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BEAT-TO-BEAT BLOOD PRESSURE ACCURATELY PREDICTS SUBSEQUENT ARM CUFF BLOOD PRESSURE VARIABILITY AFTER ACUTE ISCHEMIC STROKE

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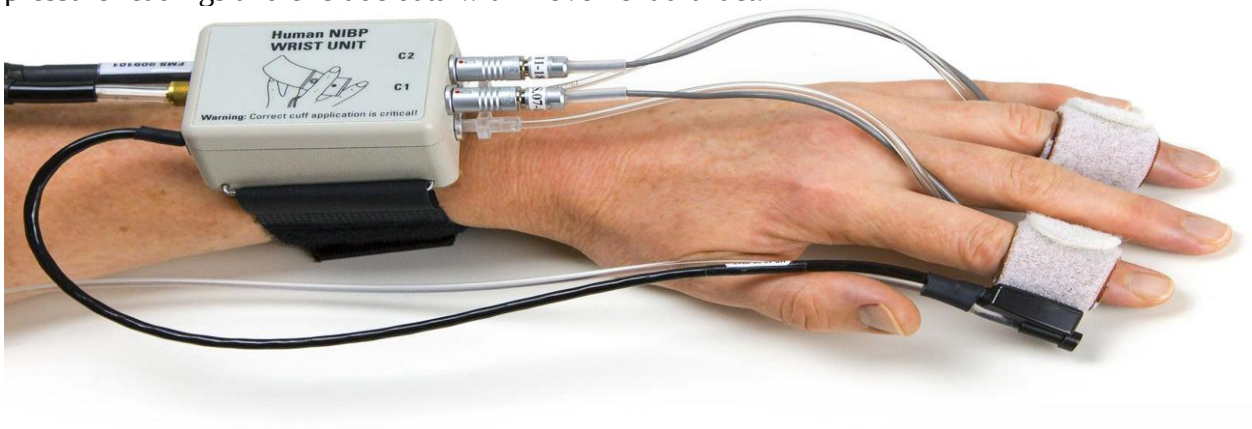
Background:

- Higher blood pressure variability (BPV) is associated with worse outcome after ischemic stroke
- Accurate quantification of blood pressure variability requires frequent measurements, which is not practical with conventional arm cuff sphygmomanometry.
- Finger photo-plethysmography (Figure 1) allows accurate beat-to-beat measurement of blood pressure.
    - **Figure 1:** Finger photo-plethysmography unit on patient. The study protocol specified that all patients be supine, with no arm movement or talking during the 15 minute period of monitoring. LabChart Pro software was used to extract blood pressure readings and exclude data with movement artifact.



Hypothesis:

- 15 minutes of beat-to-beat BPV (bBPV) will accurately predict arm cuff BPV (aBPV) for acute ischemic stroke patients' entire hospitalization.

Methods:

- We prospectively enrolled 32 patients hospitalized for acute ischemic stroke.
- BPV was measured using systolic and diastolic blood pressure to calculate standard deviation (SD), coefficient of variation (CV), absolute real variability (ARV), successive variation (SV), and residual standard deviation (rSD).
- bBPV = 15 minutes of photo-plethysmography.
- aBPV = arm cuff blood pressure during hospitalization.
- We measured bBPV with an ADInstruments NIBP System for 15 minutes, ~2 measurement/second, with three 5 minute epochs per patient.
- To examine if bBPV could predict subsequent aBPV in the patients hospitalized for stroke, we restricted the analysis to stroke patients with bBPV measured within 48 hours of stroke onset and at least 20 subsequent arm cuff blood pressure readings.

