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TITLE: A COMPARISON OF ARTERIAL TONOMETRY WITH RADIAL ARTERY CATHETER MEASUREMENTS OF BLOOD PRESSURE IN ANESTHETIZED PATIENTS
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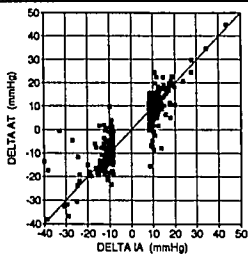
Introduction: An instrument designed to measure blood pressure continuously and non-invasively using arterial tonometry (AT) has recently been made available for clinical use. This study compares the measurements obtained from this device with those obtained simultaneously from an intra-arterial catheter (IA) to determine if AT could be used in place of IA.

Methods: With informed consent and institutional approval, 13 patients undergoing surgery in a level, supine position were studied. A 20 ga. radial arterial catheter was connected to a calibrated transducer. The AT transducer (N-CAT, Nellcor) and the oscillotonometic calibrating cuff were applied to the contralateral arm. AT and IA signals were simultaneously sampled at 100 Hz with a 16 bit A/D converter. Data obtained during oscillotonometic calibration or the aspiration or flushing of the arterial catheter were excluded. Systolic (S), diastolic (D) and mean (M) pressures were obtained from both waveforms for comparison. The difference AT-IA was calculated for S, D, and M. To evaluate the ability of AT to track changes in IA, time intervals over which mean IA (IAM) changed by 8 mmHg or more were examined. The change in AT over a time interval (ΔAT) was compared with the change in IA (ΔIA) over the same interval.

Results: AT and IA were measured simultaneously 159,686 times in 12 patients. Data could not be collected from one patient because of electrical interference. The range of the IA mean pressure was 42-150 mmHg. For mean pressure, the difference AT-IA had mean \pm SD of 1.9 \pm 3.0. (Table) There were 430 time intervals over which IAM changed by more than 8 mmHg. The magnitude of these changes in IAM had mean 11.6 with SD 4.9 and range of 8.1 - 43.6 mmHg. The change in AT minus the change in IA ($\Delta AT - \Delta IA$) for these 430 time intervals is shown in the Table. The Figure shows a graph of ΔAT vs. ΔIA for mean pressures.

Discussion: For AT to be used in place of IA, the results from the two techniques must be similar. Comparing mean blood pressure measurements, the difference between the two techniques was 1.9 \pm 3.0; thus, the 95% confidence intervals are approximately -4.1 to 7.9 mmHg. These are probably clinical acceptable limits and are better than that found in a study comparing Dinamap 1846SX with IA (-1.8 \pm 9.7). However, there were episodes of substantial error as shown by the minimum and maximum discrepancies. Detecting clinically significant changes in blood pressure over time intervals is needed for patient care. In examining changes in mean arterial pressure, the 95% confidence intervals for detecting a change in IA using AT was -11.1 to 11.3 mmHg. Further study is needed to elucidate what role if any AT may have in patient care.

	AT-IA (n=159,686)			$\Delta AT - \Delta IA$ (n=430)		
	mean \pm SD	min	max	mean \pm SD	min	max
S	2.2 \pm 6.0	-49	192	0.1 \pm 7.2	-31	40
D	1.6 \pm 3.3	-44	87	0.2 \pm 6.1	-30	35
M	1.9 \pm 3.0	-38	89	0.1 \pm 5.6	-24	32



For mean pressures, ΔAT is shown vs. ΔIA for 430 time intervals. Only intervals over which ΔIA was greater than 8 mmHg were considered.

References:

- Gorback MS, et al. J Clin Monit 7:13-22, 1991.

A425

TITLE: PHYSIOLOGICALLY BASED OSCILLOMETRIC METHOD
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A physiologically based method was developed for measurement of arterial systolic pressure (Ps), mean pressure (Pm), and diastolic pressure (Pd) for application to the finger of critically ill patients in a shock trauma intensive care unit (ICU). The clinical study was approved by the Institutional Research Committee of the LDS Hospital. Informed consents were obtained from the patients or their families through the nursing administrator. Nine ICU patients were involved in the study.

Simulation studies applied to the new method predict systematic errors of less than 2 mmHg with standard deviations (SD) less than 5 mmHg for the three pressures.

Systematic errors, which include additional uncertainty due to site difference (finger vs. central arteries), were found to be within 4 mmHg for Ps and Pm, and 8 mmHg for Pd. The average site difference in Pd (corrected for hydrostatic difference) was found to be statistically significant ($p < 0.05$).

In spite of the site difference, the systematic errors \pm SD for Ps (-3.1 \pm 6.1 mmHg) and Pm (-0.9 \pm 5.2 mmHg) by the physiologic method applied to the finger, were found to be within the standards (5 \pm 8 mmHg) of the American National Standards Institute (ANSI)¹. However, the systematic error \pm SD for Pd (7.8 \pm 6.5 mmHg) was somewhat outside the ANSI standards, presumably due to an average site difference bias of 6 mmHg.

The physiologic method was found to be more adaptive to the physiological variation in critically ill patients than the empiric oscillometric method (see Figures 1 and 2 for Pm comparisons) as evidenced by the lower interpatient variability of the physiologic method compared to the empiric oscillometric method when both methods were applied to the finger site. Inpatient variability was also found to be significantly lower by the physiologic method than by the empiric oscillometric method.

Application of the physiologic method to the forehead (temporal artery) for the purpose of reducing vasoconstrictive influences, was also explored. These results, coupled with the fact that the forehead is relatively insensitive to vasoconstriction, suggest that the forehead could serve as a successful site for pressure monitoring for the most severely vasoconstricted patients.

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References

- ANSI Document code: SP10, 1987.

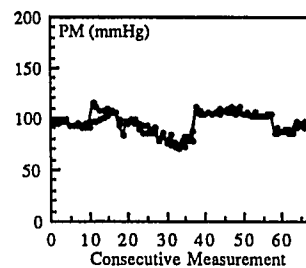


Figure 1. Consecutive measurement of Pm by the physiologic method (dark square) and direct method (open square).

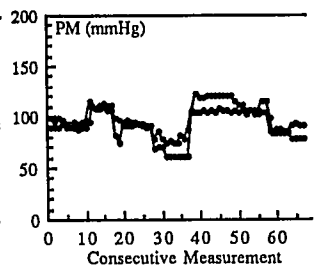


Figure 2. Consecutive measurement of Pm by the empiric oscillometric method (dark square) and direct method (open square).