Comparing a Novel Non-Invasive Photoplethysmography Device, Capable of Continuous Wireless Monitoring of Advanced Hemodynamic Properties, to the Existing Invasive Gold Standard Device, in a Porcine Model of Hemorrhagic Shock

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Introduction:

Organ failure is a common complication of hemorrhagic shock due to trauma. Balanced fluid resuscitation can improve tissue damage and prevent multiple system failure. Existing means of measuring hemodynamic status are invasive, expensive, complex to use and associated with complications. In this study, the reliability of an innovative noninvasive photoplethysmography device (PPG) for hemodynamic monitoring (Biobeat Technologies Ltd.) was compared with the invasive gold standard.

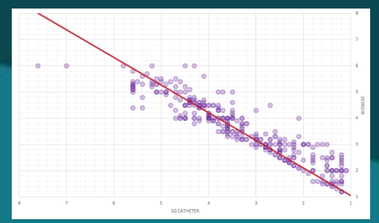
Methods:

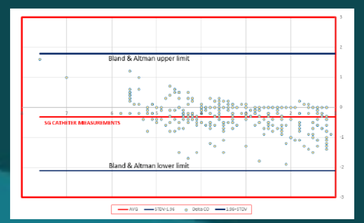
Hemorrhagic shock was induced in 10 female pigs, weight range 41-50 kg. Animals were bled 35% of total blood volume, and monitored for 7 hours (or until death occurred). Hemodynamic parameters were continuously monitored and recorded by the Biobeat monitoring system. Readings of the Biobeat device and the Swan Ganz Catheter were compared every 5 minutes during the bleeding phase, and every 20 minutes during the observation period. The Biobeat sensor was attached to their tail/tongue/skin. Parameters included: Systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP), heart rate (HR), blood oxygen saturation (SPO2), cardiac output (CO), stroke volume (SV), and cardiac index (CI).

Results:

Cardiac Output (CO)

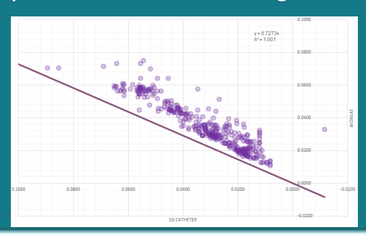
70% (R) of the data sets are equal or very close to it; the linear correlation between the two devices is 96.5%; 219 points were within range of Bland-Altman analysis (79%)

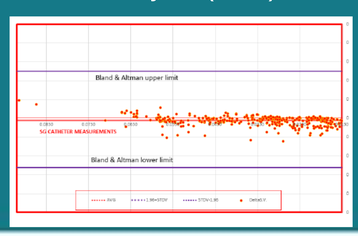




Stroke Volume

100% (R) of the data sets are equal or very close to it; the linear correlation between the two devices is 95.6%; 217 points were within range of Bland-Altman analysis (78%)

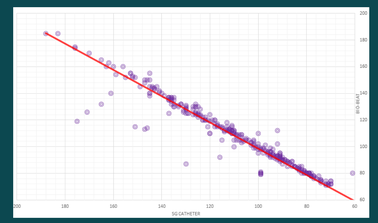


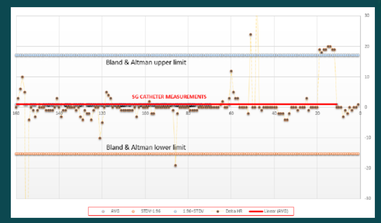


Results:

Heart Rate (HR)

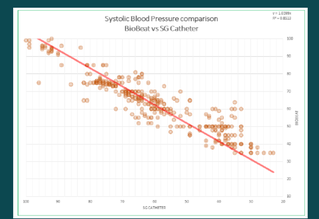
94% (R) of the data sets are equal or very close to it; the linear correlation between the two devices is 96%; 217 points were within range of Bland-Altman analysis (78%)

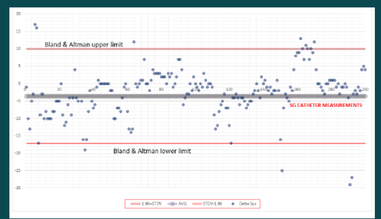




Systolic Blood Pressure (SBP)

92% (R) of the data sets are equal or very close to it; the linear correlation between the two devices is 93.5%; 212 points were within range of Bland-Altman analysis





Discussion:

There is a clear need for a technology capable of monitoring advanced hemodynamic signs. We found high accordance between the Biobeat monitor and the SG catheter in all parameters. including CO, HR, SV, SBP and DBP. The Biobeat monitoring device can be formally used as a simple, accurate and reliable non-invasive continuous wearable and wireless medical monitoring device, This enables simple and efficient way to measure complex parameters.

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