

Comparison of blood pressure measurements in upper and lower extremities in children under general anesthesia

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Background

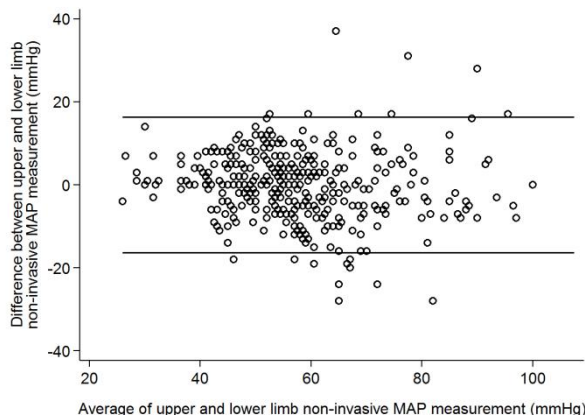
- During surgery, blood pressure can be obtained non-invasively (NIBP) by oscillometry or invasively (IBP) by an arterial cannula.
- Limited data exist comparing NIBP to IBP measurements in anesthetized children, but a tendency towards falsely elevated NIBP values has been reported in newborns.
- With BP guiding major therapeutic decisions in the perioperative period, inaccuracies may complicate the timely diagnosis and treatment of hypotension.
- In this multi-institutional study, we prospectively evaluated clinically significant errors in NIBP relative to IBP measurements.
- Our secondary aim was to investigate the consistency of upper versus lower extremity NIBP.

Methods

- Study received IRB approval at Nationwide Children's Hospital and King Fahad Medical City.
- Patients under 10 years of age, ASA 1-3, were enrolled if they were to receive general anesthesia with a planned arterial cannula.
- NIBP was measured with two separate oscillometers of the same make with appropriately sized BP cuffs placed on an upper and lower extremity.
- Mean arterial pressure (MAP) from 3 sites (radial artery, arm cuff, and leg cuff) was recorded at 5 minute intervals for 10 readings per patient.
- The primary outcome was deviation of MAP by more than 5 mmHg between IBP and at least one NIBP at any point during the study.

Results

- We have enrolled 20 boys and 16 girls to date, ages 0-8 years of age.
- Across 360 data points, MAP was 58 ± 14 mmHg at the arm, 58 ± 14 mmHg at the leg, and 61 ± 16 mmHg via the arterial cannula
- In 35 of 36 patients, IBP deviated by >5 mmHg at least once from either the arm or the leg measurements.
- In 24 patients (67%; 95% confidence interval: 49%, 81%), arm or leg NIBP over-estimated MAP by >5 mmHg at one or more time points.
- Across all data points, leg and arm MAP measurements did not show significant bias (difference: 0.02 mmHg [95% CI: -1, 1]; paired t-test $p=0.960$; Bland-Altman 95% limits of agreement: -16, 16 mmHg).



Discussion

- Previous studies comparing NIBP to IBP measurements in anesthetized children are limited and have been largely inconclusive in terms of degree of BP mismatch.
- Our preliminary results suggest NIBP and IBP generally correlate well, but clinically significant discrepancies using NIBP occurred often during the study period (10 measurements over ~50 minutes).
- No difference was noted in the accuracy of NIBP when comparing the arm and leg measurements.
- Although there was no consistent trend in over or under measuring MAP by NIBP, our findings suggest caution is necessary when using NIBP monitoring to avoid medical mismanagement.
- The results also highlight the importance of using additional intraoperative monitors such as electrocardiography, pulse oximetry, and capnography to corroborate NIBP values.

Conclusion

The frequency of clinically significant NIBP deviation supports the importance of invasive BP monitoring when hemodynamic fluctuations would be particularly detrimental.

References

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