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Correlations of echocardiographical parameters in women, which underwent laparoscopic cholecystectomy

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Abstract. Laparoscopic cholecystectomy (LCE) holds the 1st place among abdominal surgeries. Pathology of the biliary system is associated with female sex, because estrogens increase bile lithogenicity. One of the peculiarities of biliary system diseases in women is combination of them with cardiovascular diseases. Specific patterns of heart changes in women, which underwent LCE, are not clearly established yet. That's why we held a retrospective analysis of 100 case histories of women, which underwent LCE. Among analysed women frequency of arterial hypertension was 79%; obesity was diagnosed in 52%, overweight – in 30% of patients. Median of index of left ventricle (LV) myocardium weight in examined women exceeded normal values (108.34 g/m^2 with the limit to 95 g/m^2). Median of relative thickness of LV wall indicated presence of eccentric hypertrophy. In examined patients we also revealed signs of hypertrophic type of diastolic dysfunction: decrease of speed E on the background of increase of speed A and decrease of E/A ratio to 0.7. Erythrocyte sedimentation rate (ESR) in our patients directly correlated with left atrium size, thicknesses of LV posterior wall and interventricular septum, end-systolic volume, LV

myocardium weight and its indexed value. ESR also reversely correlated with ejection fraction (all r<0,05). Echocardiographical parameters also correlated with body weight, height, body mass index, age, systolic and diastolic blood pressure.

Key words: cholelithiasis, laparoscopic cholecystectomy, hypertension, heart, left ventricle.

Introduction. Cholelithiasis (CL) is one of the most widespread diseases of gastrointestinal tract. According to literature reviews, it is revealed in 10 to 40 % of population depending on age [5]. Symptomatic gallstones are usually treated by laparoscopic cholecystectomy (LCE), which holds the first place among abdominal surgeries during last decade [2]. Pathology of the biliary system is consistently associated with female sex. Gallstones occur in women threefold more frequently than in men [14]. Women make up the majority of patients with cholelithiasis and cholecystitis [6]. Predisposition of women to biliary system diseases can be explained by the fact that estrogens contribute to bile lithogenicity and sludge formation [14]. Additional risk factors for cholelithiasis in women include special medications, for instance, oral contraceptives and estrogens [7], which increase secretion of cholesterol to bile and inhibit synthesis of bile acids. These processes also lead to increased bile lithogenicity [1].

One of the peculiarities of biliary system diseases in women is combination of them with cardiovascular diseases [6], which can be explained by common exogenous and endogenous etiological factors. According to a survey of 1122 patients with CL, incidence of arterial hypertension (AH) in them was 44.6% [12], which is much higher than in population. A survey of 199 people with obesity showed that an important factor associated with the presence of gallstones was diastolic pressure [10]. Our previous studies have shown that incidence of LCE is significantly higher in women than in men. Women more often had AH, which was accompanied by elongation of in-patient treatment, more frequent obesity, less

expressed inflammatory syndrome on the background of deterioration of carbohydrate metabolism and susceptibility to hypocoagulation [4].

Despite numerous studies on this topic, specific patterns of heart changes in women, which underwent LCE were not clearly established. That's why the aim of our study was to analyze the structural and functional condition of heart in such women.

Materials and methods. We held a retrospective analysis of randomly selected 100 case histories of women, which underwent laparoscopic cholecystectomy in department of invasive methods of diagnostics and treatment of Rivne regional clinical therapeutic-diagnostical centre named after V.Polishchuk (Ukraine) during 2008-2010. Investigation includes patients aged 31 to 82 years, median 60,0[52,5;68,0] years. Concomitant pathological conditions included ischemic heart disease (74%), hypertonic disease (71%) and dilatation of varicose veins of the lower extremities (21%). Only 5% of patients did not have concomitant diseases. All patients underwent standard laboratory investigations (complete blood and urine analysis, biochemical blood analysis, coagulation analysis). Instrumental studies included ECG, echocardiography and abdominal ultrasound. Structural and functional status of heart was assessed according to echocardiography (with the use of Toshiba Nemio XG SSA-580A apparatus) with the evaluation of thickness of the posterior wall of the left ventricle (PWLV), interventricular septum (IVS), end-diastolic (EDV) and end-systolic (ESV) volumes of the left ventricle (LV), left atrium (LA), left ventricle ejection fraction (LVEF), left ventricle myocardium weight (LVMW). We also calculated relative thickness of LV walls (RTLVW) and indexed LVMW (iLVMW). According to the transmitral flow, we estimated the maximal speed of early (E) and late (A) diastolic filling of the left ventricle and calculated E/A ratio [3]. Statistical analysis of the results was performed using the software package Statistica 6,0 with calculation of Kendall criteria (τ) and its accuracy level (r). Data is presented as median [first; fourth quartile]

Results and discussion. Among analysed women frequency of arterial hypertension was 79% (1st grade – 50.6%, 2nd grade – 40.5%, 3rd grade – 8.9%). During hospitalization median of systolic pressure was 150[140;160] mm Hg, diastolic – 90[90;100] mm Hg. This indicates a failure to achieve target blood pressure. Obesity was diagnosed in 52% (65.4% - of the 1 grade, 25% - of the 2 grade, 9.6% - 3 grade), overweight – in 30% of patients. Only 18% of women had normal body weight. Thus, the incidence of hypertension (79%) and excessive body weight or obesity (82%) is significantly higher in patients which underwent LCE, than in population (23% and 55% respectively). This finding is generally in line with our previous data [4].

