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INFECTIOUS ENDOCARDITIS COURSE AFTER ASCENDING AORTA REPLACEMENT WITH A VALVED CONDUIT

Abstract

Objective. To demonstrate the peculiarities of infectious endocarditis course in patients after ascending aorta replacement using a valved conduit based on the personal observations. **Material and methods.** Six cases of delayed infectious endocarditis after ascending aorta replacement using a valved conduit are presented. **Results.** The pathological process was represented by aortic root abscess, paraprosthetic phlegmon, fistula penetrated into the conduit wall and cardiac chambers. There was no vegetation on the prosthesis therefore the diagnosis was complicated. Period from fever onset to final diagnosis lasted from 1 week to 2.5 months. The first pathologic changes in all cases were detected using transesophageal echocardiography, but this method was not informative in the early stages of the disease. **Conclusion**. Infectious endocarditis in patients after ascending aorta replacement using a valved conduit has its own peculiarities. The most frequently, the process leads to the development of aortic root abscess. Diagnosis of infectious endocarditis in such cases is difficult. Infectious endocarditis should be suspected in patients — carriers of valved conduit with unexplained fever and treatment should be started in accordance with the diagnosis. In this case, structural changes visualization to confirm the disease is not necessary.

Key words: *infective endocarditis, aorta replacement, valved conduit, aortic root abscess.*

Conflict of Interests

The authors declare no conflict of interests

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IE — infectious endocarditis, TTE — transthoracic echocardiography, TEE — transesophageal echocardiography

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Introduction

In true and dissecting ascending aortic aneurysms, a complex reconstructive intervention is indicated: simultaneous ascending aorta and valve replacement using a valved conduit. A conduit is a vascular prosthesis with a pre-sewn mechanical or biological valve. Coronary arteries are cut off during the intervention and then implanted into the sewn vascular prosthesis. According to the literature data, from 1982 to 2002, the incidence of thoracic aortic aneurysms increased twofold [1]. In this regard, an increase in the number of patients requiring surgical treatment for ascending aortic aneurysms can be expected.

Like other carriers of artificial valves, patients who undergo such an operation are at risk for infectious endocarditis (IE). The incidence of IE is not showing a downward trend. The development of IE in patients with a history of ascending aorta replacement with a valved conduit has its own characteristics. Abscesses of the aortic root with tissue destruction, fistulas, mediastinitis with fistulas on the anterior chest wall, and vegetations on the inner wall of the conduit are described [2, 3]. Repeated replacement represents a significant risk, and the use of cryopreserved allografts is the method of choice for repeated surgery [2, 4]. The diagnosis of para-prosthetic changes is often complicated. Knowing the characteristics of the IE course in this group of patients can shorten the path to diagnosis and initiation of adequate treatment and in some cases will allow to avoid repeated intervention.

We observed 6 patients — carriers of valved conduit, who developed delayed IE after ascending aorta replacement. Diagnostic difficulties were observed in each case.

Case report

Case 1

A 53 year-old male patient Ye. In 2009, the Bentall — de Bono procedure of supracoronary replacement of the ascending aorta and the arch was performed for dissecting aortic aneurysm [5]. The patient has hypertension, gout. In May 2014, the patient was admitted to the Department of Pulmonology with fever up to 40 °C. Pneumonia was not confirmed, but on antibiotic therapy, the body temperature returned to normal, and he was discharged. Two weeks later, body temperature rose to 38 °C and progressive fatigue increased. On treatment, body temperature returned to normal. The patient was discharged, but at home he again suffered febrile fever, hypotension, and tachycardia. Hospitalized. The condition was regarded as serious. There were no rales in the lungs, cardiac murmurs. Complete blood count: hemoglobin — 99 g/l, WBC — 5.6×10^9, RBC — 3.09×10^{12}. ESR 33 mm/h. e 4%, n 4% b 1% s 56%, l 29%, m 5%. Urinalysis: protein 1 g/l, epithelium 4–5–6, white blood cells 8–10, red blood cells 2–3 per HPF. Ionic blood composition: urea 5.2 μmol/l, creatinine 142 μmol/l. GFR 48 ml/min. CRP 19.16 mg/l. ECG: left axis deviation, significant myocardial metabolic abnormalities. Transthoracic echocardiography (TTE) and transesophageal echocardiography (TEE) were repeatedly performed due to suspected prosthetic valve endocarditis: there were no additional formations on the prosthesis, its function was not impaired, and the ejection fraction was normal. CT of the chest: emphysema, bronchiectasis. CT of the brain: focal lesions in the left hemisphere of the brain and cerebellum. Ultrasound examination: hepatosplenomegaly, hypoplasia of the left kidney. For a long time, the diagnosis remained unclear. Diagnostic search included screening for tuberculosis, syphilis, HIV infection, opportunistic infections, cancer, systemic inflammatory diseases. There was an attempt to explain the fever with bronchiectasis or another disorder. The diagnosis of IE was rejected due to the absence of changes on the prosthesis. In July (almost two months after the onset of fever), blood culture revealed S. aureus. On August 15 (almost three months after the onset of fever), TEE revealed abnormalities: the free edge of the lower wall of the prosthesis and its excessive mobility were visualized, blood flow appeared between the wall of the prosthesis and the aortic wall. The lower wall of the vascular prosthesis was thickened due to additional overlays. There were no additional formations on the valve flaps.

