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## CLINICAL AND DIAGNOSTIC ASPECTS OF MANAGING PATIENTS WITH VALVULAR HEART DISEASE

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The article presents the results of examination of 47 patients with valvular heart disease. According to the research findings, when investigating the causes of severe mitral regurgitation, especially in young and middle-aged people, one should primarily consider Barlow's disease, myxomatous mitral valve degeneration, as the primary cause (having excluded fibroelastic deficiency). It was found that among all cases of detected mitral valve prolapse (even minor or moderate), which is currently diagnosed quite often with the development of modern technology, stratification of patients requires additional examinations to identify people at high risk of disease progression and complications, as well as to determine the prognosis.

**Key words:** valvular heart disease, diagnosis, treatment methods, prognosis optimization.

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## КЛІНІКО-ДІАГНОСТИЧНІ АСПЕКТИ ВЕДЕННЯ ПАЦІЄНТІВ ІЗ ЗАХВОРЮВАННЯМИ КЛАПАНІВ СЕРЦЯ

У статті наведені результати досліджень 47 пацієнтів з захворюванням клапанів серця. За результатами аналізу встановлено, що досліджуючи причини розвитку тяжкої мітральної регургітації, особливо у людей молодого та середнього віку, слід в першу чергу розглядати як первинну причину (при виключенні фіброеластичного дефіциту) – хворобу Барлоу, міксоматозну дегенерацію мітрального клапана. Встановлено, що серед усіх випадків виявленого пролапсу мітрального клапана (навіть незначного чи помірного ступеня), який в даний час з розвитком сучасних технологій діагностується доволі часто, виокремлення пацієнтів, вимагає додаткових обстежень для встановлення осіб з високим ризиком прогресування захворювання і виникнення ускладнень, а також для визначення прогнозу.

**Ключові слова:** вада серця, діагностика, методи лікування, оптимізація прогнозу.

*The study is a fragment of the research project "Improving methods of diagnosis, treatment and prevention of drug-induced lesions of internal organs", state registration No. 0121U113862.*

Heart valve disease (HVD) is a common cardiac condition and one of the leading causes of cardiovascular disease and mortality. Due to the predominance of degenerative valve disease, the most common are calcifying aortic stenosis (AS) and mitral regurgitation (MR), while aortic regurgitation (AR) and mitral stenosis (MS), mitral insufficiency (MI) have been diagnosed less often.

According to statistics, HVD occurs in 4–7 % of cases, and mitral valve lesions are the most common (2.5 %). Mitral valve prolapse (MVP) is the main cause of cardiac surgery for mitral regurgitation and high-grade arrhythmias [4]. MVP is a common valvular pathology, and myxomatous degeneration of the mitral valve (MV) is the most common cause of severe MI, which requires surgical correction.

According to James S. Gammie, the share of MVP among the causes of MI is up to 60.7 % [10]. The etiology of MVP includes both acquired (fibroelastic deficiency (FED) in elderly patients) and congenital or hereditary forms, with excessive sponginess, depleted content of fibroelastic connective tissue of the mitral valve leaflets and chords of the valve.

MVP is inherited with increased gene expression in women (2: 1). The most common type of inheritance is autosomal dominant, but cases of inheritance linked to the X chromosome have been described. Genotype studies indicate an autosomal dominant type of MVP inheritance with a locus on chromosome 13.

There are two forms of mitral valve prolapse: Barlow's disease and fibroelastic deficiency. In Barlow's disease, there is a thickening and excess of leaflet tissue with destroyed collagen and elastin layers, which is manifested by multiple leaflets prolapse and chords lengthening [9]. Patients in this phenotypic group are middle-aged at the time of surgery, with a long history of noise and/or MI.

Fibroelastic deficiency is characterized by insufficient connective tissue, deficiency of elastin, collagen and proteoglycans, which is the cause of thinning of the leaflets, annuloectasis, a slight lengthening of the chords [8]. Therefore, the search for an algorithm for the differential diagnosis of heart valve disease from a theoretical and practical point of view, is an extremely important problem in cardiology.

