ASSESSMENT OF CLINICAL FEATURES AND TREATMENT OPTIMIZATION OF ACUTE VARICELLA-ZOSTER VIRUS MYOCARDITIS: AN OBSERVATIONAL STUDY

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Introduction. Varicella-zoster virus (VZV) is an infection which causes chickenpox and shingles. Chickenpox is an acute infectious disease, predominantly of childhood, that develops among unvaccinated groups of the population aged from three months to 10–14 years. But in recent years, the incidence of chickenpox among adults has doubled, and the disease in them is more severe and causes a number of complications: pneumonia, myocarditis, nephritis, meningoencephalitis, encephalitis, vasculitis, pyoderma, allergic reactions [1–4].

The issue of damage to the cardiovascular system by the herpes virus in adults with chickenpox has been little studied and, given its great social and medical significance, requires careful study.

According to S.H. Osama et al. [5], in children with chickenpox, myocarditis develops in 5.0% of cases, and other authors [3, 4] identified this disease in 10.0–12.6%. The data presented on the incidence of myocarditis among children with chickenpox must be treated with caution, since the research methods and diagnostic criteria used are different. At present, we can only state that infectious myocarditis is a very common disease, which tends to become more frequent in the future. The main reason is the prevalence of viral infections, ongoing allergization and decreased immunity in the population.

Materials and methods. We examined 240 patients with chickenpox (142 women and 98 men) aged 18 to 40 years, who were hospitalized at the Kharkiv Regional Clinical Infectious Diseases Hospital from 1993 to 2014. A mild form of the disease was diagnosed in 82 (34.2%), moderate severity – in 143 (59.6%), severe – in 15 (6.4%) patients. Acute myocarditis was detected in 40 (16.6%) patients, among them a mild form of myocarditis was observed in 14 cases, a moderate form in 16 and a severe form in 10 patients.

Chickenpox was diagnosed based on clinical and molecular genetic studies (by detecting herpes virus DNA using polymerase chain reaction). The diagnosis of myocarditis was made according to the New York Heart Association (NYHA) criteria of 1964 and 1973.

A comprehensive examination of patients was carried out using methods: general clinical (blood and urine tests), biochemical (determination of C-reactive protein (CRP), sialic acid, fibrinogen, activity of alanine and aspartic transaminases (ALT and AST)) and instrumental (electrocardiography, fluoroscopy of organs chest).

Examination of chickenpox patients was carried out in the acute period of the disease, after normalization of temperature and before discharge from the hospital. Student’s t test was used in statistical analysis. The significance of differences in absolute and relative study indicators was assessed at p<0.05. Current study did not include patients who previously suffered from diseases of the cardiovascular system (neurocirculatory dystonia, mitral valve prolapse, myocarditis, cardiomyopathy, hypertension, congenital and acquired heart defects, coronary heart disease, etc.).

Results. Analysis of the clinical data obtained showed that the features of the course of chickenpox in adults include a prodromal period lasting up to two days, which was observed in 75% of patients. At this time, they experienced a headache, lower back pain, malaise, and fever with an increase temperature to 38-39°C. Some patients developed a rash in the chest area, less often on the upper limbs and face, and the patients experienced severe itching. In 25% of patients, the clinical manifestations developed acutely, with fever and temperature rising to 37-38°C and profuse rashes appearing on the face, limbs, torso, and scalp.

In 5% of patients, rashes were determined on the oral mucosa and tonsils. Rashes with chickenpox did not occur simultaneously, but as if in a “jump” manner at intervals of 1-2 days, which was accompanied by a fever, intoxication and deterioration of the general condition (headaches, weakness, nausea, vomiting, and muscle pain, enlarged cervical and submandibular lymph nodes).

In the analysis of peripheral blood, leuko- and neutropenia, relative lymphocytosis, and a moderately increased erythrocyte sedimentation rate (ESR) were observed.

In 82 patients with a mild form of chickenpox, fever increased to 37.5-38°C, they had mild rashes,
and there was no intoxication and no clinical and electrocardiographic signs of myocarditis.

