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Chronic Cardiac Tamponade Treatment in Cardiac Neoplasms

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ABSTRACT Among complications of malignant neoplasms of the heart, tumor exudative pericarditis requires emergency surgical measures with the development of chronic tamponade. At the first stage, puncture drainage of the pericardial cavity is advisable. In case of a common tumor process and the impossibility of radical surgical treatment by the second stage, it is advisable to perform video assisted thoracoscopic pericardial fenestration with biopsy and pleurodesis, if necessary. This tactic improves the quality of life in patients and complies with modern standards of treatment of this disease.

Keywords: malignant pericardial effusion, cardiac tamponade, videotoracoscopy (VATS)
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EchoCG — echocardiography
IHCA — immunohistochemistry analysis
MSCT — multispiral computed tomography
PE — pulmonary embolism
VAT — video-assisted thoracoscopy

INTRODUCTION

Neoplasms of the heart are rare diseases. Primary tumors of the heart comprise 25%, secondary tumours comprise 75%. According to the autopsies of patients who died of cancer, primary heart tumors did not exceed 0.1%. According to the classifications of *H.A. McAllister* (1978) and B.V. Petrovsky (1988), the vast majority of primary tumors of the heart are sarcomas. Metastatic tumors of the heart make up from 0.3 to 10.9% of all tumors and 0.6% according to autopsy data [1].

The clinical symptoms of heart tumors depend on the location and extent of the tumor process. "... Typical manifestations are unexplained, rapidly progressive heart failure with an increase in heart size, hemorrhagic effusion in the pericardium, tamponade, chest pain, arrhythmias, conduction disorders, vena cava obstruction and sudden death" [2]. Sudden death in patients with cardiac tumors may be caused both by compression of the coronary vessels with the development of acute myocardial infarction, and other causes [3].

The surgical therapy is the main treatment of heart tumors. However, with a widespread tumor process, palliative or symptomatic therapy is necessary. At the same time, the goals of the so-called “best supportive care” are "... prevention

and relief of symptoms of the disease and maintaining the quality of life of patients and their families, regardless of the stage of the disease and the need for other therapies" [4]. Despite the tumor lesions of the heart that are not subject to radical treatment, the development of life-threatening complications requires emergency medical measures. One of these complications is chronic cardiac tamponade.

The purpose of the publication is to demonstrate observations of heart tumors that are rare for emergency thoracic surgery, to discuss the scope of diagnostic and therapeutic measures that improve the quality of life of patients.

MATERIAL AND METHODS

From 2014 to 2018, 16 patients were treated at the Department of Thoracic Surgery of the N.V. Sklifosovsky Research Institute for Emergency Medicine due to exudative pericarditis which accounted for 0.2% of the total number of discharged patients. The etiology of pericarditis in 10 patients has not been established. Hypertrophic cardiomyopathy was diagnosed in one patient, hypothyroidism — one patient, systemic lupus erythematosus — one patient, post-traumatic pericarditis after penetrating chest injury — one patient. Tumors of the heart caused hydropericardium with the development of chronic tamponade in 2 patients who were 71 and 68 years old. In both cases, the right atrium was affected. Preoperative diagnosis was performed using various radiotherapy methods. X-ray was performed on a stationary device *Baccara Apelem*, France. Ultrasound studies were performed with devices *Logic* 500 *Pro*, *Logic P* 5, *General Electric*, USA, multuspiral computed tomography (MSCT) was performed with *Aquilion PRIME* tomograph*, Toshiba*, Japan. Punctures and pericardial drainage were performed under X-ray control in the operating room for endovascular interventions. The general purpose drainage catheter *Pigtail* 8 *F* was used for drainage of the pericardial cavity. Video-assisted thoracoscopy (VTS) was performed under general balanced anesthesia and separate ventilation of the lungs. Utilized endosurgical equipment and instruments were used. There were no complications and deaths associated with puncture and endosurgical interventions.

Clinical observations.

