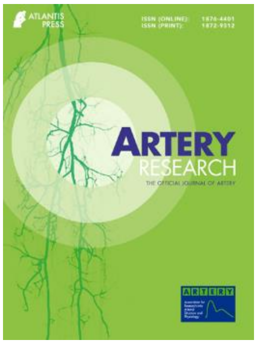

Artery Research

ISSN (Online): 1876-4401 ISSN (Print): 1872-9312
Journal Home Page: https://www.atlantis-press.com/journals/artres

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To cite this article: J.J. Wang, G. de Vries, J.V. Tyberg (2012) P2.11: ESTIMATION OF LV STROKE VOLUME BY IMPEDANCE CARDIOGRAPHY: ITS RELATION TO THE AORTIC RESERVOIR, Artery Research6:4, 167–167, DOI: https://doi.org/10.1016/j.artres.2012.09.092

To link to this article: https://doi.org/10.1016/j.artres.2012.09.092

Published online: 21 December 2019

P2.11

ESTIMATION OF LV STROKE VOLUME BY IMPEDANCE CARDIOGRAPHY: ITS RELATION TO THE AORTIC RESERVOIR

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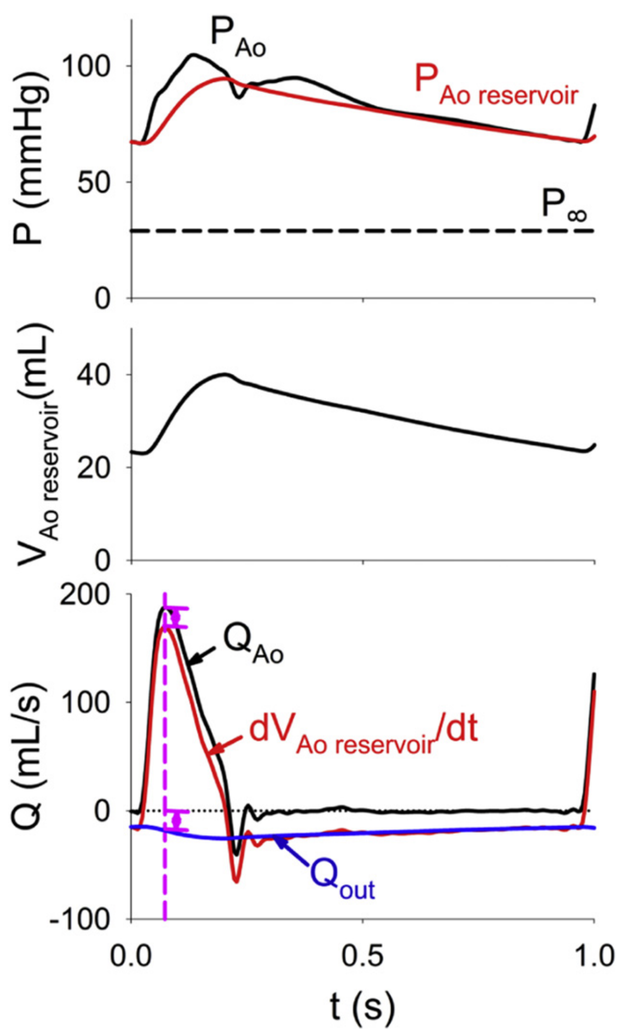
Impedance cardiography (ICG) is a noninvasive technique used to estimate left ventricular stroke volume (SV_{LV}) using thoracic impedance (ΔZ). It remains controversial, partly because ICG parameters have not been successfully related to hemodynamic events. We hypothesized that the change in ΔZ may be proportional to the variation in thoracic blood volumes, primarily aortic blood volume.
Nine anaesthetized dogs were divided into two groups: the "Aortic Volume Group" (n=5), where aortic and IVC (inferior vena cava) dimensions were measured ultrasonically, and the "Reservoir Volume Group", where aortic and IVC reservoir volumes were calculated using the reservoir-wave approach. Measurements were made under control conditions, with nitroprusside, with methoxamine (Mtx), and after volume loading.
In both groups, the maximum rate of increase in ΔZ, $(dZ/dt)_{max}$, strongly correlated with the maximum rate of change in aortic/reservoir blood volume (r^2= 0.85 and 0.95, respectively), which in turn were proportional to SV_{LV}. As shown in the figure, the aortic reservoir volume ($V_{Ao\ reservoir}$) explains SV_{LV} in that measured aortic flow (Q_{Ao}) equals the sum of $dV_{Ao\ reservoir}/dt$ and calculated Q_{out}. The LV and IVC contributions to ΔZ were small under control conditions (~5 and 1%, respectively), but the LV contribution increased slightly with administration of Mtx and after volume loading (to 7 and 10%, respectively).
We conclude that the change in thoracic impedance (ΔZ) during the cardiac cycle is proportional to the change in aortic reservoir volume, which mechanistically explains why ICG and standard measures of cardiac output have sometimes been shown to correlate well.



