

## Anesthetic Management of Renal Cell Carcinoma with Inferior Vena Caval Extension

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### ABSTRACT

Renal Cell Carcinoma (RCC) is the most common malignancy affecting Kidney with an incidence of 85%. It is usually asymptomatic, may present with metastases. Inferior Vena Cava (IVC) involvement occurs in 5-10% of patients. The mainstay of management of RCC remains surgical and chemotherapy is of limited value. IVC extension requires meticulous preoperative preparation, coordination amongst Urology and Cardiothoracic team for safe outcome. In this present case report, we encountered RCC with IVC extension up to the junction of Right atrium and IVC, which was managed using Cardiopulmonary bypass and was successful multidisciplinary team management.

**Keywords:** IVC, Cardiopulmonary bypass, RCC, Thrombus, TEE

### INTRODUCTION

Surgical resection of renal cell carcinoma with tumor invasion into inferior vena cava (IVC) or right atrium (RA) will be a life-threatening procedure as the tumor can embolise or it can lead to massive blood loss. The tumor or thrombus migration can occur into the IVC in 4-10% of the patients and into RA 1% of patients with RCC, respectively [1,2].

### CASE SCENARIO

A 52 year asymptomatic male was detected to have a left renal mass on routine medical checkup. Investigations revealed hemoglobin 10 g%, creatinine 1.61 mg/dl, ECG and echocardiography found to be normal except for an IVC mass extending up to the right atrium with a normal LV and RV function. CT abdomen showed T1/T2 heterogeneous diffuse mass almost replacing the entire renal parenchyma, with left renal vein and IVC extension reaching up to the right atrium (level IV tumor as per Mayo classification).

As per the ASA, standards monitors were connected to the patient, patient was given general anesthesia intubated and a trans-esophageal echocardiography probe was inserted. Preoperative TEE showed a mass in the inferior vena cava extending till the junction of IVC and the right atrium (**Figure 1**). The surgical plan was to do left radical nephrectomy along with IVC mass excision. Following Laparotomy incision, left renal mass was exposed and IVC was mobilised and cardiothoracic surgical team was called

in. Median sternotomy was performed; after systemic heparinization, superior venacava and right femoral vein were cannulated. Aortic cannulation was done and cardiopulmonary bypass was instituted after confirming ACT >480 s. Aorta was cross clamped intermittently in the supra coeliac part and IVC opened after snaring the intracardiac part of it. IVC mass was removed enbloc along with the left renal mass. Patient was gradually weaned off bypass with inotropic support. The total CPB time was 77 minutes. Protamine administered to reverse Heparin in the ratio of 1:1. Post-operative TEE showed no mass in the IVC or any evidence of embolism into RV or pulmonary artery (**Figure 2**). Patient's LV and RV systolic function was found to be normal. This patient had extensive blood loss (4-5 L) in the intraoperative period. Blood volume was replaced with 4U of fresh blood, 4U of packed cells and coagulopathy was managed with 6U Fresh frozen plasma. Patient abdomen and chest was packed in view of extensive blood oozing and

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it was closed in layers on the first post-operative day. Acidosis and volume loss were corrected and Patient was extubated on POD 2. Inotropes and vasopressors were

weaned off gradually and patient discharged from the post-operative ICU to ward on POD 4 and discharged from the hospital on POD 8.