With chickenpox of moderate severity, the fever of patients increased to 38-39°C, severe intoxication and profuse rashes occurred, including on the mucous membranes. In this group, a mild form of myocarditis was diagnosed in 14 patients, a moderate form – in 16 patients.

In severe cases of chickenpox, 15 patients had high fever – 39.5-40°C, a very profuse rash, and severe intoxication. Severe myocarditis was diagnosed in 10 cases.

Acute myocarditis developed mainly in patients with chickenpox with moderate and severe forms of chickenpox on the 2nd-3rd days of the disease, during the appearance of rashes on the skin and visible mucous membranes, less often on the 6th-10th days. Patients with myocarditis often complained of pain in the heart (85.0%) and palpitations (96.0%), less often shortness of breath, mainly in patients with severe myocarditis (8.6%). In 12.0% of the examined patients, only general weakness and fatigue were noted, which had no diagnostic value, but were sometimes regarded as signs of damage to the nervous system, asthenia, often accompanying chickenpox.

There was pain in the heart area of an aching, pressing, stabbing or burning nature, mostly constant, lasting several hours, and its occurrence was not associated with psycho-emotional or physical stress. Sometimes myocarditis began with subjectively felt heart rhythm disturbances. The pulse is usually rapid, often weak due to vascular insufficiency, which often accompanies myocarditis. Bradycardia was detected in three patients. The size of the heart in mild forms of myocarditis, as a rule, remains within the normal range, and in moderate and severe forms they are moderately enlarged on the left due to the left ventricle, which is associated with myogenic dilatation of the heart. During auscultation, the heart rhythm was more often normal; arrhythmia was less often recorded. The first tone above the apex is weakened, the second tone above the pulmonary artery with the development of heart failure is intensified, often split.

A common symptom of myocarditis was a systolic murmur over the apex and left border of the sternum, usually quiet or moderate in intensity, due to relative insufficiency of the left atrioventricular valve. In some patients, systolic murmur was associated with prolapse of the left atrioventricular valve leaflets into the left atrium cavity.

Blood pressure in 15 (37.5%) patients with myocarditis was decreased, in 4 (10.0%) was increased, and in another 21 (52.5%) it was remained normal.

In patients with chickenpox, with the development of myocarditis, leuko- and neutropenia, relative lymphocytosis and accelerated ESR remained in the peripheral blood.

When studying the dynamics of biochemical parameters in patients with chickenpox with an uncomplicated course in the blood, a moderate increase in the content of CRP was revealed on average to 1.2±0.06 mg/l (normal 0.5±0.03 mg/l, p<0.01); sialic acid – on average up to 2.6±0.4 µmol/l (normal 1.8±0.1 µmol/l, p<0.01); fibrinogen – on average up to 3.2±0.2 g/l (normal 2.6±0.15 g/l, p<0.05); the activity of ALT and AST did not increase significantly and averaged 0.6±0.06 µmol/l (p>0.1) and 0.48±0.09 µmol/l (p>0.1), respectively.

With increasing severity of chickenpox, the levels of CRP, sialic acids, and fibrinogen in the blood of patients increased significantly (p<0.05) and in patients with a severe form averaged 2.0±0.1 mg/l, 3.4±0.35 µmol/l, 3.6±0.24 g/l, respectively.

The content of CRP, sialic acids and fibrinogen in their blood depended on the degree of intoxication and the extent of chickenpox rashes on the skin, mucous membranes, and, possibly, the involvement of internal organs in the pathological process. When comparing the blood levels of CRP, sialic acids and fibrinogen in patients with chickenpox with an uncomplicated course and in patients with myocarditis, there were no significant differences (p>0.5), therefore these biochemical indicators are not specific for the diagnosis of myocarditis and reflect the dynamics of the infectious disease caused by herpesvirus. Determination of the activity of the organ-specific enzyme AST, ALT may be more specific for identifying myocardial damage in patients with chickenpox.

