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# An Early Prosthetic Valve Endocarditis in Presence of COVID-19-Associated Pneumonia

**Abstract**

**Introduction.** Coronavirus disease (COVID-19)-associated pneumonia was a dangerous disease at the beginning of 2021. However, there are almost no records of early infectious endocarditis of prosthetic heart valve in the presence of such a disease. We present an interesting clinical case of successful treatment of complicated pathology.

The COVID-19 outbreak involved unique clinical complications that were superimposed on the progressive heart failure due to prosthetic mitral valve dysfunction (its detachment) which did not allow time for active anti-inflammatory therapy. Urgent replacement of the prosthesis made it possible to eliminate the infection and paved the way for successful long-term antibacterial, antifungal and antiviral therapy.

**The aim.** To determine the features of management of patients with complex clinical pathology: prosthetic valve endocarditis associated with COVID-19 and severe lung inflammation in the early postoperative period.

**Case report.** This work presents rare clinical case. A 46-year old male patient underwent successful surgery (mitral valve replacement with posterior leaflet preservation and left atrium resection) at the Department of Surgical Treatment of Acquired Heart Diseases of the National Amosov Institute of Cardiovascular Surgery and was discharged in satisfactory condition. One month later, he was hospitalized again and diagnosed with an early infectious endocarditis of prosthetic mitral valve and bilateral polysegmental COVID-19-associated pneumonia. After a week of medicinal preparation (antibacterial therapy), the patient underwent repeat mitral valve replacement in the presence of progressive heart insufficiency due to increasing paravalvular insufficiency. Postoperative period elapsed without significant complications. The patient was discharged in satisfactory condition on day 15 after surgery and primary rehabilitation.

**Conclusion.** Having a specific etiology, pneumonia significantly damaged mitral prosthesis structures by increasing paravalvular insufficiency. Consequently, the patient underwent life-saving repeat mitral valve replacement in the presence of COVID-19-associated pneumonia and under massive antibacterial treatment which continued for 60 days after the patient's discharge. An important element of successful treatment of COVID-19-associated pneumonia is the selection of adequate antibacterial, antifungal and antiviral drugs.

***Keywords****: cardiopulmonary bypass, heart surgery, complicated surgery of prosthetic valve, mitral valve reoperation, progressive heart failure, A-V postoperative block.*

**Introduction.** Early prosthetic valve endocarditis is a serious surgery risk; however, it becomes extremely risky when combined with coronavirus disease (COVID-19)-associated pneumonia [1, 2, 3, 4, 5, 6, 7, 8].

Replacement of an infected prosthesis with new mechanical prosthesis made it possible to suspend the activity of infected prosthesis with residual effects not going beyond the lungs and being subject to rapid conversion within a month under severe antibacterial, antiviral and antifungal therapy.

**The aim.** To determine the features of the management of patients with complex clinical pathology: prosthetic valve endocarditis in the presence of COVID-19 and severe lung inflammation in the early postoperative period.

**Case report.** This was a rare case from the clinical practice. A 46-year old male patient diagnosed with type IV mitral valve insufficiency stayed in the National Amosov Institute of Cardiovascular Surgery of the National Academy of Medical Sciences of Ukraine, at the Department of Surgical Treatment of Acquired Heart Diseases, from February 05, 2021 till February 18, 2021. The patient had moderate pulmonary hypertension, permanent form of atrial fibrillation for 2 years and type IIA heart failure (HF) with preserved left ventricular ejection fraction (LVEF). Echo findings obtained on February 05, 2021 (4 days prior to surgery) are shown in Table 1.

**Table 1**

*Echo findings before surgery*

| Parameters (units) | Values |
|---|---|
| BSA ($m^2$) | 2.01 |
| LV EDV (mL) | 165 |
| LV EDV / BSA (mL/$m^2$) | 82.1 |
| SV (mL) | 98 |
| LV SV / BSA (mL/$m^2$) | 48.8 |
| LVEF | 0.59 |
| LA diameter (cm) | 5.0 |
| PASP (mm Hg) | 40 |
| Aortic valve | Three cusps, indurated, Ca (+), aortic valve pressure gradient 9 mm Hg, regurgitation (+) |
| Mitral valve | Significant prolapse of both cusps, mucoid degeneration, regurgitation ++(+) |
| Tricuspid valve | Normal, regurgitation +(+) |

BSA, body surface area; EDV, end-diastolic volume; LA, left atrium; LV, left ventricle; PASP, pulmonary artery systolic pressure; SV, systolic volume; MV, mitral valve.

