Relationship between structural and functional changes of the left ventricular and uric acid and obesity in children and adolescent

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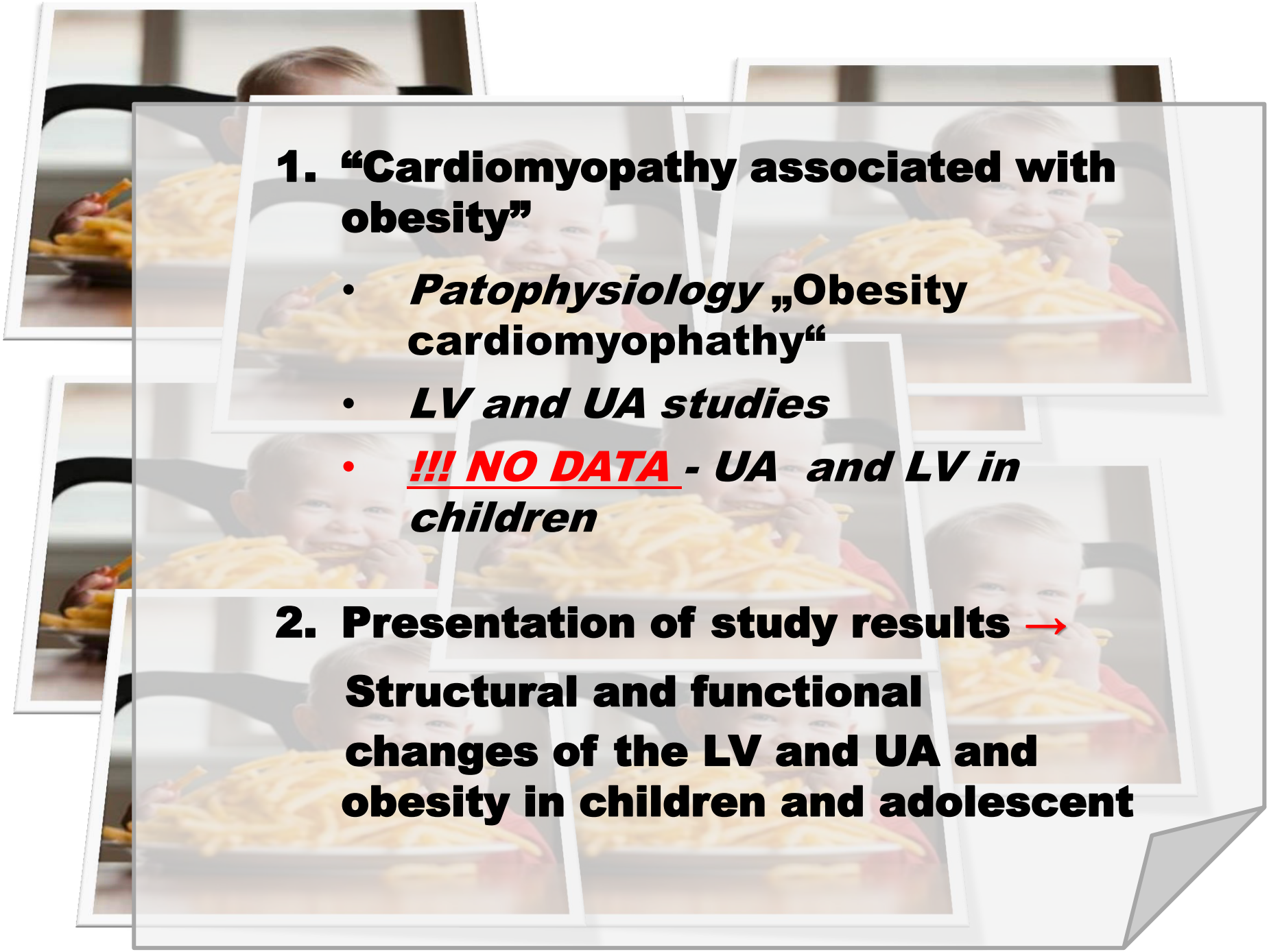
Project title: „Origin and pathogenesis of obesity in relation to non-traditional obesity risk factors“



