



**Perioperative Anesthetic
Management for
Renal Cell Carcinoma Resection**



Resection of high grade renal cell carcinoma (RCC) with invasion into the inferior vena cava presents significant surgical and anesthetic management challenges. Although the incidence of need for cardiopulmonary bypass is low and the short-term mortality is approximately 3-4%, the immediate availability of advanced mechanical cardiopulmonary rescue as well as clinicians skilled in management is critical.

IVC tumor/thrombus is classified based upon anatomic landmarks and degree of extension into the IVC, relationship with liver, and whether the right atrium is involved (Table 1).

Table 1-Renal cell extent classification

Level	Anatomic landmarks
I	Thrombus limited to renal vein
II	Superior extent of the thrombus is below the level of the infrahepatic IVC
IIIa	Infrahepatic thrombus extending into the retrohepatic IVC but below the major hepatic veins
IIIb	Hepatic thrombus extending into the retrohepatic IVC reaching the ostia of the major hepatic veins
IIIc	Thrombus extending into the suprahepatic, infradiaphragmatic IVC
IIId	Suprahepatic, supradisphragmatic, infra-atrial thrombus (Figure 1 and 2)
V	Thrombus extending into the right atrium

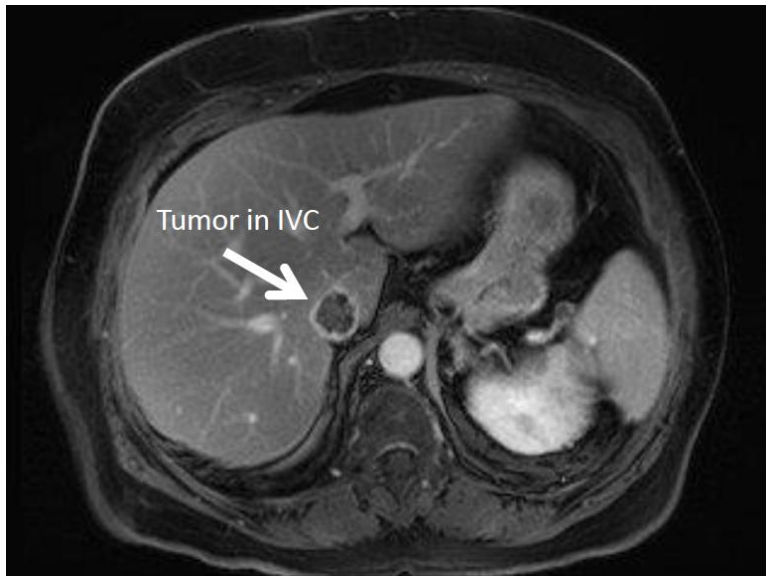


Figure 1 – Tumor in IVC

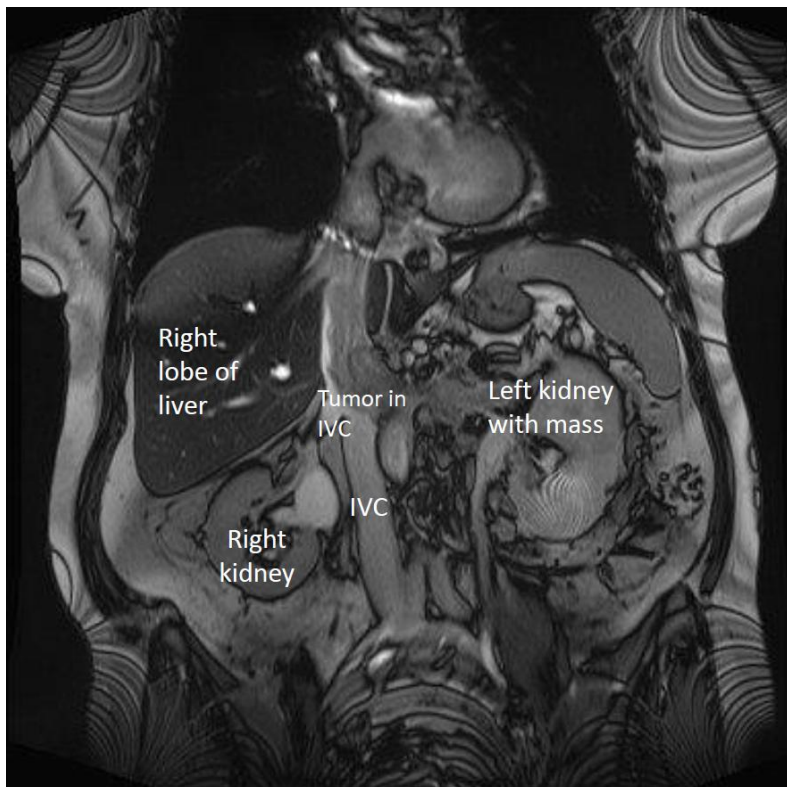


Figure 2 - Left renal mass invading IVC and extending above diaphragm

Anesthetic Management

The anesthetic management of cases involving level III and IV RCC is primarily focused on planning for major inter-operative complications, primarily massive hemorrhage as well as tumor or thrombus central embolization.

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Pre-operative planning is imperative as the approach to this disease is often multidisciplinary involving Urology, General Surgery, and Cardiac Surgery. Higher grade tumor excision is more challenging as these have higher blood loss. Caval invasion makes IVC dissection more difficult and increases the risk of inadvertent major vessel injury (Table 2). Several important questions should be asked of the surgical team during planning and discussed again during a detailed pre-operative huddle (Table 3).

Table 2 – Anesthetic Planning for Renal Cell Carcinoma Excision

Required	Recommended	Optional
Standard ASA monitors Arterial line Large bore IV access Central line	TEE Rapid infusion system Bypass available Perfusion service available CT surgeon available	Epidural catheter PA line