**The purpose** of the study was to optimize the early diagnosis of heart valve disease in adults, to determine the diagnostic algorithm for doctors of the general treatment network for timely detection of patients with this pathology.

**Materials and methods.** The object of the retrospective study was 47 patients with HVD, who underwent treatment and examination on the basis of the cardiology department of KP “M.V. Sklifosovsky Poltava Regional Clinical Hospital“ in 2018–2020.

Patients were divided into groups as follows: Group I – 30 patients with mitral regurgitation of degree II (mean age was  $60.28 \pm 6.59$  years); Group II – 17 patients with Barlow's disease (mean age of patients was  $58.32 \pm 6.71$ ).

Exclusion criteria: rheumatic lesions of the mitral valve (MV), patients with hypertrophic cardiomyopathy, Marfan's syndrome and endocarditis, acute ischemic heart disease, heart failure of functional class IV according to NYHA, uncontrolled arterial hypertension, endocrine disorders (diabetes mellitus).

Mitral regurgitation criteria were assessed by echocardiography as recommended by the American College of Cardiology and the American Heart Association and the European Society of Cardiology. One of the parameters in the assessment of patients was systolic pressure in the right ventricle. Another parameter that indicated the presence of mitral regurgitation was the size of the left atrium (LA). Echocardiography revealed mitral valve prolapse as an abnormal systolic movement of the leaflet in the left atrium  $\geq 2$  mm outside the saddle annular level measured in the parasternal long axis.

The diagnosis of Barlow's disease was verified on the basis of echocardiographic data and confirmed by intraoperative observations (according to discharge epicrisis): prolapse of the bicuspid mitral valve due to excess tissue and elongation of the chords, with annular abnormalities such as ring dilatation with calcification or without it.

Patients in both groups, in addition to the general clinical examination, underwent (before and after 1 month of treatment) daily monitoring of the electrocardiogram (ECG) using the Holter system “LABTECH Ltd”, software version V4.04.RC14), determination of lipid profile (total cholesterol (HVD), triglycerides (TG), low-density lipoproteins (LDL) and high-density lipoproteins (HDL), atherogenicity index (AI) using an automatic biochemical analyzer Sapphire 400 (“Hirose Electronic System”).

Standard transthoracic echocardiograms (TTE) were performed using ultrasound devices (Philips Medical System, Acuson X300 from “Siemens”). Images were stored digitally and analyzed offline using EchoPAC (version 112, GE Medical Systems) and QLAB (Philips Medical System). All available TTEs performed before the operation on the MV were analyzed by two observers. Left ventricular end-diastolic size (EDS of LV), left ventricular end-diastolic volume (EDV of LV) and left ventricular end-systolic size (ESV of LV) were measured in parasternal long-axis projection, and ejection fraction (EF) and left atrial volume (LAV) were calculated using the Simpson method.

The volume of the left atrium was indexed [left atrial volume index (LAVI)] by body surface area. The severity of mitral regurgitation was classified according to current guidelines using a multiparameter approach, and MR was classified as mild (grade I), mild-moderate (grade II), moderate-severe (grade III), and severe (grade IV). Systolic pressure in the pulmonary artery was assessed by measuring the maximum tricuspid regurgitation flow rate using the simplified Bernoulli equation in combination with the right atrial pressure as recommended.

The annular diameter of the tricuspid valve was measured in the apical four-chamber projection of the right ventricle (RV).

All MV functions were performed in parasternal projection along the long axis in accordance with modern recommendations: the diameter of the MV ring was determined in the end-systolic phase, just before the opening of the MV leaflets.

All patients received standard therapy, including anticoagulants, beta-blockers, aldosterone antagonists, 52.4 % of respondents received statins. According to the indications, diuretics and antiarrhythmic drugs were used.

