

FEATURES OF PERIOPERATIVE COMPLICATIONS OF SURGICAL TREATMENT OF PATIENTS WITH INTRAVENOUS SPREAD OF RENAL CELL CARCINOMA

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Difficult situations in the surgery of tumor thrombi of the inferior vena cava are very common, since this surgical intervention is characterized by significant technical problems and severe perioperative complications. The most dangerous of them include massive bleeding, acute heart failure and pulmonary embolism with tumor masses, heart and kidney failure. It is these problems that are most often the causes of perioperative mortality. It is believed that many factors influence the complication rate.

In our study, which included 124 patients (53 of them with III (n=27) and IV (n=26) levels of intraluminal tumors), intra- and postoperative mortality was 2.4% and 4.0%, respectively. Mortality was recorded only in patients with retro hepatic or supradiaphragmatic thrombi. Among our patients, the most common complications were renal failure, heart failure, and IVC blood thrombosis, with a severe complication rate of up to 25%. Radical nephrectomy with vena cava thrombectomy is a complex surgical intervention, which is accompanied by a high level of intra- and postoperative complications. The frequency of complications significantly depends on the level of spread of the intracaval tumor. This surgical operation requires the modernization of the surgical technique for the removal of retro hepatic and supradiaphragmatic thrombi. The improvement of methods for assessing its complexity and predicting severe complications is also needed.

Key words: renal cell carcinoma, tumor thrombus, surgical complications.

Connection of the publication with planned research works.

The work was carried out in accordance with the research work of the Department of Surgery of Kharkiv National Medical University on the topic "Improvement and development of methods of diagnosis and surgical treatment of diseases and injuries of the abdominal cavity and thorax, vessels of the upper and lower extremities using minimally invasive techniques in patients with a high risk of developing postoperative complications", state registration number 0119U004991.

Introduction.

Intravenous tumor thrombi in kidneys are a serious surgical problem, as they spread into the lumen of the inferior vena cava (IVC) in 4-10% of cases, and in 1% of cases reach the level of the right atrium [1]. Their removal is accompanied by a high level of intra- and postoperative complications, as well as a high rate of perioperative mortality. The complexity of performing vena cava thrombectomy and the level of complications significantly depend on the speed of spreading intraluminal tumor, since retro hepatic and supradiaphragmatic thrombi require using many additional surgical techniques, which can be accompanied by many specific complications [2].

One of the most common complications occurring during the removal of tumor thrombi from the inferior vena cava lumen is massive bleeding. Total blood loss during surgery, including vena cava thrombectomy, is determined by many factors and is mainly the result of bleeding from damaged collateral vessels during the removal of the kidney and inferior vena cava, from the IVC lumen after thrombus removal, as well as from the vena cava, hepatic veins and parenchyma liver during their intraoperative injury [3].

The main causes of perioperative mortality, along with acute blood loss, are pulmonary embolism with tumor masses during fragmentation of a neoplastic

thrombus, multiple organ failure associated with massive bleeding, and significant surgical trauma [4].

The radical nephrectomy with vena cava thrombectomy is also believed to have a high rate of severe postoperative complications (10-50%), including arrhythmia, heart failure, renal failure with the need for hemodialysis, IVC blood thrombosis [5].

The aim of the study.

To analyse the rate of significant perioperative complications of vena cava thrombectomy in 124 patients who were operated on in one clinical centre over the past 10 years.

Object and research methods.

Characteristics of patients. The studied sample included 78 (62.9%) men and 46 (37.1%) women. The age of the patients varied from 17 to 76 years and averaged 58.4 ± 10.5 years. According to the ECOG scale, patients were distributed as follows: 0-61 (49.2%), 1-50 (40.3%) and 2-13 (10.5%). The average values of their body mass index (BMI) reached 26.2 ± 4.2 kg/m², which indicated that the majority of patients had excessive weight. The glomerular filtration rate (GFR) averaged 62.6 ± 5.8 ml/min/1.73 m². A moderate decrease in GFR (30-59 ml/min/1.73 m²) occurred in 55 (44.4%) cases, while a pronounced decrease in GFR (15-29 ml/min/1.73 m²) was noted only in 4 (3.2%) patients. Clinical manifestations of IVC blockade occurred in 45 (36.3%) patients. Moderate ascites was found in 7 (5.6%) cases. Budd-Chiari syndrome was recorded in 3 (2.4%) patients.