1. **“Cardiomyopathy associated with obesity”**
   - ***Patophysiology* „Obesity cardiomyophathy“**
   - ***LV and UA studies***
   - ***!!! NO DATA - UA and LV in children***

2. **Presentation of study results →**

Structural and functional changes of the LV and UA and obesity in children and adolescent

"Cardiomyopathy associated with obesity"

For obese individuals it is possible to observe a complex *functional and structural* changes

→ *typical form of cardiomyopathy*

??? *It is not quite clear:*

Hypertrophy of the left ventricle in obese individuals

1. ***Increased adipose of the heart***

or

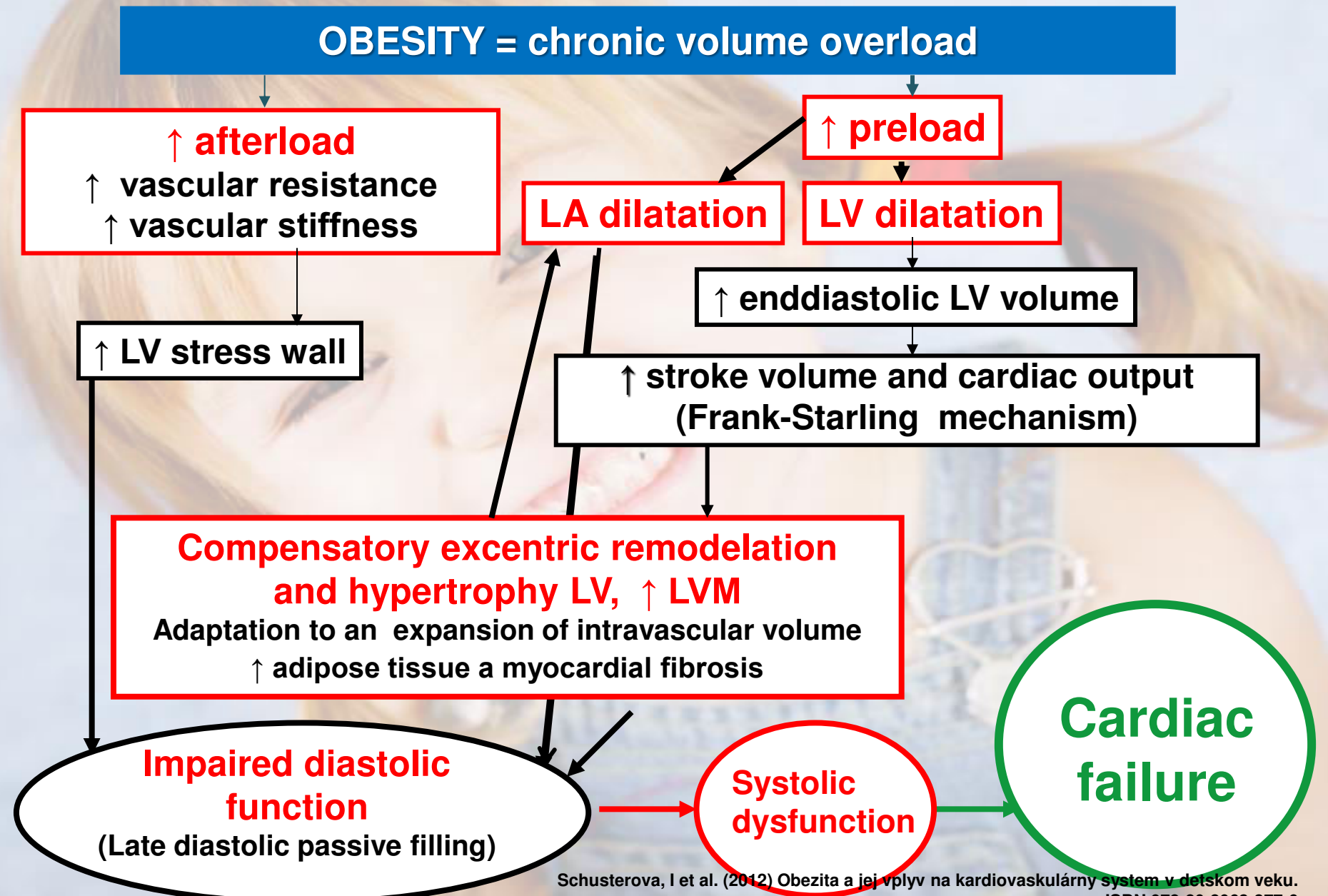
Accompanying diseases → hypertension, DM, sleep respiration disorder 2.