Table 3 – Questions During Evaluation and Pre-operative Huddle

Which teams are involved (i.e. cardiac surgery, transplantation, urology, general surgery)?
Where does the tumor extend?
Do you anticipate a need for bypass?
Should a percutaneous “return” cannula for veno-veno be placed before hand?
Do you anticipate a sternotomy for access to the IVC or right atrium?
What other procedures need to be performed?
Have other abdominal procedures been performed before?
Where will the patient receive?

Fukazawa et al studied 70 patients with tumor thrombus invasion of the inferior vena cava. Those with level IV tumor had a higher need for extracorporeal support, blood loss, and hospital length of stay (Table 4).

Table 4- Comparison of level III and level IV renal cell carcinoma

Measure	Level III	Level IV
Number	58 (82.9%)	12 (17.1%)
Extracorporeal support	2	3 (25%)
Blood loss	1540 ±206	6978±2968
TEE Use	77.6%	100%
Hospital LOS	8.1 days	18.8 days
Mortality	1	2

Seven other studies performed between 2003 and 2011 have evaluated similar parameters (Table 5).

Table 5-Operative and Anesthetic Measures for Level III and IV RCC

Measure	Level III	Level IV	Average
Blood loss	1540-4400 (600-15,000)	2,500-6,978 (800-30,000)	
Bypass			7.1-100%
Mortality	0-19%	8.3-33.3%	

TEE offers several advantages to central venous or pulmonary artery catheterization alone during resection. TEE is performed in “real time” and allows visualization of the extent of tumor involvement into the inferior vena cava as well as the right atrium. The presence of a patent foramen ovale (PFO) should be assessed as paradoxical embolization would cause significant morbidity. TEE may detect acute signs of tumor embolization including right heart dilatation and hypokinesis, tricuspid regurgitation (TR), and visualization of mass in the pulmonary artery or right heart.

Resection of stage III and IV masses may require interruption of venous return from the inferior vena cava which compromises cardiac output. Either veno-venous (VV bypass) or full cardiopulmonary bypass may be required to maintain hemodynamic stability or to facilitate resection from the right atrium.

VV bypass is utilized to facilitate venous return only. The femoral vein is accessed to allow drainage to the venous pump. A “return” cannula is placed via the internal jugular or subclavian approach (Figure 3) and confirmed with chest x-ray (Figure 4). The “return” cannula may also be placed directly into the right atrium when a sternotomy has been performed.