All patients gave informed consent for the necessary research methods.

Characteristics of the main tumors. The histological structure of the tumors in 120 (96.8%) cases was represented by renal cell carcinoma. In 4 (3.2%) cases, the following neoplasms were recorded: the kidney angiosarcoma – 2, transitional cell carcinoma of the kidney – 1, metastases of embryonic testicular cancer in the retroperitoneal lymph nodes – 1. Among all 124

patients, right-sided tumors were found in 82 (66.1%) cases, while left-sided tumors were observed in 42 (33.9%) cases. The average size of the main neoplasms was 9.8 ± 4.4 cm.

Characteristics of tumor thrombi. A modified classification of tumor thrombi from the Mayo Clinic (level IV was subdivided into IV a – supradiaphragmatic non-atrial and IV b – atrial thrombi) was used in the study. The thrombi distribution according to their level is presented in **table 1**.

Table 1 – Thrombi distribution according to their levels

Levels of thrombi	I	II	III	IV		Total
				IV a	IV b	
n	35	36	27	13	13	124
%	28.2	29.0	21.8	10.5	10.5	100

The average length of the intraluminal part of the tumor was 6.2 ± 4.5 cm, and the width was 2.5 ± 1.3 cm. The thrombi length varied from 0.7 to 16.5 cm, and the width – from 0.2 to 6 cm. The dimensions of the atrial part of the tumor thrombus averaged 2.2 ± 1.3 cm. The length of the atrial tumor masses did not exceed 1.5 cm in 6 (46.2%) of 13 patients. 2 (15.4%) patients had the atrial tumor masses in the range from 1.5 cm to 3 cm. The dimensions of the intra-atrial part of the tumor exceeded 3 cm in 5 (38.4%) cases and reached 5 cm in one patient.

In 88 (71.0%) cases, intraluminal caval tumors were assessed as solid, in 20 (16.1%) patients it was fragile or tender. In 16 (12.9%) patients, the thrombus consistency was not homogeneous, as it included areas of dense and tender consistency. Invasion of an intraluminal tumor into the IVC wall of various lengths was recorded in 46 (37.1%) patients. In 23 (18.5%) patients, tumor thrombi had signs of retrograde spread. Blood thrombosis of the sub renal inferior vena cava of various length below the tumor thrombus was detected in 28 (22.6%) patients.

Methods of surgical treatment. Radical or cytoreductive nephrectomy with vena cava thrombectomy was performed in 116 (93.6%) cases. Kidney resection with removal of the IVC tumor thrombus was performed only in 2 (1.6%) patients (1 – RCC, 1 – AML). Removal of local recurrence after nephrectomy was performed in 3 (2.4%) patients. In 2 (1.6%) cases of RCC caval spread from metachronous metastases to the adrenal gland, thrombectomy was combined with adrenalectomy. One (0.8%) patient with lymphatic retroperitoneal metastases of embryonic testicular cancer underwent extended lymphadenectomy in combination with vena cava thrombectomy.

Chevron surgical technique was used in 123 (99.2%) cases. In one patient (0.8%) with renal angiomyolipoma which spread to the IVC supra diaphragmatic area, kidney resection with vena cava thrombectomy was performed from the thoracolumbotomy access in the 10th intercostal space. All operations were performed without using extracorporeal circulation and systemic hypothermia.

After mobilization of the colon hepatic angle and the duodenum mobilization according to Kocher, the inferior vena cava was isolated in the area of the subhepatic, cava renal, and sub renal segments, as well as the contralateral renal vein. In some patients, further control of

the renal artery was started. In right-sided tumors, the artery was ligated in the inter-aorto-caval area or in the renal sinus area. If it was impossible to isolate the right renal artery, the technique of its control after thrombectomy described by D.V. Shchukin et al. [6] was used. The same technique was applied for all left-sided tumors. Preoperative mobilization of the renal artery was not used in any of the cases. In patients with a cava renal segment thrombus, the caval part of the tumor was palpated with its displacement into the renal vein and application of vascular clamp to the distal end of the thrombus. In situations where the intraluminal tumor was located in the subhepatic IVC, the classical technique of three tourniquets was used by putting clamps on the vena cava above and below the thrombus, and on the contralateral renal vein. With a higher spread of the tumor, the technique of four tourniquets was applied by clamping of the hepatoduodenal ligament with a Satinsky clamp (Pringle maneuver). In 45 (36.3%) patients with retro hepatic and supradiaphragmatic levels of tumor thrombosis, classical liver mobilization was performed with the intersection of the triangular, coronary and falciform ligaments. In 8 (6.5%) cases, classical mobilization was combined with piggyback mobilization of the liver, which included transection of all veins draining into the IVC, except for the main hepatic veins.

