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P2.21

AGREEMENT OF CENTRAL BLOOD PRESSURE MEASURED BY APPLANATION TONOMETRY AND ECHOTRACKING

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Background: Some studies have shown the interest of measuring central blood pressure (CBP). Usually measured non-invasively through a function transfer by applanation tonometry (Sphygmocor[®]) CBP can also be calculated by echotracking (Art.Lab[®]) at the common carotid artery assuming the fact that the distension waveform is similar to a pressure curve and thus be more precise. However, the agreement between CBP derived from these two devices remains not clear.

Objectives: To analyse the agreement between CBP and study the discrepancies between the two techniques.

Materials and methods: 74 Patients from Pharmacology Department in Paris and from Surgery, Medical, Molecular, and Critical area pathology Department at Pisa university were matched for age, sex and BP. CBP was estimated by the onboard transfer function of the Sphygmocor[®] derived from radial measurement. Echotracking measurements were performed on right CCA (ART.LAB) and treated to obtain CBP. Pearson's correlation and Bland&Altman graph were performed for carotid SBP and PP, and multivariate regressions to found the determinants of discrepancies.

Results: The correlations between the carotid BP were good (SBP: $r=0.79$; PP: $r=.77$, $p<0.001$). We showed a small overestimation (<2 mmHg) of carotid SBP and PP by echotracking compared to applanation tonometry. Major determinants of discrepancies were center effect and age [$\beta=13.1(1.8)$, $p<0.001$; $\beta=0.1(0.01)$, $p=0.049$ respectively] for carotid PP and only center [$\beta=11.8(2.1)$, $p<0.001$] for carotid SBP.

Conclusion: This study shows a good agreement between the two techniques. Discrepancies could be explained by the differences between the two populations, and the Sphygmocor transfer function and calibration.

P2.22

THE NEWEST METHOD FOR THE DIAGNOSIS OF PULMONARY ARTERIAL HYPERTENSION

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Objectives: Pulmonary arterial hypertension (PAH) is a devastating lung vascular disease. Despite advances in the diagnosis of this condition, early detection and ascertainment of the genesis of pulmonary hypertension are still a difficult task. We supposed that the method of Single photon emission computed tomography - computed tomography (SPECT/CT) imaging facility is a good alternative in the diagnosis of genesis of pulmonary hypertension, especially in the early period of the disease and in patients with complex differential diagnosis.

Methods: We examined 10 people with suspected pulmonary hypertension. Previously, patients underwent right heart catheterization and CT-angiography. Three patients diagnosed with pulmonary hypertension was not confirmed, in four cases was suspected idiopathic pulmonary hypertension and in three cases - pulmonary embolism. After that, seven patients with pulmonary hypertension were performed SPECT / CT with intravenous injection of the radiopharmaceutical ⁹⁹Tc-MAA (macro-aggregates of albumin).

Results: Due to the capabilities of the SPECT / CT to assess perfusion at the level of subsegmental pulmonary artery, the diagnosis of pulmonary embolism was additionally established in two patients from the group with idiopathic pulmonary hypertension. In other cases, the diagnoses were correct.

Conclusions: In our data we established, that the using of SPECT / CT has helped us to establish the correct diagnosis that allows us to assign the proper and timely treatment. So, we confirmed our hypothesis, that the modern method of diagnosis of pulmonary hypertension - SPECT / CT - is no less accurate than the standard methods, and is probably preferable in difficult diagnostic cases.

P2.23

ASSESSING MYOCARDIAL FUNCTION USING SPECKLE-TRACKING ECHOCARDIOGRAPHY IN AN OLDER POPULATION

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Background: Left ventricular systolic dysfunction, an independent predictor of heart failure (HF) and cardiovascular mortality, may be worse in South Asians and African-Caribbeans (than Europeans) as they have more adverse cardiovascular risk factor profiles.

Objectives: We sought to investigate ethnic differences in speckle-tracking echocardiography (STE)-derived strain (ϵ) and strain rate (SR) in a community-based cohort of European, South Asian and African-Caribbean older men, and the role of CVD risk factors in accounting for these differences.

Methods and results: We recruited 339 men (113 from each ethnic group) with echocardiographic data from the Southall and Brent REvisited (SABRE) cohort, and measured peak systolic longitudinal ϵ and SR. Anthropometric, haemodynamic, fasting blood and conventional and tissue Doppler echocardiographic data were also collected. There were no significant differences in peak systolic longitudinal ϵ between Europeans (mean \pm SD, $-17.7\pm 3.1\%$), South Asians ($-16.9\pm 2.9\%$) and African-Caribbeans ($-17.1\pm 3.0\%$) ($p=0.200$). Peak systolic longitudinal SR also showed no significant ethnic variation (Europeans: $-0.50\pm 0.12s^{-1}$, South Asians: $-0.48\pm 0.10s^{-1}$, African-Caribbeans: $-0.47\pm 0.11s^{-1}$, $p=0.198$). Age-adjusted peak systolic longitudinal SR and (tissue Doppler-derived) peak systolic myocardial velocity (s') were compared in subjects with and without hypertension, coronary heart disease (CHD) and diabetes mellitus. Subjects with hypertension and CHD had an attenuated SR and s' compared to those without, but diabetes mellitus was associated with a lower s' only. P-values were more significant for s' than SR.