Clinical diagnosis: delayed prosthetic valve infectious endocarditis, acute, with damage to

the aorto-vascular anastomosis, S. aureus bacteriologically. Partial separation of the conduit. Brain embolism.

Condition after supracoronary replacement of the ascending aorta and the arch with the vascular prosthesis ATS medical 29 of July 2, 2009, for De Bakey type 1 dissecting aortic aneurysm with compression of the left renal artery.

Vancomycin was prescribed. From the next day, body temperature returned to normal and did not rise in the future. Vancomycin treatment continued for 28 days. Complete blood count and CRP level returned to normal. Due to moderate dysfunction of the prosthesis, it was decided to abstain from repeated replacement. The patient was discharged in satisfactory condition; echocardiography and cardiac surgeon's follow-up were recommended.

Case 2

A 19-year-old female patient K. The patient had congenital heart disease (bicuspid aortic valve, aortic valve stenosis, ascending aortic aneurysm, coarctation of the aorta, hypoplasia of the ostium of the right coronary artery, patent ductus arteriosus and abnormality of brachiocephalic arteries). In 2014, the Bentall — de Bono procedure of ascending aorta replacement with a valved conduit with reimplantation of the ostia of coronary arteries, aortic isthmus plasty, and ligation of patent ductus arteriosus was performed. Deterioration occurred on July 10, 2016, after a long stay on the beach and eating mushrooms and fat sour cream: dizziness, nausea, headache, and vomiting appeared. The patient and the doctor at the place of residence associated this deterioration with overheating and dietary errors. On July 13, weakness in the limbs, double vision, blurred speech and lethargy appeared. The patient was admitted to the Department of Neurology (ICU). Objectively: right-sided hemiparesis, oculomotor disorders. Brain MRI: multiple foci of ischemia. Echocardiography: no prosthesis dysfunction and additional formations were detected. Fever persisted from the moment of admission. The patient received levofloxacin. After blood culture was obtained (S. aureus), vancomycin was prescribed with improvement in the form of body temperature normalization. On August 26, abnormalities were revealed via TEE. Along the perimeter of the aortic fibrous ring, an anechogenic fluid space of up to 1.9 cm in height was visualized — an abscess cavity. Doppler ultrasound revealed blood flow in the cavity of the abscess. A defect in the connection of the conduit with the fibrous ring, the blood flow through it into the abscess cavity, and shunt from the abscess cavity to the right atrium were visualized. Along the walls of the conduit in the ascending section, a hypoechoic space was located. Conclusion. Signs of an abscess of the aortic fibrous ring with a partial detachment of the aortic conduit and drainage into the paraaortic tissue and into the cavity of the right atrium.

Clinical diagnosis: delayed prosthetic valve infectious endocarditis, acute, with damage to the prosthesis of the aortic valve and aorta, tricuspid valve, S. aureus bacteriologically. Abscess of the area of the fibrous ring of the aortic valve with drainage into the paraaortic tissues and into the cavity of the right atrium, partial detachment of the aortic conduit. False aneurysm of the ascending aorta. Complication. Brain embolism, secondary meningoencephalitis, intracerebral hemorrhage of the right frontal lobe. Right hemiparesis. Oculomotor disorders. Secondary post-congestive atrophy of the right optic nerve.

Condition after the Bentall — de Bono procedure of the ascending aorta and arch replacement with valved conduit Carbomedics 21mm-AR, No. S1014 478-B, with reimplantation of the coronary artery ostia, aortic isthmus plasty, and ligation of patent ductus arteriosus (September 24, 2014).

Operated on September 1, 2016. Paraprosthetic phlegmon with partial melting of the right coronary artery was detected. The cavity of the left ventricle is connected with a false aortic aneurysm; prosthetic detachment by 40% of the diameter of the circle, para-prosthesis to right atrium fistula. The Bentall — de Bono procedure for repeated replacement of the ascending aorta with a valved conduit MedInge ADM 21mm, No. 90972, with reimplantation of the ostium of the left coronary artery, suturing of the para-prosthesis to right atrium fistula, removal of vegetation from the

cavity of the right atrium and tissue treatment with an antiseptic solution was performed.