To control the supradiaphragmatic IVC and the right atrium, both extra pericardial and trans pericardial approaches were used, which included 4 types of surgical approaches through the diaphragm from the abdominal cavity according to Zhernovoi I. et al. [7].

In all cases, after surgical access to the supradiaphragmatic area, a tourniquet was placed around the cava-atrial junction and the right atrium was palpated to determine the localization of the tumor thrombus apex. Next, a “milking maneuver” (displacing thrombus with fingers below the diaphragm or the mouths of the main hepatic veins) was performed and a vascular clamp was applied above the top of the thrombus. The next step was longitudinal cavotomy with the evacuation of intraluminal tumor masses from the IVC lumen. If the remains of a thrombus were found on the endothelium, curettage of this zone was carried out. In case of suspicion of tumor invasion into the vessel wall, lateral or segmental resection of the IVC was performed.

Extra pericardial approaches to the supradiaphragmatic IVC or right atrium were applied to 29 (23.4%) patients, while trans pericardial approaches were used in 5 (4.0%) patients. Lateral resection of the IVC at the suprarenal level was necessary in 42 (33.9%) cases. In situations of blood thrombosis of the IVC below the tumor thrombus (n=28), either thrombi removal using a Fogarty catheter (n=13/46.4%) or ligation of the IVC in the sub renal area (n=15/53.6%) was carried out.

Organ-sparing surgery with vena cava thrombectomy was performed in two (1.6%) patients. One of them had a renal angiomyolipoma with spread to the supradiaphragmatic part of the IVC, the second had a renal cell carcinoma of a single kidney with a thrombus in the cava renal segment of the IVC. In the first case, the standard tumor enucleoresection was used under conditions of thermal ischemia with opening of the main renal vein lumen and simple evacuation of a freely floating thin thrombus without control of its distal end. In the second case, extracorporeal enucleoresection of the

kidney was used with its subsequent autotransplantation.

Surgical complications were subdivided into intraoperative, early (up to 30 days after surgery) and late postoperative (from 30 days to a year after surgery). Early postoperative complications were assessed using the Clavien-Dindo scale. The volume of intraoperative blood loss was determined by the sum of the volume of the suction contents and the difference in the weight of the blood-soaked and dry gauze material. In this case, 1 g was considered equal to 1 ml of blood.

The statistical processing of the results was carried out using the software «Statistica 5.5, 6.0», Excel 97, 2000 in Windows. The average values of each indicator, the average arithmetic mean error, and confidence intervals were calculated. All samples were assessed for compliance with the normality of the variance distribution, and if this compliance was present in the compared groups, Student's t-test was used.

Research results and their discussion.

Intraoperative blood loss. The average volume of blood loss in our study was 2132.3±1615.9 ml (varied from 300 ml to 7800 ml). Bleeding with a volume of more than 3 liters occurred in 29 (23.4%) patients, while blood loss of more than 5 liters was observed in 10 (8.1%) patients. The characteristics of these indicators according to the levels of tumor thrombus spread are shown in **table 2**.

The volume of blood loss was significantly higher in level III and IV thrombi compared with thrombi in the cava renal and subhepatic segments of the IVC ($p<0.05$), but did not differ when comparing supradiaphragmatic non-atrial and atrial thrombi ($p>0.1$). This trend was also noted in the analysis of cases with massive blood loss (more than 3 liters and more than 5 liters).

