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CLINICAL CASE REPORT

EFFECTIVE USE OF EXTRACORPOREAL MEMBRANE OXYGENATION IN SURGICAL TREATMENT OF KIDNEY CANCER PATIENT WITH TUMOR THROMBOSIS

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ABSTRACT

The presented clinical case demonstrates the potential of medical technologies with organ replacement in the treatment for kidney cancer (KC) with a tumor thrombus located in the retrohepatic inferior vena cava (IVC) complicated by thromboembolism of the medium and small branches of the pulmonary artery (PATE). The treatment outcomes in such patients are usually poor due to a great number of complications and high mortality. The literature data estimates operative mortality rate of 13 %, and the frequency of early postoperative complications reaches 60 %. Standard approaches to anesthesia in case of thromboembolism and the threat of massive PATE are ineffective. In this clinical case, we chose the therapeutic tactics with extracorporeal membrane oxygenation (ECMO) in the intra- and early postoperative period in order to avoid or minimize life-threatening complications in the KC patient with a tumor thrombus in IVC and PATE. The effective use of ECMO minimized the risk of fatal complications during nephrectomy with thrombectomy for a malignant kidney tumor in the patient with pulmonary embolism and subcompensated disorders of the oxygen transport function of the lungs. The main objective of medical care for this patient involved both the radical treatment of kidney cancer and the elimination of a potential cause of thromboembolism of the pulmonary artery branches, fragments of hematogenous and tumor microthrombi. The total duration of ECMO was 30 hours. No significant complications in organs and systems were recorded during the surgery and in the early postoperative period. The development and implementation of new technologies, including devices for oxygen blood saturation and carbon dioxide elimination, undoubtedly gives a chance for a cure for cancer patients with decompensated organ and functional capabilities.

Keywords:
kidney cancer, tumor thrombus, extracorporeal membrane oxygenation, pulmonary embolism, nephrectomy with thrombectomy, blood gas transport function

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КЛИНИЧЕСКОЕ НАБЛЮДЕНИЕ

ЭФФЕКТИВНОЕ ПРИМЕНЕНИЕ ЭКСТРАКОРПОРАЛЬНОЙ МЕМБРАННОЙ ОКСИГЕНАЦИИ В ХИРУРГИЧЕСКОМ ЛЕЧЕНИИ БОЛЬНОЙ РАКОМ ПОЧКИ С ОПУХОЛЕВЫМ ТРОМБОЗОМ

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РЕЗЮМЕ

Представленный клинический случай демонстрирует возможности медицинских технологий с органозамещением в лечении рака почки (РП) с опухолевым тромбом расположенным в ретропеченочном отделе нижней полой вены (НПВ), осложненного тромбоэмболией средних и мелких ветвей легочной артерии. Опыт лечения данной группы пациентов является крайне неудовлетворительным из-за большого количества осложнений и высокой летальности. По имеющимся данным литературы, операционная летальность составляет около 13 %, а частота ранних послеоперационных осложнений достигает 60 %. Стандартные подходы анестезии в случае состоявшейся тромбоэмболии и угрозы развития массивной тромбоэмболии легочной артерии (ТЭЛА) являются малоэффективными. Для возможности избежать или минимизировать жизнеугрожающие осложнения, в данном клиническом случае больной РП с опухолевым тромбом в НПВ и проявлением ТЭЛА нами была выбрана тактика терапии с применением экстракорпоральной мембранной оксигенации (ЭКМО) в интра- и раннем послеоперационном периоде. Эффективное применение ЭКМО позволило минимизировать риск развития фатальных осложнений при выполнении нефрэктомии с тромбэктомией по поводу злокачественного новообразования почки у пациентки с ТЭЛА и субкомпенсированными нарушениями кислородно-транспортной функции легких. Основной задачей медицинской помощи данной пациентке являлось не только радикальное лечение рака почки, но и ликвидация потенциального источника тромбоэмболии ветвей легочной артерии в виде фрагментов гематогенных и опухолевых микротромбов. Общая продолжительность ЭКМО составила 30 часов. За время проведения хирургического вмешательства и в раннем послеоперационном периоде значимых осложнений со стороны органов и систем зафиксировано не было. Разработка и внедрение новых технологий, в том числе устройств для насыщения крови кислородом и элиминации углекислого газа, несомненно дает шанс на излечение онкологическим пациентам с декомпенсированными органными и функциональными возможностями.

