NONINVASIVE CONTINUOUS BLOOD PRESSURE MONITORING COMPARED TO INVASIVE BLOOD PRESSURE MONITORING: A SYSTEMATIC REVIEW AND META-ANALYSIS

Presenting Author: Sang-Hyun Kim, MD, PhD, Department of Anesthesiology & Perioperative Care, University of California Irvine

Co-Authors: Marc Lilot MD, Kulraj Sidhu MD, Maxime Cannesson, MD, PhD, Department of Anesthesiology & Perioperative Care, University of California Irvine.

Introduction: Noninvasive continuous blood pressure monitoring is advantageous because this method can avoid complications related to arterial cannulation. With the advancement of technology, there are several commercially available monitors on the market and several small, single-center studies have been published during the past 15 years. Our aim was to conduct a systematic review and meta-analysis in order to assess the accuracy of these noninvasive technologies.

Methods: We searched PubMed for noninvasive continuous blood pressure monitoring systems that are commercially available currently. We searched terms such as noninvasive, continuous, blood pressure, Nexfin, T-line, Tensys, CNAP, bias, precision, limit of agreement, Bland Altman, surgery, anesthesia, and critical care. We limited the search to articles in English and to studies with adult subjects. After retrieving all articles, three reviewers selected relevant articles through title and abstract discrimination. Inclusion criteria were studies that compare noninvasive continuous blood pressure monitoring to invasive blood pressure monitoring, and studies that have extractable data for meta-analysis [e.g., bias, SD, or 95% limit of agreement (LOA)]. Primary outcome data was bias and LOA. Statistical analysis, and more specifically, investigation of heterogeneity across studies and calculating random effects estimates, was performed via methods detailed in a previously published study [1]. Data are expressed as bias ± SD (95% LOA).

Results: We retrieved 382 articles (as of December 11, 2012) using the above-mentioned keywords and selected 14 relevant studies, including a total of 597 patients. Of the 14 studies, CNAP was the most frequently tested (7 studies), followed by T-line (4 studies) and Nexfin (3 studies). Overall bias (SD) was 3 ± 9 mmHg (-14 to 20 mmHg) for MAP; -3 ± 10 mmHg (-23 to 16 mmHg) for systolic arterial pressure; 6 ± 8 mmHg (-11 to 22 mmHg) for diastolic pressure. Overall bias (SD) for MAP was 2 ± 6 mmHg (-10 to 14 mmHg) for CNAP; 2 ± 6 mmHg (-10 to 13 mmHg) for T-line; 3 ± 7 mmHg (-10 to 16 mmHg) for Nexfin (Figure 1).

Conclusion: The current noninvasive continuous blood pressure monitoring technologies provide acceptable measurements compared to invasive blood pressure monitoring based on their small overall biases for both MAP and systolic arterial pressure, which were all within maximum values proposed as standards by the Association for the Advancement of Medical Instrumentation [2]. However, relatively wide limits of agreement in the current study imply that more improvements in repeatability are required for these technologies to be widely used in clinical practice.
References:

Figures:
Figure 1: Forest Plot Showing Bias and Limits of Agreement for Mean Arterial Pressure Measured with CNAP, T-Line, and Nexfin

Ilies*, during induction of anesthesia; Ilies**: during maintenance of anesthesia; Hahn*, software ver 3.0, Hahn**, software ver 3.5.