Patient A., aged 71, admitted on Feb 26, 2015 after falling on the street with a transtrochanteric-subtrochanteric fracture of the hip. Doppler ultrasound of the lower extremities revealed non-occluding floating thrombosis of the right common femoral and great saphenous vein. An emergency thrombectomy from the right common femoral vein, Troyanov-Trendelenburg operation and osteosynthesis of the proximal right femur of the gamma nail were performed. Subsequently, chest X-ray revealed a significant expansion of the shadow of transverse heart diameter. Ultrasound examination of the pleural cavities revealed uncoupling of the pleural layers due to fluid: up to 5.2 cm on the left, and up to 5.4 cm on the right. Drainage of both pleural cavities was performed, 700 ml of serous fluid were evacuated. After managing hydrothorax, hydropericardium was detected during echocardiography (EchoCG) with uncoupling of the pericardial layers in diastole along the contour of the right ventricle 2.5 cm wide. In the apex region, localized hydropericardium 12.0x10.0 cm was found with single small dense inclusions. Puncture and drainage of the pericardial cavity were performed at the Pirogov-Delorma point; 1,200 ml of serous hemorrhagic fluid were evacuated. Cytological examination didn't reveal tumor cells. MSCT of the chest revealed volume formation of the right atrium with calcification and dimensions 80x62x63 mm (Fig. 1*A),* mediastinal lymphadenopathy, manubrium tumor, not associated with the formation in the heart (Fig. *1B),* the minimum bilateray hydrothorax. Th formation of the manubrium of the sternum was first discovered in 2014. A puncture biopsy was performed at the place of residence, which did not reveal atypical cells.

Drainage tubes from the pericardial cavity and from the pleural cavities were removed on day 3-4 after drainage. Later, muffled heart sounds, the expansion of the boundaries of the heart, jugular veinous distention were observed. In connection with aggravation of the clinical picture of chronic cardiac tamponade on March 11, 2015, a consistent bilateral VTS was performed. On the left, the pericardium was without pulsation, tense, thickened, hyperemic, infiltrated. During fenestration of the pericardium under pressure, about 400 ml of serous-hemorrhagic fluid were released. A hole of 6x4 cm was formed in the wall of the pericardium. Pleurodesis with talc and drainage of the left pleural cavity were performed. On the right, the pericardium was thin, with no visible changes. We revealed its significant protrusion without pulsation. When opening the pericardial cavity, the air was discharged on the right. The fenestration of right pericardium of 6x6 cm was performed. Pericardioscopy identified whitish nodular tumor of the right atrium, of cartilage density (Fig. 1*C),* not invading the pericardium. A biopsy of the neoplasm and pleurodesis with talc were performed [5]. The planned histological examination revealed signs of chondroma with chondrocyte dysplasia. In the postoperative period, 400–500 ml of serous fluid were evacuated from the pleural cavities per day, and therefore additional pleurodesis was carried out through the drainage tubes with doxycycline [6]. The volume of discharge through drainages significantly decreased. The control X-ray examination and ultrasound of the pleural cavities revealed localized parietal fluid accumulations, and the minimum volume of fluid in the pericardium. Drainage tubes were removed. On April 6, 2015, the patient was discharged under the supervision of an oncologist at the place of residence in relatively satisfactory condition. Subsequently, the patient did not seek additional medical care.