Figure 3 – Venous return line in the right neck

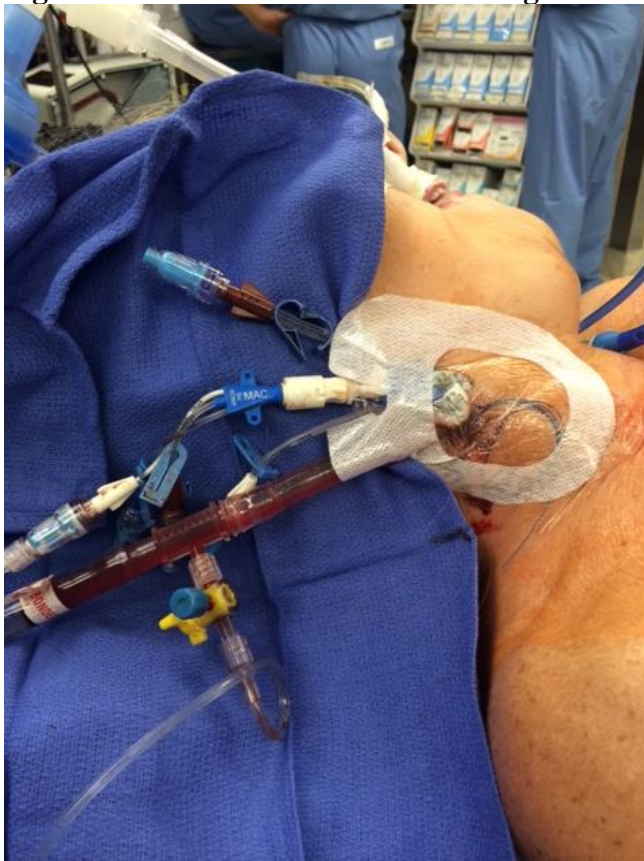
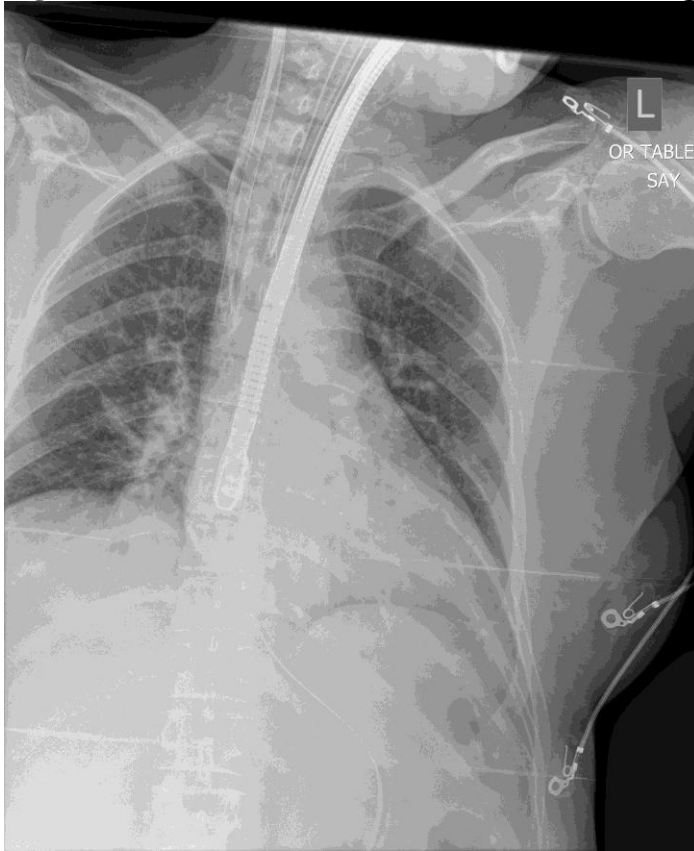


Figure 4 – CXR of venous “return” line via the right internal jugular vein



Cardiopulmonary bypass may be used when other procedures must occur such as involvement of the pericardium or atrial structures. Bypass allows improves cell salvage, higher flows, heating and cooling of the body, and venting of the heart if necessary. Bypass would also allow administration of cardioplegia if myocardial standstill is needed (ie. For embolectomy).

Post-operative management of may be accomplished in a well staffed advanced post anesthetic care unit (PACU) for uncomplicated cases with lighter blood loss and without the use of cardiopulmonary bypass. Prolonged cases, those with cardiopulmonary bypass, massive blood loss, or hemodynamics instability, or a need for high level vasopressors or inotropic agents should recover in an intensive care unit setting.

References:

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