Functional changes progressing to the stage of heart failure without the concurrent contribution of ischemic heart disease 3.

Owan, T., Litwin, S. E.: Is there a cardiomyopathy of obesity? *Curr. Heart Fail. Rep.*, 4, 2007, pg. 221 – 228.

Rutter, M. K., Parise, H., Benjamin, E. J., et al.,: Impact of glucose intolerance and insulin resistance on cardiac structure and function: sex-related differences in the Framingham heart study. *Circulation*, 107, 2003, pg. 448 – 454.

Patophysiology „Obesity cardiomyophathy“



Schusterova, I et al. (2012) Obezita a jej vplyv na kardiovaskulárny system v detskom veku.
ISBN 978-80-8063-377-6

URIC ACID in adolescence and adulthood

Uric acid (UA) → **best predictor of the metabolic unhealthy obese (MS features and ↑ CVS RF)**

!!! UNTIL NOW

LV and UA studies

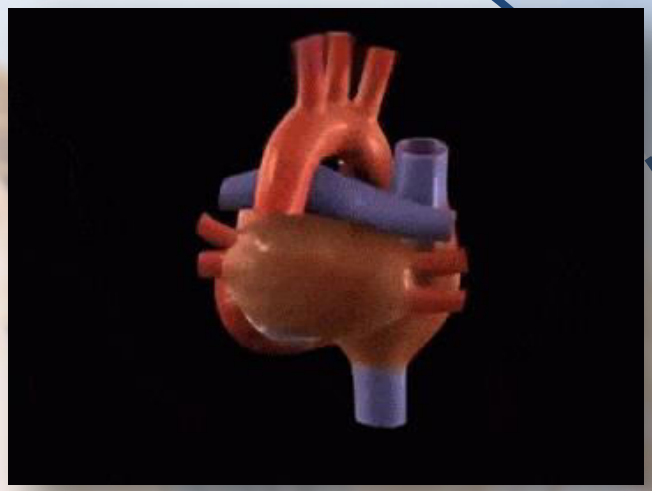
- ***Not many UA level and hemodynamics***
- ***Relationship between the UA levels and LVH*** → **contradictory results**

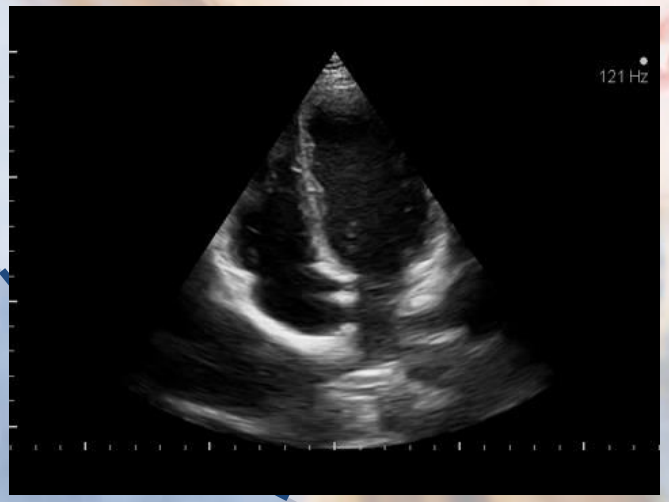
Gustafsson D, Unwin R. The pathophysiology of hyperuricaemia and its possible relationship to cardiovascular disease, morbidity and mortality. BMC Nephrol. 2013 Jul 29;14:164. doi: 10.1186/1471-2369-14-164.

