THE RELATIONSHIP BETWEEN DIASTOLIC FUNCTION AND CENTRAL HEMODYNAMICS IN DIABETIC HYPERTENSIVE PATIENTS

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BACKGROUND: Diabetic hypertensives patients present different hemodynamic pattern than only hypertensive patients. We aimed to investigate the relationship between the diastolic function and the pulse pressure amplification (PPA), an index combining both arterial stiffness and wave reflexion, in diabetic hypertensives subjects compared to hypertensive subjects.

Table 1. Characteristics of the population.

Variables	TOTAL (n=123)		NO DIAB (n=79)		DIAB (n=44)		
	Mean/N	SD/%	Mean/N	SD/%	Mean/N	SD/%	P value
Age, years	59.03	13.15	56.42	14.36	63.73	9.03	**0.0028**
Male gender	67	54.5	39	49.4	28	63.6	0.1277
Weight, kg	78.89	14.85	78.14	15.24	80.23	14.19	0.457
Height, cm	168.15	8.79	168.00	9.02	168.41	8.45	0.8058
Body mass index, kg/m2	27.85	4.49	27.65	4.77	28.21	3.97	0.5132
Waist circumference, mm	95.80	12.63	93.54	12.96	99.86	11.06	**0.0073**
Glycated hemoglobin	6.29	1.15	5.67	0.60	7.20	1.15	**<.0001**
Total cholesterol, mmol/L	4.53	1.07	4.79	1.02	4.08	1.02	**0.0004**
HDL cholesterol, mmol/L	1.32	0.42	1.38	0.41	1.22	0.42	0.0513
Triglycerides, mmol/L	1.27	0.78	1.20	0.77	1.41	0.79	0.1647
LDL cholesterol, mmol/L	2.65	0.89	2.88	0.84	2.24	0.83	**0.0001**
Smoking, n° pack-years	10.42	16.08	6.84	13.44	17.00	18.48	**0.0007**
Duration of hypertension, years	10.86	9.05	10.11	9.42	12.21	8.26	0.2186
Natremie, mmol/L	139.78	2.10	139.84	2.18	139.67	1.97	0.6879
Kaliemie, mmol/L	3.99	0.53	3.95	0.53	4.04	0.55	0.3765
Creatinine, mcmol/L	85.99	22.53	83.62	20.50	90.30	25.49	0.1185
Glycemie, mmol/L	6.18	1.77	5.39	0.70	7.66	2.18	**<.0001**
Urinary protein, gr/24h	0.32	0.70	0.22	0.28	0.50	1.10	0.1045
Hemodynamic parameters							
SBP - brachial artery, mmHg	160.81	28.34	160.04	29.72	162.20	25.96	0.6862
DBP - brachial artery, mmHg	97.02	16.13	97.00	16.27	97.07	16.06	0.9822
Mean arterial pressure, mmHg	118.38	19.19	118.15	19.95	118.81	17.98	0.8552
PP - brachial artery, mmHg	63.73	17.90	63.08	18.20	64.91	17.50	0.5883
Heart rate, bpm	72.72	12.78	71.66	13.89	74.64	10.36	0.2167
cf-PWV, m/s	13.06	3.93	12.42	4.08	14.21	3.38	**0.0146**
SBP - aortic, mmHg	148.33	27.69	147.49	29.36	149.82	24.65	0.6572
DBP - aortic, mmHg	98.38	16.30	98.43	16.61	98.30	15.92	0.9651
PP - aortic, mmHg	49.94	17.41	49.06	17.92	51.52	16.53	0.4549
AIx, %	27.15	13.61	27.99	13.85	25.66	13.20	0.3654
PP amplification, %	1.313	0.184	1.326	0.195	1.289	0.162	0.2799
Echocardiografic parameters							
LV diastolic diameter	50.17	5.37	50.28	5.58	49.98	5.04	0.7672
Diastolic septum thickness	10.43	1.70	10.33	1.63	10.60	1.83	0.4102
Diastolic posterior wall thickness	9.00	1.49	8.78	1.46	9.40	1.47	**0.0261**
e_dvg	4.94	0.78	4.91	0.90	5.00	0.50	0.5541
e_siv	1.03	0.21	1.01	0.22	1.06	0.18	0.1898
e_pp	0.89	0.19	0.86	0.20	0.94	0.15	**0.0155**
Left ventricular mass, gr	178.53	45.56	175.61	47.57	183.65	41.83	0.3523
Left ventricular mass index	93.37	21.66	92.26	22.38	95.31	20.44	0.4588
Ejection fraction, %	68.69	6.43	69.19	5.72	67.77	7.55	0.2447
E wave peak	76.51	23.31	76.56	20.74	76.43	27.58	0.9774
A wave peak	82.59	21.40	77.72	17.75	90.89	24.56	**0.001**
E wave	199.24	45.53	191.26	39.58	213.20	51.99	**0.0102**
E' wave	9.30	2.68	9.38	2.86	9.16	2.34	0.6736
E/A ratio	0.95	0.30	1.01	0.31	0.86	0.24	**0.007**
E/e' ratio	8.72	3.35	8.79	3.56	8.59	2.98	0.7553
Medications							
insuline	17	13.8	.	.	17	38.6	.
biguanid	25	20.3	.	.	25	56.8	.
sulfamide	17	13.8	.	.	17	38.6	.
ACE inhibitors	19	15.6	12	15.2	7	16.3	0.8741
Sartans	49	40.2	19	24.1	30	69.8	**<.0001**
Angiotensin blockers	65	52.9	30	38.0	35	79.6	**<.0001**
Diuretics	55	44.7	33	41.8	22	50.0	0.3225
Calcium channel blockers	61	49.6	45	57.0	16	36.4	**0.0285**
Beta blockers	32	26.2	21	26.6	11	25.6	0.9044
CV risk factors							
Diabetes	44	35.8	.	.	44	100.0	.
Diabetes duration, years	14.93	11.29	.	.	14.93	11.29	.
Smoking (present/past)	63	51.2	35	44.3	28	63.6	**0.0398**
Smoking, n° pack-years	10.42	16.08	6.84	13.44	17.00	18.48	**0.0007**
Hypertension	109	88.6	71	89.9	38	86.4	0.5569
Familiarity for CHD	10	8.1	5	6.3	5	11.4	0.3274
Familiarity for Stroke	6	4.9	4	5.1	2	4.6	0.8983
Stroke	7	5.7	4	5.1	3	6.8	0.6872
CHD	12	9.9	6	7.6	6	14.3	0.2411
Miocardial infarction	7	5.7	3	3.8	4	9.1	0.2245
Revascularization	11	8.9	5	6.3	6	13.6	0.1734
Periferal artery disease	7	5.7	2	2.6	5	11.4	0.0969
Aneurisma of abdominal aorta	1	0.8			1	2.3	0.179
Carotid plaques	26	41.9	11	29.0	15	62.5	**0.0091**
Metabolic Syndrome	45	36.6	17	21.5	28	63.6	**<.0001**

