Early Detection of Hypovolemia

Technology #j340

Early detection of hypovolemia is clinically important because severe hypovolemia, blood loss of more than 1 liter, can lead to rapid decline and cardiovascular collapse. By the time the tachycardia or low blood pressure associated with severe hypovolemia is finally detected, the patient will already have severe medical complications. To date, the reliable clinical detection of hypovolemia requires a pulmonary arterial catheter while under mechanical ventilation, a procedure which has been associated with medical complications and increased mortality.

Dartmouth’s researchers developed a noninvasive procedure to monitor changes in blood flow using existing FDA approved pulse oximeters. It detects morphological changes caused by less than normal blood volume in the respiratory induced variation in the photoplethysmogram (PPG) in non-ventilated subjects. These changes are characterized by statistically robust metrics that were developed to characterize the top and bottom envelope of the PPG, and the shape of the cardiac pulses.

The use of these metrics was validated in nonintubated healthy volunteers with a Lower-Body Negative Pressure (LBNP) chamber which induces central hypovolemia by sequestering blood in the hips and lower extremities. Hypovolemia corresponding to sequestration of more than 1 liter of blood (LBNP > 60 mmHg) was consistently detected using these metrics before significant change in blood pressure, or tachycardia are observed.

Possible applications of Dartmouth’s device include monitoring outpatient surgery patients for internal blood loss, and women undergoing Cesarean Sections where it is hard to manually determine blood loss. Triage of trauma victims is another medical application. This device will also detect hypovolemia caused by dehydration, making it applicable to monitoring athletes and others who have to work under heat stress.

This technology is claimed in the published United States Patent Application No. 11/624,065. We are seeking an industrial partner interested in its commercialization. (Ref: J340)