Ключевые слова:
рак почки, опухолевый тромб, экстракорпоральная мембранная оксигенация, тромбоэмболия легочной артерии, нефрэктомия с тромбэктомией, газотранспортная функция крови

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RELEVANCE

In the structure of oncological morbidity, kidney cancer (RP) is one of the leading localizations and occupies the 10th place [1]. According to the literature, a feature of the clinical course of renal cell carcinoma is venous invasion with the penetration of the tumor into the lumen of the renal vein, which is fixed in 25–30 % of cases. Invasion of the inferior vena cava (IVC), up to the right atrium, is registered in 4–10 % of patients, the spread of a tumor thrombus into the right chambers of the heart is diagnosed in 1 % of patients [2].

The interaction of various branches of science and medicine contributes to the introduction of new technologies in modern oncology. It is important to solve the problems of early diagnosis and pathogenesis of tumors, including the study of the mechanisms of normal functioning of the kidneys and their pathological changes in tumor processes [3]. Of course, the application of multimodal principles of antitumor therapy is of priority importance, but the only effective method in the treatment of patients with KCcomplicated venous thrombosis is surgical. At the same time, until recently, patients with diagnosed tumor invasion of IVC were considered incurable. The treatment experience of this group of patients was extremely unsatisfactory due to the large number of complications and high mortality [2; 4]. At the same time, back in 1972, Skinner D. G. et al. It was determined that KC with widespread thrombosis in conditions of total tumor removal is potentially curable. Moreover, the survival rate of patients after surgery – nephrectomy with thrombectomy depends on the prevalence of the malignant process [5]. There is an opinion that the degree of venous invasion and localization of a tumor thrombus also affect the survival of patients who underwent combined surgery. Thus, according to Shiff B. (2021), the 5-year survival rate of patients with non-metastatic KC and retrohepatic thrombi reaches 70 %, and in patients with suprahepatic tumor thrombosis – 55 % [6].

It should be noted that today the choice of treatment tactics for this category of patients remains a very difficult problem. According to various data, the operational mortality is about 13 %, and the frequency of early postoperative complications reaches 60 %. Venous thromboembolic complications (3.8 %), pneumonia (3.6 %) and acute renal failure (3.1 %) predominate in patients after nephrectomy with removal of a tumor thrombus [2]. Research by Borza T. it was shown that the number of early postoperative complications depends on the extent of the thrombus, so at the level of thrombus 0 (renal vein), complications develop in 8.7 % of cases; at level I (mouth of the renal vein) – in 15.3 % of cases; at level II (subhepatic department of IVC) – in 14.2 %, level III (retrohepatic department IVC) – in 17.8 %, IV (intra-atrial) – in 30.0 % of cases ($p < 0.001$) [7]. To minimize complications and hospital mortality, Marshall V. et al. in 1970, cardiopulmonary bypass was used for the first time for surgical removal of a tumor thrombus of III and IV grade of spread, which remains relevant today [2]. The main advantage of this medical technology is the prevention of the development of thromboembolic complications. At the same time, it should be borne in mind that cardiopulmonary bypass requires additional traumatic and complex manipulations, which can lead to an increase in the risk of perioperative complications, including fatal ones [4].

The improvement of medical technologies makes it possible to expand the criteria of surgical and functional operability of oncological patients with decompensated concomitant pathology, as well as with a widespread tumor process. Nevertheless, the complicated course of cancer causes additional difficulties in the treatment of patients with KC. Despite the possibilities of modern diagnostic technologies, more than 40 % of patients with KC are detected in common stages, or there is a metastatic lesion. The absence of obvious clinical signs contributes to the latent course of the process, and the onset of the disease, in such cases, may be bleeding, pulmonary embolism (PE), acute cardiovascular insufficiency due to a decrease in the ejection fraction of the right ventricle and /or blocking of the heart valves [2].