The postoperative period was complicated by pneumonia, septic shock, multiple organ failure, rhythm and conduction disorders. Despite long-term treatment, death occurred.

Pathological Diagnosis:
Principal diagnosis. I 33.0. Delayed prosthetic valve infectious endocarditis, acute, with damage to the prosthesis of the aortic valve and aorta, tricuspid valve. Focal productive myocarditis. Abscess of the fibrous ring of the aortic valve with drainage into the paraaortic fatty tissue, cavity of the right atrium, partial detachment of the aortic conduit, moderate tricuspid valve regurgitation. Complication of the underlying disease. Multifocal brain damage: secondary meningoencephalitis, intracerebral hemorrhage of the right frontal lobe.

Complications of the postoperative period. Right focal and confluent suppurative pneumonia (Kl. Pneumonia 10^8, Ps. Aeruginosa 10^8 were isolated bacteriologically from lung tissue). Severe dystrophic changes in the liver, kidneys, myocardium. Focal necronephrosis.

Condition after surgical replacement of the ascending aorta and the arch with a valved conduit for congenital heart disease, aortic aneurysm. Concomitant disease. Abnormality of brachiocephalic vessels: aneurysm of the proximal subclavian artery. Megacolon.

Case 3

A 55-year-old male patient P. On July 1, 2014, the Bentall — de Bono procedure for replacement of the ascending aorta with a valved conduit with reimplantation of the coronary artery ostium for true aortic aneurysm and bicuspid aortic valve, removal of blood clots from bifurcation. Aggravation on August 17, 2016: rise in body temperature to 39 °C with chills. Antibacterial treatment was initiated. Echocardiography (September 7): moderate hypertrophy of left ventricle walls, the function of the prosthesis is not impaired, additional formations are not visualized. Blood culture (September 7): S. aureus, sensitive to cephalosporins, carbapenems, was isolated. TEE (September 9): in the area of the fibrous ring along the perimeter of the conduit, heterogeneous echogenicity with the presence of anechogenic inclusions is visualized, Doppler ultrasound revealed moderate blood flow. Conclusion. Signs of an abscess of the area of attachment of the conduit to the fibrous ring. ECG: first-degree AV block, complete right bundle branch block. TEE (October 10): an increase in the abscess cavity, partial detachment of the prosthesis from the fibrous ring in the area of aortic-mitral contact with drainage of blood into para-aortic tissues, according to Doppler US, the abscess is completely stained with color.

Clinical diagnosis: delayed prosthetic valve infectious endocarditis, acute, with damage to the prosthesis of the aortic valve and aorta, S. aureus bacteriologically. Abscess of the area of attachment of the conduit to the fibrous ring. Partial detachment of the prosthesis from the fibrous ring in the area of aortic-mitral contact with drainage of blood into para-aortic tissues. Condition after the Bentall — de Bono procedure for replacement of ascending aorta with valved conduit Carbomedics 27 mm-AR, No. S10384178-B, with reimplantation of the coronary artery ostium (July 1, 2014) for ascending aortic aneurysm and bicuspid aortic valve. First-degree AV block, complete right bundle branch block.

Antibacterial therapy was carried out for 8 weeks. During therapy, body temperature returned to normal and did not rise anymore, blood and urine tests were normal, signs of prosthetic dysfunction did not progress, peripheral blood circulation was not affected. It was decided not to perform the surgery.

This case demonstrates the low ability of TTE in the early diagnosis of aortic root abscesses in carriers of conduits and the need for TEE performance with the first suspicion of an infection in this area.

Case 4

A 30-year-old patient P. History of ascending aorta replacement with a valved conduit for ascending

