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How to proceed in the case of a tumour thrombus in the inferior vena cava with renal cell carcinoma

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ABSTRACT

Renal cell carcinoma accounts for about 3% of all malignant tumours in humans at adult age. The occurrence of a tumour thrombus in the inferior vena cava was recorded in 4% up to 10% of patients. In the period of 2006–2014 in the Department of Surgery of the Teaching Hospital and Faculty of Medicine in Plzen we operated a total of 12 patients at the age from 44 to 80 for renal cell carcinoma with a tumour thrombus. Our results have proven clearly the benefit of nephrectomy with tumour thrombectomy in patients with renal cell carcinoma growing through the venous system.

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Introduction

Renal cell carcinoma accounts for about 3% of all malignant tumours in humans at adult age. In Europe, the annual incidence is approximately 2% with an increasing occurrence of small localized tumours due to incidental finding in the case of imaging examinations (ultrasound, computed tomography). Up to 60% of patients are asymptomatic. In the case of advanced cancer, typical three symptoms can be found – macrohemituria, lumbago and palpable tumour. Clear cell renal cell carcinoma represents approximately 75% of all renal tumours. Renal cell carcinoma spreads per continuitatem (both to the surrounding tissues and by angioinvasion into the renal vein and the inferior vena cava). The tumour metastasizes primarily hematogenous (lungs, bones, liver), lymphogenous rarely (lumbar nodes). Therefore, CTA (computed tomography angiography), or, where applicable, MRA (magnetic resonance angiography), which, in addition to staging, confirms or excludes the presence of a tumour thrombus, is the most suitable method for the diagnostics. The occurrence of a tumour thrombus in the inferior vena cava (IVC) was recorded in 4% up to 10% of patients.

Group of patients

In the period of 2006–2014 in the Department of Surgery of the Teaching Hospital and Faculty of Medicine in Plzen we operated a total of 12 patients at the age from 44 to 80 for renal cell carcinoma with a tumour thrombus. In 2 cases the tumour thrombus grew into the renal vein. In 10 cases the
tumour thrombus grew into the inferior vena cava, of which in one case supradiaphragmatically up to the level of the right atrium of the heart (Table 1).

The correct diagnostics of the tumour thrombus ingrowth into venous system using CTA was determined in 11 cases and in these cases the surgery was conducted by a vascular surgeon. We always proceed very carefully and we try hard not to fragment the tumour thrombus and to eliminate pulmonary embolism. In 2 cases of tumour ingrowth into the renal vein the surgery was free of complications. In both cases the finding allowed to apply a wall clamp onto the inferior vena cava at the orifice of the renal vein and the execution of safe nephrectomy with direct suture of the inferior vena cava.

In the cases of the tumour thrombus spreading into the inferior vena cava subdiaphragmatically we always primarily apply a clamp above the proximal end of the tumour thrombus and the remaining part of the renal vein. After cavotomy at the orifice of the affected renal vein it is possible in most cases to remove the tumour mass which “floats” in the inferior vena cava and can be removed as a whole. After thrombectomy (even in the case that it is necessary to execute a small excision at the orifice of the renal vein) we finish nephrectomy. In neither case we caused a significant narrowing of the inferior vena cava and had to implant a prosthesis of the inferior vena cava (Figs. 1–6).

We have had only one case of lethal pulmonary embolism with this procedure. The patient was a lady 62 years old with an advanced tumour of the left kidney with the spread of tumour thrombus up to the hepatic veins. The patient also had 2 distant metastases in the lungs. In addition to the tumour thrombus, a blood thrombus was present in the inferior vena cava distally from the renal veins and deep vein thrombosis was proven in the bed of the left lower extremity. Massive pulmonary embolism appeared as early as prior to handling the tumour itself and considering the tumour dissemination no cardiac surgery was indicated.

The case of the tumour thrombus spreading up to the level of the right atrium of the heart concerned a 70 years old lady with an advanced tumour in the right kidney with tumour duplicity in the sigmoid colon accompanied by recurring

<table>
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Figs. 1 and 2 – A CTA image of renal cell carcinoma with a tumour thrombus growing through the left renal vein into the inferior vena cava.
enterorrhagia but without provable cancer metastases. Considering the finding of the calcified head of the tumour thrombus up to the level of the right atrium of the heart, the surgery was planned with the assistance of a cardiac surgeon. (Fig. 7) With the extracorporeal blood circulation there was a risk of bleeding from the large intestine and therefore a heart surgery was prepared but kept stand-by until the intraoperative finding. We released the tumour with the right kidney; the tumour growing through the inferior vena cava was freely movable. We applied a clamp on to the inferior vena cava below the tumour to prevent the tumour thrombus being washed away by the blood flow and we disconnected the orifice of the renal vein from the inferior vena cava. The whole tumour thrombus was washed away from the inferior vena cava freely and then we applied the clamp onto the inferior vena cava centrally and closed the vena cavotomy by suture. (Figs. 8–10) Both the surgery and the postoperative development were without complications. In the control PET/CT after a month, neither tumour embolism in the lungs nor any other
metastases were proven and the patient subsequently underwent the resection of the sigmoid colon with a finding of tubulovillous adenoma with low-degree dysplasia.