The development of surgical technologies and the possibilities of anesthesiological support, including substitution therapy, cardiopulmonary bypass, hypothermia and other techniques allow optimizing the treatment of patients with KC with vascular invasion [4]. An important point is the fact that thromboembolism has taken place at the diagnostic stage, which undoubtedly limits the possibility of radical treatment. Moreover, the choice of tactics of specialized care in this case is extremely difficult. Often, patients with KC with signs of PE are doomed to a fatal outcome. Standard anesthesia approaches in the case of thromboembolism and the threat of massive PE are ineffective. In order to avoid or min-

imize life-threatening complications, in this clinical case of a KC patient with a tumor thrombus in the IVC and a manifestation of PE, we chose a therapy tactic using extracorporeal membrane oxygenation (ECMO).

Extracorporeal membrane oxygenation is a method of temporarily maintaining the function of the heart and/or lungs when they are damaged using hardware extracorporeal circulation combined with an oxygenator to saturate the blood with oxygen and eliminate carbon dioxide. The basis of the ECMO method is the use of a special polymer membrane that allows oxygenating venous blood circulating through the extracorporeal circuit. At the present stage of development of medical technologies, ECMO is effectively used in the practice of treating primary pulmonary etiology, as well as extrapulmonary pathology complicated by decompensated respiratory insufficiency [8; 9]. At the same time, there is a danger of patients developing pathological conditions caused by the ECMO procedure itself. In addition to potential complications associated with invasive technical features, it is possible to develop unpredictable and uncontrollable life–threatening conditions that are associated with forced heparinesis during the procedure – these are massive bleeding, intracranial hemorrhages, as well as limb ischemia, set thrombosis, neurological complications (convulsive syndrome, ischemic stroke) [10]. Due to these circumstances, before performing ECMO, it is necessary to evaluate the criteria for the reversibility of the functional state and the prognosis of the disease as a whole [11].

It should be noted that the choice of tactics for the treatment of a patient with KCwith clinical manifestations of PE and subcompensated lung function disorders was based on the prevention of the following complications: cardiorespiratory, hemorrhagic, water-electrolyte, neurological, etc. We took into account the initial violations of the oxygen transport function of the lungs, as well as the high risk of intraoperative thromboembolic complications with fatal outcome. When detailing the upcoming therapy of a patient with KC with PE, we comprehensively reviewed the principles, technologies and possible complications of ECMO. They chose to use the veno-venous ECMO (VV/ECMO) technique. It is known that VV/ECMO provides balanced oxygen enrichment of the blood of patients with hypoxic respiratory insufficiency, and is also a method of reserving a situation with a high risk of death, with the underlying disease that caused respiratory failure. During the procedure, oxygenated and decarboxylated blood, passing through the membranes, is injected into the right atrium, and then released into the pulmonary circulation by the preserved cardiac function of the patient [8].

In this clinical case, the main task of highly qualified medical care was not only to rid the patient of a malignant disease, but also the simultaneous elimination of a potentially dangerous source of PE, represented by fragments of hematogenous and tumor microthrombs.

The purpose of the study was to demonstrate a clinical case of the use of extracorporeal membrane oxygenation during nephrectomy with thrombectomy for malignant neoplasm of the kidney in a patient with PE and initial disorders of oxygen transport function of the lungs.

Clinical case

Patient D., 63 years old, applied at her place of residence in September 2019, complaining of a persistent cough, weakness, shortness of breath with little physical exertion, an increase in body temperature to 38 °C. For five days, she was treated at the Central District Hospital for lower-lobe pneumonia on the left, where a further examination revealed the formation of the right kidney. She independently applied to the National Medical Research Center for Oncology ("NMRC for Oncology"), where the diagnosis – cancer of the right kidney was confirmed by magnetic resonance imaging, and signs of thromboembolism of small and medium branches of the pulmonary artery, significant pulmonary hypertension were revealed. The patient was hospitalized in the oncourology department for surgical treatment of KC.

