

Systolic Pressure Modulation

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Introduction

Systolic Pressure Variation (SPV) is defined as the difference between maximum and minimum systolic pressures during one cycle of ventilated breathing. The SPV increases for decreasing (circulating) blood volume and can therefore be used to detect hypovolaemia. Since the heart beats (semi-)independently, SPV values for subsequent respiratory cycles fluctuate highly, making it difficult to correctly detect hypovolaemia. We propose the notion of Systolic Pressure Modulation (SPM), which is more consistent over time. Fujita et al. mentioned a similar method, but neither a derivation nor a justification of the method was given [1].

Methods

The heart rate is in general not an integer multiple of the respiratory frequency. Therefore, systolic peaks for subsequent respiratory cycles have different alignments with respect to the inspiratory start. This implies that causes that give rise to the variation of systolic pressures [2] have differing influence on the systolic peaks for subsequent respiratory cycles. The effect results in a modulated pressure signal. Systolic pressure peaks then represent samples of the modulation envelope of this signal. The SPM is defined as the difference between the maximum and the minimum values of the envelope. Fluctuations in subsequent SPV values are caused by the fact that the points used for calculation alter each cycle.

Results

Figure 1 shows two subsequent systolic pressure modulation signals, using a time window of 30 seconds. Although the SPM does not change much, the SPV values differ a lot.

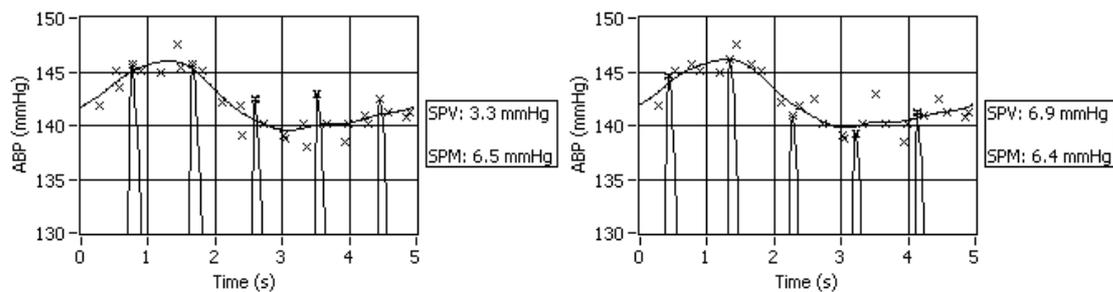


Figure 1: subsequent systolic modulation signals (time window of 30 seconds)

Conclusions

We propose a new method that does not show the fluctuations that occur in subsequent SPV values and results in a more consistent indicator for hypovolaemia.

References

1. Yoshihisa Fujita, Atsuo Sari, Tokunori Yamamoto, *On-line Monitoring of Systolic Pressure Variation*, *Anesth Analg* (2003), 96:1529-1530
2. A.J.D. Parry-Jones, J.A.L. Pittman, *Arterial pressure and stroke volume variability as measurements for cardiovascular optimisation*, *Int J Intensive Care* (2003), Summer:67-71