Statistical analysis of the study materials was performed using SPSS for Windows Release 13.00, SPSS Inc., 1989–2004. The main statistical characteristics included:  $M \pm SEM$ , SD, where M is the mean, SEM is the standard error; SD – standard deviation. P is the difference between the groups according to the non-parametric equivalent to the two-sample Student's study – Mann-Whitney test. The difference between the compared values was considered probable at  $p < 0.05$ .

**Results of the study and their discussion.** According to the results of the study, patients with regurgitation of the mitral valve degree II in comparison with patients with Barlow's disease revealed differences in the size of the RV and RV systolic pressure. The size of the right ventricle is larger than in

patients with mitral regurgitation. Patients with Barlow's disease are characterized by a larger mean diameter of the MV ring, which was 4.2 cm vs. 2.98 cm. In echocardiography Barlow's disease was characterized by diffuse, excess leaflets' tissue with prolapse of the bicuspid valve. The valve leaflets were also thickened (>3 mm) when measured in diastole using M-mode. Pronounced annular dilatation was another sign of Barlow's disease with frequent calcifications. The groups also differed in left ventricular (EDD) ( $p < 0.001$ ). The main echocardiographic parameters that characterize patients are presented in table 1.

Table 1

**Echocardiographic characteristics of patient groups**

Parameters	Group I, n=30	Group II, n=17	p-value
EDD of LV, cm	5.7±0.7;4.8	6.1±0.9;5.2	0.559
EDD of LV, ml	167.8±50.4;144.4	177.1±58.5;152.1	0.001
ESD of LV, cm	3.9±0.3;3.8	3.9±0.1;4.1	0.784
Diameter of RV, cm	3.0±0.5;2.9	2.7±0.5;2.6	0.005
RV systolic pressure, mm Hg	47.6±16.9;43.2	41.6±14.3;39.1	0.001
LA diameter	5.0±1.1;4.5	4.8±0.9;4.6	0.001
MV diameter, cm	2.9±0.6;2.2	5.2±0.5;5.1	0.038
EF, %	57.4±8.3;64.2	59.1±6.6;53.3	0.250

Notes: M is the mean, SEM is the standard error, SD is the standard deviation, P is the difference between the groups according to the nonparametric equivalent to the two-sample Student's t-test – the Mann-Whitney test.

Clinical characteristics of the first group: 30 patients with heart valve disease, whose mean age was 60.28±6.59; 0.90 (M±SEM; SD, where M is the mean, SEM is the standard error; SD is the standard deviation) maximum – 68 years, minimum – 52 years. The number of men who took part in the survey was 26 (55.3 %) and 14 (44.7 %) women, the mean age of men was 68.71±1.16, 6.74 years, and women 66.82±1, 28, 5.98 years. 19 (40.4 %) patients were under 60 years of age, and 21 patients (51.1 %) were elderly (60–68 years).

In 27 out of 40 (79 %) subjects lesions of one mitral valve only were diagnosed. 28 (74.5 %) out of 40 people had hypercholesterolemia. 16 (44 %) patients out of 40 had postinfarction atherosclerosis (according to discharge epicrisis). 9 (19.1 %) out of 40 patients developed pulmonary edema during hospitalization. 37 (89.4 %) of those surveyed suffered from hypertension grade II. 35 (74.5 %) out of 40 patients had a history of angina. Concomitant tricuspid insufficiency was observed in 24 (53.2 %) patients out of 40.

In 6 (25.7 %) patients were diagnosed with chronic heart failure (HF) grade I according to M.D. Strazhesko, V.Kh. Vasylenko, functional class II (FC) according to NYHA, in 33 (70.2 %) - HF grade IIA., FC III according to NYHA and in 1 (2.1 %) HF grade IIB FC III according to NYHA.

Clinical characteristics of 17 patients with Barlow's disease: the mean age of patients was 58.32±6.71; 0.90 (M±SEM; SD, where M is the mean, SEM is the standard error; SD is the standard deviation), maximum – 58 years, minimum – 50 years. According to gender characteristics, the distribution was as follows: 8 (53.3 %) men and 7 (46.7 %) women. The mean age of men was 57.71±1.16, 6.74 years, and women 58.82±1.28, 5.98 (M±SEM; SD) years.