Table 2. Multiregression analysis for determinants of pulse pressure amplification in non-diabetic and in diabetic subjects.

NON DIABETICS (n=58)

	Estimate	SE	P value	Partial R2
Intercept	1.47647	0.12897	<.0001	.
Gender, F/M	-0.10653	0.02916	0.0006	0.20739
Age, years	-0.0063	0.00112	<.0001	0.3819
Mean arterial pressure, mmHg	-0.00239	0.00075406	0.0026	0.1645
Heart rate, bpm	0.00816	0.0013	<.0001	0.43679
E/e' ratio	**0.0073**	**0.00457**	**0.1161**	**0.0477**
Familiarity for CHD, y/n	0.10841	0.0535	0.048	0.07452

DIABETICS (n=42)

	Estimate	SE	P value	Partial R2
Intercept	1.65309	0.22678	<.0001	.
Gender, F/M	-0.1415	0.03911	0.0009	0.27215
Age, years	-0.00442	0.00226	0.0587	0.09841
Mean arterial pressure, mmHg	-0.00138	0.00113	0.2328	0.04043
Heart rate, bpm	0.00651	0.00187	0.0013	0.2575
E/e' ratio	**-0.01503**	**0.00636**	**0.0238**	**0.13766**
Angiotensin blockers, y/n	-0.10923	0.04723	0.0267	0.13255

METHODS: We examined 123 patients admitted to the one day hospital of the Hotel-Dieu Hospital (Paris, France) for cardiovascular risk assessment. Anthropometric, laboratory and clinical measurements were collected. Hemodynamic parameters (central blood pressure, aortic pulse wave velocity [PWV], augmentation index [AIx] and PPA) were measured using applanation tonometry. Standard ultrasound echocardiography was performed.

