Adoption of Continuous Beat-to-Beat Nocturnal Blood Pressure Measurement in Ambulatory Blood Pressure Monitoring

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Introduction
• Abnormal nocturnal blood pressure (BP) such as non-dipping or nocturnal hypertension (reverse-dipping) represents a potent marker for current and future cardiovascular risks.
• Accurate BP measurement reflecting “sleep” BP is important.
• Standard cuff-based ambulatory nocturnal BP measurement yields limited data points potentially resulting in imprecise results.

Hypothesis
• Spot check nocturnal BP does not capture true average nocturnal BP as measured by continuous beat to beat BP recording.

Methods
• Design: Prospective observational
• Subjects: Patients undergoing clinically indicated in-lab polysomnography (PSG)
• BP measurement: Beat-to-beat fashion by noninvasive Caretaker® device that uses a pulse decomposition analysis algorithm
• Sleep wakefulness status was ascertained by PSG
• Analysis:
  • Comparison between “every 30 min periodic systolic BP data starting at the onset of BP recording” and “average BP data from entire 30 min continuous beat-to-beat BP measurement” both by Caretaker® for entire recording time and by sleep state (sleep vs. awake)
  • BP variability defined as SD of the rolling difference between the 100 point mean of systole on continuous BP measurement by the patient’s sleep state

Results

Characteristics of study participants ( n = 13)
• Age: 52 (12) yo, Male (8/13), BMI 34, HTN (11/13)
• Diagnostic PSG: 9/13, Split night PSG: 4/13

Sleep characteristics of study participants ( n = 13)
• Any OSA (AHI>5) present: 10/13
• Significant OSA (AHI>15) present: 6/13
• Average total sleep time: 385 min

Main results ( n = 13)
• Mean SBP of Sleep and Awake were similar [135.3 (19.8) vs. 134.5 (18.7) mmHg, P=0.45] (Figure 1- Box Plot)
• Mean nocturnal SBP by periodic BP measurement was higher compared with beat-to-beat-derived average BP (139.1 mmHg [20.3] vs. 134.7 [19.5], p< 0.0001) (Figure 2)
• The difference between the two methods remained similar when continuous BP was derived from sleep vs. awake period (4.5 mmHg [5.9] vs. 5.0 [5.6], p< 0.75)
• BP variability was more pronounced during awake compared with sleep period (4.6 mmHg [1.3] versus 3.3 [1.3], p<0.0001)

SBP comparison between hypothetical spot check BP vs. continuous beat-to-beat (Example)

Sample BP trend by sleep/awake state (Example from 3 subjects)

Conclusion
• Periodic BP measurement currently adopted by standard ambulatory nocturnal BP may not yield true nocturnal sleep BP pattern due to its spot-check nature and lack of sleep-aware information
• Incorporation of beat-to-beat continuous BP measurement along with sleep recording can provide more accurate and meaningful nocturnal BP information

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