There were no coronary artery diseases discovered according to coronarography dated February 08, 2021.

The surgery took place on February 09, 2021. In particular, mitral valve replacement with posterior cusp preservation was performed, PLANIX 29 mm (bicuspid mechanical prosthesis) was implanted and the LA appendage resection was performed (Prof. Volodymyr V. Popov). Postoperative period was unremarkable, the wound healed by primary intention. The total blood loss was up to 300.0 mL during the hospital period, so the donated blood components (red blood cells, plasma) were not used. Hemoconcentrator and cell saver were not used. Sinus rhythm restoration was confirmed by echo at discharge. The patient was discharged in satisfactory condition without the signs of inflammatory process and with normothermia on February 18, 2021. Echo findings obtained on day 8 after surgery (February 17, 2021) are shown in Table 2.

**Table 2**

*Echo findings after surgery in the hospital period*

| Parameters (units) | Values |
|---|---|
| BSA ($m^2$) | 2.01 |
| LV EDV (mL) | 140 |
| LV EDV / BSA (mL/$m^2$) | 69.7 |
| SV (mL) | 80 |
| LV SV / BSA (mL/$m^2$) | 39.8 |
| LVEF | 0.57 |
| LA diameter (cm) | 5.0 |
| PASP (mm Hg) | 38 |
| MV prosthesis | MV prosthesis pressure gradient 11 mm Hg |
| Tricuspid valve | Normal, regurgitation +1 |

There was no data about pulmonary disease at discharge (Fig. 1).

Nevertheless, the patient's body temperature increased to 40 °C on February 28, 2021 (day 20 after surgery),

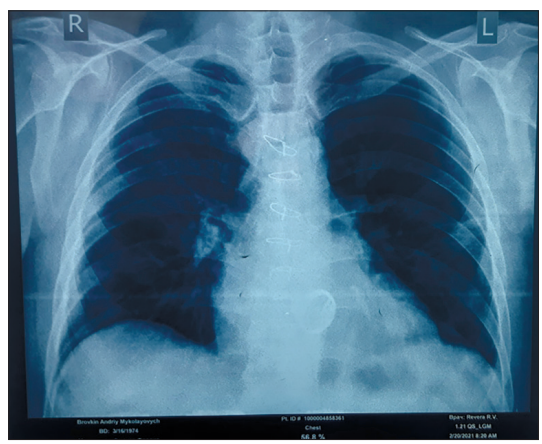


**Fig. 1.** *Chest X-ray dated February 20, 2021 (day 11 after surgery and day 2 after discharge)*

**Fig. 2.** *Chest X-ray dated March 16, 2021*

**Table 3**

*Preoperative echo findings at the second hospitalization*

| Parameters (units) | Values |
|---|---|
| BSA ($m^2$) | 1.98 |
| LV EDV (mL) | 151 |
| LV EDV / BSA ($mL/m^2$) | 76.3 |
| SV (mL) | 82 |
| LV SV / BSA ($mL/m^2$) | 41.4 |
| LVEF | 0.54 |
| LA diameter (cm) | 4.8 |
| PASP (mm Hg) | 48 |
| MV prosthesis | MV prosthesis pressure gradient 19 mm Hg, regurgitation ++. Moderate paravalvular insufficiency. Linear movable formations (vegetation) are visible on the LV side |
| Tricuspid valve | Normal, regurgitation up to ++(+) |

and the fever lasted for a week. COVID-19-associated pneumonia was diagnosed. Afterwards, subfebrile temperature was present, but general weakness and shortness of breath increased. The patient consulted the National Amosov Institute of Cardiovascular Surgery and was hospitalized with an early mitral valve prosthesis infectious endocarditis on March 15, 2021. The patient had pulmonary hypertension, type IIA HF, normal LVEF and bilateral polysegmental pneumonia. Chest X-ray is shown on Fig. 2.

Echo findings obtained on March 16, 2021 during second hospitalization are shown in Table 3.

