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## Successful perioperative management of infective endocarditis in a patient after COVID-19

Infective endocarditis in patients after COVID-19 has a more severe course. Cardiovascular pathology and pathophysiological changes in other organs and systems due to COVID-19 should be considered. We present a clinical case of successful cardiosurgical treatment of a patient with multiple heart valve pathology due to infective endocarditis associated with COVID-19 and coronary artery disease.

**Key words:** COVID-19, aortic insufficiency, mitral insufficiency, tricuspid insufficiency, coronary artery disease, respiratory failure.

Cardiovascular pathology is a leading cause of mortality in the population worldwide. According to the State Statistics Service for 2020, cardiovascular diseases were responsible for 66.26 % of deaths in Ukraine [1]. Coronavirus infection significantly worsens the course and prognosis in patients with this pathology [2]. Currently, optimal treatment approaches for such comorbid patients are under development due to the novelty of the infection.

### Case report

A 54-year-old female was referred to our hospital with severe shortness of breath at rest, palpitations and paroxysmal tachycardia, swelling of the lower extremities, chest pain during physical exertion, and significant limitation of physical activity. Symptoms appeared three months ago after she suffered from a COVID-19 infection. Based on the patient's anamnesis and medical documentation, her COVID-19 was accompanied by severe respiratory failure, and a decrease of SpO<sub>2</sub> to 62 %. One month later on echocardiographic (EchoCG) examination by a local cardiologist, a severe aortic insufficiency was detected.

At the time of admission the patient was in severe condition. EuroScore II – 22.2 %. Upon physical

examination: cyanosis of the nasolabial triangle. There was swelling of the lower extremities up to the knee. A trophic ulcer of 4 cm in diameter on the left tibia. Blood pressure 120/15 mm Hg, equal on both arms. Heart rate 107 beats per minute. Arterial blood oxygen saturation – 92 %.

ECG demonstrated sinus rhythm, regular, sinus tachycardia, and signs of left ventricular hypertrophy. Preoperative blood tests were significant for increased creatinine level (147 mmol/L), and increased urea level (14.0 mmol/L). Chest X-Ray did not reveal visible infiltrative and focal changes in the parenchyma of both lungs.

EchoCG demonstrated: Left ventricle end diastolic volume (LV EDV) 206 ml, left ventricle end systolic volume (LV ESV) 64 ml, Ejection fraction (EF) 69 %. Aortic valve (AV): Mobile «filamentous» mass (vegetation?) visualized in the projection of the Left ventricular outflow tract (LVOT), non-coronary leaflet perforation. Maximal AV pressure gradient – 15 mm Hg, regurgitation ++(+). Aortic regurgitation pressure half time (AR PHT) 155 msec. Mitral valve (MV): the diameter of the fibrous ring 4.0 cm, regurgitation +++, excentric along the posterolateral wall of the left atrium (LA). LA diameter 5.4 cm. Tricuspid valve (TV): regurgitation ++; systolic pressure in the right ventricle 64 mm Hg;