Discussion. The study showed that in patients with chickenpox with mild myocarditis, AST activity in the blood serum did not increase significantly and averaged 0.5±0.15 µmol/l (normal 0.48±0.08 µmol/l, p>0.5). AST activity was increased in 14 of 16 patients with moderate and in all 10 patients with severe myocarditis and averaged 1.85±0.02 µmol/l (p<0.01).

ALT activity was increased in three out of 16 patients with moderate myocarditis and in 8 out of 10 patients with severe myocarditis, which could be associated with liver involvement in the pathological process.

All of the listed subjective and objective clinical symptoms of acute infectious myocarditis can be combined with each other, causing a different clinical picture. In most cases, the patient did not have all the described symptoms and the clinical picture of myocarditis was determined only by some of them.

Assessing the clinical symptoms of acute infectious myocarditis is complicated by the simultaneous presence of symptoms of the underlying infectious disease. Therefore, it is often difficult to detect which complaints are due to the underlying
disease, and which are associated with myocarditis.

The clinical picture of the disease becomes even more polymorphic and difficult to differentiate if hepatitis, pneumonia and other complications of a viral infection are added to the pathology of the heart muscle.

One of the main reasons for the variation in the clinical picture of infectious myocarditis is the degree of damage to the heart muscle. The polymorphism of the clinical picture of infectious myocarditis has certain etiological, pathogenetic, morphological and other reasons that must be taken into account when examining patients when making a diagnosis. X-ray and electrocardiographic examinations are important in the diagnosis of herpesvirus myocarditis.

According to our data, an increase in heart size is characteristic of patients with infectious myocarditis. Sometimes cardiomegaly, detected by X-ray examination, becomes the first sign of myocarditis. An informative radiological quantitative indicator is the cardiothoracic ratio (CTR) – ratio of the transverse size of the cardiac shadow to the transverse size of the chest at the level of the dome of the diaphragm.

The studies carried out revealed a significant, moderate or slight increase in heart size in the majority of patients with myocarditis. X-ray examination revealed functional heart disorders in 88.4% of patients in the form of sluggish, decreased amplification, rapid pulsations, and in 33.0% – arrhythmic ones.

Various changes in electrocardiograms are recorded in 100% of patients with herpesvirus myocarditis. When assessing ECG data, it is necessary to take into account the severity of myocardial damage, the nature of its course (acute, subacute), period (exacerbation, remission). In patients with acute myocarditis, the ECG shows numerous changes in individual indicators or their combination.

In the first days of the examination, tachycardia was recorded in 35 (87.5%), bradycardia in 5 (12.5%), and ventricular extrasystole in 18 (45%) patients. Conduction disturbances were recorded relatively rarely. Thus, a slowdown in atrioventricular conduction of the first degree was detected in 8 (20.0%) patients, intra-arterial conduction in 10 (25.0%), and right bundle branch block in 6 (15.0%).

The voltage of the P waves in standard lead II was below normal in 6 (15.0%) patients with severe and in 5 (12.5%) patients with moderate myocarditis. The electrical axis of the heart was deviated to the left in 27 (67.5%) patients, to the right – in 3 (7.1%), the normogram was recorded in 10 (25.0%) patients. Changes in the P wave were found in 12 (30%) patients in the form of increased voltage, jaggedness or widening up to 0.12 s. The PQ interval was prolonged in 6 (15.0%), QS – in 8 (20.0%), QT – in 13 (32.5%) patients.

The ST segment was normal in 10 (25.0%) patients. ST segment depression occurred in 26 (65.0%) and ST segment elevation in 4 (10.0%) patients. In most patients, ST segment depression was 0.5-1.0 mm and did not exceed 2 mm. ST segment elevation did not exceed 3-4 mm. ST segment depression in most patients is horizontal, less often it increases in the form of a curved line.

T waves were normal in 5 (12.5%) patients with infectious myocarditis, negative, isoelectric or biphasic – in 35 (87.5%). The amplitude of the negative T wave rarely exceeded 5 mm. The T waves were symmetrical and pointed. All described electrocardiographic changes in patients with myocarditis were observed in various combinations.