The diagnosis was confirmed with transesophageal echocardiography (Fig. 3).

The pleural puncture was made on March 15, 2021 (day 7 before repeated surgery – repeated replacement of the mitral valve) due to left sided hydrothorax. 500 mL of serous liquid was removed. The complete blood count showed anemia (hemoglobin 92 g/L on admission), increased erythrocyte sedimentation rate (ESR) up to 29 mm/h and white blood cell differential moved to the left (banded neutrophils 8%). The level of C-reactive protein was 39.6 mg/L, procalcitonin was 0.11 ng/mL. The lung vital capacity was 73%. According to echo dated March 16, 2021, the sinus rhythm was disrupted and the atrial fibrillation with a rate of 80/min was observed. The pre-surgery preparation was carried out, which included antibacterial and antifungal therapy. No growth of microorganisms was discovered during numerous bacteriological blood and pleural fluid tests. Hyperthermia up to 37.5-38.0 °C was observed before re-operation.

Repeat mitral valve replacement was performed on March 22, 2021 by professor Volodymyr V. Popov. Operative risk was 10.05% according to the EuroSCORE II system.

The surgery lasted for 370 minutes with cardiopulmonary bypass (CPB) for 121 min and general hypothermia (29.7 °C). Aortic cross-clamping time was 77 min and intraoperative blood loss was 150 mL with the use of Cell-Saver.

The surgery was performed with median sternotomy for the second time. Right heart was isolated from adhe-

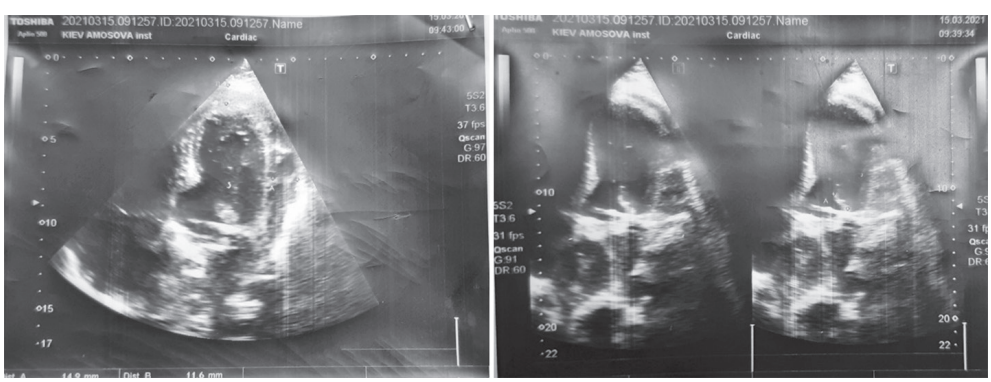


**Fig. 3.** *Transesophageal echocardiography dated March 15, 2021*

sions. Aorta and venae cavae were cannulated, CPB procedure was started with Custodiol antegrade cardioplegia of 1500 ml, administered into aortic root. Cardiac electrical activity disappeared during the first minute. LA was incised. Small vegetation was observed on the mitral valve prosthetic cuff and annulus. The prosthesis and vegetation were removed. The formerly preserved posterior cusp of the mitral valve was also removed. The bed was treated with antiseptic solutions multiple times according to the scheme developed in the Institute. St. Jude Medical mechanical heart valve 29 mm was implanted with the help of 14 Z-type stitches and Prolene 2-0 suture without any synthetic materials.

Since the seals were not used during prosthesis implantation due to infectious endocarditis, the surgeon had to make deep Z-type stitches through inflamed tissues of annulus and LA. The probability of full atrioventricular (AV) block was very high in such case. The heart restored its function by itself after atrium closure and aorta clamp removal. General warming of the patient up to 36.8 °C was provided. After CPB was removed, central venous pressure was 60 mm WG, LA pressure was 180 mm WG, arterial blood pressure was 115/70 mm Hg. Inotropic support was introduced with noradrenalin (0.07 μg/kg/min) and dobutamine (5.0 μg/kg/min) after CPB was removed.

Postoperative period lasted for 43 hours in the intensive care unit without any complications. Artificial lung ventilation lasted for 6 hours. Inotropic support with dobutamine was tapered from 3 to 1 μg/kg/min during the first 24 hours and was stopped the next day.

