters were not signicant. Analyzing the respiratory variability with chaos techniques, it has been found that the Hurst exponent is lower in the infected population (0,64 against 0.66 in healthy with p value$<$0.03), which implies a more complex breathing pattern. Moreover, we observe that the duration of central apneas have a different distribution in each group : the infected newborns exhibit generalized extreme value (GEV) distribution, the non infected trend to lognormal distribution.