Inferior Vena Cava Thrombectomy for Renal Cell Carcinoma with Thrombus

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Abstract

Up to 10% of patients with renal cell carcinoma have intracaval neoplastic extension. The results of nephrectomy and caval cavotomy to remove the renal tumour and caval thrombus were reviewed. From September 1991 to October 1997, 16 consecutive patients (13 males, 3 females) with a mean age of 59 years (range 4.5 to 7.5 years) underwent radical nephrectomy together with cavotomy and thrombectomy (15) or caval resection (1). The tumour thrombi extended to the infrahepatic vena cava in 9 patients, intrahepatic cava in 5 and suprahepatic cava in 2. The surgical approaches included abdominal (8), right thoraco-abdominal (5) and abdominal with median sternotomy (3), respectively; cardiac bypass was not required. The mean cava clamp time was 15 minutes and the average operative time was 127 minutes (range 70 to 190 minutes). There was no operative mortality but the complication rate was 31%. The mean hospital stay was 12 days (range 7 to 23 days). Ten patients had Robson's stage IIIa disease, 4 had stage IIIc disease and 2 had stage IV disease. During a mean follow up of 20 months (range 1 to 54 months), 6 patients were alive with no recurrence and 10 patients had died of the disease. The survival of stage IIIa patients was significantly better than stage IIIc and IV patients. In summary, caval thrombectomy is associated with acceptable operative morbidity and mortality; however, advanced staged disease dictates a short survival.

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Key words: *Renal tumour, Thrombus, Vena cava*

Introduction

A characteristic feature of renal cell carcinoma is the development of tumour thrombus extending into the inferior vena cava (IVC). This takes place in 4% to 10% of cases.[1-3] However, long-term survival after surgical treatment is possible in patients with localised tumour with IVC thrombus in the absence of lymph node or distant metastasis.[4-7] In this setting, radical surgery remains the only curative therapy.[8,9] Today, advances in surgical technique and new insights permit removal of caval thrombi without significant surgical risk.[10,11] Our experience in radical nephrectomy and caval thrombectomy for renal tumour with caval extension is reviewed.

Patients and Methods

From September 1991 to October 1997, 181 radical nephrectomies were performed of which 16 patients (13 males, 3 females) with a mean age of 59 years (range 45 to 75 years) underwent radical nephrectomy together with cavotomy and thrombectomy (15) or caval resection (1).

Upon diagnosis of renal tumour and finding of suspicious filling defect in the vena cava, further investigations were done where indicated to delineate the extent of caval involvement and the status of the wall of the vena cava. These investigations included Doppler ultrasound scan, magnetic resonance imaging and inferior veno-cavagram. The tumour thrombi extended to the infrahepatic vena cava in 9 patients, hepatic cava in 5 patients and suprahepatic cava in 2 patients (Table I). Correspondingly, the surgical approaches included transabdominal (8), thoraco-abdominal (5) and abdominal plus median sternotomy (3) pending the extent of tumour in the IVC. Cardiothoracic surgery and bypass facilities were available, but bypass was not required in any of the cases.

The Kaplan Meier survival curve was used to assess survival.

Surgical Techniques

For easy reference to the exact control of the drainage of the IVC, it will be easier to refer to Figure 1.

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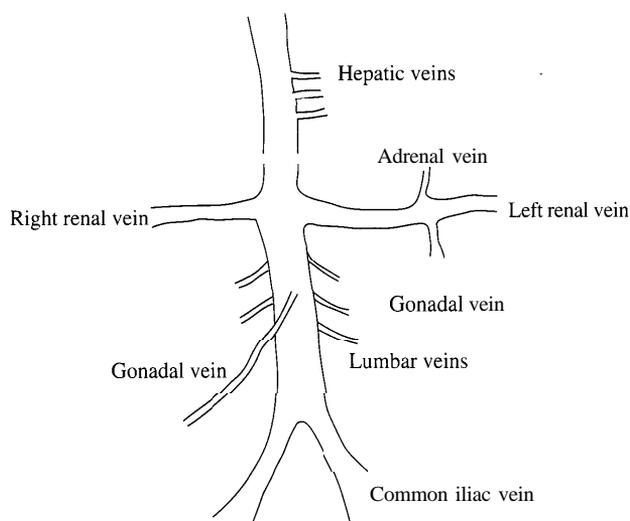
Fig. I. Tributaries of the inferior vena cava.