7 patients (46.7 %) were middle-aged (40–44 years) and 3 patients (20 %) were young (35 years and older), 5 (33.3 %) patients were under 60 years of age. 11 (73.3 %) out of 17 people had chronic form of coronary heart disease (CHD) in the form of angina pectoris. 4 (26.7 %) of the subjects suffered from hypertension. 15 (93.3 %) of 17 patients had a history of arrhythmia in the form of atrial fibrillation.

The case history of a 49-year-old patient with normosthenic body build without risk factors for coronary heart disease was analyzed. The woman was under the supervision of a cardiologist for 5 years for mitral valve prolapse. She applied to a cardiologist with signs of heart failure and constant atrial fibrillation. There is no anamnesis of chronic diseases, rheumatic heart disease was excluded.

Objective examination draws attention to the manifestations of chronic heart failure (pronounced general weakness, decreased exercise tolerance, edema of the lower extremities, pulse deficit, cardiac arrhythmia, tone I weakening over the apex of the heart, systolic noise whose epicenter was heard above the apex beat and was well conducted into the left axillary area and interscapular space).

In additional survey methods:

In the ECG (fig. 1) signs of atrial fibrillation with a heart rate of 103 – 72 and signs of left ventricular hypertrophy with its systolic overload.

TTE: Mitral valve: M-shaped, the movement of the leaflets is differently directed, opening - 24.0 mm. The leaflets are compacted, thickened to 6.6 mm. Blood flow: speed 1.0 m/s, gradient 4.1 mm Hg, regurgitation +++ (70 mm Hg). Tricuspid valve: M-shaped, leaflets movement is differently directed. Blood flow: speed 0.8 m/s, gradient 3.0 mm Hg, regurgitation ++ (30 mm Hg).

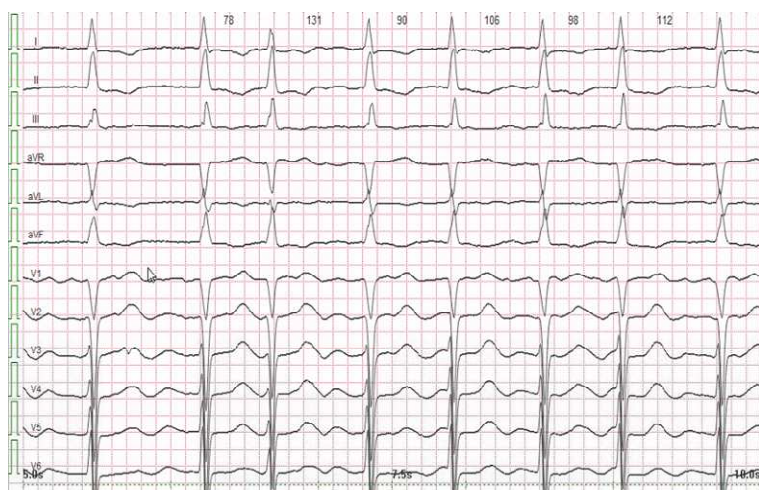


Fig.1. ECG

Pulmonary artery: diameter 23.0 mm; speed 0.9 m/s; gradient 3.4 mm Hg, systolic pulmonary artery pressure 40.0 mm Hg. Left atrium: 46.0 mm \* 67.0 mm, enlarged. Right ventricle: EDD 26.0 mm, the cavity is not enlarged. The thickness of the anterior wall in diastole is 6.0 mm. Right atrium: 45.0 mm \* 58.0 mm, the cavity is enlarged. Atrial septum – unchanged. There is no fluid in the pericardium. Conclusion: atrial enlargement. Fibrous changes of mitral valve leaflets. Mitral valve insufficiency of grade III. Pulmonary hypertension. Sclerotic changes of the aortic walls (fig. 2, 3).