Conclusions: There were no significant ethnic differences in longitudinal ϵ & SR. SR could detect myocardial dysfunction in subjects with CHD and hypertension, but was inferior to s' .

P2.24

A COMPARISON OF AORTIC PULSE WAVE VELOCITY MEASURED BY COMPLIOR AND SPHYGMOCOR IN PATIENTS WITH COPD AND HEALTHY VOLUNTEERS

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Objectives: A number of non-invasive devices have been used to measure arterial stiffness in COPD. The aim of this study was to compare the Complior device with the gold standard SphygmoCor Vx device, in patients with COPD and healthy volunteers.

Methods: Aortic PWV was measured during a single visit in 18 (10 male) patients with COPD and 39 (18 male) healthy volunteers. Using Complior with the intersecting tangent algorithm, PWV was derived using a direct carotid-femoral artery measurement $\times 0.8$ in 20 subjects, and a subtractive distance (carotid artery to sternal notch and sternal notch to femoral artery) in 37 subjects. All SphygmoCor measurements were calculated using the subtractive distance.

Results: Patients and volunteers were similar in gender, mean age 67 years and BMI 26.5kg/m². Using Complior there was no difference in PWV between the direct or subtractive path length in patients or volunteers. Using pooled data, there was no difference in PWV between Complior and SphygmoCor in COPD, and moderate consistency with an intraclass correlation coefficient (ICC) of 0.64. Pooled data for volunteers showed a mean difference in PWV of 1.0 (1.2)m/s ($p<0.05$) but consistency was high ICC 0.92. Bland-Altman plots showed no systematic bias with only one outlier in each group, but greater variability in COPD (Figure 1a&b).

Conclusion: There was no difference and moderate consistency in PWV measured by Complior and SphygmoCor in COPD. However in healthy volunteers PWV differed between devices but showed high consistency. Although Complior and SphygmoCor were consistent they should not be used interchangeably.

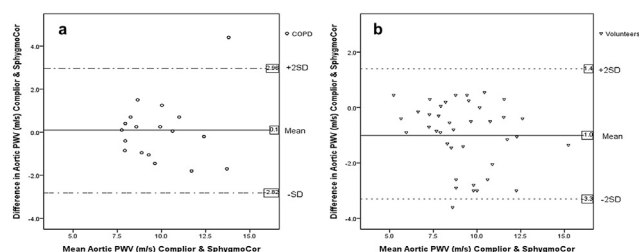


Figure 1 Bland-Altman plot comparing PWV by Complior and SphygmoCor in a) Patients with COPD b) Volunteers.

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ECHOCARDIOGRAPHIC VALIDATION OF A NOVEL METHOD FOR NONINVASIVE ESTIMATION OF CARDIAC OUTPUT BASED ON PULSE CONTOUR ANALYSIS

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Surgical or critically ill patients often require continuous assessment of cardiac output (CO) for diagnostic purposes or guiding therapeutic interventions. A new method of non-invasive estimation of CO, based on pressure wave analysis, has been recently developed, but its validity has been examined only *in silico*. Aim of this study was to evaluate the reproducibility, precision and accuracy of the "Systolic Volume Balance" method (SVB).

Methods: Twelve subjects underwent 2-D transthoracic echocardiography (Doppler) for CO measurement which was used as reference value. The application of SVB method required aortic pressure wave analysis and estimation of total arterial compliance (C_t). Aortic pulses were derived by mathematical transformation of radial pressure waves recorded by applanation tonometry (SphygmoCor). C_t was estimated by the "pulse pressure" method. The agreement, association, variability, bias and precision between the reference (Doppler) and estimated (SVB) values of CO were evaluated by Spearman correlation coefficient, intraclass correlation coefficient (ICC), coefficient of variation (CV), root mean square error (RPSE), mean difference, SD of differences (SDD), percentage error (PR) and Bland-Altman analysis.

Results: Both SVB and Doppler provided highly reproducible measures of CO when two repeated measurements were performed (ICC>0.9, SD of difference <0.4 L/min, CV<5%, PR<17%). CO estimation by the SVB method was comparable with the respective measure by Doppler indicating a good agreement and accuracy (Table).

Table. Accuracy and precision of CO estimation by the SVB method compared to the reference method (Doppler).