Creatine kinase-MB values were 66 μmol/L and total creatine phosphokinase was 987 μmol/L on March 23, 2021. The exudate volume was 500 mL over the whole period, including serous exudate from the pleural cavities.

After the patient's discharge from the intensive care unit, medical treatment (Meronem, Metronidazole, Rifampicin, Fluconazole, anticoagulant therapy etc.) was continued successfully. An artificial cardiac pacemaker (DDD) was implanted on April 02, 2021 due to constant third-degree AV block.

Echo findings obtained before hospital discharge on April 05, 2021 are shown in Table 4.

In postoperative period, pneumonia symptoms were still observed, but oxygen support was not necessary (Fig. 4).

ESR and leukocytosis decreased during treatment. The dynamics of complete blood count values is shown in Table 5.

Complaints about shortness in breath decreased with time, and X-ray showed decrease of pneumonia evidence (Fig. 5).

The level of C-reactive protein decreased to 28.03 mg/L (March 30, 2021), and the level of procalcitonin was <0.1 ng/mL (March 30, 2021). The maximum body temperature was 37.2 °C on day 3 after surgery. There was

**Table 4**

*Echo findings at the second hospitalization*

| Parameters (units) | Values |
|---|---|
| BSA ($m^2$) | 1.98 |
| LV EDV (mL) | 150 |
| LV EDV / BSA (mL/$m^2$) | 76.1 |
| SV (mL) | 87 |
| LV SV / BSA (mL/$m^2$) | 43.9 |
| LVEF | 0.58 |
| LA diameter (cm) | 4.4 |
| PASP (mm Hg) | 42 |
| MV prosthesis | MV prosthesis pressure gradient 12 mm Hg, regurgitation (+) |
| Tricuspid valve | Normal, regurgitation up to + |

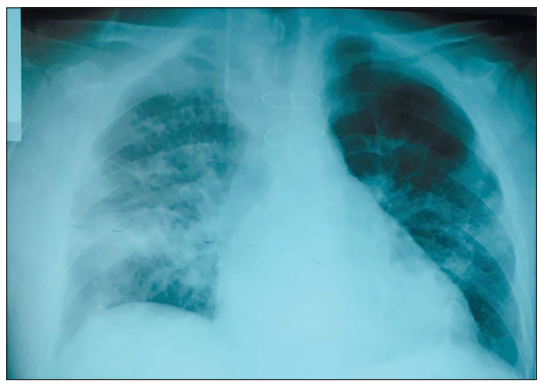

**Fig. 4.** *Chest X-ray dated March 25, 2021 (day 4 after surgery)*

no hyperthermia during the last 8 days in the hospital. The wound healed with primary intention.

The patient was discharged on day 15 after surgery in satisfactory condition.

After hospital discharge, the following treatment was recommended for 60 days:

- Fluconazole 100 mg twice daily per os for 60 days
- Meronem 1.0 twice daily intravenously by drop infusion for 60 days
- Metronidazole 500 mg three times daily per os for 10 days
- Rifampicin 150 mg twice daily per os for 60 days
- Warfarin 5 mg per day under international normalised ratio control (constantly)
- Meloxicam 7.5 mg twice daily per os after meals for 1 month
- Dexamethasone 4 mg intramuscularly for 10 days

The offered treatment was successful, as proved by X-ray 39 days after hospital discharge (Fig. 6).

In 1 year and 3.5 months after repeated surgery (on July 04, 2022), the patient underwent examination at the

**Table 5**

*Clinical indicators of blood at the stage of the second hospitalization in the postoperative period*

| | Date | | | | | | |
|---|---|---|---|---|---|---|---|
| **Values** | **March 16, 2021** | **March 18, 2021: before surgery** | **March 23, 2021: day 3 after surgery** | **March 29, 2021: day 8 after surgery** | **April 01, 2021: day 11 after surgery** | **April 02, 2021: day 12 after surgery** | **April 05, 2021: day 15 after surgery** |
| Hemoglobin (g/l) | 92 | 98 | 110 | 99 | 100 | 109 | 105 |
| Red blood cells ($\times 10^{12}$/L) | 3.2 | 3.2 | 3.6 | 3.4 | 3.4 | 3.8 | 3.6 |
| ESR (mm/h) | 20 | 29 | | 30 | 2 | 10 | 8 |
| White blood cells ($\times 10^{9}$/L) | 8.0 | 7.7 | 13.6 | 8.6 | 7.1 | 3.5 | 6.4 |
| Platelets ($\times 10^{9}$/L) | 335 | 363 | 290 | 358 | 407 | 404 | 334 |