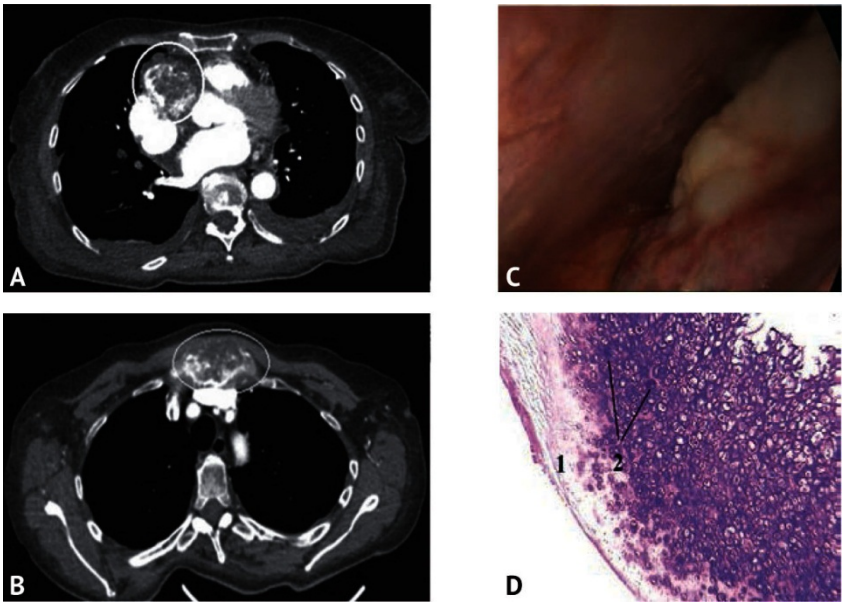

Fig. 1. A 71-year-old female patient A., right atrial chondroma. A – SCT with intravenous contrast, axial view. The tumor of the right atrium (encircled); B — SCT with intravenous contrast, axial view. The mass tumor of the manubrium (encircled); C — surgery endoscopic photo (video assisted thoracoscopy). Pericardioscopy: whitish tumor tissue (encircled) of cartilaginous density originating from the right atrium. D — incapsulated (1) chondroma with focal displasy of chondrocytes, magnification x100

Patient G., 68 years old, arrived independently on Feb 10, 2018 and complained of significant dyspnea with minimal exertion. The complaints appeared a month ago. On an outpatient basis, EchoCG revealed a significant hydropericardium and volume formation of the right heart. Upon admission, the chest X-ray revealed dramatically expanded shadow of the heart in transverse diameter (Fig. 2*A*). Ultrasonography revealed a 4 cm uncoupling of pericardial layers. Due to the growing chronic tamponade of the heart, a puncture and drainage of the pericardial cavity at Larrey point was performed. We evacuated 800 ml of hemorrhagic fluid. Cytological examination of the pericardial fluid showed no atypical cells. The cytogram of the pericardial fluid was represented by lymphocytes and neutrophilic leukocytes. After pericardial drainage, the patient's condition improved. The chest X-ray showed positive dynamics compared to initial X-rays. EchoCG revealed a volumetric formation of the right chambers of the heart invading the cavity of the left atrium and moderate stenosis of the right atrioventricular ostium, tricuspid regurgitation grade 1. Left ventricular ejection fraction 63%.

The chest MSCT revealed a volumetric formation of the right chambers of the heart and pericardium, accumulating contrast, with infiltrative growth, compressing the trunk of the right coronary artery (Fig. 2*B*). Signs of embolism of the branch of the 9-q segmental pulmonary artery on the right (PE), massive lymphadenopathy of the mediastinum, minimal bilateral hydrothorax were revealed. Due to the prevalence of the tumor process, radical surgical treatment was not possible. According to vital indications, the right sided VTS was performed on February 20, 2018 for the prevention of repeated cardiac tamponade and for morphological verification of the tumor. The pericardium was tense, thickened, infiltrated, hyperemic, without pulsation. When opening the pericardium under pressure, a turbid brown-colored hemorrhagic fluid emerged (Fig. 2*C*). Pericardial fenestration was performed. Changes suspicious for fibrinous pericarditis were detected (Fig. 2*D*). The tissue was taken for histological examination from the lymph node of the mediastinum enlarged to 4.5 cm (group 2 on the right). The planned histological examination revealed lymphoproliferative disease. The material was sent for immunohistochemical analysis (IHCA), which verified diffuse B-cell lymphoma (Fig. 2*E*).