aortic aneurysm (visceral manifestation of psoriatic arthritis) and dissecting aortic aneurysm in 2013. Deterioration on September 23, 2018, when nausea, vomiting, diarrhea, mental disorders, psychomotor agitation appeared. Acute poisoning, intestinal infection was assumed. He was admitted to the central district hospital, from where he was transferred to the regional hospital. The condition was serious. Heart rate was 125 beats per minute. BP was 100/60 mm Hg. No rales during auscultation. TTE revealed no dysfunction of the prosthesis, additional formations. Complete blood count: hemoglobin 180 g/l, red blood cells 5.91×10^{12}, white blood cells 15.7×10^{9} e 5% n 22% s 59% l 9% m 5%. ESR 1 mm/h. Urinalysis: protein 1.32 g/l, white blood cells — high, red blood cells — high, hyaline casts 4–5–6, bacteria — high. Biochemical analysis: total protein 56 g/l, urea 14.3 mmol/l, creatinine 238 mmol/l, AST 308 U/l, ALT U/l, creatine kinase 7,283 U/l. Contrast-enhanced CT of the brain with densitometry: in the right hemisphere in the parietal lobe there is a zone of low density of irregular shape with clear contours measuring 26.5 × 27 × 38 mm, in the central part there is an area of increased density 16 × 22 × 9 mm, in the occipital lobe there is a section of reduced density measuring 13 × 28 × 27 mm, in the left hemisphere in the occipital lobe there is a zone of reduced density measuring 32 × 28 × 21 mm; in this zone vessels and a section of increased density measuring 16 × 10 × 7 mm were traced. During contrasting in areas of hemorrhagic impregnation, the accumulation of contrast was determined. Brain abnormalities are regarded as multiple cardioembolic infarctions of both hemispheres with secondary parenchymal hemorrhagic impregnation and the formation of intracerebral hemorrhages. Blood culture: S. aureus. TEE (October 4): along the perimeter of the fibrous ring, semicircular heterogeneous echogenicity with anechoic inclusions up to 8 mm in width is determined (aortic root abscess). Color Doppler imaging determines blood flow in the zone of conduit detachment from the fibrous ring, drainage of the abscess into the right chambers, regurgitation in the area of valve leaflet closure to the level of the left ventricle outflow tract (Figures 1, 2).

Clinical diagnosis: delayed prosthetic valve infectious endocarditis, acute, with damage to the aortic root, valved conduit, tricuspid valve, S. aureus bacteriologically. Abscess of the aortic root, drainage of the abscess into the right chambers. Conduit detachment. Tricuspid valve regurgitation. Bilateral polysegmental destructive pneumonia. Pleuritis. Cardioembolic infarctions of both hemispheres of the brain. Multiple infarctions of the spleen and both kidneys. Nephritis.

Condition after the Bentall — de Bono procedure for replacement of ascending aorta with valved conduit Carbomedics No. 25/28 SN S 1086553-B,

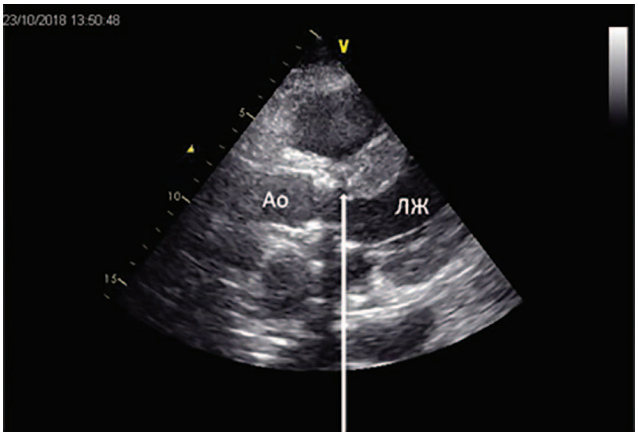

Figure 1. *Transesophageal echocardiography of patient P. LV – left ventricle. Ao – aorta. The arrow shows the zone of conduit detachment from the fibrous ring of the aorta*

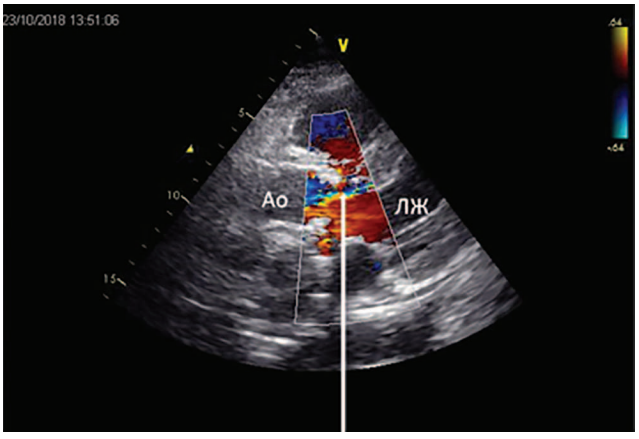

Figure 2. *Transesophageal Doppler echocardiography of patient P. LV – left ventricle. Ao – aorta. Color Doppler imaging determines blood flow in the zone of conduit detachment from the fibrous ring (arrow).*

with reimplantation of the coronary artery ostia (July 11, 2013) for ascending aortic aneurysm. Complications: multiple brain embolism with secondary parenchymal hemorrhagic impregnation and the formation of intracerebral hemorrhages of small volume.