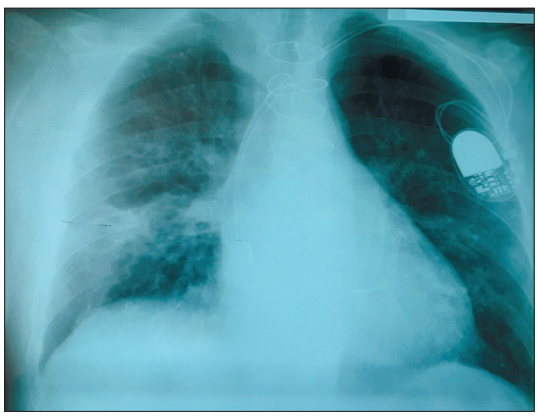

**Fig. 5.** *Chest X-ray dated April 05, 2021 (day 16 after surgery)*

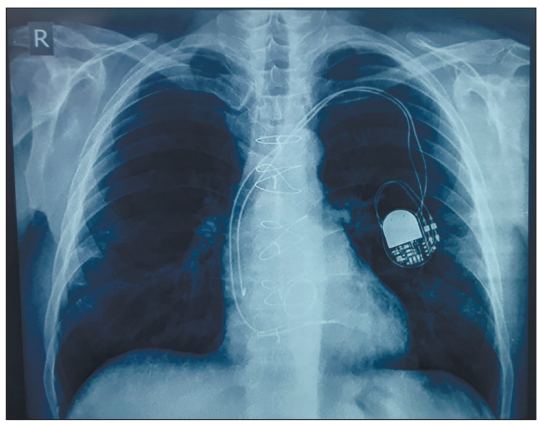


**Fig. 6.** *Chest X-ray dated May 17, 2021 (day 55 after surgery)*

National Amosov Institute of Cardiovascular Surgery. The state of health was good without any complaints. The patient started working as a tractor driver 3 months after hospital discharge, working 12 hours a day and farming 741 acres of his own land.

Echo findings are shown in Table 6.

According to the data in Table 6, the LV volume and pulmonary pressure decreased, and there were no signs of the mitral valve prosthesis dysfunction.

No signs of the mitral valve prosthesis dysfunction, deposits or new formations on the prosthesis were found during computed tomography (CT) imaging on July 04, 2022 (Fig. 7, 8, 9).

**Discussion.** The distinctive feature of this clinical case is the possibility to repeat mitral valve replacement in presence of active COVID-19-associated pneumonia and progressive heart insufficiency due to intraprosthetic fistula and septic intoxication. Although the pathogen of inflamed prosthesis was not identified from bacteriological test swab, continuous balanced antibacterial and antifungal therapy for 60 days gave the opportunity to gain stable remission and general recovery from COVID-19-associated pneumonia and other concurrent pathogens which could not be identified even after numerous blood culture and swab tests of removed mitral valve prosthesis.

It is important to emphasize that no synthetic material was used during prosthesis implantation in the inflamed

**Table 6**

*Echo findings 1 year and 3.5 months after repeated surgery*

| **Parameters (units)** | **Values** |
|---|---|
| BSA ($m^2$) | 2.01 |
| LV EDV (mL) | 112 |
| LV EDV / BSA ($mL/m^2$) | 56 |
| SV (mL) | 72 |
| LV SV / BSA ($mL/m^2$) | 36 |
| LVEF | 0.64 |
| LA diameter (cm) | 4.6 |
| PASP (mm Hg) | 30 |
| MV prosthesis | MV prosthesis pressure gradient 10 mm Hg, regurgitation (+) |
| Tricuspid valve | Normal, regurgitation up to + |