Initial data of computed tomography of the chest, abdominal cavity and pelvis with intravenous contrast:

– there are areas of pneumosclerosis in the lungs on both sides, in the lumen of the inferior lobar artery on the left and its segmental branches, filling defects in the arteries of the lingual segments, narrowing their lumen to 0.3 cm; intra–thoracic lymph nodes – aortic windows and preaortic up to 1.4 cm;

– tumor of the upper and middle segments of the right kidney 12.6 × 7.6 × 10.8 cm with germination of the pelvis, kidney collar, right adrenal gland, tumor thrombus in the right renal vein up to 7.2 cm with spread in the IVC for 5.9 cm; massive extrarenal

component, inseparable from the right lobe of the liver (germination of the S1 segment of the liver for up to 2.5 see).

Laboratory parameters at the time of hospitalization: 1. General blood test: hemoglobin 100 g/l, erythrocytes 3.1 × 10^{12}/l, color index 0.89, hematocrit 31 %; 2. General urine analysis: specific gravity 1016, protein, sugar, acetone-not detected, leukocytes – 3–4 in the field of vision, erythrocytes – 3–4 in the field of vision; 3. Biochemical blood analysis: glucose 7.86 mmol, amylase 48.6 units/L, ASTL 28.6 units / L, ALTL 27.6 units /L, creatinine 95.3 mmol/L, urea 8.59 mmol/L, total protein 59.6 g/l, bilirubin 16.5 mmol/l; 4. Acid-base state: PCO_2 – 47 mm Hg, PO_2 – 79 mm Hg. pH – 7.32, deficiency or excess of bases (BE) – 5 mmol/L, bicarbonate (HCO_3) – 32.1 mmol/L, SO_2 – 90 %, Na^+ – 145.0 mmol/L, K^+ – 3.8 mmol/L, Cl^- – 104.0 mmol/L, Ca^{2+} – 1.08 mmol/L (laboratory signs subcompensated respiratory acidosis).

Electrocardiogram: heart rate (HR) – 112 per minute, sinus tachysystole, decreased recovery processes in the myocardium of the posterior parts of the left ventricle.

Consultation of a pulmonologist: community-acquired left-sided polysegmental pneumonia; respiratory insufficiency of the 2nd degree, there is no data for infectious pathology of the lower respiratory tract. Therapist consultation: myocardiodystrophy, arterial hypertension stage 3, risk 2, chronic heart failure stage II, functional class 2, risk IV.

Comparison of ultrasound and computed tomography data made it possible to accurately determine the topography of tumor formation and thrombus. Thus, the cranial border of the thrombus was located in the retrohepatic section of the IVC (gradeIII thrombosis), and the extrarenal component of the tumor had signs of germination into the right adrenal gland and partially the liver capsule.

Based on the above, a clinical diagnosis was established: cancer of the right kidney $T_4N_xM_0$ (tumor thrombus IVC, grade III) clinical group 2. Complication: thromboembolism of the left pulmonary artery (tumor genesis), anemia of mixed genesis. Concomitant diagnosis: myocardiodystrophy; stage II chronic heart failure, functional class 2, risk IV.

Taking into account the ineffectiveness of conservative methods of treatment of the complicated course of KC, as well as the initial subcompensated violations of the oxygen transport function of the lungs and the risk of fatal complications, a consultation of specialists of anesthesiologists, resuscitators and oncologists determined a plan for surgical treatment of the patient using the BB/ECMO technique in the intra- and early postoperative period. In addition, we have not ruled out the possibility of emergency connection of veno-arterio-venous ECMO (VAV/ECMO) in case of massive PE and total heart failure.