Surgery was performed. About 500 ml of serous exudate were detected in both pleural cavities. The fibrous ring of the aortic valve was represented by an abscess with suppurative discharge. Five U-shaped sutures hold the aortic valve prosthesis (Figure 3).

An abscess cavity and a valved conduit at a distance of 5 cm were removed. There were no blood clots, vegetations, or elements that interfere the movement of the prosthesis (Figure 4).

The prosthesis fully retained its functionality. The cavity of the left ventricle and the rest of the prosthesis were treated with a 1.5% solution of hydrogen peroxide and a solution of betadine. Repeated replacement of the aortic valve and the ascending aorta with a valved conduit MedInzh 23/26 mm SN 102282 was performed. Before the implantation, ostia of the right and left coronary arteries were interconnected by an 8-mm vascular prosthesis according to the Cabrol procedure. The distal section of the vascular prosthesis was sewn into the remaining prosthesis. A vascular prosthesis of 8 mm was implanted in a valved conduit. Cabrol

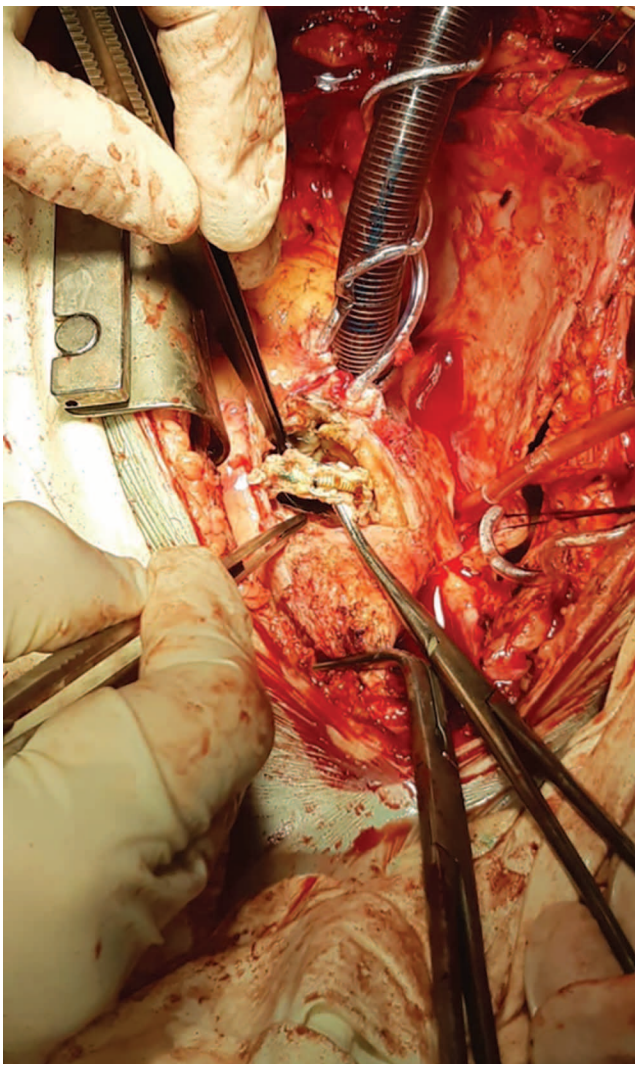

Figure 3. *Stage of operation – prosthesis removal. Prosthesis is impregnated with creamy pus. Freely removed. The area of fixation of the prosthesis is preserved only for 1/4 of the cuff circumference*