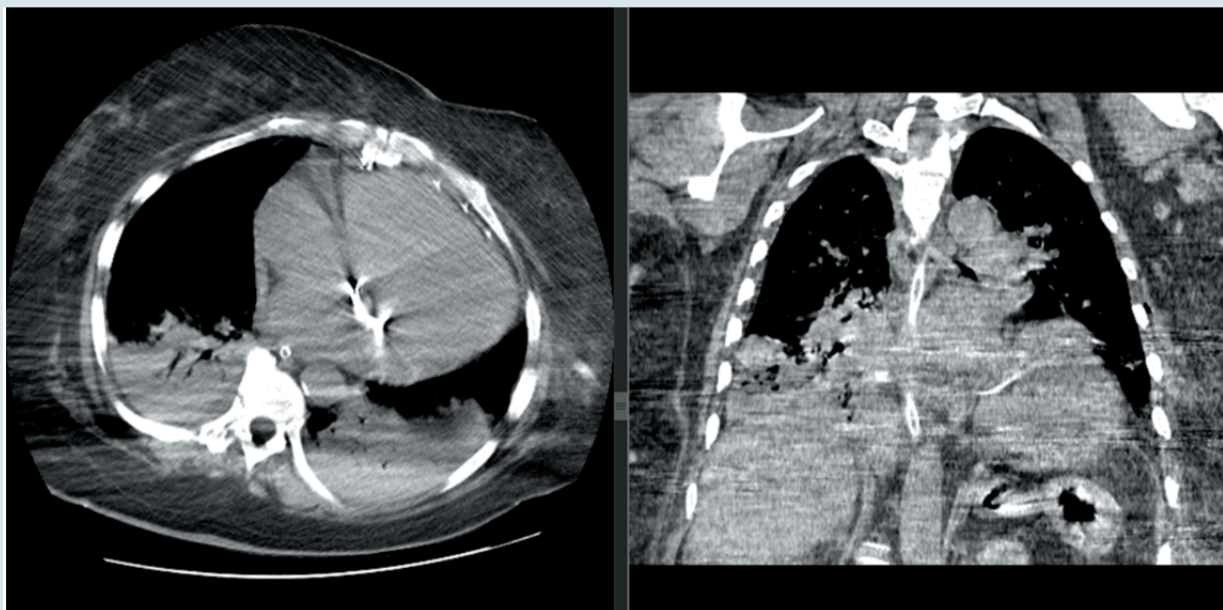


Fig. Chest MSCT

Coronary angiography revealed Left Anterior Descending artery stenosis 80 %.

The patient was qualified for surgery: aortic and mitral valve replacement (AVR, MVR), tricuspid valve repair, and coronary artery bypass grafting (CABG). The informed consent of the patient and her relatives for the surgical intervention was obtained. During the operation, total destruction of the aortic leaflets was revealed. The AV was excised, LVOT, aortic annulus, and root were topically treated with antiseptic solution. Upon the revision of the mitral valve – severe insufficiency due to myxomatous degeneration of both leaflets and dilatation of the fibrous ring. Mitral valve was replaced with a mechanical prosthesis (Abbot, Masters Series, № 29). The chordal apparatus of the posterior leaflet was preserved. A mechanical prosthesis (Abbot, Masters Series, № 21) was implanted in the AV position. Upon the revision of the TV – severe insufficiency due to the dilatation of the ring. TV repair was performed in a standard De Vega fashion. Upon hydraulic test the TV is competent. CABG of LAD was performed. Aortic cross-clamp, bypass, and operative times were 102, 146, and 170 min, respectively. Intraoperative transesophageal echocardiography demonstrated the optimal function of the aortic and mitral mechanical prostheses, trivial TV insufficiency.

The early postoperative period was complicated by acute renal and pulmonary failure. Creatinine level increased to 225 mmol/l, and urea level to 21 mmol/l. After two sessions of hemodialysis, creatinine decreased to 160 mmol/L and urea to 13

mmol/l. Due to the severe respiratory failure, the patient required a prolonged ventilation support. In the first 2 days, during attempts of transfer to independent breathing, the saturation level critically dropped to 63 %. Multislice spiral computed tomography (MSCT) of the chest cavity was performed. Signs of subatelectasis of the lower parts of both lungs, bilateral lower lobe pneumonia, indirect signs of pulmonary hypertension were detected (Fig.).

Inotropic support was carried out by continuous infusion of medium doses of dobutamine for five days after surgery.

The patient received combined antibiotic therapy: imipenem 1500 mg per day for 7 days, amikacin 1g per day for 7 days and vancomycin 1g per day for 10 days from the first day after surgery, cefoperazon and sulbactam 4 g per day from the 9th day after surgery. The respiratory function gradually improved. After 40 hours of mechanical ventilation in intermittent positive pressure ventilation (IPPV) mode with a controlled volume of 500 ml, the patient was successfully extubated and transferred to independent breathing with SpO<sub>2</sub> 97 % using oxygen support of 10 l/min. On the 5th postoperative day she was transferred to the ward.

On examination at the time of transfer from ICU: blood pressure (BP) 130/80 mm Hg, pulse 87 per min, central venous pressure (CVP) 7 mm Hg, SpO<sub>2</sub> with independent breathing 82 %, and with oxygen support 8 L/min – 99 %.

EchoCG on the 6<sup>th</sup> postoperative day: EDV – 149 ml, EF – 51 %. The function of AV and MV prostheses is not impaired. Trivial TV regurgitation.

Active rehabilitation measures were carried out: breathing exercises with increased load, lymphatic drainage massage, general strengthening exercises. Oxygen support (O<sub>2</sub>S) was continued. On the 7<sup>th</sup> postoperative day, the patient was on O<sub>2</sub>S with a flow rate of 4 l/min. On the 9<sup>th</sup> postoperative day, SpO<sub>2</sub> with independent breathing was 89–90 %, SpO<sub>2</sub> with sporadic O<sub>2</sub>S of 2 L/min – 99–100 %. On the 10<sup>th</sup> postoperative day it was possible to achieve SpO<sub>2</sub> – 95–97 % with independent breathing without O<sub>2</sub>S.

As a result of treatment, the external respiratory function was stabilized, the symptoms of respiratory failure decreased. A control Chest X-Ray was performed. Signs of pulmonary subatelectasis and lower lobe pneumonia disappeared.

On the 15<sup>th</sup> postoperative day, the patient was discharged from the hospital for rehabilitation in a specialized institution.