UA and LV in children

!!! NO DATA

have been published regarding the influence of the UA level on the structural and functional changes of the LV in case of obesity in children





Aim of our study was to asses the influence of UA on LV in obese children

Presentation of study results

Study Group and Methods

- *25* (age 13,0 ± 2,3) *overweight and obese subjects* (13.0 ± 2.3 years of age, 9 female)
- *24 lean healthy subjects* (12.9 ± 3.4 years of age, 12 female)

✓ Blood pressure, waist circumference, fasting plasma glucose and insulin, UA were measured

✓ Left ventricular (LV) and left atrium (LA) structural and functional parameters were measured by transthoracic echocardiography

Anthropometric and biochemical variables in obese and overweight and lean control

Variables	Overweight and obese (BMI ≥ 85 percentile) N=25	Lean control (BMI < 85 percentile) N=24	p-value
Anthropometric variables			
Age (years)	13.0 ± 2.3	12.9 ± 3.4	0.36
Body weight (kg)	72.3 ± 19.6	50.5 ± 14.3	p < 0.01
Height (cm)	164.0 ± 16.4	161.3 ± 13.2	0.56
BMI (kg/m2)	27.4 ± 3.5	18.8 ± 3.1	p < 0.01
BMI percentile	94.3 ± 3.5	36.2 ± 2.83	p < 0.01
BMI Z-score	-0.38 ±1.014	2.09 ± 0.51	p < 0.01
Waist circumference (cm)	95.5 ± 12.6	73.1 ± 8.8	p < 0.01
Biochemical variables			
Uric acid (umol/l)	321.4 ± 67.5	281.9 ± 69.3	0.16
Glucose (mg/dl)	89,4± 9,1	88.7±8.2	0.42
Insulin (IUl L)	15.4 ±7.2	8.0±4.2	p < 0.05
HOMA-index	3.47±1.97	1.9±1.88	p < 0.001

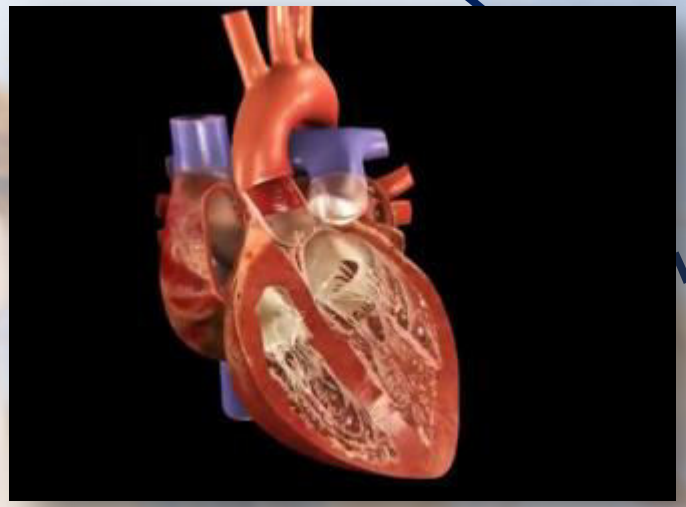
Data are shown as the mean ± standard deviation
BMI, body mass index; HOMA index, homeostasis model assessment of insulin resistance

Echoparameters in obese and overweight and lean control

Parameter	Obese and overweight Mean ± SD	Lean control Mean ± SD	P- value
LV structural echoparameters			
IVSd M (cm)	0.91 ± 0.20	0.75 ± 0.18	p< 0.01
LVd M (cm)	4.85 ± 0.56	4.30 ± 0.50	p< 0.01
PWThd M (cm)	0.82 ± 0.15	0.73 ± 0.16	0.06
LV area sys (cm^2)	17.4791 ± 3.54	16.19 ± 4.043	0.27
LV area dia (cm^2)	33.7173 ± 6.52	28.11 ± 4.62	p< 0.01
LVM (g)	149.00 ± 10.18	54.43 ± 43.41	p< 0.01
LVMIV ($g/m^{2.7}$)	39.55 ± 28.27	10.11 ± 8.27	p<0.001
LV functional diastolic echoparameters			
E wave MV (m/s)	1.02 ± 0.23	0.96 ± 0.11	0.23
A wave MV (m/s)	0.60 ± 0.10	0.51 ± 0.11	p< 0.01
IVRT MV (ms)	177.52 ± 70.43	132.68 ± 34.00	p< 0.01
DT MV (ms)	143.13 ± 55.72	186.32 ± 75.06	p< 0.05
LV functional systolic echoparameters			
LV volume dias (cm^3)	118.50 ± 34.74	85.35 ± 21.73	p<0.001
LV EF (%)	61.09 ± 8.630	56.20 ± 9.90	0.09
LV SV (ml)	74.36 ± 29.75	48.58 ± 18.86	p< 0.01