Aortic valve: tricuspid, leaflets opening 18.0 mm. Blood flow: speed 0.9 m/s, gradient 3.6 mm Hg, leaflets compacted. Left ventricle: end-diastolic dimension (KDD) of LV 54.0 mm; end-systolic dimension (ESD) of LV 37.0 mm; end-diastolic volume (EDV) of LV 142.0 ml; end systolic volume (ESV) of LV 60.0 ml; stroke volume 81.0 ml. EF 37%, LV mass 297.0 g. The thickness of the interventricular septum 11.0 mm., the ratio of early and late mitral velocity – 0.8. The thickness of the posterior wall in diastole is 11.4 mm, the movement is sufficient.

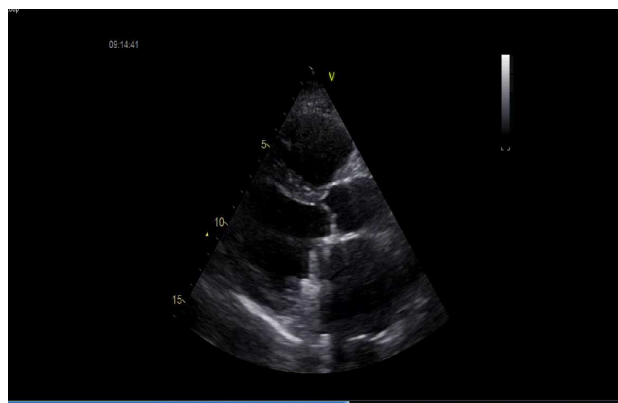


Fig.2. Dilatation of the left atrium

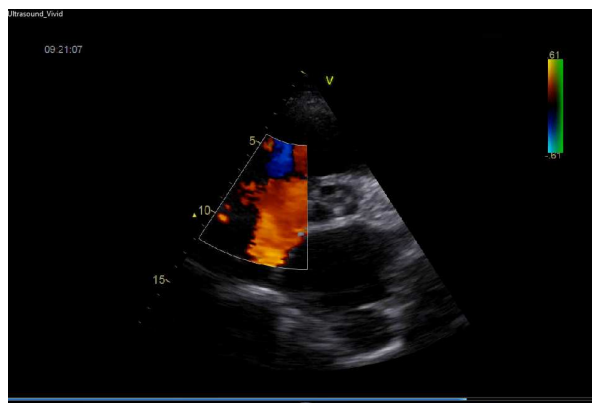


Fig.3. Backflow on the tricuspid valve. Color Doppler mapping - A4C, Color Doppler

Esophageal echocardiography: Mitral valve: prolapse of both leaflets, myxomatous changes, regurgitation +++. Tricuspid valve: regurgitation ++ (+). Coronary angiography: initial changes in the coronary arteries. Abdominal cavity organs (ACO) ultrasound: Diffuse changes in the parenchyma of the liver and pancreas.



Fig.4. Condition after mitral valve prosthesis and tricuspid valve plastics (according to De Vega).

Due to the increase in the manifestations of heart failure during treatment (triphase 10 mg, eplerenone 50 mg, carvedilol 12.5 mg, rivoroxaban 20 mg) and the onset of an attack of cardiac asthma at night, the patient was referred to a cardiac surgeon. The cardiac surgeon recommended surgical treatment, namely mitral and tricuspid valve plastics. Intraoperatively, the redundancy of several segments of both leaflets, dilatation of the fibrous ring, thickening of the chords and their elongation were macroscopically determined, cracks were found in the base of the leaflets with microthrombi and calcinates.

Mitral valve replacement with St. Jude Medical® mechanical prosthesis, tricuspid valve plastic according to De Vega, left atrial auricle plastic (fig. 4). It is the dilatation of the fibrous ring that has become a differential feature between Barlow's disease and connective tissue dysplasia.

In the early postoperative period, the patient developed an acute cerebrovascular accident that required neurological treatment for 6 days. Computed tomography of the brain: signs of acute cerebral circulatory disorders of the ischemic type in the area of the right middle cerebral artery, manifestations of vascular encephalopathy, moderate atrophy of the brain.