Intraoperative monitoring included: continuous monitoring of the electrocardiogram and hemodynamic parameters, monitoring of neuromuscular conduction and pulse oximetry (SpO_2). The depth of anesthesia was monitored using a bispectral index of brain activity. Data of functional indicators before surgery: blood pressure (BP) – 168/109 mm Hg, heart rate – 110 per minute, respiratory rate (BH) – 22 per minute. Initial indicators of blood gas composition: partial oxygen tension of arterial blood (pO_2) – 89 mm Hg; partial voltage of arterial carbon dioxide (pCO_2) – 46 mm Hg; pH – 7.32; BE – 3.4; HCO_3 – 24.0 mmol/l, $SatO_2$ – 89 %. These indicators demonstrate a subcompensated state of the patient's blood gas transport function. Anesthetic provision corresponded to the generally accepted principles of multicomponent anesthesia: introductory anesthesia – induction: propofol (3 mg/kg), rocuronium bromide (1 mg/kg), fentanyl (4 mcg/kg).; maintenance of anesthesia – metered administration of propofol (3–4 mg/kg), anesthesia – fentanyl 100–150 mcg/kg/min. After tracheal intubation, the patient was transferred to artificial lung ventilation in volume control mode (Drager Infinity C 700, Germany). Infusion therapy was carried out according to the standard procedure with the dosed administration of a balanced crystalloid solution (4.5 ml/kg*h).

Before the operation, the right femoral vein (draining cannula 21 Fr) and the right internal jugular vein (return cannula 19 Fr) were punctured and catheterized under ultrasound navigation, and the left femoral artery was cannulated for emergency connection of the VAV/ECMO. Then, the VAV/ECMO procedure was started by the Cardiohelp device (Maquet, USA) with the specified parameters: pump capacity (PC) 3200, oxygenated blood volume (V) – 3.4 l/min, oxygen flow (Flow O_2) 4.5 l/min, while the intake pressure (Rven) – 67 mm Hg. art., ΔP (pressure difference before and after the oxygenator) 22 mm Hg, SvO_2 – 60 %. Anticoagulation with heparin 350 U/h was carried out under the control of active blood clotting time (ABC), activated partial thromboplastin time (APTT), prothrombin time (Automatic clotting timer – "ACT Plus", USA).

The indicators of the coagulation system in dynamics made it possible to rationally dose the level of heparin in the patient's blood when using the procedure for organ protection. Optimal heparinization was displayed on the automatic timer graph taking into account time intervals and indicating the required amount of protamine sulfate to neutralize heparin. Constant monitoring of blood clotting indicators significantly reduces complications of a hemorrhagic nature and, accordingly, minimizes the number of repeated surgical interventions for developed bleeding. Ventilation parameters after the start of the BB/ECMO were changed compared to the stage before the start of the oxygenation procedure. Ventilation mode: respiratory volume 4.5–5.0 ml/kg, the level of constant positive pressure in the respiratory tract 8–10 cm H_2O, fractional oxygen content in the inhaled mixture 60 % [12]. The assessment and correction of the functional state of the patient was carried out taking into account the data of her oxygen status (pO_2, pCO_2, $SatO_2$) and the dynamics of indicators of the acid-base state (ABS) of arterial blood.

After organoprotective preparation, the patient underwent a combined operation in the volume: median laparotomy, radical nephradenalectomy on the right with liver resection, cavatrombectomy. Surgical intervention was performed taking into account the prevalence of the malignant process and the anatomical topography of the tumor thrombus. A feature of the combined operation was a phased vascular mobilization: before the removal of the thrombus, tourniquets were placed on the hepatoduodenal ligament, contralateral renal vein, on the IVC at the level of the lower border of the thrombus and above the tip of the thrombus; after cavatomy and removal of the tumor thrombus from the IVC, the walls of the vein were revised and the cavatomic wound was sutured. The vascular stage of the operation was 1 hour and 25 minutes. To prevent post-hemorrhagic syndrome and in connection with intraoperative blood loss at the stage of thrombus removal and liver resection, a Cell-Saver type device (Haemonetics, USA) was used. This blood-saving tactic contributed to the effective correction of hypovolemia while maintaining a balanced oxygen-transport function of the blood. The volume of reinfusion was 900 ml, which made it possible to dispense with additional blood transfusion in the intraoperative period.