Analyzing key echocardiographic parameters characterizing arterial hypertension, we must note that the median of indexed LVMW in women exceeded normal values (108.34 g/m^2 with the limit for women to 95 g/m^2, Table 1).

Table 1. Echocardiography parameters in examined women

Parameter,	Median	First quartile	Fourth quartile	Normal values
Left atrium (sm)	3,6	3,3	3,9	2,0 – 4,0
Interventricular septum (sm)	1	0,9	1,1	0,6 – 1,1
Posterior wall of left ventricle (sm)	1	0,9	1,1	0,6 – 1,1
ESV (sm^3)	41	32	49	45 – 75
EDV (sm^3)	118	94,5	135	110 – 145
EF (%)	64,5	62	68	55 – 65
LVMW (g)	198,39	164,26	248,35	-
iLVMW (g/m^2)	108,34	95,16	135,15	Women – to 95
RTLVW, units	0,40	0,35	0,43	Less than 0,40
Maximal speed E, m/s	0,48	0,41	0,60	0,7 – 1,2
Maximal speed A, m/s	0,70	0,60	0,81	0,42 – 0,7
E/A, units	0,70	0,6	0,78	1,0 – 2,2

However, median of RTLVW was 0.40 units, indicating the presence of eccentric hypertrophy. Talking about transmitral flow, we must say that its parameters change depending on several factors: heart rate, age and preload. In the examined patients with heart rate median of 75 bpm we revealed signs of diastolic dysfunction: decrease of speed E on the

background of increase of speed A and as a result, decrease of the E/A ratio to 0.7. Such changes characterize hypertrophic type of diastolic dysfunction.

Rajkumari R. et al. (2013) revealed significantly higher levels of erythrocyte sedimentation rate (ESR) and white blood cells in patients with hypertension than in normotensive ones. This finding allowed them to hypothesize that hypertension is an "inflammatory" disease [11]. Combination of arterial hypertension with pathological conditions of gallbladder has led to greater activation of inflammation syndrome in our patients. With the help of correlation analysis, we found that expression of inflammation syndrome in examined women was associated with structural and functional parameters of heart. ESR significantly correlated with age (τ=0,20, r=0,004) and eight parameters of echocardiography: directly with LA size, thicknesses of PWLV and interventricular septum in diastole, end-systolic volume, LVMW, iLVMW and the maximum speed of late diastolic filling A. Reversely ESR correlated with ejection fraction (all r<0,05). According to the literature, ESR in patients with coronary heart disease was significantly higher than in patients without coronary artery disease. Body mass index, incidence of type 2 diabetes, total cholesterol, low density lipoproteins and C-reactive protein were also higher in such patients [9].

Despite the introduction of new high-tech research methods, scientific interest to the formula of peripheral blood for diagnostic and prognostic purposes is still high. According to recent clinical studies (2013), high ratio of neutrophils to lymphocytes is an independent predictor of cardiovascular mortality and is associated with vascular stiffness [13]. In examined patients leukocyte count directly correlated with heart rate (τ=0,20, r=0,05).

The level of fibrinogen had 7 significant correlations: direct correlation with age (τ=0,18, r=0,008) and 6 correlations with blood count parameters, including leukocytes, band neutrophils and erythrocyte sedimentation rate, which confirms role of fibrinogen as a marker

of inflammation. Several meta-analysises showed that the increase of markers of systemic inflammation, including C-reactive protein, interleukin-6 and fibrinogen is an independent predictor of coronary heart disease and an additional factor of cardiovascular risk [8]. Fibrinogen did not have any correlations with echocardiographic parameters, but, anyway, its level can predict future functional and structural changes.

Level of urea directly correlated with a number of structural parameters of heart: ESV, EDV, LVMW, iLVMW and LA size. This can be explained by hypoxia and impaired renal function in hypertensive patients, which leads to increase of urea and creatinine, and consequently, to overproduction of renin, which is promoting the conversion of angiotensin I to angiotensin II, playing a leading role in the development of left ventricle hypertrophy and diastolic dysfunction.

Echocardiographical parameters of examined women also correlated with body weight, height, body mass index, age, systolic and diastolic blood pressure. This finding confirms the dependence of LV remodeling and hypertrophy on the hypertension, overweight and obesity. Correlation (τ = 0,18, r = 0,038) of late diastolic filling speed A with diastolic pressure indicates a negative effect of increased afterload on the functional possibilities of LP. Our results also indicate impairment of diastolic filling with age (correlation of E/A with age τ=-0,25, r=0,004). In addition, LVMW and iLVMW inversely correlated with hemoglobin (τ=-0,17, r =0,017 and τ= -0,19, r=0,006) and directly with ESR (τ=0,22, r=0,002 and τ=0,23, r=0,001).

Conclusions. Among women, which underwent LCE, hypertension, overweight and obesity are more frequent than in population. Increase of ESR is associated with LV hypertrophy and decrease of its contractile function. Left ventricular remodeling depends on presence of obesity and hypertension.

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