Based on the above, the final clinical diagnosis was formulated: Barlow's disease. Prolapse of both mitral valve leaflets. Mitral insufficiency of stage III. Tricuspid insufficiency of stage II. Pulmonary artery hypertension of stage III. Permanent form of atrial fibrillation, tachysystolic variant of HF IIA FC III with preserved left ventricular fraction CHA2 DS2 VASC 2 b. HAS-BLED 2b.

Polymorphism of clinical symptoms and instrumental studies of HVD causes diagnostic difficulties in physicians. Collection of anamnesis and objective status do not permit to verify the diagnosis due to the absence of pathognomonic symptoms. The gold standard and key in the diagnosis of MI and its causes remains TTE. The greatest pathognomonic feature is the "pronouncement of the valve leaflets": visualized "waving" thickenings (>3 mm) and enlarged anterior and posterior leaflets of the MV mainly in the free edge, prolapse and/or pseudoprolapse of two or more leaflet segments.

About 10 % of patients with Barlow's disease have significant calcification in the posterior semicircle of the fibrous ring with a possible transition to the subvalvular chords and papillary muscles, which can be observed both by TTE and confirmed by intraoperative analysis of the valve [1].

Therefore, when examining the causes of severe mitral regurgitation, especially in young and middle-aged people, primarily as the primary cause should be considered (excluding fibroelastic deficiency) Barlow's disease, myxomatous degeneration of the mitral valve or tendon chords. With age, the frequency of cases in the population increases, as well as the severity of clinical manifestations and a variety of complications.

This can be explained by the attaching of comorbid conditions: coronary heart disease, hypertension, calcifying heart valve disease. All this requires the practitioner, among all cases of detected mitral valve prolapse (even minor or moderate), which is now diagnosed quite often with the development of modern technology, to identify patients who require additional examinations to identify people at high risk of disease progression and occurrence of complications, as well as to determine the prognosis. Adults with complex defects or with manifestations of cyanosis, pulmonary hypertension or complicated valvular disease require annual examination in specialized centers with constant adjustment of treatment [5].

This was stated in the updated recommendations of the European Society of Cardiology and the European Association of Cardiothoracic Surgery 2021 for the management of patients with HVD. The document emphasizes the importance of medical examination as the first stage of diagnosis. To diagnose and determine the severity of the disease in the first place it is proposed to use non-invasive research methods, including echocardiography. The use of catheterization is only possible if the diagnostic imaging is not informative enough [2, 7, 9].

Early surgical treatment is increasingly prescribed to asymptomatic patients with aortic stenosis, aortic and mitral regurgitation due to experience and high safety. Percutaneous techniques are increasingly used in inoperable patients and people at high risk of complications with aortic stenosis and mitral regurgitation [3, 6].

## Conclusion

According to the recommendations of the working group of the European Society of Cardiology, further studies on HVD require: 1) identification of genetic, anatomical and clinical risk factors at different stages of initiation and progression to identify high-risk individuals and identify relationships between risk factors; 2) performing new epidemiological studies using computed tomography, TTE and magnetic resonance imaging.

*Prospects for further development: the development of diagnostic algorithms will permit timely detection of HVD in middle-aged people, prevent the development of complications and improve the quality of patients' life.*

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Стаття надійшла 14.05.2021 р.

DOI 10.26724/2079-8334-2022-2-80-183-188

UDC 616-073+616-073.763.5+616-089+616.352-007.253

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## USING ULTRASOUND DIAGNOSTICS AND MAGNETIC RESONANCE TOMOGRAPHY IN SURGICAL TREATMENT OF COMPLICATED FORMS OF ACUTE PARAPROCTITIS