IVSd– Enddiastolic interventricular septum thickness;
LVd M Enddiastolic diameter in M Mode;
PWThd M - Enddiastolic posterior wall thickness;
LVM- Left ventricle mass;
LVMIV – Left ventricle mass indexing to body height$^{2.7}$; E wave - Mitral inflow Doppler component during early diastole;
A wave - Mitral inflow Doppler component during late diastole;
IVRT MV –Isovolumic relaxation time from blood flow Doppler evaluation;
DT – Deceleration time from blood flow Doppler evaluation; EF - Ejection fraction;
SV – Stroke volume;

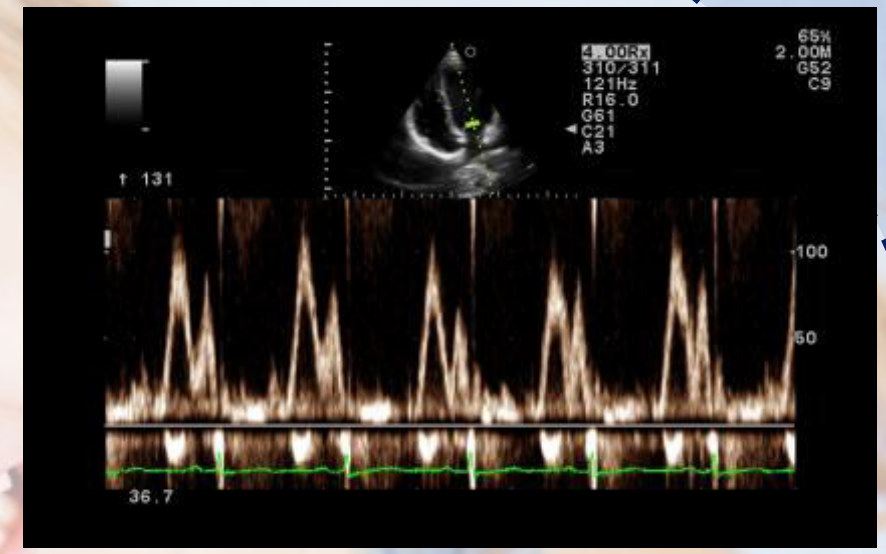
UA and LV structural echoparameters



LV structural echoparameters	Uric Acid
IVSd M (cm)	p< 0.01 r=0.44
PWThd M (cm)	p< 0.05 r=0.34
LV area sys (cm2)	p< 0.05 r=0.36
LV area dia (cm2)	p<0.001 r=0.57
LVM (g)	p=0.99
LVMIV (g/m2.7)	p=0.96

IVSd– Enddiastolic interventricular septum thickness;
LVd M Enddiastolic diameter in M Mode; PWThd M - Enddiastolic posterior wall thickness; LVM- Left ventricle mass; LVMIV – Left ventricle mass indexing to body height$^{2.7}$;