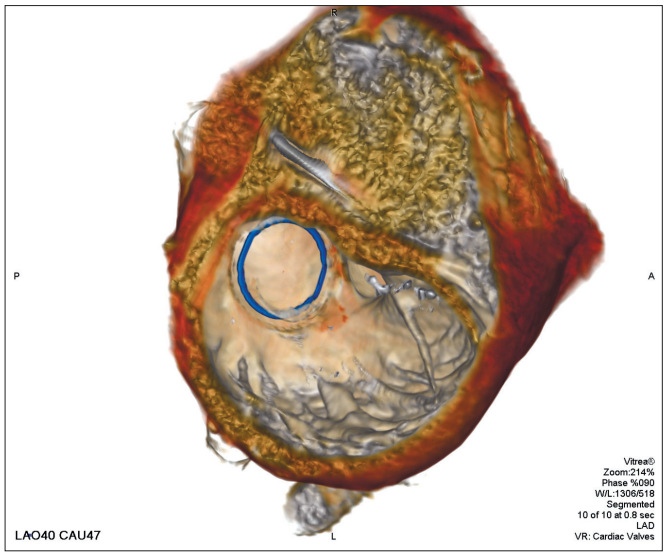


**Fig. 7.** *Heart CT imaging on July 04, 2022 (1 year and 74 days after the second surgery)*

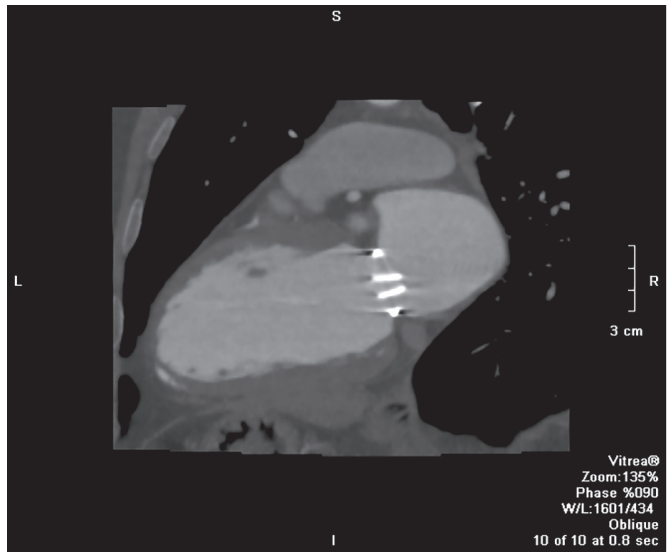


**Fig. 8.** *Heart CT imaging on July 04, 2022*

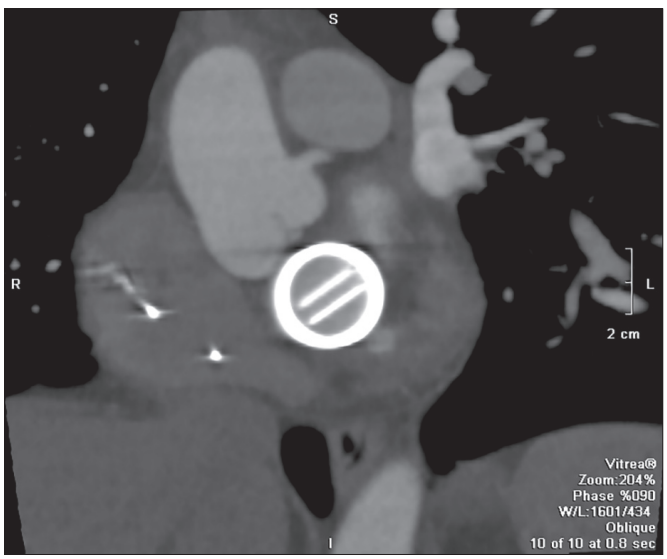


**Fig. 9.** *Heart CT imaging on July 04, 2022*

area of left AV annulus. However, an infection of conductive tracts should be expected when gripping the tissues deeply around annulus in order to avoid paravalvular insufficiency. As a result, full constant third-degree AV block and implantation of an artificial cardiac pacemaker (DDD) became an important element of hospital treatment stage completion.