When assessing the main sources of blood loss in 124 patients, the following results were obtained:

Table 2 – Characteristics of hemorrhagic complications in 124 patients

	Level I (n=35)	Level II (n=36)	Level III (n=27)	Level IV (n=26)		Total (n=124)
				IV a (n=13)	IV b (n=13)	
Average blood loss, ml	908.6±539.8	1852.8±1122.4*	2514.8±1296.1*#	3615.4±1896*#	3923±2111.5*#α	2132.3±1615.9
Bleeding ≥ 3 l	0	4 (11.1%)	7 (25.9%) *	9 (69.2%) *#α	8 (61.5%) *#α	29 (23.4%)
Bleeding ≥ 5 l	0	1 (2.8%)	2 (7.4%)	3 (23.1%) *#	4 (30.8%) *#	10 (8.1%)

Notes: * is $p<0.05$ when compared with level I; # is $p<0.05$ when compared with level II; α is $p<0.05$ when compared with level III; β is $p<0.05$ when compared with level IVa

1) damage to the massive venous collaterals of the retroperitoneal space during ligation of the renal artery, during the isolation of the inferior vena cava or kidney, was the main cause of bleeding in 56 (45.2%) patients;

2) damage to the inferior vena cava, lumbar, hepatic or diaphragmatic veins caused blood loss in 16 (12.9%) cases;

3) bleeding from the lumen of an IVC isolated segment during thrombus evacuation – in 92 (74.2%) patients;

4) a combination of several sources of bleeding – in 102 (82.3%) cases.

Perioperative mortality. Perioperative mortality was observed in 8 (6.5%) of 124 patients (3 (2.4%) of them were intraoperative, 5 (4.1%) cases were postoperative). Characteristics of deceased patients are presented in **table 3**. The male to female ratio in this population was 5:3. The average age of deceased patients was 59.1±7.1 (from 45 to 68) years. The status on the ECOG scale in 4 cases was assessed as 1, in other 4 patients it was 2, and the average body mass index corresponded to overweight (25.9±4.6 kg/m²). GFR did not exceed an average of 43.6±5.4 ml/min. Heart failure was noted in all 8 patients (NYHA II – 5, NYHA III – 3 patients), and the average LVEF was 42±3.8%.

The size of renal tumors varied from 3.0 to 17.0 cm (mean 9.6±4.6 cm). In 5 (62.5%) cases, tumor thrombi spread above the diaphragm (level IV a – 2, level IV b – 3), in 3 (37.5%) cases they penetrated into the IVC to its retro hepatic segment (level III). Signs of retrograde

Table 3 – Characteristics of Deceased Patients

Patients/parameters	1	2	3	4	5	6	7	8
Sex	female	male	female	female	male	male	male	male
Age, years	45	62	68	55	56	60	64	63
BMI, kg/m ²	18.4	25.8	28	28.6	19.4	26.8	31.4	28.8
ECOG	2	2	1	2	2	1	1	1
LVEF, %	40	48	40	38	40	42	42	46
Heart failure (NYHA)	III	II	II	II	III	II	III	II
GFR, ml/min	38.6	42.8	44.5	42.6	34.6	46.4	46.6	52.6
Side of tumor location	left	right	left	right	left	left	left	left
Tumor size, cm	17.0	6.0	10.0	3.0	6.0	9.0	14.0	12.0
Thrombus level	IV b	IV b	IV b	IV a	IV a	III	III	III
Retrograde thrombus spread	–	+	–	+	–	–	+	+
Blood clot below the tumor	–	–	–	+	–	+	–	–
Invasion of the IVC wall	+	+	+	+	+	–	–	–
Volume of blood loss, ml	7000	3500	6400	1200	5600	1800	6200	3800
Intraoperative death	–	+	+	+	–	–	–	–
Postoperative death, days	7	–	–	–	1	9	5	6
Cause of death is bleeding	–	–	+	–	+	–	–	–
Cause of lethality is AHF	+	+	–	–	–	–	+	+
Cause of mortality is tumor embolism	–	–	–	+	–	–	–	–
Cause of mortality is acute renal failure and cerebral edema	–	–	–	–	–	+	–	–

Table 4 – Distribution of the surgery duration in accordance with the levels of tumor thrombi

Thrombus spread rate, n=124	Average duration of surgery, min
Level I, n=35	161.4±32.6
Level II, n=36	183.6±30.5*
Level III, n=27	198.5±32.8*
Level IV a, n=13	227.7±57.6*#α
Level IV b, n=13	243.8±43.1*#α

Notes: * is p <0.05 when compared with level I; # is p <0.05 when compared with level II; α is p <0.05 when compared with level III; β is p <0.05 when compared with level IV a

spread of the intraluminal tumor were present in 50% of cases, and blood thrombosis of the IVC below the tumor thrombus was noted in 2 (25%) cases. The invasion of an intraluminal tumor into the wall of the IVC was recorded in 5 (62.5%) of 8 patients.

