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Heart rate variability and outcomes prediction in critical illness

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Introduction: Heart rate variability (HRV) is an indicator of the dynamic equilibrium between the sympathetic and parasympathetic divisions of the autonomic nervous system. We hypothesized that baseline HRV variables and changes during resuscitation may predict outcomes from critical illness.

Methods: A prospective, observational study was performed on inpatients that required a rapid response team (RRT) consultation. 24-hour holter monitoring and serial measurements of physiological and biochemical data were made. Heart rate variability was measured as time domains measured over 24 hours (SDNN, ASDNN, rMSSD, pNN50%, SDANN, mean NN) and frequency domains measured hourly (very low frequency- VLF, low frequency- LF, high frequency- HF, low/high ratio). The research ethics committee approved the study protocol (RAC no. 2151069).

Results: 53 patients were enrolled, mean APACHE II score was 23.5±6.3, age 52±24.3 years. Day one SOFA score was 8.9 (range 1, 23). 40 patients (75.5%) required ICU admission; ICU mortality rate was 27.5%. HRV was significantly higher in RRT consultations who stabilized and did not require ICU admission; time domains; ASDNN [33(IQR21) vs. 18(IQR21), p=0.024], rMSDD [23(IQR19) vs. 15(IQR18), p=0.036] and frequency domains; mean VLF [16.6(IQR7.3) vs. 9.3(IQR10), p=0.018], mean LF [12.4(IQR11) vs. 5.4(IQR7), p=0.009], mean HF [9.3(IQR12) vs. 4.8(IQR7), p=0.011]. Baseline HRV was significantly higher in survivors; ASDNN [31.5(IQR24) vs. 12(IQR9),p=0.002], rMSDD [25(IQR19) vs. 11.5(IQR10), p=0.012], pNN50% [6(IQR9.5) vs. 0.75(IQR2.5), p=0.002], mean NN [732.5(IQR291) vs. 570(IQR87), p=0.006], mean VLF [12.1(IQR11.8) vs. 5.3(IQR4), p=0.002], mean LF [8.5(IQR10.2) vs. 3.4(IQR4.6), p=0.009], mean HF [7.5(IQR6) vs. 3.3(IQR3.9), p=0.005]. Survivors also demonstrated a significantly larger increase in HRV over 24 hours of resuscitation; delta VLF [3(IQR8.1) vs. -0.6(IQR8), p=0.015], delta LF [3.2(IQR5.9) vs. -0.3(IQR7.6), p=0.017].

Conclusion: HRV analysis appears to be a powerful identifier of outcomes in critical illness. Baseline values and changes over the first 24 hours of resuscitation accurately predicted both the need for ICU admission and survival

Biography

Mouhamad Ghyath Jamil completed his Graduation at Aleppo University. After completing his Residency in Internal Medicine at University of North Dakota, he joined the university as an Associate Professor. He completed his fellowship in Pulmonary, Critical Care and sleep Medicine at George Washington University. He is Board Certified in Internal medicine, Pulmonary, Critical Care and Sleep medicine. He is currently a Consultant in Pulmonary, Critical Care and Sleep Medicine at King Faisal Hospital and Research Center. He is the Medical Director; Medical ICU and Sleep Medicine Unit. He is an active member of many societies including ACCP, SCCM, ASSM, SCCS, STC, and MCCA. He has a major interest in E-health and Simulation; he established the first Tele-ICU program in Middle East.

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