TITLE: EVALUATION OF A CONTINUOUS NONINVASIVE BLOOD PRESSURE MONITOR DURING DELIBERATE HYPOTENSION IN ORTHOPEDIC PATIENTS

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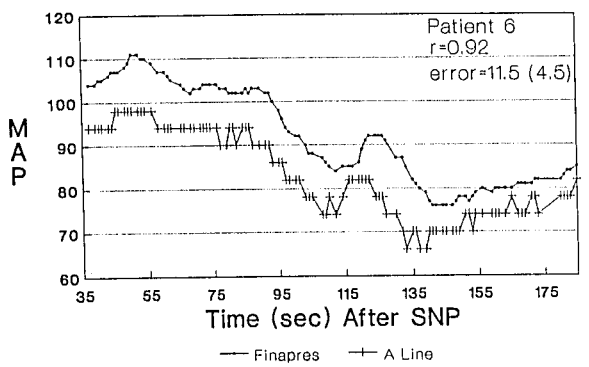
INTRODUCTION: Deliberate hypotension is often induced during spinal surgery in an attempt to decrease blood loss. Arterial lines are usually inserted to monitor blood pressure during this procedure because of the potency of the hypotensive agents, the extreme rapidity with which blood pressure can fall, and the narrow margin of safety of this technique. Recently, a noninvasive device that continuously measures arterial pressure using the Penaz methodology has been introduced into clinical practice (Finapres™, Ohmeda, Englewood, CO)[1]. Reduction of morbidity and patient discomfort from from arterial catheter insertion is a potential benefit of such a device. We therefore designed this study to evaluate the performance of the Finapres relative to that of direct arterial blood pressure monitoring during induced hypotension.
METHODS: After receiving permission from our Institutional Review Board, we recorded blood pressure in seven patients undergoing deliberate hypotension as part of their anesthetic technique for spinal surgery. Non-tapered, 20 gauge teflon catheters were inserted percutaneously into the radial artery and blood pressure measured using disposable Cobe transducers and a Hewlett-Packard (HP) 78205D pressure module. A Finapres pressure cuff was applied to the thumb or middle finger of the hand containing the arterial catheter. The Finapres was connected to the serial port of a computer while analog outputs from the HP corresponding to the pressures being measured were digitized using an A/D converter inside the same computer. At an interval of approximately every other heart beat, the Finapres and HP values were sampled by the computer and stored for subsequent analysis. In most patients the arterial transducer was zeroed at the same height as the Finapres cuff. Where a hydrostatic difference was present, HP arterial pressures were adjusted accordingly. Three sample epochs were analyzed: A) 20 minutes of normal blood pressure prior to onset of hypotensive agent; B) 30 minutes following onset of hypotensive agent; C) 20 minutes of stable hypotension. Differences between Finapres and HP systolic, mean and diastolic blood blood pressures were determined during each epoch, and the average differences used to calculate the group mean and standard deviation for each interval. Descriptive statistics and correlation coefficients were calculated using the program SYSTAT (Systat, Inc.).
RESULTS: A total of 3775, 5731, and 3267 data pairs were analyzed in epoch A, B, and C, respectively. In the Table are listed the average errors during each sample period for mean blood pressure; correlation coefficients for epoch B (induction of hypotension) are also listed. Over the three epochs the average errors in systolic, mean and diastolic pressure were 0.2 [9.4], 5.2 [7.1] and 8.5 [8.3], respectively. In the Figure, Finapres and arterial mean pressures during the induction of hypotension with sodium nitroprusside (SNP) for patient 6 are displayed. This patient had one of the largest average difference in pressure between Finapres and HP, yet the Finapres accurately tracked changes in pressure during the induction of hypotension. Similar traces for most of the other patients showed even closer agreement.
DISCUSSION: In all patients, the Finapres demonstrated excellent correlation with simultaneously measured arterial pressure during the induction of hypotension. The Finapres tended to overestimate systolic, mean and diastolic pressure, but very accurately tracked changes in pressure, even during dramatic falls in mean pressure. The errors noted may have been due to the more distal recording site of the Finapres, or to mechanical problems related to cuff positioning. While more study is indicated, it appears that the Finapres functions well enough during induced hypotension to be considered as a replacement for invasive arterial monitoring during such cases.

Table: Finapres vs A-Line MAP Errors and Correlation Coefficients (R)

PT	Error(SD) EPOCH A	Error(SD) EPOCH B	Error(SD) EPOCH C	R EPOCH B
1	-8.7(5.4)	-6.2(4.8)	7.6(4.8)	0.96
2	-0.5(2.4)	-5.4(3.9)	-0.5(2.4)	0.96
3	6.4(2.6)	12.4(5.5)	15.2(2.5)	0.89
4	15.0(3.8)	4.5(6.4)	15.0(3.8)	0.87
5	-0.6(3.2)	3.0(2.7)	4.4(3.2)	0.97
6	12.3(3.7)	11.5(4.5)	10.1(4.8)	0.92
7	5.2(3.5)	5.9(3.2)	3.5(2.6)	0.91
all	4.2(8.2)	3.7(7.7)	7.9(5.9)	0.93(0.04)

Figure 1: Simultaneous Finapres and Arterial MAP During Induction of Hypotension



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