Infrahepatic: The "Chevron" incision was most commonly used. The incision could be joined with a median sternotomy where necessary. Alternatively, a right thoraco-abdominal incision was employed. The limitation of the right thoraco-abdominal incision was that it could only deal with a right-sided tumour and cardiac bypass was not possible and in case of a left-sided tumour, the IVC cannot be accessed from a left thoraco-abdominal incision. The kidney was mobilised together with the Gerota's fascia. After ligating and cutting the ureter and renal artery, the vena cava was dissected from its bifurcation to the caudate lobe. The contralateral renal vein was also dissected.

Rommel snares were placed on the lowest part of the IVC, the contralateral renal vein, and the infrahepatic vena cava above the right renal vein; the short lumbar veins were clipped or ligated individually as they easily tear and the ends are retracted into the bony spine. After this dissection the whole IVC should be mobilised. Trial occlusion was applied to test for adequate venous return with the anaesthetist monitoring the blood pressure by an arterial line and central venous pressure continuously. If there was too much drop in blood pressure and central venous pressure, the lower aorta was snared before its bifurcation to minimise the blood outflow to the lower limbs. The renal vein was then resected to allow en bloc resection of the renal tumour together with the thrombus, while cavotomy and thrombectomy were performed in a relatively bloodless field. The cavotomy site was the extension of the site of entry of the renal vein into the IVC. When the left renal vein was snared, the left renal artery was not clamped because the gonadal and inferior adrenal veins could form collaterals. When the right renal vein was snared, the right renal artery had to be controlled and the ischaemic time noted as there were no collaterals from the right renal vein. The kidneys took

30 minutes of warm ischaemia. Finally, the caval incision was closed with a 3/0 prolene running suture.

Intrahepatic and Suprahepatic: For caval thrombus with further cranial extension, the intrahepatic cava was exposed by incising the triangular ligament and mobilising the right hepatic lobe medially and upwards. The vena cava was clamped supradiaphragmatically via a median sternotomy and opening the pericardium and applying the snare at the level of the intrathoracic portion of the vena cava. There were 2 patients who had thrombus felt at this portion of the IVC and the snare was able to get over the distal part of both. Otherwise, a finger could be inserted into the atrium with a purse-string suture to push the thrombus to below the snare. In addition, another snare was applied to the porta hepatis to control blood flow into the liver. Additional controls were done on the inferior mesenteric artery, superior mesenteric artery and coeliac trunk to avoid congestion of the bowel. In this way the portal circulation is controlled. The lower aorta was also controlled to minimise blood running off to the lower limbs. Preparation for a graft if required should be done before the vascular control. The liver usually take 15 minutes of warm ischaemia. When the IVC was opened, there was always a gush of blood around 300 ml from the liver. Caval wall resection proceeded when invasion into the wall was noted intraoperatively. The continuity of the cava was re-established by placement of a vascular graft. In one of the patients, there was enough collateral drainage as the IVC was completely occluded, therefore a resection was done without grafting.

Results

Pathological Findings

Ten patients had Robson's[12] stage IIIa disease, 4 had stage IIIc disease and 2 patients had stage IV disease (Table I). Tumour grade was grade II renal cell carcinoma (RCC) in 7 patients and grade III RCC in 8 patients. One last patient had a squamous cell carcinoma of the kidney with the wall of IVC invaded by tumour.

Operative Details

The average duration of operation was 133 minutes (70 to 190). The average IVC clamp time was 15 minutes (range 8 to 40 minutes) including the patient with caval reconstruction using a Gortex graft (clamp time 40 minutes). The blood loss was 2167 ml (range 300 to 10,000 ml). Blood transfusion averaged 1407 ml (range 0 to 4720 ml).

Complications and Mortality

Postoperative complications were observed in 31% of the patients. One complication was an intra-abdominal abscess which was drained percutaneously. The other complications included acute renal failure (1), transient

TABLE I: SUMMARY OF PATIENTS WHO HAD CAVAL THROMBECTOMY

		Remarks	Number
Stage	IIIa	IVC thrombus only	10
	IIIc	Thrombus + <2 cm lymph nodes	2
		Thrombus + >2 cm lymph nodes	2
	Iv	Tumour beyond Gerota's fascia	1
		Liver metastasis	1
Level	I	Infrahepatic	9
	II	Intrahepatic	5
	III	Suprahepatic	2
Side	Right		10
	Left		6

TABLE II: ROBSON'S STAGING

		Remarks
Stage I		Tumour within capsule
Stage II		Tumour invasion of perinephric fat
Stage III	IIIa	Involvement of regional lymph nodes
	IIIb	Involvement of renal vein and cava
	IIIc	Involvement of both
Stage IV		Adjacent organs or metastases

jaundice (1), wound infection (1), and persistent deep vein thrombosis (DVT) in one patient who had the DVT preoperatively. The hospital stay averaged 12 days (range 7 to 23 days). There was no operative mortality.

