CHANGES IN THE BLOOD PRESSURE SIGNAL AUTOCORRELATION FUNCTION PRIOR TO HYPOTENSION IN SEPTIC SHOCK

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Introduction: Hypotension during septic shock may lead to worsening tissue perfusion and organ damage. Currently, hypotension is not detectable until blood pressure has decreased by a significant degree. We suggest that physiologic changes occur prior to hypotension that may be detected using novel methods of physiologic signal analysis. We hypothesized that the autocorrelation function (ACF) applied to the blood pressure signal immediately before the onset of hypotension would significantly differ from values analyzed earlier. **Methods:** We studied 28 episodes of hypotension (defined as an acute drop of > 20 mmHg of the mean blood pressure over a 2 min period) in 4 septic patients (age range 0.25-3 yrs). We defined seven 20 sec segments prior to the hypotensive episode. The first segment preceded the hypotensive episode by 20 sec and the other 6 non-overlapping segments spanned 100-220 sec prior to the episode. The ACF is a measure of the signal correlation at time (t) with time (t + n) for a range of delay values (n). The ACF was calculated for delays ranging from 0 sec to the average interpulse interval. The minimum value of the ACF in this range was used to characterize each of the signal segments. We applied the binomial test to determine whether the value for the first segment was consistently less than or greater than the other six segments for each hypotensive episode. We considered $p < 0.05$ as significant. **Results:** In 21/28 (75%) episodes the minimum ACF coefficient of the first segment was less than or greater than the other 6 segments ($p < 0.001$); the ACF coefficient was less than the other 6 segments in 15/28 (54%) ($p<0.001$); and, the ACF coefficient was greater than the other 6 segments in 6/28 (21%) ($p = 0.094$). **Conclusion:** We conclude that changes in the blood pressure signal precede an acute decrease in the mean blood pressure by at least 20-40 sec in 75% of patients in this pilot study. These signal changes may reflect physical changes, such as vasodilation, at the arteriolar level. The underlying physiologic mechanisms remain to be determined. We suggest that changes in the ACF of the blood pressure signal may detect imminent hypotension prior to any change in mean blood pressure in patients with septic shock.