Title: Evaluation of a Device Producing Noninvasive, Pulsatile, Calibrated Blood Pressure from a Finger

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Introduction. A noninvasive method yielding a blood pressure recording similar to the one obtained from an invasive arterial line would be very useful for monitoring during anesthesia. We present here a comparison of the information available from such a method (FIN) with that from intra-arterial pressure (IAP). To evaluate the offset accuracy of the device, we compared mean pressures.

Methods. The protocol was approved by both the University and the Hospital Human Research Committees, and informed consent was obtained from each patient. To measure pressure, a small inflatable cuff is wrapped around a finger. The pressure inside the cuff is changed very rapidly to null the pressure across the wall of the finger artery. The rapidly changing cuff pressure thus continuously and almost instantaneously reflects the pressure inside the artery. The result is a calibrated pulsatile pressure wave form, similar to that obtained from an IAP. We compared IAP and FIN (two prototypes) in 17 male patients in whom an arterial line was required (9 undergoing open-heart surgery). Prototype 2 was used in all 17 patients, prototype 1 in 11/17 patients. The prototypes were calibrated mechanicaly before the series of studies, and electrically before each study. Intra-arterial pressure was measured through a 2-inch, 20-gauge cannula, connected to a Hewlett-Packard 1280 transducer via a 4-foot Teflon connecting line. The transducer was set at tricuspid level, while the hand was placed on the table, about 10cm below tricuspid level. All pressures were recorded onto analog tape. After playback onto a strip-chart recorder, including electronic averaging, we manually sampled the mean pressure every 160 sec, unless there were no changes, or the changes were very rapid. In the latter two cases, we extracted samples less or more frequently, respectively. If either FIN pressure or the IAP was unavailable, the entire sample was omitted from analysis. We performed descriptive statistics and least-squares regression analysis on the data. Because of the non-normal distributions involved, we converted individual patient slopes to angles, and correlation coefficients to Fisher z-transforms, before calculating a mean.

Results. We took 3135 pairs of samples over 91 3/4 hours of recording. We edited out 265 samples. In addition, the IAP side of one patient with cannula-induced arterial spasm, the left side of one patient with left carotid-subclavian stenosis, and the left (only) side of a patient who developed 3:1 heart block with subsequent erratic FIN behavior were omitted from the analysis. Figure 1 shows a strip-chart record from one of the patients. Note the relative fidelity with which the FIN pressure follows IAP. Mean arterial pressure for all cases ranged from 2-165 torr. The mean difference between IAP and FIN pressures was 0.8 torr, with a SD of ± 5.4 and a range of -4.6 to %7.9. The regression slopes ranged from 0.798 to 1.22, with a mean of 0.97. The range of the y intercepts was -22 to 17. The mean correlation coefficient was 0.96, with a range of 0.89 to 0.98. The average of the slope of the best-fit line through the origin was 1.01, with a range of 0.95 - 1.11.

Discussion. Although the two prototypes do not represent the final model, they both performed very well, with an accuracy, reliability and freedom from artifact which already approach that of IAP. The fact that it is noninvasive and simple to use makes it attractive for monitoring under many circumstances.

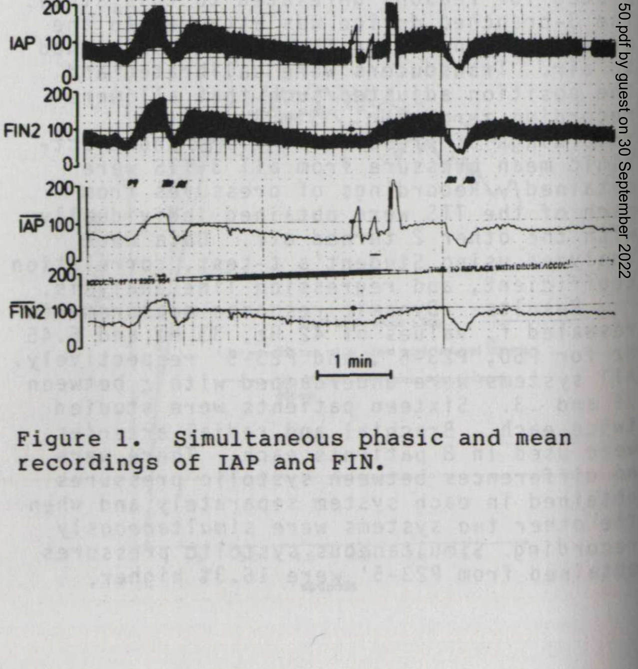

Figure 1. Simultaneous phasic and mean recordings of IAP and FIN.