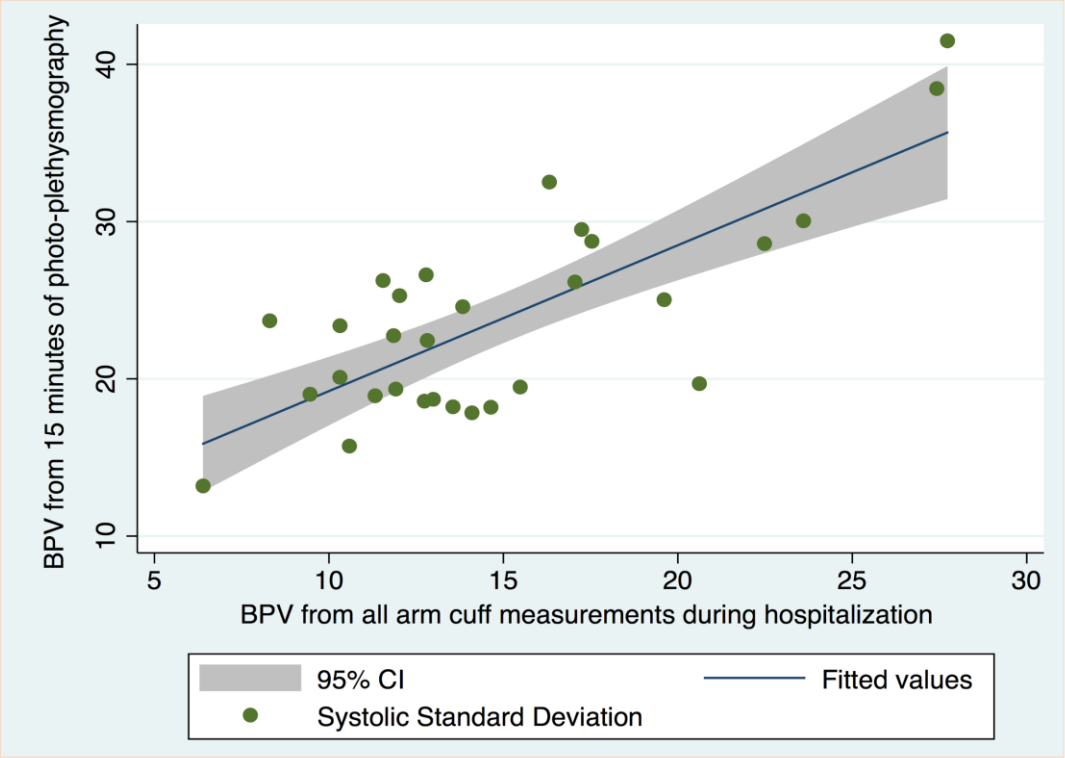
- We report Pearson's correlation coefficient for five different statistical estimations of variability.

Results:

- Mean±SD Age of 60.1±13.9 years, and 19/30 of enrolled patients were male.
- Average NIHSS in the study was 5.1.
- Mean±SD discharged mRS was 2.2±1.3
- The mean±SD time from stroke onset to bBPV measurement was 2.2±1.5 days.
- There was a mean±SD of 1830±54 photo-plethysmography readings for bBPV per participant.
- For the comparison between bBPV and subsequent aBPV, 30 patients met criteria with a mean of 62 arm cuff readings.
- For systolic blood pressure, the correlation between aBPV and bBPV was moderate to excellent (Table 1 and Figure 2).
- For diastolic blood pressure, the correlation between aBPV and bBPV was only poor to moderate (Table 1 and Figure 2).
    - **Table 1.** Pearson's correlation coefficient between arm cuff and finger photo-plethysmography BPV, showing superior agreement for systolic BPV.

Blood Pressure Variable	Pearson's Correlation Coefficient
Systolic Mean	0.687
Systolic Standard Deviation	0.762
Systolic Coefficient of Variation	0.543
Systolic Absolute Real Variability	0.830
Systolic Successive Variation	0.723
Systolic Residual Standard Variation	0.604
Diastolic Mean	0.599
Diastolic Standard Deviation	0.517
Diastolic Coefficient of Variation	0.298
Diastolic Absolute Real Variability	0.410
Diastolic Successive Variation	0.458
Diastolic Residual Standard Variation	0.448

Figure 2. Scatter plot of systolic standard deviation, with BPV from photo-plethysmography on the y-axis and arm cuff on the x-axis. The correlation coefficient is 0.762. Note that photo-plethysmography generally reports slightly higher variability.



Conclusions:

- This pilot study demonstrates the feasibility of predicting longer-term BPV with 15 minutes of finger photo-plethysmography in the first two days after acute ischemic stroke onset.
- As opposed to deriving BPV from arm cuff measurements, which takes days, our approach allows early and rapid identification of patients who will subsequently have high BPV and may benefit from therapeutic intervention.

References:

1 Manning LS, Rothwell PM, Potter JF, et al. Prognostic Significance of Short-Term Blood Pressure Variability in Acute Stroke Systematic Review. Stroke 2015;46:2482–90.