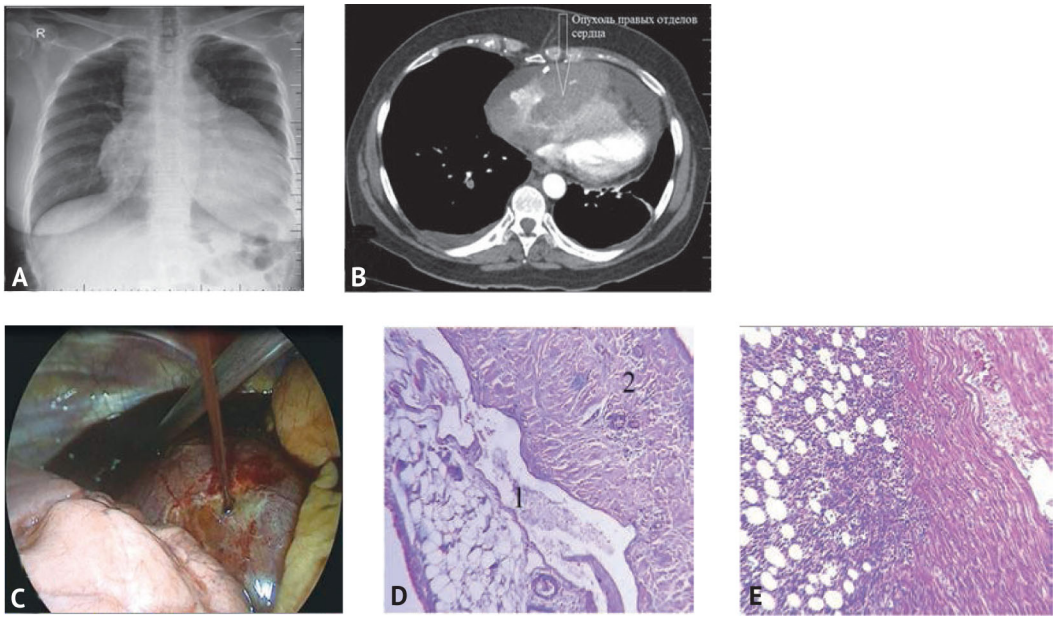

Fig. 2. A 68-year-old female patient G., diffuse B-cell mediastinal lymphoma, invading the right heart. A — plane chest X-ray: large-volume hydropericardium. A significant increase in the transverse dimensions of the heart, the bulging of the right heart, the smoothness of the waist of the heart and the bulging of the left ventricle contour; B — SCT with intravenous contrast, axial view. The arrow indicates the volume of the formation of the right heart; C — intraoperative endoscopic photo (video assisted thoracoscopy). The intense wall of the pericardium above the right side of the heart is incised. Under the pressure the fluid stream of "meat slops" color comes out; D — histological preparation. Reactive pericarditis. Pericardial thickening and fibrosis, enlargement of the lumen of the lymphatic vessels (1), leukocyte extravasation (2). Hematoxylin and eosin stain, magnification x100; E — histological preparation. Diffuse infiltration of the epicardium and myocardium. B-cell lymphoma. Hematoxylin and eosin stain, magnification x100

The control ultrasound didn't reveal free fluid in the pericardial cavity, there was a small volume of bilateral hydrothorax. On Feb 27, 2018, the patient was discharged under the supervision of an oncologist at the place of residence with the improvement of the condition. She was re-hospitalized 22 days later in a general severe condition, dyspnea, not associated with hydropericardium or hydrothorax. The patient died on March 19, 2018 from repeated pulmonary embolism. Autopsy revealed a widespread tumor lesion of the heart. The diagnosis of massive pulmonary embolism was confirmed.

DISCUSSION

Acute heart hemotamponade is often found in victims with injuries of the pericardium and heart. The clinical manifestations of this complication are well known: hypotension, tachycardia, weak, paradoxical pulse, no cardiac impulse, muffled heart tones, expansion of the borders of the heart, cyanosis of the face and neck, jugular venous distention. The emergency thoracotomy, pericardiotomy, evacuation of blood and clots from the pericardial cavity, wound closure of the heart and elimination of other possible sources of bleeding are indicated in case of acute hemotamponade.

