

DRAFT FINAL REPORT

Examination of Real-time Heart Rate Variability During Active Hemorrhage

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EXECUTIVE SUMMARY

Autonomic Nervous System (ANS) Monitoring based on Real-time Heart Rate Variability (rt-HRV) techniques is a unique and novel means of non-invasively monitoring the physiologic status of patients undergoing surgery. In many surgical cases, large amounts of blood can be lost leading to hypovolemia. Severe hypovolemia can place the patient at risk. Foreknowledge of the hypovolemic state can help prevent additional complications. Forty patients were studied during high blood-loss surgeries in a major trauma center. ANS monitoring parameter (Low Frequency area, High Frequency area, and Low to High Ratio) information was collected and analyzed. The ANS monitoring parameter data were found to be sensitive to the physiological stresses of blood loss even in the anesthetized state. This preliminary study provides evidence that ANS monitoring, using rt-HRV, offers physicians additional, and potentially earlier, information regarding the physiologic state of their general surgery patients and the onset of hypovolemia.

This document only addresses the immediate intra-operative period from sometime after the patients' entry into the operating room, to after bleeding is controlled and the patient is again stable but still under anesthesia. Estimated blood-loss data were recorded in the anesthesia record.

The fundamental research questions that were expected to be to be answered from this test and evaluation project are:

- 1) "Is ANS monitoring sensitive to changes in physiologic conditions resulting from hypovolemic states while under anesthesia?"; and
- 2) "Can ANS monitoring detect earlier the onset of hypovolemia?".

These questions provided the basis for the data collection and analysis portions of the project documented herein.