The volume of intraoperative blood loss among the deceased patients ranged from 1200 to 7000 ml (mean 4437.5±2190.8 ml). The causes of death in 3 cases of intraoperative mortality were the following: 3500 ml bleeding (n=1), acute heart failure (n=1) and pulmonary embolism (n=1). The embolism was recorded in the operating room at the stage of anesthesia. Mortality in the postoperative period was observed on days 1-9 (average 5.6±2.9 days). The cause of death in all 5 cases was acute heart failure in 3 cases, bleeding in one case, and acute renal failure with cerebral edema in one case.

Surgery duration. The duration of operations did not exceed 194.4±44.5 minutes (from 100 to 320 minutes) on average. **Table 4** shows the operation time at different levels of thrombus spread.

The analysis of this parameter presented objective differences between the extent of intraluminal tumor masses and the time of surgery. The duration of surgical interventions was the longest for “high” (level III and IV) thrombi. Differences between intrapericardial and atrial tumor thrombi were not statistically significant.

Postoperative complications. The spectrum of postoperative complications is presented in **table 5**.

Having analyzed the results of treatment of all 124 patients, 63 (50.8%) postoperative complications were recorded. Their frequency depended on the level of thrombus spread only in terms of mortality, IVC blood thrombosis and heart failure. These differences were significant only when comparing level I thrombi with thrombi of other levels. The most frequent complications were renal and heart failure, as well as blood

thrombosis of the inferior vena cava. Severe complications (Clavien-Dindo III-IV-V) were observed in 31 (25%) cases and predominated in patients with retro hepatic and supradiaphragmatic thrombi (**table 6**). However, there were no significant differences in the frequency of this indicator among thrombi of III, IV a, and IV b levels.

Difficult situations in the surgery of tumor thrombi of the inferior vena cava are very common, since this surgical intervention is characterized by significant technical problems and severe perioperative complications. The most dangerous of them include massive bleeding, acute heart failure and pulmonary embolism with tumor masses, heart and kidney failure. It is these problems that are most often the causes of perioperative mortality. It is believed that many factors influence the complication rate. The most important of them are the high level of intraluminal tumor spreading, the experience of the surgeon and the frequency of performing such operations in a medical institution [2]. It is also necessary to take into account the differences in surgical techniques that can be used in patients with the same level of the tumor thrombus spreading.

The analysis of the largest studies on the results of nephrectomy with vena cava thrombectomy demonstrates that the levels of perioperative complications with this intervention vary from 15% to 78%, and perioperative mortality from 3% to 16% [5]. A large Mayo Clinic study of 540 patients provides a detailed account of both complication characteristics and time course. The frequency of intraoperative and early postoperative mortality was 1.3% and 1.9%, respectively. This work objectively indicates a decrease in operational mortality from 3.8% in 1970-1989 to 2.0% in 1990-2000 [4]. This figure changed from 8.1% to 3.8% in patients with thrombi of the inferior vena cava. Undoubtedly, this trend reflects the accumulation of experience and improvement of methods of surgical treatment of this complex pathology. Toren et al., who studied caval thrombi in 816 Canadian patients, reported a 7% in-hospital mortality rate [8]. Notably, 75% of deaths occurred in situations where the surgeon performed the first two thrombectomy. The mortality rate increased to 15% in patients undergoing surgery with using artificial circulation.

Freifeld Y. et al. from the United States conducted the largest study based on data from the National Cancer Data Base, which included 2664 patients with caval thrombi [9]. The perioperative 30- and 90-day mortal-