On the contrary, the development of chronic tamponade occurs gradually. Its pathogenesis is well studied [7]. In our observations, exudation into the pericardial cavity, associated with the tumor process, repeatedly and fairly quickly reached the marginal reserve pericardial volume. Therefore, the method of choice was a permanent internal discharge of pericardial exudate.

In both cases, we encountered a diffuse-infiltrative tumor lesion of the right atrium. There is only a single mention of chondromas in the myocardium in the references to literary sources. Lymphomas, the most common mediastinal neoplasms, are extremely rare in the heart [1].

The appearance of symptoms of pericardial effusion with the development of chronic cardiac tamponade indicates neglect of the tumor process [7]. Preoperative diagnosis of heart tumors is based both on traditional methods: X-ray, echocardiography, cytological examination of the pericardial exudate, MSCT, magnetic resonance imaging. In recent years, positron emission computed tomography and invasive methods have played an important role in the diagnosis of tumors, allowing the biopsy of tumor tissue to be performed. The use of VTS is recommended when the transthoracic biopsy is impossible or ineffective and it is impossible to exclude lymphoma. Direct biopsy of the tumor allows to obtain a sufficient amount of material for histological and IHCA verification of the tumor, which directly affects the tactics of treatment [4].

Puncture drainage of the pericardial cavity is indicated in emergency situations, and is aimed at eliminating cardiac tamponade. The exudate obtained during the procedure is subject to cytological, biochemical, general clinical and bacteriological studies. In our observations, it did not reveal tumor cells. In the first patient, the tumor was the formation of cartilaginous density, from which material for histological examination was hardly taken. In the second observation, 71% of the cell composition of the exudate was represented by lymphocytes, which could indirectly indicate the tumor character of the exudate. Therefore, a biopsy of the tumor was indicated.

Based on the prevalence of the tumor process, the question arises: is external drainage the optimal final method in the palliative treatment of tumor exudative pericarditis? Probably, only in a very serious condition with intolerance of a larger operation by a patient. Prolonged external drainage leads to infection and fragmentation of the pericardial cavity. In addition, dysfunction and migration of the catheter is possible. To eliminate these shortcomings, some authors urge to form a wide

subxiphoidal “window” [8] or to create an intrapleural pericardial “window” under the control of a mediastinoscope, using the parasternal access with rib cartilage resection [9]. However, in our opinion, the most effective and developed access and method of fenestration is VTS. Abroad, favorable results of VTS for fenestration of the pericardium, as well as talc pleurodesis in 12 patients with heart tumors complicated with tamponade and exudative pleurisy are reported [10]. It should be noted that the common tumor process is often accompanied by exudative pleuritis, which treatment is urgent as well. We believe that this problem is solved quickly and less traumatic in inoperable cancer patients by spraying talc under video control. Unfortunately, the domestic medical industry does not yet produce much-needed special preparations for pleurodesis .

CONCLUSION

Summarizing all the above, it should be noted that in exudative pericarditis complicated by chronic cardiac tamponade caused by previously undiagnosed tumor of the heart, first of all, external drainage of the pericardial cavity should be performed to eliminate tamponade together with a complex of clinical and laboratory studies. The diagnosis of the tumor process extent includes the use of the entire set of diagnostic methods. If it is impossible to perform radical surgical intervention, given the persistent recurrent course of tumor pericarditis, it is advisable to create conditions for permanent internal drainage of the pericardial cavity. A biopsy of the tumor under visual control will allow to solve the problem of the possibility of using adjuvant therapy.

Thus, the considered approach to the treatment of tumor pericarditis, complicated by cardiac tamponade, allows to improve the quality of life of this difficult category of patients and meets modern standards of treatment for this disease.

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