In infectious myocarditis, ECG changes were most often observed in leads II, III, AVF, V4-V6, which corresponds to the inferoapical and inferolateral sections of the left ventricle. In this case, changes in the ECG were often limited to leads II, III and AVF or V4-V6. The second region of myocardial damage in myocarditis according to ECG changes in leads I, II, AVL and V4-V6 is the anterolateral wall of the left ventricle. The data obtained indicate that infectious myocarditis in most cases is a regional and much less often a diffuse process. In addition, different areas of the myocardium are affected with different frequencies.

Thus, according to our data, the most common electrocardiographic changes observed during infectious myocarditis in patients with chickenpox are a decrease in the amplitude of the T wave, the appearance of a biphasic and negative T wave. Our experience allows us to assert that changes in the T waves are valuable, and sometimes the only diagnostic signs of infectious myocarditis, which is consistent with the data of Gauer RL et al. [6].

The second most common electrocardiographic change in infectious myocarditis is ST segment depression. According to available data [8], the cause of ST segment depression is myocardial ischemia caused by vasculitis and perivascular inflammation. Our studies have shown that in patients suffering from infectious myocarditis, changes in the T wave and depression of the ST segment are reversed to a small extent or do not change at all when patients take nitro compounds and β-blockers, while their reverse development is noted when anti-inflammatory treatment is carried out and normalization. Moderate depression of the ST segment in two or three leads is often the only objective sign of infectious myocarditis.

A curved upward displacement of the ST segment, not exceeding 4-5 mm above the isoline, according to some authors [6, 7], is a sign of subepicardial or more extensive myocardial damage.
Pericarditis can only be assumed in those cases where there is inherent pain and a pericardial friction noise is heard. ST segment elevation on the electrocardiogram without symptoms of pericarditis is a sign of subepicardial myocarditis [6]. Both depression and ST segment elevation can be observed in more or fewer leads, reflecting less or more extensive myocardial damage. In our opinion, a displacement of the ST segment upward from the isoelectric line may be a sign of subepicardial myocarditis, but more often it is a sign of inflammation covering all layers of the myocardium.

With myocarditis, parenchymal focal or diffuse damage to any area develops in the intramural, subendocardial and subepicardial layers of the ventricles wall.

Uneven myocardial damage leads to a change in the resting and action transmembrane potential during the repolarization period (ST – T), as a result of which a potential difference arises between areas of the heart with more or less altered and intact myocardium [8]. In this case, the total vector of the T wave deviates in the direction opposite to the most affected area, and therefore a negative or low (flattened) T wave is recorded on the ECG in the corresponding leads.

The vector of the ST segment, depending on the predominant lesion of the subendo- or subepicardial layers, deviates in the opposite direction or is directed towards the inflammatory focus; accordingly, the segment is shifted down or up from the isoelectric line.

Depending on the severity of myocarditis, pathological changes on the ECG persisted for from two to three to four to six weeks, and sometimes longer.

Diagnosis of myocarditis in patients with chickenpox is often difficult because the disease:
- can occur latently, without clinical symptoms;
- subjective and objective symptoms may be few in number;
- symptoms can be very varied;
- the symptoms are not very specific, i.e. they also occur in other heart diseases.

As with myocarditis of any other pathology, in the herpesvirus group there are: mild, moderate, and severe forms.

Mild myocarditis was characterized by the absence of heart enlargement and manifestations of heart failure. The course of myocarditis can be asymptomatic, without any subjective manifestations, in which heart damage is detected only when recording an ECG (sinus tachycardia, slowing of atrioventricular conduction of the first degree, rare ventricular extrasystoles, flattened biphasic or negative T wave, ST segment depression).

The course of moderate myocarditis is characterized by cardialgia, shortness of breath, rapid heartbeat, interruptions in cardiac activity, weakening of the first tone and the appearance of systolic murmur at the apex of the heart and at Botkin’s point, an increase in heart size, a decrease in the voltage of the QRS complex, a negative T wave and ST segment depression, Deceleration of atrioventricular conduction of the first degree, ventricular extrasystoles. Symptoms of circulatory failure are absent or correspond to stage I.