At the stage of removal of a tumor thrombus, the patient had a decrease in blood pressure to 68/52 mm Hg with an episode of compensatory tachysystole – heart rate 124 per minute. Emergency connection of vasopressive therapy (dosed administration of dobutamine – 3 mcg/kg/min) allowed to normalize hemodynamic parameters in a short time. Prior to the completion of the operation, the average blood pressure was maintained at the level of 65–75 mm Hg. No other serious cardio-respiratory disorders were recorded before the end of the operation. The study of the gas state of arterial blood at the stage of cavatomy and thrombus removal had no obvious negative dynamics: pCO_2 – 43 mm Hg, pO_2 – 110 mm Hg, pH – 7.41, BE – 7.1 mmol/l, HCO_3 – 31.2 mmol/l, $SatO_2$ – 96 %. The total time of anesthesia was 4 hours and 50 minutes.

After the operation, the patient, in the conditions of drug sedation, continued BB / ECMO with the same parameters. Against the background of compensated respiratory and hemodynamic parameters, an hour after the completion of the operation, cardiac arrhythmias were registered in the patient in the form of episodes of polyphocus atrial tachycardia, which were stopped within 30 minutes by the introduction of beta-blockers. These symptoms did not exclude myocardial ischemia, thromboembolism, impaired perfusion-transport function of blood, electrolyte disorders, etc. After additional diagnostic studies, life-threatening pathological conditions were excluded, the ECMO procedure was continued for another 12 hours. The parameters of BB/ECMO in the first hour in the intensive care unit were: RPM 2655 rpm, V – 3.2 l/min, Flow O_2 – 3 l/min. To complete the procedure, the centrifuge pump speed was gradually reduced by 10–15 % by analyzing respiratory status data and indicators of the coagulation and anticoagulation systems (D-dimer, APTT, fibrinogen, activated coagulation time, antithrombin activity). During thromboelastometry (Rotem, Germany), no serious deviations from the norm were recorded. Hemodynamics with a tendency to hypotension persisted. The extended artificial ventilator (Hamilton G5, Switzerland) had a pneumoprotective purpose and was aimed at adequate maintenance of gas exchange, which was ensured by conducting auxiliary ventilation in pressure support mode with a low respiratory volume of 3.5 ml/kg. Respiratory deficiency was not recorded, which was confirmed by the data of the gas composition of arterial blood. The level of sedation, from 0 to 2 on the Richmond Agitation-Sedation Scale (RASS), which corresponded to light sedation,

was maintained by dosed administration of a highly selective agonist of α2-adrenergic receptors – dexmedetomidine 0.6 mcg/kg/h. Muscle relaxants were not used. With stable gas exchange rates, 4 hours after the completion of the operation, the patient was transferred to an auxiliary (spont) ventilation mode with parameters: FiO_2 – 43 %, PEEP – 9 cm H_2O, PS – 15 cm H_2O, f – 16–26 in min., Vt – 480–540 ml.

Objective data: consciousness (outside sedation) is clear, according to the Glasgow scale of 15 points; the tongue is moist; the abdomen is soft, symmetrical, moderately painful, with palpation in the area of the postoperative wound, sluggish peristalsis is heard, there is no stool; adequate diuresis, corresponds to parenteral fluid administration. Under the control of gas exchange indicators, the degree of respiratory support gradually decreased. The patient is extubated. Auscultation: vesicular respiration in the lungs, weakened in the lower parts, more on the left, moist, wired wheezing, decreasing after coughing; the heart tones are rhythmic, muted. During the next day of the patient's stay in the intensive care unit, no significant complications from organs and systems were recorded. The total duration of the BB/ECMO was 30 hours. According to the data of an automatic timer with extended blood clotting indicators (APTT, fibrinogen, activated clotting time, antithrombin activity), we were guided in choosing the optimal amount of protamine sulfate to neutralize heparin. After the procedure was completed, the patient was prescribed the introduction of unfractionated heparin in a standard dosage.