**Conclusion.** The possibility of reprosthetics of the mitral valve in presence of active COVID-19-associated pneumonia and progressive HF due to intraprosthetic fistula and septic intoxication has a chance of success. With such early postoperative prosthetic valve endocarditis, it is not advisable to wait for the consequences of COVID-19 to pass and a co-infection to be detected. It is necessary to carry out surgical intervention with radical cleaning of the focus of infection in the ring and reliable fixation of the prosthesis, avoiding intraprosthetic fistulas and recurrence of infection in the area of the prosthesis. Radicality of elimination of the infection during the prosthesis removal should be maximal to avoid recurrence of the infection. In this case, the surgeon provided maximum removal of vegetations and made wide grips of the fibrous ring without using Teflon strips. This made it possible to form an ideal fixation of the prosthesis, but at the same time an artificial AV block occurred. An important element of successful treatment is long-term antibacterial and antifungal treatment for 60 days after discharge.

**Conflict of interest.** The authors have no conflicts of interest to declare.

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## Ранній протезний ендокардит за наявності асоційованої з COVID-19 пневмонії

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**Резюме.** COVID-19-асоційована пневмонія на початку 2021 року була загрозливим захворюванням. Проте в літературі майже не описано випадків раннього інфекційного ендокардиту протезованого клапана серця на тлі подібного захворювання. Ми представляємо цікавий клінічний випадок успішного лікування складної патології, ускладненої пневмонією.

Спалах COVID-19 інфекції створив унікальні клінічні ускладнення, які накладалися на прогресуючу серцеву недостатність за рахунок дисфункції мітрального протеза – його відриву, що не залишало часу на активну протизапальну терапію. Термінова заміна протеза дала змогу усунути спалах інфекції та створила шляхи для успішної довготривалої антибактеріальної, протигрибкової та противірусної терапії.

**Мета –** визначення особливостей ведення пацієнтів зі складною клінічною патологією, а саме протезного ендокардиту за наявності COVID-19 інфекції та тяжкого запалення легень у ранній післяопераційний період.

**Клінічний випадок.** Під час страшної ковідної епідемії випадки приєднання COVID-19 в ранньому післяопераційному періоді після заміни мітрального клапана – це майже фатальний вирок. Але пацієнт Б., чоловік, 46 років, був успішно прооперований (протезування мітрального клапана зі збереженням задньої стулки та резекції вушка лівого передсердя) у відділі хірургічного лікування набутих вад серця ДУ «Національний інститут серцево-судинної хірургії імені М. М. Амосова НАМН України» та виписаний у задовільному стані. Через місяць був повторно госпіталізований з діагнозом: ранній інфекційний ендокардит протезованого мітрального клапана серця, двобічна полісегментарна COVID-19-асоційована пневмонія. Після тижневої медикаментозної підготовки (антибактеріальна терапія) пацієнту на тлі прогресуючої серцевої недостатності за рахунок зростання розміру параклапанної недостатності було виконано репротезування мітрального клапана. Запальний процес у легенях був в активній фазі, але через прогресування серцевої недостатності ми не могли чекати. Післяопераційний період перебігав без суттєвих ускладнень, на 15-у добу після операції та початкової реабілітації хворий був виписаний у задовільному стані з рекомендаціями продовження антибактеріальної терапії на 60 днів.

**Висновки.** Можливість репротезування мітрального клапана на ниві активної фази COVID-19-асоційованої пневмонії та наявності прогресуючої серцевої недостатності за рахунок парапротезної фістули не є безнадійною операцією. Не потрібно чекати ліквідації наслідків COVID-19, а також ідентифікації асоційованої інфекції при цьому ранньому післяопераційному протезному ендокардиті. Слід провести активну хірургію, зокрема радикальне чищення джерела інфекції на місці фіброзного кільця та надійну фіксацію протеза, уникаючи парапротезних фістул та рецидиву інфекції на місці протеза. Пролонгована антибактеріальна та протигрибкова підтримка протягом 60 днів після виписування, вибір відповідних антибактеріальних, протигрибкових і противірусних препаратів є важливими елементами успіху лікування. Через 1 рік після операції пацієнт працює фермером з гарним результатом.

***Ключові слова****: штучний кровообіг, ускладнена операція протезування клапана, реоперація мітрального клапана, прогресуюча серцева недостатність, AV-післяопераційний блок.*

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