

Cuff-less blood pressure measurement using the pulse transit time - a comparison to cuff-based oscillometric 24 hour blood pressure measurement in children

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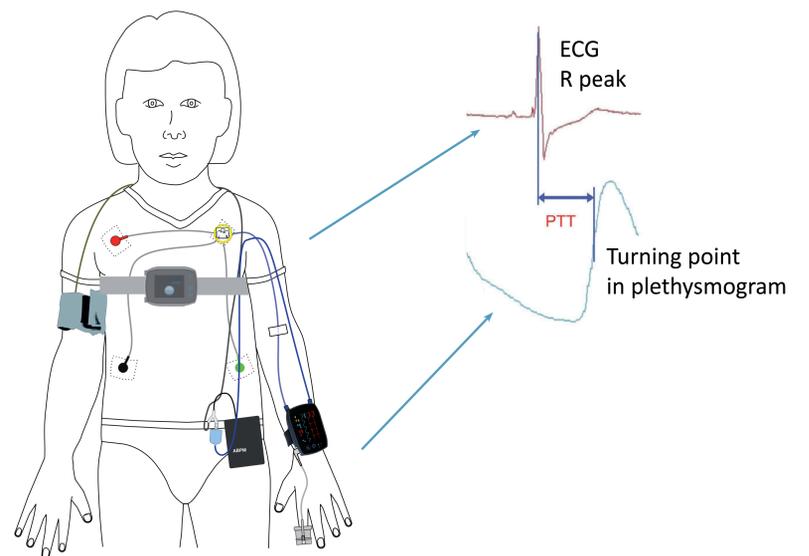
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Objective:

Ambulatory blood pressure monitoring (ABPM) is recommended as mandatory for diagnosis of hypertension in children and adolescents. In general cuff-based ABPM has several important limitations, e.g. fail recordings due to high motoric activity and arrhythmia. Furthermore, the inflation and deflation process of the cuff is disturbing the patient's sleep. Arousal reactions are caused and followed by blood pressure (BP) fluctuations. SOMNOtouch™ NIBP (SOMNOmedics GmbH) is a cuff-less BP monitor, based on pulse transit time (PTT) measurement. It provides a beat-to-beat, non-invasive and non-reactive measurement of BP.

Previous studies in adults showed a good agreement between conventional ABPM and the SOMNOtouch™ NIBP. Here, a comparison of both methods is provided for children.

Application of SOMNOtouch NIBP™ depending on height, weight and age:

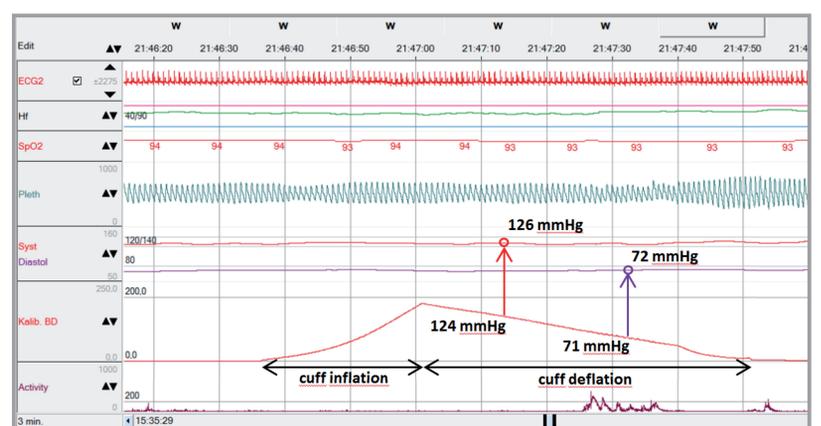


Left: Application of SOMNOtouch™ NIBP depending on height, weight and age. Light grey: 5-12 year old child, application of device on thorax with belt. Dark grey: 13-18 year old child, application at wrist. **Right:** R-peak and turning point of Pleth are used for determination of PTT.

Design and method:

The SOMNOtouch™ NIBP is determining the blood pressure by calculating the time between R-spike of the ECG and peripheral recorded pulse wave. At the beginning of each recording a one-point calibration with a cuff device must be performed.

Systolic (SBP) and diastolic (DBP) blood pressure were measured in 27 children (6 females, mean age 10.7 ± 2.6 years, 152.7 ± 15.6 cm, 48.7 ± 17.4 kg) using an oscillometric ABPM (Mobil-O-Graph PWA, I.E.M.). Measurement intervals were 2/h during daytime (6-22 h) and 1/h during night-time (22-6 h). Simultaneously, BP was recorded based on PTT (SOMNOtouch™ NIBP) on the contralateral arm. For determination of artefacts motoric activity, body position, oxygen saturation and the cuff pressure curve were recorded. All fail recordings of cuff measurements due to arrhythmia, activity or arousals during sleep and artefacts in cuff in/deflation were excluded from analysis (approximately 25%).



Original data showing ECG, heart rate, oxygen saturation (SpO2), plethysmogram (Pleth), PTT based SBP and DBP, cuff pressure and activity.

Results:

Overall, 304 values were recorded in 27 patients. 76 values were excluded due to artefacts (mentioned above). Preliminary results of 228 BP values revealed a linear correlation of SBP and DBP ($r = 0.8$ for SBP, $r = 0.7$ for DBP). Limits of agreement in Bland-Altman plot were +22 and -17 mmHg, with a mean difference of 2.2 mmHg, for SBP, resp. +22 and -12 mmHg, with a mean difference 4.9 mmHg, for DBP.

Conclusions:

Our preliminary results imply that PTT and ABPM-based BP values are closely correlated in children during a 24-hour measurement in case invalid recordings were excluded. Despite high activity of children, the PTT method provides considerably more BP values than the cuff-based method.