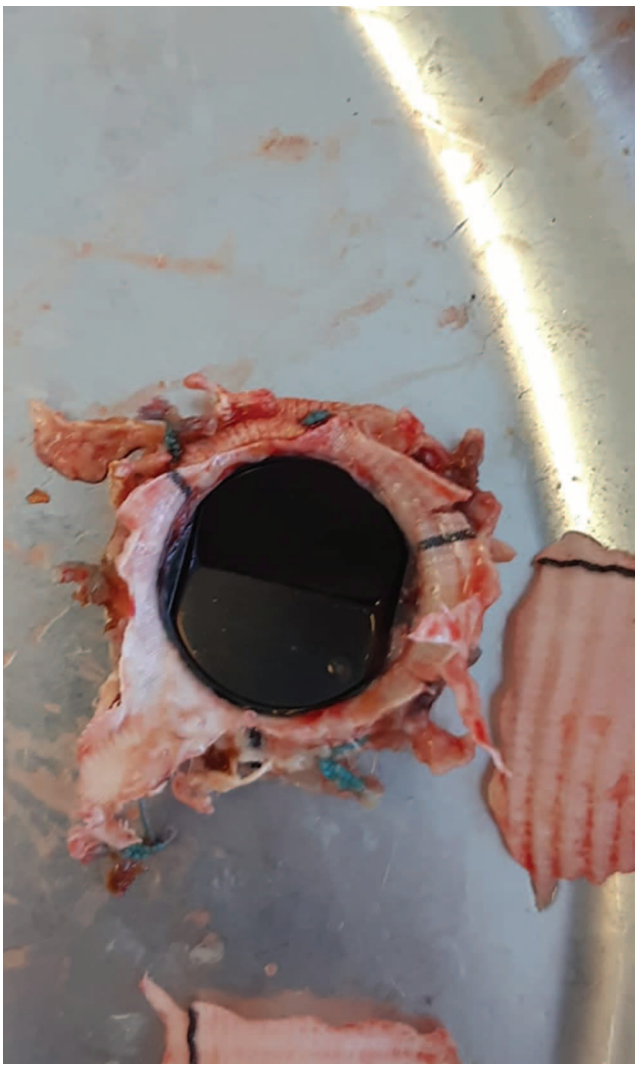

Figure 4. *Extracted prosthesis. There are no blood clots, vegetations or elements that interfere the movement of the prosthesis. The prosthesis fully retained its functionality*

shunt into the right atrium was performed using a patch of PTFE and 4.0 suture.

The postoperative period was complicated by mediastinitis, sepsis, septic shock, multiple organ failure. During treatment with reserve antibiotics, febrile fever persisted. It was decided to perform resternotomy for mediastinal drainage. When transferring the patient for transportation to the operating room, ventricular fibrillation occurred, three 270-J defibrillator discharges restored cardiac activity. The dose of inotropic support was increased, syndromic therapy, drainage of the pericardial cavity were performed. In connection with the progression of renal failure, prolonged renal replacement therapy with citrate anticoagulation was performed on the Prismaflex device. Repeatedly: rotation of antibiotic therapy, taking into account blood culture results. Hemodynamic disorders gradually increased, requiring an increase in doses of inotropic agents. On November 6, 2018, percutaneous tracheostomy was performed. The condition gradually worsened, resistant hypotension and saturation decrease were observed. Intensive treatment for a month and a half had no effect.

Pathological Diagnosis:
Principal diagnosis. I 33.0. Infectious endocarditis of the aortic valve prosthesis, the tricuspid valve, delayed, acute, S. aureus, Kl. pneumonia bacteriologically. Abscess of the aortic root, drainage of the abscess into the right chambers. Conduit detachment. Anterior suppurative mediastinitis. Fibrinous pericarditis. Bilateral focal and confluent suppurative pneumonia with abscessing in S9–S10 of the left lung (Klebsiella pneumoniae 10^7 was isolated from the lung). Multiple infarctions of the kidneys and spleen with organization. Anemia (Hb-75 g/l). Productive myocarditis. Glomerulitis.

Complications of the underlying disease. Multiple cardioembolic infarctions of both hemispheres of the brain with secondary parenchymal hemorrhagic impregnation and the formation of intracerebral hemorrhages of small volume. Severe dystrophic changes in the liver, kidneys, myocardium. Focal necronephrosis (serum urea — 25.8 mmol/l).

Condition after the Bentall — de Bono procedure for replacement of the ascending aorta with valved conduit Carbomedics No. 25/28 SN S 1086553-B, with reimplantation of the coronary artery ostia (July 11, 2013) for ascending aorta aneurysm.

Case 5

A 22-year-old patient B. Four years ago, he underwent ascending aorta replacement for aneurysm associated with congenital aortic defect. He became acutely ill on April 16, 2017, for no apparent reason, with body temperature rising to 38 °C with chills. He took antipyretics, without effect. On admission, the condition was serious. Hemorrhagic rash on the skin. BP was 100/70 mm Hg. Heart rate was 94 beats per minute. Breathing was vesicular, no rales. Rhythmic tones. No murmurs. Complete blood count: hemoglobin 141 g/l, white blood cells 10.1×10^9/l, red blood cells 4.3×10^{12}/l, platelets 81×10^9/l, ESR 20 mm/h, n 10% s 76% l 12% m 2%. Urinalysis: protein 0.66 g/l, leukocytes 1–3, red blood cells 6–8 per HPF. TTE revealed no vegetations, no prosthesis dysfunction. TEE (April 21, after 5 days from the onset of the fever): no abnormalities were detected. Based on the following signs: a foreign body in the heart, fever with high temperature, immune disorders (hemorrhagic rash, proteinuria, hematuria), and taking into account personal experience, despite the absence of Echo abnormalities, infectious endocarditis was diagnosed. Vancomycin therapy was initiated. There was no effect from antibiotic therapy. Further, blood culture revealed S. aureus, sensitive to benzylpenicillin and cephalosporins. The treatment was switched to benzylpenicillin. On benzylpenicillin, a clinical effect was noted — body temperature returned to normal, appetite appeared, skin rash disappeared, lab test results improved. TEE showed an increase in the volume of echo positive tissues in the aortic fibrous ring area; no other changes were noted. Antibacterial therapy was carried out for four weeks, after which the patient was discharged in satisfactory condition.