An hour after the end of ECMO, the patient's functional parameters corresponded to the norm: pCO_2 – 40 mm Hg, pO_2 – 118 mm Hg, pH – 7.40, BE – 5.4 mmol/L, HCO_3 – 26.2 mmol/L, $SatO_2$ – 96 %, BP – 114/52 mm Hg, according to cardiac monitoring – sinus rhythm, heart rate 89 per minute, pulse at the periphery of satisfactory tension and filling, pulse deficit was 10 %.

The planned treatment corresponded to generally accepted norms and standards. On the 4th day of the postoperative period, the patient was transferred to the specialized department in a satisfactory condition to continue treatment. The final severity of surgical complications according to the Clavien–Dindo classification corresponded to the second degree (anemia, increased blood creatinine levels, an episode of cardiac arrhythmia). Patient D., on the 17th day, was discharged for planned restorative treatment and, later, was registered at the dispensary at the place of residence. During the next examination of the patient in the consultative and diagnostic department of the "NMRC for Oncology" in 2021, no signs of disease progression were revealed.

DISCUSSION

A characteristic feature of KC is the spread of the tumor into the lumen of the venous vessels. So, after damage to the intra-organ network, the tumor grows into the lumen of the renal vein, and then into the lumen of the IVC. A common neoplastic process, in rare cases, reaches the cavity of the right atrium with prolapse into it. In fact, vascular invasion worsens the survival of patients with KC, however, radical surgery with thrombectomy gives a chance for recovery [2].

The risk of an unfavorable outcome (development of complications and sudden death) in the intra- and postoperative period depends on the initial somatic status of the patient, concomitant organ dysfunction, as well as the features of the combined operation. Successful nephrectomy with thrombectomy in patients with KCis possible only in conditions of coordinated work of anesthesiological and surgical teams of specialists. The technical specifics of the operation consists in observing certain principles: circular mobilization of IVC s above and below the thrombus, ligation of collaterals, as well as compression of the hepatoduodenal ligament and contralateral renal vein, removal of the thrombus and reconstruction of the IVC s with preservation of the venous bed [4].

The task of the anesthesiologist is to ensure that the operation is performed with the maximum possible compensation for the functional state of the patient, including gas exchange. During the stage of kidney mobilization and IVCs, there is a risk of thrombus fragmentation with the development of a massive pulmonary embolism and sudden death during surgery. Undoubtedly, the use of cardiopulmonary bypass during surgery reduces the likelihood of thromboembolic complications. However, the facts accumulated to date indicate a number of complications of a hemorrhagic nature and technical difficulties of carrying out this bypass technique [4]. The development of new technologies and optimization of devices used in artificial blood circulation undoubtedly contributes to improving the immediate results of treatment of patients, including those with oncological pathology. The initial disturbances of the oxygen transport function of the lungs and the high risk of

massive intraoperative thromboembolic complications with the development of a fatal outcome were the basis for the use of the ECMO procedure. The ECMO technique consists in partially or completely providing the systemic blood flow with adequate blood oxygenation and carbon dioxide elimination using a centrifuge pump [8].

The presented clinical case demonstrates the effective use of modern technologies in the radical treatment of KC complicated by thromboembolism of medium and small branches of the pulmonary artery. The main goal facing the anesthesiological team during the combined operation was to prevent the development of critical hypoxemia and hypercapnia, life-threatening cardiac complications with the control of the dynamics of the coagulation and anticoagulation systems, as well as the prevention of pain syndrome and acute renal failure.

CONCLUSION

The use of new medical technologies in anesthesiology and resuscitation gives a chance to cure cancer patients with decompensated organ and functional capabilities. Thus, the effective use of extracorporeal membrane oxygenation made it possible to minimize the risk of fatal complications when performing nephrectomy with thrombectomy for malignant neoplasm of the kidney in a patient with PE and initial disorders of oxygen transport function of the lungs.

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