Parameter	Value
Mean difference (L/min)	0.780
Standard deviation of difference (L/min)	0.323
Limits of agreement (L/min)	0.15–1.41
Coefficient of variation (%)	13.0
Root mean squared error (L/min)	0.678
Spearman correlation coefficient	0.939
Intraclass correlation coefficient	0.797
Percentage error (%)	20

Conclusion: CO estimation by the SVB method is highly reproducible and accurate in comparison with the CO measurement by Doppler. Future studies, though, are required to assess the clinical utility of this method.

P2.26

ASSESSING CHARACTERISTICS OF THE CARDIO-ANKLE VASCULAR INDEX (CAVI) AND ITS PWV FOR ARTERIAL FUNCTION – ARM-LEG DIFFERENCES AND REPEATABILITY

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Background: Vasera is a machine developed to evaluate arterial stiffness by measuring pulse wave velocity (PWV) and cardio-ankle vascular index (CAVI), apparently independent of blood pressure (BP). The 4-cuff device measures right (R) and left (L) brachial and ankle BP, deriving the CAVI value and cardi-ankle (ca)PWV. We assessed the operating characteristics of this novel technique in clinical practice.

Method: A total of 108 patients, (13 healthy controls, 76 hypertensive, 19 with type 2 diabetes) aged 18-80 years, were measured with the Vasera 1500 (Fukuda-Denshi, Tokyo, Japan) after 10 minutes rest in a temperature controlled room. Patients with known vessel disease were excluded. Repeat visits were made after about 2 weeks.

Results: Mean±SD BMI and age were 29.6±6.1 kg/m² and 50.8±16.1y respectively. Within-visit R and L CAVI were 7.8±1.5, and 7.8±1.7 units, and R and L PWV 8.1±1.5 and 8.1±1.6 m/sec. The difference between brachial systolic R and L BP, 2.5±7mmHg, correlated with both R-PWV and L-PWV (r=0.29 for both, p=0.009). No significant correlation was seen between brachial or ankle R and L systolic and diastolic BP differences and R/L-CAVI, nor was there significant correlation between ankle R/ L systolic and diastolic BP difference and R-PWV or L-PWV. In 24 patients, between-visit differences in CAVI (R) were 0.14 (95%CI -0.4 to 0.6, not significant, NS) and in caPWV 0.5 (-0.3 to 1) m/sec – NS.

Conclusion: Between-visit repeatability for both CAVI & caPWV was good. The correlation between difference in arm BP and caPWV suggests possible subclinical subclavian or aortic stiffness /disease.

P2.27

A ROBUST METHOD FOR AUTOMATIC MEASUREMENTS OF DIAMETER, DISTENSION AND IMT IN HUMANS AND SMALL ANIMALS

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ARTIC is a new segmentation-based tracking algorithm used to automatically measure diameter, distension and intima media thickness (IMT) in arteries using B-mode ultrasound. ARTIC is initiated with a mark in the center of lumen and can then perform automatic measurements in about 1000 frames/second. To show the robustness and versatility of ARTIC evaluations were made with four different ultrasound scanners, Philips HDI5000, Philips iU22, VisualSonics Vevo 2100 and ULA-OP (Florence University) with different file-formats, including DICOM. The repeatability of automatic measurements of diameter, distension and IMT was evaluated in a) the carotid artery in humans of various age and health and b) the aorta in premature rabbit-pups having a diameter of less than 1 mm. Further the measurements of ARTIC were compared to those of a previously phantom validated method. Finally, differences in measured diameter, distension and IMT when using different scanners were evaluated. The mean diameter of the measurement ranged from 5771-6604 μm (humans) and 768 μm (rabbit pups), the mean distension

Type of evaluation		CV(%)
IJ22 Carotid artery	Diam.	0.7
20 subjects Age 21-62	Dist.	4.1
Healthy Normotensive	IMT	2.3
ARTIC vs Validated method	Diam.	0.4
20 subjects Age 25-57 years	Dist.	2.4
Healthy Normotensive	IMT	1.9
HDI5000 Carotid artery	Diam.	1.8
10 subjects Age 23-39 years	Dist.	4.2
Healthy Normotensive	IMT	4.2
ULA-OP Carotid artery	Diam.	1.4
10 subjects Age 23-39 years	Dist.	6.4
Healthy Normotensive	IMT	5.8
HDI5000 Carotid artery	Diam.	1.4
12 subjects Age 60-76 years	Dist.	8.8
Healthy Normotensive	IMT	6.6
ULA-OP Carotid artery	Diam.	2.0
10 subjects Age 65-86 years	Dist.	8.7
Various Health	IMT	3.6
HDI5000 vs ULA-OP	Diam.	1.8
10 subjects Age 23-39 years	Dist.	8.5
Healthy Normotensive	IMT	9.1
Vevo 2100 Aorta	Diam.	13.0
10 premature rabbit pups	Dist.	13.0
	IMT	6.1