Clinical diagnosis: delayed prosthetic valve infectious endocarditis, acute, with damage to the aortic root, S. aureus bacteriologically. The Bentall procedure for replacement of the ascending aorta

with a valved conduit Carbomedics 25 mm, S\N S 1108497-B, with reimplantation of the coronary artery ostia for aneurysm of the ascending aorta and congenital aortic defect (November 12, 2013). Hemorrhagic vasculitis. Glomerulitis.

This case demonstrates the potential of timely drug treatment for managing the infection without surgical intervention.

Case 6

A 58-year-old patient A. In 2013, ascending aorta replacement with a valved conduit for aortic aneurysm was performed. On September 28, 2018, fever with body temperature of up to 38 °C and pain in the right lumbar region appeared. The patient was admitted to the hospital. On antibiotic therapy, episodes of fever with body temperature of up to 39.5 °C occurred. On October 7, 2018 TTE was performed: enlargement of both atria, hypertrophy of the left ventricle walls. No zones of hypokinesis were revealed; myocardial contractility was satisfactory. In the projection of the aortic valve and the ascending aorta, a valved conduit was visualized. Transaortic gradient was 14 mm Hg. There was no prosthesis dysfunction. Additional formations on the prosthesis were not located.

On October 16, changes were detected via TEE: on the half of the fibrous ring perimeter of the aortic valve, an abscess measuring 1.0 × 2.0 cm in height is visualized with heterogeneous contents and liquid inclusions. No blood flow in the abscess cavity was revealed. Antibacterial treatment was continued. On November 22, 2018, negative changes were revealed via TEE: aortic root abscess enlargement (Figure 5).

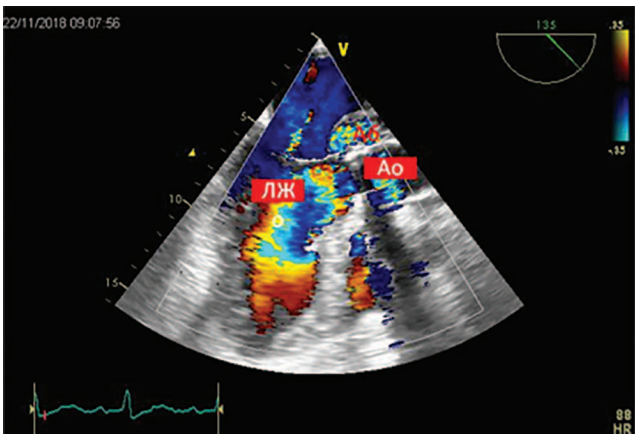

Figure 5. *Transesophageal Doppler echocardiography of patient A. LV – left ventricle. Ao – aorta. Ab – aortic root abscess. There is blood flow in the abscess cavity (stained with color)*

The abscess cavity is anechogenic, additional hyperechoic thin parietal structures (fibrin and vegetation overlays) are visualized in the cavity, height of the abscess cavity is 2.2 cm, spreads to 2/3 of the aortic valve fibrous ring and up to 5.0 cm along the ascending aorta. Intensive blood flow is recorded in the abscess cavity; there is minimal shunt to the left atrium. Doppler US revealed no significant aortic regurgitation, mitral regurgitation was negligible. Conclusion. Abscess of the aortic root with signs of incomplete detachment of the conduit and signs of drainage into the left atrium. S. epidermidis was isolated bacteriologically from the blood.

Clinical diagnosis: delayed prosthetic valve infectious endocarditis, acute, with damage to the aortic root, valved conduit, S. epidermidis bacteriologically. Abscess of the aortic root. Condition after the Bentall — de Bono procedure for replacement of the aortic valve and ascending aorta with valved conduit Carbomedics 25/58 No. S 1065975-B, with reimplantation of the coronary artery ostia (February 21, 2013).