## Discussion

COVID-19 is a viral disease that was first reported in December 2019 in Wuhan (Central China) and has rapidly become a pandemic. Most people infected with the virus present with a mild to moderate respiratory illness and recover without a special treatment [3]. Elderly and people with concomitant health conditions are at risk of developing a severe form of COVID-19 [2]. It may be complicated by: acute respiratory distress syndrome in 67 % of cases, acute kidney injury in 29 %, liver dysfunction in 29 % and acute cardiac injury in 23 % [3].

Most frequent cardiovascular complications of COVID-19 are: arrhythmias (sinus tachycardia, orthostatic tachycardia, ventricular arrhythmias); acute myocarditis; progressive heart failure; thromboembolic complications; acute coronary syndrome [4]. Infective endocarditis (IE) is also among possible complications of coronavirus infection. Direct action of the COVID-19 virus, the inflammatory phase of disease and cytokine storm, neurohumoral damage in the cardiovascular system, severe hypoxia, electrolyte abnormalities, increased shear stress and hypercoagulable state may be caused by COVID-19 infection. J.A. Quintero-Martinez et al. reported 21 cases of IE after COVID-19. 28.6 % patients required critical care management. 33.3 % underwent IE-related cardiac surgery and 23.8 % died during their IE hospitalization. The mean time interval between COVID-19 and IE diagnosis was 16.7 ± 15.0 days [5]. IE was diagnosed in our patient 1 month after discharge from infectious department. We assume that her severe COVID-19 caused dramatic decrease in immunity level in

her organism that could lead to the manifestation of IE.

A growing number of studies demonstrate an increase of patients with cardiovascular disease manifested after COVID-19, as was in our case [6]. As a result of the pandemic, the ability of the healthcare system to provide a specialized medical treatment, in particular to cardiovascular patients, is severely limited due to the overload of hospitals with COVID-19 patients. This leads to the delay of the diagnosis and treatment, increasing the number of patients admitted to cardiac surgery in a decompensated state.

The recovery period of the lung parenchyma after COVID-19 takes a significant time. In most cases, pathologic changes in pulmonary tissue remain for life, especially, if a person has had a severe coronavirus disease [7]. That is why a postoperative period in cardiac surgical patients after COVID-19 can be accompanied by severe pulmonary failure, as was in our case.

For this reason, in such patients in the pre- and postoperative periods, MSCT should be actively used as the optimal method for detecting COVID-associated changes in the lung parenchyma. Active individual O<sub>2</sub>S scheme, breathing and general strengthening exercises should be introduced in the protocol of medical management. Our patient was critically dependent on O<sub>2</sub>S in immediate postoperative period. After this protocol we were able to wean our patient from O<sub>2</sub>S during 10 days.

Acute kidney injury (AKI) is also among most common complications of severe form of COVID-19, occurring in 0.5–7 % of cases and in 2.9–23 % of intensive care unit (ICU) patients. Our patient also had AKI. It required 2 sessions of hemodialysis to resolve the problem. Respiratory failure is strongly related to AKI occurrence in COVID-19. Acute respiratory distress syndrome has been identified as a risk factor for AKI in comorbid patients [8]. Because of high risk of complications in different organs and systems a multidisciplinary approach to treatment should be used in such patients.

Our case presents an obese patient after severe COVID-19 infection, who had multiple valve pathology, CABG and IE. She underwent a triple valve surgery. Her postoperative course was complicated with acute respiratory and kidney insufficiency. The result of her treatment was successful due to active and timely multidisciplinary management that we recommend to all patients of this group.

## Conclusions

Patients with a history of severe COVID-19 are a separate cohort of cardiac surgery cases. The

risk of postoperative pulmonary and renal complications or multiorgan failure is higher in this group. MSCT should be actively used as a most reliable method for detection of COVID-19 associated pulmonary pathology. O<sub>2</sub>S and breathing strengthening exercises should be introduced in

the protocol of management. Associated AKI can be effectively resolved by means of hemodialysis. Multidisciplinary approach involving experts of different medical specialties plays a key role in successful management of this complex group of patients.

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*All authors contributed equally to the writing of the article.*

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## Успішне періопераційне лікування інфекційного ендокардиту в пацієнта після COVID-19

Інфекційний ендокардит у пацієнтів після COVID-19 має тяжчий перебіг. Слід враховувати серцево-судинну патологію та патофізіологічні зміни в інших органах і системах як наслідок COVID-19. Представлено клінічний випадок успішного кардіохірургічного лікування хворого з патологією клапанів серця внаслідок інфекційного ендокардиту, асоційованого з COVID-19, та ішемічною хворобою серця.

**Ключові слова:** COVID-19, аортальна недостатність, мітральна недостатність, трикуспідальна недостатність, ішемічна хвороба серця, дихальна недостатність.