In severe herpesvirus myocarditis, there are complaints of shortness of breath, tachycardia, cardialgia, interruptions in heart function, weakened first tone and short systolic murmur over the apex of the heart, an increase in heart size, a decrease in the voltage of the QRS complex, negative T waves, depression of the ST segment, slowing of the atrioventricular and intraventricular conduction, ventricular extrasystoles, increased AST activity, stage I or IIA circulatory failure.

Currently, the following areas are distinguished in the treatment of acute myocarditis: etiological, pathogenetic, symptomatic, treatment of complications.

Antiviral drugs are used as etiological therapy, in particular acyclovir 5-10 mg/kg, intravenous infusions every 8 hours, 7-10 days.

Pathogenetic therapy includes the prescription of anti-inflammatory drugs (ortofen, indomethacin, etc.), antihistamines (loratadine, claritin), antioxidants and drugs that improve metabolism in the myocardium (trimetazidine, corvitin, vasonate).

Treatment of complications is carried out according to indications: antiarrhythmic drugs (Nebilet, Concor, Cordaron), antiplatelet agents (Clopidogrel), diuretics (Veroshpiron, Torsemide, Hypothiazide) are prescribed.

In case of congestive heart failure, patients with myocarditis are recommended to remain in bed, limit the consumption of table salt and liquid, take diuretics, angiotensin-converting enzyme inhibitors (lisinopril, perindopril, enalapril) or angiotensin receptor blockers (losartan, candesartan, etc.), beta-adrenergic receptor blockers (carvedilol, nebivolol) in gradually increasing doses. To prevent thromboembolic complications, patients are injected subcutaneously with fondaparinux 2.6 mg/day. Physical activity during the period of viremia is dangerous because it leads to the spread of inflammatory changes in the myocardium.

The duration of bed rest for mild and moderate myocarditis averaged one to two weeks, for severe cases it increased to four with a gradual expansion of the regime under the constant supervision of a cardiologist.

The prognosis of the disease depended primarily on the extent of damage to the heart muscle, the presence of left ventricular dysfunction and the severity of chickenpox.

During the complex therapy, all patients experienced clinical recovery from chickenpox and myo-
carditis: body temperature normalized, intoxication and rashes disappeared, pain in the heart area, shortness of breath, tachycardia were leveled, biochemical indicators normalized (blood levels of CRP, sialic acid, fibrinogen, AST activity), heart rhythm, conductivity and repolarization processes (ST segment and T waves) in the myocardium. Patients returned to their professional activities or studies.

The duration of treatment for patients with infectious myocarditis depended on the severity of the disease and the effectiveness of the treatment used.

According to a morphological study, acute inflammation of the myocardium in the form of lymphocytic infiltration lasts from several weeks to several months, its duration based on ECG changes is 1-2 months, according to laboratory studies – at least 1 month, according to clinical symptoms – from several weeks up to several months [1, 9-12].

It can be assumed that the inflammatory process in the heart muscle continues after the reverse development and disappearance of the clinical manifestations of myocarditis, further proceeding subclinically, gradually transforming into dilated cardiomyopathy [12, 13]. Thus, when treating infectious myocarditis, long courses of treatment are required – from two to six months, and sometimes longer.

A course of treatment not exceeding several weeks is clearly insufficient; it only allows for the elimination of the most acute clinical symptoms. But the inflammatory process in the heart muscle can continue subclinically until the next exacerbation, especially since herpes virus infection can transform into a chronically active form and maintain the inflammatory process in the heart muscle. Therefore, patients who have recovered from herpesviral myocarditis should be monitored by a cardiologist and an infectious disease specialist and, if necessary, receive antiviral therapy.