RESULTS: Diabetic hypertensive subjects (n=44) were older than hypertensive subjects (n=79) (mean age[SD] 64[9] vs 56[14], p<0.05), and they presented similar cardiovascular risk factors frequencies. Gender was equally distributed. The diastolic function, assessed by the E/E' ratio was significantly positively correlated with PWV in total population (r=0.19, p=0.03), with no differences between the two groups. At the contrary, E/E' ratio was not correlated with PPA in total population, but it was significantly and negatively correlated with PPA only in the diabetic group (p for interaction 0.007, r= - 0.35, p=0.02). The multiregression analysis (containing all the confounding variables) in this group revealed as significant (p value<0.05) determinants of PPA: the diastolic function (partial-R2=0.14), gender (partial-R2=0.27), heart rate (partial-R2=0.26), angiotensin blockers treatement (partial-R2=0.13).

Figure 1. Correlation plots between the E/E' ratio and Pulse wave velocity in total population (A), and by the diabetes status (B). P for interaction = 0.5 (adjusted for age, gender, mean arterial pressure and heart rate).

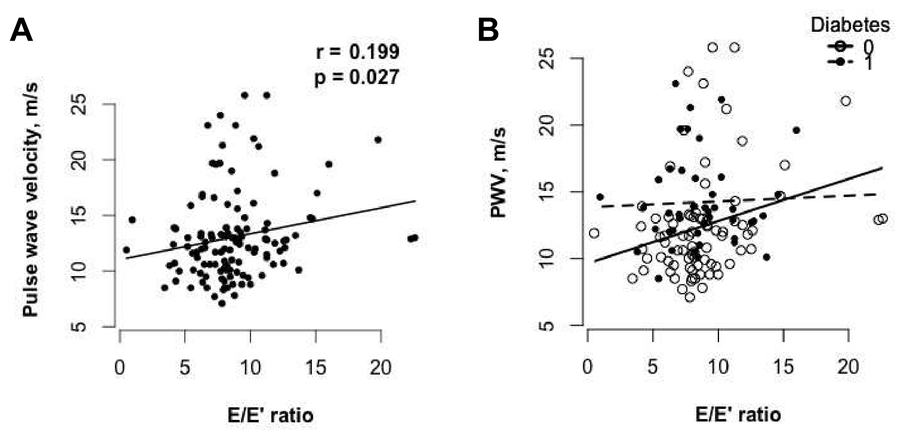
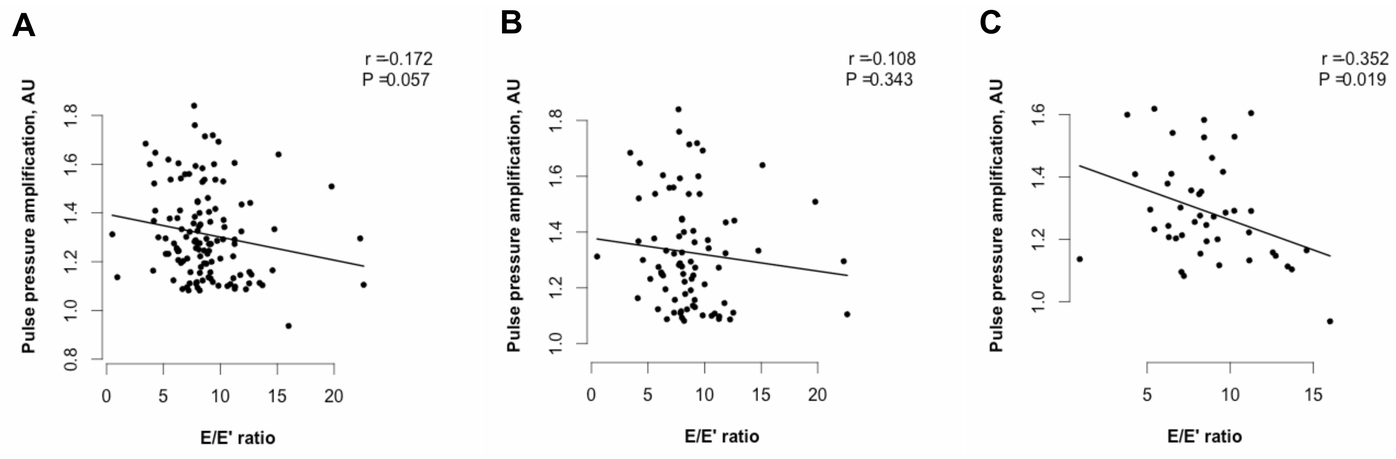


Figure 2. Correlation plots between the E/E' ratio and Pulse pressure amplification in total population (A), in non-diabetic (B) and diabetic subjects (C). P for interaction = 0.007 (adjusted for age, gender, mean arterial pressure and heart rate).



CONCLUSION: We confirmed that diabetic hypertensive patients have different hemodynamic behaviour than hypertensive non-diabetic patients. The results suggest that the mechanisms linking diastolic function with PPA are more prominent in diabetic patients.