UA and LV functional diastolic echoparameters



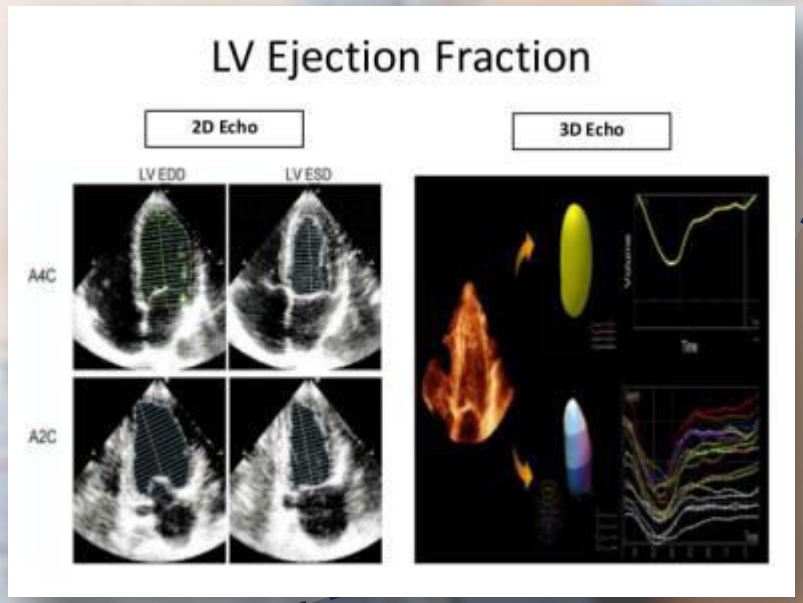
LV functional diastolic echoparameters	Uric Acid
E wave MV (m/s)	p=0.87
A wave MV (m/s)	p=0.34
IVRT MV (ms)	p=0.74
DT MV (ms)	p=0.81
PHT MV (ms)	p=0.82

E wave - Mitral inflow Doppler component during early diastole; A wave - Mitral inflow Doppler component during late diastole; IVRT MV –Isovolumic relaxation time from blood flow Doppler evaluation; DT – Deceleration time from blood flow Doppler evaluation;

UA and LV functional systolic echoparameters

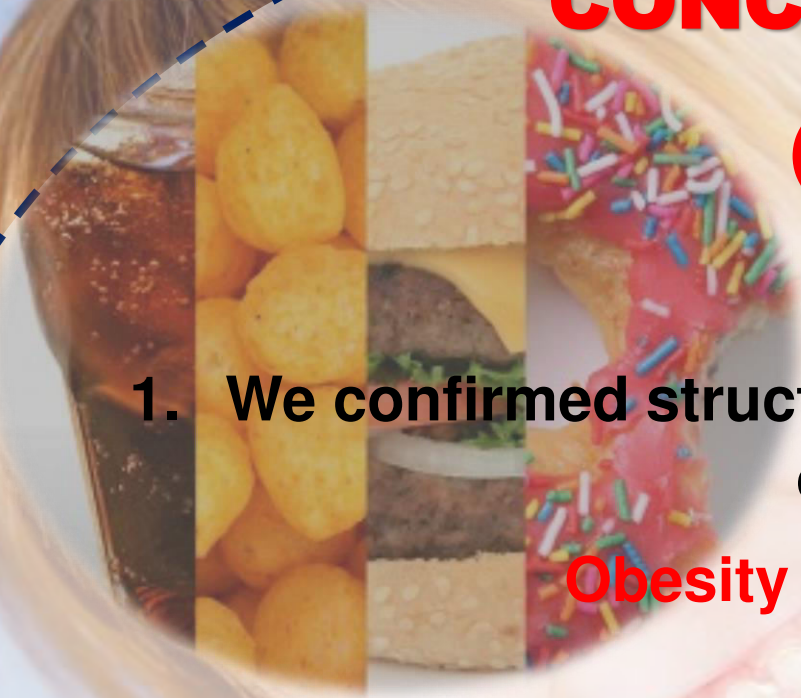
LV functional systolic echoparameters	Uric Acid
LV volume dias (cm3)	p<0.001 r=0.59
LV EF (%)	p<0.001 r=0.21
LV SV (ml)	p<0.001 r=0.40

EF - Ejection fraction; SV – Stroke volume;



CONCLUSION

(1)



1. We confirmed structural and functional changes of LV in obese individuals →

   Obesity caused left volume overload

2. This changes seems to be influenced by UA, but the association between the signs of left volume overload and UA has not yet been clarified

CONCLUSION

(2)

Further studies with a larger amount of patients are required to elucidate this biological mechanism of such complex relationship
(between structural and functional changes of the LV and UA and obesity)

Thank you for your attention