Table 5 – Spectrum of postoperative complications

	Level I n=35	Level II n=36	Level III n=27	Level IV a n=13	Level IV b n=13	Total n=124
Postoperative mortality	0	0	3 (11.1%) *#	1 (7.7%)	1 (7.7%)	5 (4.0%)
IVC blood thrombosis	0	5 (13.9%)*	3 (11.1%) *	4 (30.8%) *	1 (7.7%)	13 (10.5%)
Surgery for blood thrombosis	0	1 (2.8%)	0	0	0	1 (0.8%)
Oligoanuria	1 (2.9%)	6 (13.9%)	4 (14.8%)	5 (38.5%)	1 (7.7%)	17 (13.7%)
The need for hemodialysis	0	2 (2.8%)	1 (3.7%)	2 (7.7%)	1 (7.7%)	6 (4.8%)
Bleeding	0	0	1 (3.7%)	0	1 (7.7%)	2 (1.6%)
Bleeding requiring surgery	0	0	1 (3.7%)	0	0	1 (0.8%)
Intestinal obstruction requiring surgery	0	0	1 (3.7%)	0	0	1 (0.8%)
Pulmonary embolism	0	1 (2.8%)	0	1 (7.7%)	1 (7.7%)	3 (2.4%)
Heart failure	1 (2.9%)	3 (8.3%) *	3 (11.1%)	4 (30.8%) *	3 (23.1%) *	14 (11.3%)
Total	2 (5.7%)	18 (50%)	17 (63%)	17	9 (69.2%)	63 (50.8%)

Notes: * is p <0.05 when compared with level I; # is p <0.05 when compared with level II; α is p <0.05 when compared with level III; β is p <0.05 when compared with level IV a.

ity rate after nephrectomy with thrombectomy in this study was 3.3% and 6.6%, respectively. 90-day mortality in patients with T3c tumors did not exceed 8.8%. They concluded that for patients with stage T3c tumors, who require the highest degree of surgical skill, in institutions with a large volume of operations, there are advantages not only in overall survival, but also in reducing short-term mortality.

The international consortium (International Renal Cell Carcinoma-Venous Thrombus Consortium (IRCC-VTC)) demonstrated a clear correlation between thrombus levels according to the Mayo Clinic classification and perioperative mortality [10].

In our study, which included 124 patients (53 of them with III (n=27) and IV (n=26) levels of intraluminal tumors), intra- and postoperative mortality was 2.4% and 4.0%, respectively. Mortality was recorded only in patients with retro hepatic or supradiaphragmatic thrombi.

The levels of surgical blood loss in most studies, which studied the results of vena cava thrombectomy, averaged 2-2.5 liters [4, 11-13]. The duration of the operation is a highly variable parameter and differs significantly in different clinics. At the same time, there is a clear correlation between these parameters and the levels of caval tumor spread. This trend was also demonstrated in our study.

The negative impact of the level of IVC tumor thrombosis on the incidence of postoperative complications has been confirmed by many studies, including this work [4, 12, 13, 14]. Among our patients, the most common complications were renal failure, heart failure, and

Table 6 – Distribution of severe and mild complications according to the level of thrombus spreading

	Level I n=35	Level II n=36	Level III n=27	Level IVa n=13	Level IVb n=13	Total n=124
Complications (Clavien-Dindo I-II)	1 (2.9%)	12 (33.3%) *	7 (25.9%) *	9 (69.2%) *#α	3 (23.1%) *β	32 (25.8%)
Severe complications (Clavien-Dindo ≥ III)	1 (2.9%)	6 (16.7%)	10 (37.0%) *	8 (61.5%) *#	6 (46.2%) *#	31 (25.0%)

Notes: * is p<0.05 when compared with level I; # is p<0.05 when compared with level II; α is p<0.05 when compared with level III; β is p<0.05 when compared with level IVa/.

IVC blood thrombosis, with a severe complication rate of up to 25%.

Conclusions.

Radical nephrectomy with vena cava thrombectomy is a complex surgical intervention, which is accompanied by a high level of intra- and postoperative complications. The frequency of complications significantly depends on the level of spread of the intra-caval tumor. This surgical operation requires the modernization of the surgical technique for the removal of retro hepatic and supradiaphragmatic thrombi. The improvement of methods for assessing its complexity and predicting severe complications is also needed.

Prospects for further research.

In the future, it is planned to study the parameters of intravenous tumour thrombi that affect the complexity of nephrectomy with thrombectomy.

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ХАРАКТЕРИСТИКА ПЕРІОПЕРАЦІЙНИХ УСКОДНЕНЬ ХІРУРГІЧНОГО ЛІКУВАННЯ ПАЦІЄНТІВ ІЗ ВНУТРІШНЬОВЕННИМ ПОШИРЕННЯМ НИРКОВО-КЛІТИННОГО РАКУ

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Резюме. Вступ. Видалення пухлин нирок з неопластичними тромбами нижньої порожнистої вени належить до операцій високої складності, тому що часто супроводжується значними технічними проблемами і важкими періопераційними ускладненнями.