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The results of surgical treatment of 134 patients with ischiorectal and pelviorectal acute paraproctitis were analyzed. Among them 81 (60.4 %) were men, 53 (39.6 %) were women aged 19 to 78 years. Ischiorectal acute paraproctitis was diagnosed in 71 (52.9 %), retrorectal – in 21 (15.8 %), pelviorectal – in 17 (12.7 %), horseshoe – in 16 (11.9 %), panparaproctitis (pelvic phlegmon) – in 9 (6.7 %) patients. The use of ultrasound and magnetic resonance imaging for the diagnosis of acute paraproctitis was analyzed in 67 (50.0 %) patients. Establishing the location of the abscess in the pararectal cell spaces, visualization of the primary purulent course and the affected crypt, permitted performing primary radical surgery in 79.1 % (53/67) of patients in the main group. In the comparison group, primary radical surgery was performed in 48 % (32/67) of patients. According to the Bayesian formula, the probability of complications during non-radical surgery in the main group of patients was 0.31, and in the comparison group – 0.43. The probability of no complications during non-radical surgery in the main group of patients was 0.69, and in the comparison group – 0.57, which confirmed the efficacy of ultrasound and magnetic resonance imaging in the diagnosis and treatment of patients with acute paraproctitis in the main group, relative to the comparison group.

**Key words:** acute paraproctitis, ultrasound examination, magnetic resonance imaging, surgical treatment, Bayesian formula.

## І.М. Шевчук, О.В. Новицький, А.Л. Шаповал, І.Я. Садовий, А.С. Сверстюк, С.С. Сніжко ЗАСТОСУВАННЯ УЛЬТРАЗВУКОВОЇ ДІАГНОСТИКИ І МАГНІТНО-РЕЗОНАНСНОЇ ТОМОГРАФІЇ У ХІРУРГІЧНОМУ ЛІКУВАННІ СКЛАДНИХ ФОРМ ГОСТРОГО ПАРАПРОКТИТУ

Проаналізовані результати хірургічного лікування 134 хворих ішіоректальним і пельвіоректальним гострим парапроктитом. Серед них 81 (60,4 %) чоловік, 53 (39,6 %) жінки, віком від 19 до 78 років. Ішіоректальний гострий парапроктит діагностований у 71 (52,9 %), ретроректальний – у 21 (15,8 %), пельвіоректальний – у 17 (12,7 %), підковоподібний – у 16 (11,9 %), панпарапроктит (флегмона тазу) – у 9 (6,7 %) хворих. Застосування ультразвукового дослідження та магнітно-резонансної томографії для діагностики гострого парапроктиту проаналізовано у 67 (50,0 %) хворих. Встановлення розташування гнійника в параректальних клітковинних просторах, візуалізація первинного гнійного ходу і ураженої крипти, дозволила виконати первинно-радикальні оперативні втручання у 79,1 % (53/67) пацієнтів основної групи. У групі порівняння первинно-радикальні оперативні втручання були виконані у 48 % (32/67) хворих. Згідно формули Байєса ймовірність розвитку ускладнень при радикальних оперативних втручаннях у основній групі пацієнтів становила 0,31, у групі порівняння – 0,43. Ймовірність відсутності розвитку ускладнень при нерадикальних оперативних втручаннях у основній групі пацієнтів становила 0,69, у групі порівняння – 0,57, що підтвердило ефективність проведення ультразвукового дослідження та магнітно-резонансної томографії при діагностиці та лікуванні пацієнтів з гострим парапроктитом основної групи, відносно групи порівняння.

**Ключові слова:** гострий парапроктит, ультразвукове дослідження, магнітно-резонансна томографія, хірургічне лікування, формула Байєса.

*The study is a fragment of the research project “Improving surgical tactics in diseases of the neuroendocrine system in order to improve treatment outcomes and quality of patients’ life”, state registration No. 0122U001740.*

Patients with acute paraproctitis (AP) make up 0.43–1 % of the total number of surgical patients and 24–50 % of the number of patients with rectal diseases. Diagnosis of AP by examination, palpation, digital rectal examination, or bimanual examination, not all forms of the disease are sufficiently informative. More often difficulties arise, in the so-called “deep forms” of a disease – ischiorectal and pelviorectal AP [3, 11]. Radical surgery for AP involves the opening of the abscess, leaks, elimination of the primary purulent passage and its internal opening in the affected crypt of the rectal mucosa.