Survival

With a mean follow-up of 20 months (range 1 to 54 months), 6 patients were alive with no recurrence and 10 patients had died of the disease. The survival for patients with stage IIIa disease was significantly better than patients with stage IIIc and IV disease. The survival curve is shown in Figure 2.
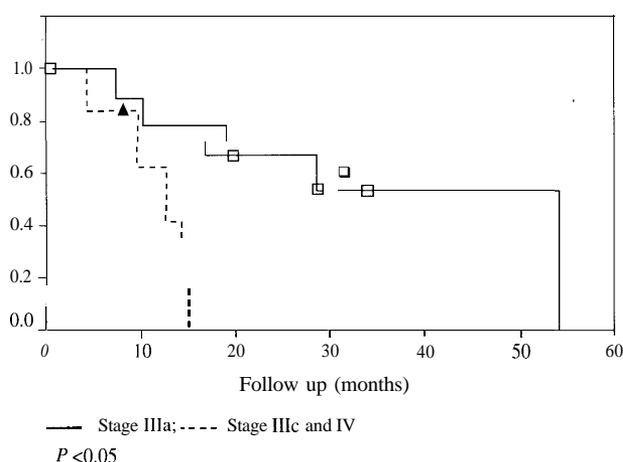

Stage IIIa; ---- Stage IIIc and IV
P <0.05

Fig. 2. Survival probability in relation to stage.

Discussion

For our patients, we used the Robson's staging as shown in Table II. Since surgical removal is the main stay in the treatment of renal cell carcinoma, complete removal of the renal tumour with its caval extension should be offered whenever feasible.[5]

The surgical approach we employed was based on the preoperative assessment of level of tumour extension using CT scan, Doppler ultrasound, venography, magnetic resonance scan and echocardiogram where indicated. We found that CT scan cannot determine the exact level and magnetic resonance can sometimes be misleading because the coronal or sagittal cuts may not be exactly in line with the cava. The most accurate method in our series to determine the exact upper limit is the conventional cava venography through the superior vena cava if there is complete obstruction otherwise a groin approach is sufficient. Doppler ultrasound is operator depended but can yield good results. The level of the venal cava extension must be determined preoperatively so that the surgeon can plan for an appropriate surgical approach and anticipate special manoeuvres that might be required during resection. The wall of the IVC should be noted of any direct invasion and this can be picked up on the CT scan or magnetic resonance. When the wall of the IVC is invaded by tumour, which is uncommon, preparation for an IVC graft should be made. When the IVC has been totally obstructed with enough collaterals developed, it can be resected from its bifurcation to the level of the renal vein without a graft. Occasionally, when the preoperative imaging studies were equivocal, intraoperative ultrasound has been reported to be helpful.'"

With careful preoperative evaluation and planning, we were able to obtain proximal and distal control of the tumour thrombus in all cases. We did not encounter any intra-atrial thrombus, and bypass was not required. There was no operative mortality. In the literature, operative mortality ranging from 0% to 16% have been reported.[14-19]

The five-year survival rates reported in the literature ranged from as much as 25% to 69%.[6,7,14,16,19] In fact, controversy remained about the prognostic significance of renal caval thrombus for patients with renal cell carcinoma.[19] Some authors found that this adversely affected survival in renal cell carcinoma.[20,21] Others stated that caval thrombus had no significant adverse impact on survival.[16-19]

We found that nodal involvement or metastatic disease significantly affected the survival in our patients. This was in line with the recent report by Kuczyk and associates.[19] They noted that for patients with caval thrombus, neither the propagation of the tumour into

the vena cava, nor level of the cranial extension of the thrombus, had any prognostic value during univariate or multivariate statistical analysis. Only the presence of regional lymph node or distant metastasis was an independent prognostic factor for patients with RCC with a significant decrease in long-term survival. The result of this series also shows that for patients with lymph node metastasis proven on frozen section, it is better to perform a palliative nephrectomy rather than to continue with the radical surgery which carries a higher morbidity and mortality.

In conclusion, in the absence of lymph node metastasis or metastatic disease on preoperative imaging, or if enlarged lymph nodes were found to be reactive hyperplasia during surgery, then radical surgical excision and caval thrombectomy are still warranted for the treatment of patients with RCC with neoplastic extension into the cava because of a reasonable survival and acceptable risks.

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