Мета роботи – аналіз рівня значних періопераційних ускладнень венакватромбектомії у 124 пацієнтів, оперованих в одному клінічному центрі протягом останніх 10 років.

Об'єкт і методи дослідження. У дослідження було включено 78 (62,9%) чоловіків і 46 (37,1%) жінок. Вік хворих варіював від 17 до 76 років і в середньому становив 58,4±10,5 років. Правобічні пухлини мали місце у

82 (66,1%) випадках, лівобічні – у 42 (33,9%). Середні розміри основних новоутворень становили $9,8 \pm 4,4$ см. Кавальні тромби мали I, II, III і IV рівні відповідно в 35 (28,2%), 36 (29%), 27 (21,8%) і 26 (21%) спостереженнях. Усі операції проводили без використання штучного кровообігу.

Результати. Серйозні інтраопераційні ускладнення при виконанні венакаватромбектомії мали місце в 21% випадків з рівнем інтраопераційної летальності 2,4%. Частота інтраопераційних ускладнень була значно вищою серед пухлинних тромбів III і IV рівнів. Середній об'єм крововтрати становив $2132,3 \pm 1615,9$ мл, при цьому частота масивних кровотеч (понад 5000 мл) не перевищувала 8,1%. Середня тривалість операції досягла $194,4 \pm 44,5$ хвилини. Післяопераційні ускладнення були зафіксовані в 50,8% спостережень. Їхня частота залежала від рівня поширення тромбу. Важкі ускладнення (Clavien-Dindo III-V) спостерігалися у 25% випадків і переважали у хворих із ретропечінковими і супрадіафрагмальними тромбами. Рівень післяопераційної летальності становив 4,0%.

Висновки. Частота ускладнень венакаватромбектомії значно залежить від рівня поширення внутрішньокавальної пухлини. Дана хірургічна операція потребує модернізації хірургічної техніки видалення ретропечінкових і супрадіафрагмальних тромбів, а також потребує вдосконалення методик оцінки його складності та прогнозування тяжких ускладнень.

Ключові слова: нирково-клітинний рак, пухлинний тромб, хірургічні ускладнення.

FEATURES OF PERIOPERATIVE COMPLICATIONS OF SURGICAL TREATMENT OF PATIENTS WITH INTRAVENOUS SPREAD OF RENAL CELL CARCINOMA

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Abstract. *Introduction.* Removal of renal tumors with neoplastic thrombi of the inferior vena cava refers to operations of high complexity as it is often accompanied by great technical problems and severe perioperative complications. The study presents the analysis of the rate of significant perioperative complications of vena cava thrombectomy in 124 patients operated on in the same clinical center during the last 10 years.

Object and research methods. The study included 78 (62.9%) men and 46 (37.1%) women. The age of the patients varied from 17 to 76 years and averaged 58.4 ± 10.5 years. Right-sided tumors occurred in 82 (66.1%) cases, and left-sided tumors were recorded in 42 (33.9%) patients. The mean size of the renal neoplasms was 9.8 ± 4.4 cm. Caval thrombi had levels I, II, III, and IV in 35 (28.2%), 36 (29%), 27 (21.8%), and 26 (21%) cases, respectively. All surgeries were performed without using artificial circulation.

Results. Severe intraoperative complications during vena cava thrombectomy occurred in 21% of cases with the intraoperative mortality rate of 2.4%. The frequency of intraoperative complications was significantly higher among tumor thrombi of III and IV levels. The average volume of blood loss was 2132.3 ± 1615.9 ml with the incidence of massive bleeding (over 5000 ml) not exceeding 8.1%. The average duration of surgery was 194.4 ± 44.5 minutes. Postoperative complications were recorded in 50.8% of cases. Their frequency depended on the level of thrombus spreading. Severe complications (Clavien-Dindo III-V) were observed in 25% of cases and prevailed in patients with retro hepatic and supradiaphragmatic thrombi. Postoperative mortality was 4.0%.

Conclusions. The complication rate of vena cava thrombectomy significantly depends on the level of intra-caval tumor spreading. This surgical operation requires the modernization of the surgical technique for the removal of retro hepatic and supradiaphragmatic thrombi, as well as the improvement of methods for assessing its complexity and predicting severe complications.

Key words: renal cell carcinoma, tumor thrombus, surgical complications.

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