Surgery was performed on November 29. Findings: valve detachment from the fibrous ring. The fibrous ring of the aortic valve is represented by an abscess with suppurative discharge. Seven U-shaped sutures hold the prosthesis. There is a cavity between the prosthesis and the fibrous ring. The Cabrol procedure for replacement of the aortic valve and the ascending aorta with a valved conduit with reimplantation of the coronary artery ostia and the Cabrol shunt were performed (surgery lasted 9 h 55 min). On December 11, 2018, a Vitatron E60DR pacemaker with ELBI 221C-53 / 211C-58 passive fixation electrodes was implanted.

The course of the postoperative period was complicated by multiple organ failure with the gradual relief of all symptoms on long-term treatment. Discharged in satisfactory condition.

Discussion

Statistical data on the incidence of IE after the ascending aorta replacement are scarce. Few reports available in the literature allow us to conclude that prosthetic valve IE in people after such intervention is relatively rare. Malashenkov A. I. et al. (2009), summarizing the long-term results of aorta replacement with a xenopericardial conduit containing a mechanical valve, noted the development of IE, which caused death, in three out of 121 patients [6]. In the group of 3,200 patients with proven IE, studied by Ramos A. et al. (2016), 27 patients were carriers of valved conduits [7]. According to Monsefi N. et al. (2014), IE occurred with a frequency of 0.3% within a period of up to 5 years after the surgery, and with a frequency of 3% after more than 5 years [8]. We did not encounter patients with IE after ascending aorta replacement until 2014, although such interventions have been performed for more than a quarter of a century in our center. Perhaps the appearance of these cases is associated with an increase in the volume of ascending aortic aneurysm surgery. However, the widespread increase in the number of interventions for ascending aortic aneurysms makes IE relevant. Of our patients, two fell ill with IE two years after the intervention, one in 4 years and three in 5 years.

Endocarditis in patients with a history of ascending aorta replacement has its own characteristics. There are reports of frequent damage to extravalve structures, which we also observed. Ramos A. et al. (2016) found paravalvular abscesses in 62.5% of IE cases in this group [7]. Colleagues from the A. N. Bakulev National Medical Research Center of Cardiovascular Surgery observed abscesses of the aortic root with tissue destruction and fistula formation, mediastinitis with fistulas on the anterior chest wall [2–4]. An infection normally does not extend to a vascular graft [7].

In our patients, the pathological process was manifested by the development of an abscess of the aortic root, paraprosthetic phlegmon, abscess burst in the right ventricle, left atrium, prosthesis detachment from the aortic ring. In one case, mediastinitis developed. In all the cases that we encountered, there were no vegetations on the valves and the prosthesis ring. The absence of vegetation, which is one of the "big" criteria of IE, determined diagnostic challenges. Severe paravalvular aneurysms can be visualized via TTE [9], but TEE is preferable for early diagnosis. In all cases, it was TEE that allowed us to visualize changes in the aortic root. Cardiac MRI can also be used to diagnose aortic root aneurysms [9].

Undoubtedly, personal experience and an idea of where the process is likely to occur, is of importance. The diagnosis of our first patient presented the biggest challenge. The time to the establishment of diagnosis was reduced from 2.5 months to 11 days as experience accumulated.

Conclusion

Fever may be the reason for the patient to visit the therapist, general practitioner, infectious disease specialist, or rheumatologist. For doctors of these specialties, awareness of the clinical signs of IE in patients with aortic conduit is as important as for a cardiologist and cardiac surgeon. Knowing the characteristics of IE in this group of patients will speed up diagnosis and improve treatment outcomes. Fever in carriers of a valved conduit should be a reason to immediately suspect IE. Considering such symptoms as the presence of a foreign body in the heart, high fever in the absence of obvious reasons, inflammatory changes in the blood, changes in the urine, the appearance of foci in the internal organs and brain that are suspicious facilitates the diagnosis. It is of great importance that, in carriers of aortic conduits, infection can lead to an abscess of the aortic root, which is difficult to visualize via TTE. In patients with a history of the ascending aorta replacement with a valved conduit, echocardiography is indicated at the slightest suspicion of IE. In patients without clear alternative reasons for fever, IE should be suspected and treatment should be performed even in the absence of convincing echocardiographic signs of IE. Changes in echocardiography may appear later, when drug treatment becomes ineffective and surgery becomes risky. Multiple repetition of blood culture is advisable. Early diagnosis increases the patient's chances for recovery. In our group, three out of six patients

received successful drug treatment and did not require surgical treatment.

Contribution of Authors

N. A. Morova — the contribution of the author to the development of the concept and design, the role of the author in collecting data, writing the manuscript, the role of the author in the final statement, consent to be responsible for all stages of the work.

V. N. Tsekhanovich — the role of the author in collecting data and verifying critical intellectual content, the role of the author in the final statement for publication.

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