P2.12

COMPARISON OF THE CENTRON CBP301 AND SPHYGMOCOR XCEL DEVICES FOR THE ESTIMATION OF CENTRAL PRESSURE

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Non-invasive devices for determining central blood pressure (BP) are available, which are suitable for routine clinical use. The aim of this study was to compare estimates of central systolic BP (cSBP) provided by two recently developed, cuff-based devices: the Centron cBP301 and the SphygmoCor XCEL. Both devices were compared with the SphygmoCor system.
In 103 subjects (58 females), age range 18-84 years, brachial BP was measured and cSBP derived using the XCEL and Centron devices. Radial artery waveforms were recorded and calibrated, in turn, to the brachial systolic and diastolic BP obtained with the XCEL and Centron devices.
Brachial cuff pressures measured with the XCEL and Centron devices were highly correlated (r=0.93, P<0.001, SBP; r=0.90, P<0.001, DBP) and in good agreement, with a mean difference (±SD) between devices of 1±7 mmHg (P=0.2) for SBP and 1±4 mmHg for DBP (P=0.3, Table 1). Similarly, estimates of cSBP were also highly correlated (r=0.90, P<0.001) and in good agreement (mean difference of 1±7 mmHg, P=0.2). When each device was compared with the SphygmoCor, there were strong correlations between estimates of cSBP (r=0.97, P<0.001, Centron; r=0.98, P<0.001, XCEL). There was also good agreement, with a mean difference of 0±4mmHg (P=0.9, Centron) and 0±4mmHg (P=0.7, XCEL).
The Centron and XCEL devices produce similar estimates of brachial and central pressure, and both provide similar estimates of cSBP to the SphygmoCor. These cuff-based devices have the advantage of being operator-independent and simple to use, and are thus potentially suitable for use in routine clinical environments.

Table 1 Estimates of cSBP provided by the Centron and XCEL devices.

	XCEL	Centron	Diff	P	*r*	P
Brachial SBP (mmHg)	127±19	127±18	1±7	0.2	0.93	<0.001
Brachial DBP (mmHg)	75±10	75±10	1±4	<0.001	0.90	<0.001
MAP (mmHg)	92±12	86±11	6±5	<0.001	0.91	<0.001
cSBP (mmHg)	115±16	114±16	1±7	0.2	0.90	<0.001
Heart Rate (bpm)	68±12	69±12	-1±6	<0.001	0.88	<0.001

P2.13

AUGMENTATION INDEX IS MORE AFFECTED BY CARDIAC FUNCTION THAN REFLECTION MAGNITUDE

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The augmentation index (AI) is a measure of wave reflection but also depends on the wave shapes of the forward and reflected pressure waves. The shape of the forward wave is determined by the interaction between the heart and the vasculature and thus is, in part, determined by cardiac function. The reflection magnitude, (RM, the ratio of the backward and forward wave), may be less dependent on cardiac function. We therefore investigated quantitatively how cardiac function affects AI and RM.
A mathematical model of the arterial system allowed calculation of pressures using flow waves with a range of shapes from convex to concave, with the form factor (peak flow / stroke volume; convex flow has a low form factor) ranging from 5.5 to 9.6. Arterial stiffness was varied from 0.5 to 3 times control and AI and RM were calculated from central aortic pressure and flow.
The form factor of the flow had a larger effect on the AI than on the RM, and at all form factors arterial stiffness had a larger effect on the AI than on the RM.
We conclude that the flow wave shape, and thus cardiac function, has a considerable effect on the AI.