**Conclusions.** The results of the study allowed us to draw the following conclusions:

1) acute myocarditis was diagnosed in 16.6% of patients with chickenpox caused by type 3 herpesvirus. In 12.0% of patients, myocarditis was asymptomatic, and the clinical picture was veiled by the primary infectious process;

2) in the diagnosis of acute myocarditis in patients with chickenpox, clinical, laboratory, electrocardiographic and radiological studies are of great importance. An increase in the blood serum of patients with chickenpox CRP, sialic acid and fibrinogen reflects the severity of the disease (intoxication, damage to the skin, mucous membranes, various organs) and is not specific for myocarditis;

3) a high correlation was revealed between the severity of chickenpox, the incidence and severity of acute myocarditis in adults;

4) drug treatment of acute myocarditis in patients with chickenpox should be early and include antiviral drugs (acyclovir), drugs that affect inflammatory, autoimmune and allergic reactions, restoration and maintenance of hemodynamics, effects on metabolic processes in the myocardium, and symptomatic treatment of complications.

**REFERENCES:**


10. Cherukuri ASS, Belay NF, Nasereldin DS, Mohammed DO, Mohamed S, Elkhaezen A,


Summary

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The purpose of the study: to explore the frequency of development, features of the clinical course and treatment of acute myocarditis in adults with chickenpox.

Materials and methods. This study included 240 patients with chickenpox between the ages of 18 and 40 years. Clinical, biochemical, molecular genetics and instrumental examination methods were used for assessment. Examination of selected patients was carried out in the acute period, after normalization of body temperature and before being discharged from the hospital. Student’s t test was used for statistical evaluation.

Results and discussion. Acute myocarditis was diagnosed in 16.6% of patients with chickenpox caused by Varicella-zoster virus. A high correlation has been revealed between the severity of chickenpox and the frequency of development, as well as the severity of acute myocarditis in adults.

Conclusions. An increase in CRP, sialic acid and fibrinogen in the blood serum of chickenpox patients reflects the severity of the disease, but is not specific for myocarditis. Treatment of acute myocarditis in patients with chickenpox should be early and comprehensive.

Key words: Varicella-zoster virus, chickenpox, myocarditis, clinical features, diagnosis, blood indicators, treatment.

РЕЗЮМЕ

ОЦІНКА КЛІНІЧНОГО ПЕРЕБІГУ, ТА ОПТИМІЗАЦІЯ ЛІКУВАННЯ ГОСТРОГО ВІРУСНОГО МІОКАРДИТУ, ВИКЛИКАНОГО ВІРУСОМ ВАРИЦЕЛЛА-ЗОСТЕР: ОБСЕРВАЦІЙНЕ ДОСЛІДЖЕННЯ

ВОЛОБУЄВА О.В., ДОРОШ Д.М., ПАВЛІКОВА К.В., ВОЛОБУЄВ Д.О., ГРЕК І.І., КУШНІР В.Б.

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Мета дослідження: вивчити частоту розвитку, особливості клінічного перебігу та лікування гострого міокардиту у дорослих, хворих на вітряну віспу.

Матеріали та методи. Це дослідження включало 240 хворих на вітряну віспу у віці від 18 до 40 років. Для оцінки використовували клінічні, біохімічні, молекулярно-генетичні та інструментальні методи дослідження. Обстеження відбранних хворих проводили в гострому періоді, після нормалізації температури тіла та перед випискою зі стаціонару. Для статистичної оцінки використовувався критерій Стьюдента.

Результати та обговорення. У 16,6% хворих на вітряну віспу, спричинену вірусом Varicella-zoster, діагностовано гострий міокардит. Виявлено високий кореляційний зв’язок між тяжкістю вітряної віспи та частотою розвитку, а також тяжкістю гострого міокардиту у дорослих.

Висновки. Підвищення СРБ, сіалової кислоти та фібриногену в сироватці крові хворих на вітряну віспу відображає тяжкість захворювання, але не є специфічним для міокардиту. Лікування гострого міокардиту у хворих на вітряну віспу має бути раннім і комплексним.

Ключові слова: вірус Варицелла-зостер, вітряна віспа, міокардит, клінічний перебіг, діагностика, показники крові, лікування.

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