In one case of incorrect diagnostics and unrecognized spread of the tumour thrombus into the renal vein in a 44 years old male patient nephrectomy was executed by an urologist. After the surgery complicated due to hyposaturation and blood-circulation instability the patient was performed CTA diagnostics with an image of the acute dilatation of the right heart with a dysfunction of the right ventricle, which proved embolism into the right atrium and the left branch of the pulmonary artery. (Fig 11) After the heart surgery – extraction of the tumour from the right atrium and embolectomy of the pulmonary artery the function of the heart was restituted and the vascular surgeon subsequently completed the thrombectomy of the left tumour thrombus from the vena cavotomy. Further postoperative development was free of complications.

Fig. 7 – A CTA image of renal cell carcinoma with a tumour thrombus up to the level of the right atrium of the heart.

Fig. 8 – Lifted right kidney with membranes, the renal vein and the inferior vena cava filled with a tumour thrombus, released distal part of the inferior vena cava.

Fig. 9 – Direct suture of vena cavotomy.

Fig. 10 – System as a whole – the kidney including the tumour thrombus as one piece.
Results

Of 12 patients who underwent a surgery in our department for renal cell carcinoma with ingrowth of the tumour thrombus into the vascular system, one female patient died of postoperative massive embolism. In the remaining cases the surgeries were free of complications and all patients were discharged from hospital to be cared for by their urologists and oncologists. From the histological point of view all cases concerned clear cell renal cell carcinoma.

Six patients have been surviving without a proof of cancer progression within a range of 1–8 years. In two cases the patients have been surviving for 2–7 years as of the surgery with proven pulmonary metastases which appeared in 1 and 4 years after the surgery and the patients are stationary within the framework of their oncological treatment. In 3 patients operation was performed in the presence of distant metastases. 2 patients have been surviving for 2 and 3 years under the oncological treatment. One male patient died of ischemic ictus one year and a half after the surgery (Table 1).

Methods

The treatment of renal cell carcinoma is above all surgical, specifically radical nephrectomy – including the fat capsule and Gerota's fascia, in the case of tumours exceeding 5 cm in the upper pole and with adrenalectomy. Regional lymphadenectomy is not performed as a standard (lymphogenous metastases are uncommon). Laparoscopic operate with tumours in 8–10 cm, without invasion into the perirenal structures and tumour thrombus. Conservative surgery – the resection of the pole or the excision of the tumour is possible if the size of the tumour does not exceed 5 cm, it is indicated especially in a kidney being solitary anatomically and functionally and in the case of tumours on both sides. The remaining standard treatment of renal cell carcinomas with a tumour thrombus is nephrectomy supplemented with tumour thrombectomy.

Although renal cell carcinoma with a tumour thrombus is classified in stadium T3 according to the TNM classification, several studies have proven 5-year survival in up to 60% of cases unless distant metastases were proven. Results of this radical approach are comparable to those for a tumour in stadium T1 and T2, which means the one confined to the kidney only [1–7]. The benefit of nephrectomy and thrombectomy in the case of metastases has not been defined well yet. In symptomatic patients (torpid oedema in lower extremities, cardiac dysfunction, abdominal pain, hematuria), removal of the tumour or reduction in its size together with the tumour thrombus may improve the quality of the patient's life. Combination of the cytoreductive surgery and oncological treatment can finally result in the extension of the patient's survival.

Localization of the tumour thrombus is important for the technique of the surgery. However, in all cases the assistance or the performance of the surgery by a vascular surgeon is of great advantage. According to the localization of the tumour thrombus, we distinguish among 3 methods of the surgical approach:

- in the renal vein – it is necessary to localize the tumour thrombus by palpation gently to prove that it does not spread into the inferior vena cava, the Satinsky clamp is positioned at the orifice of the renal vein and the vein with the tumour thrombus is separated by a circumferential excision and nephrectomy is finished. The defect in the inferior vena cava is closed carefully to prevent its diameter narrowing.
- in the inferior vena cava under the level of the diaphragm – in the opening part of the surgery it is necessary to secure the inferior vena cava above as well as below the tumour thrombus to prevent embolism. After the application of the clamps cavotomy is executed. It is important to execute thrombectomy without any unnecessary fragmentation of the tumour. Upon completion of thrombectomy, lavage of the inferior vena cava and its closure nephrectomy is finished. In the case of ingrowth of the tumour thrombus into the wall of the inferior vena cava (most frequently in the area of the renal vein orifice), part of the inferior vena cava wall must be resected and, where applicable, a PTFE prosthesis must be implanted.
- in the inferior vena cava above the level of the diaphragm – extracorporeal blood circulation in cooperation with a cardiac surgeon is necessary to eliminate pulmonary embolism.

Conclusion

Our results have proven clearly the benefit of nephrectomy with tumour thrombectomy in patients with renal cell carcinoma growing into inferior vena cava. The benefit of the surgery is obvious even in the case of patients with distant metastases which remain stationary on a long-term basis with the today's possibilities of the oncological treatment.
Our experience confirms the necessity of performing these surgeries on a centralized basis with a team formed by an experienced vascular surgeon and a cardiac surgeon.

Conflict of interest

There is no conflict of interest.

Ethical statement

The research was done according to ethical standards.

Funding body

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Informed consent

The patients agreed to participate in the research.

References