**Figure 1.** RCC involving the IVC reaching the junction of right atrium.

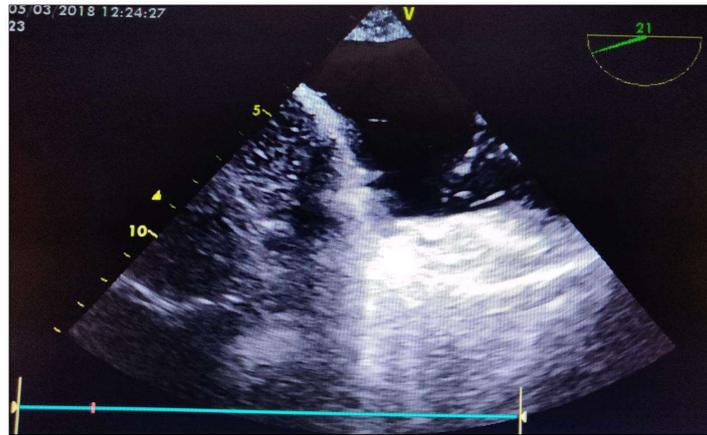


**Figure 2.** Right atrium after removing the IVC tumor.

## DISCUSSION

Renal cell carcinoma constitutes <5% of all malignancies and it is the commonest malignancy of kidney with 85% incidence. Usually asymptomatic in its early stage, 30-40% patients present with metastasis [3,4], IVC invasion occurs in 5-10% of RCC patients [5-9]. Surgical resection remains gold standard in treatment of RCC and chemotherapy has a limited efficacy [5-10]. Despite a 5 year survival rate of 40-70% after surgical resection [10], advanced or metastatic tumors carry perioperative morbidity and mortality with

rates of 30-40% and 2-8%, respectively [11-13]. Several classification systems have been proposed to describe extension of tumor thrombus based on anatomic landmarks. One of the most popular classification schemes is the Novick staging system (**Figure 3**) in which level I thrombi are limited to the renal vein or extend >2 cm within the IVC. Level II thrombi extend >2 cm cephalad within the IVC but do not reach the level of the liver. Level III thrombi extend into the intrahepatic IVC and level IV thrombi extend above the diaphragm [14].



**Figure 3.** Thrombi are limited to the renal vein.

Preoperative anticoagulation is given usually for some patients to prevent the further spread of the tumor thrombus and in this case, patient received LMWH till the night before surgery as a prophylactic measure. Woodruff et al. [13] suggested that patients with caval tumor thrombus should receive low molecular-weight heparin preoperatively unless contraindicated, such as in the setting of renal dysfunction.

The use of TEE intra-operatively allows us to localize tumor, compute its size and extension, analyse its spread in long and short axes and will allow us to compare preoperative and post-operative cardiac function and embolic events like pulmonary embolism or presence of intra cardiac air. In this case, there was no post-operative LV or RV dysfunction and there were no embolic events. A similar case report was published by Spelde and Steinberg [14] wherein there was RV dysfunction and pulmonary embolism in their case.

Cardiopulmonary bypass has remained a mainstay strategy for those tumors extending above the diaphragm for the main advantage that it offers a bloodless surgical field. Deep Hypothermic circulatory arrest has also been adopted by few authors to minimise the blood in the surgical field. First described by Morita et al. [15], CPB with deep hypothermic cardiac arrest (DHCA) has become a common surgical technique for patients with tumor thrombus that extends above the level of the diaphragm. A normothermic CPB is considered superior to DHCA due to associated coagulopathy, prolonged surgical time and delayed recovery associated with the latter. Vogt et al. [16] also reported no perioperative deaths and no cases of renal failure, pulmonary embolism or neurologic complications for 11 patients managed with normothermic CPB. Radak et al. [17] reported on 5 patients managed with normothermic CPB with no perioperative deaths or pulmonary emboli. This case was managed at a temperature of 31°C during the time of cardiopulmonary bypass.

In the management of such cases, meticulous preoperative work up of the patient and patient's co morbidities, careful

intraoperative anesthetic management, a good surgical team minimising the blood loss, intraoperative TEE to evaluate any embolic events and heart failure and a good post-operative management of complications, if any, will improve the patient's outcome and reduce the morbidity and mortality. Multidisciplinary approach is the need of hour for such cases.

Intraoperative TEE guides the surgeons to remove the tumor enbloc and to record any evidence of RV dysfunction or embolism into the pulmonary artery.

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