

USE OF CARDIOPULMONARY BYPASS WITH DEEP HYPOTHERMIC CIRCULATORY ARREST IN THE MANAGEMENT OF IVC TUMOR THROMBUS

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ABSTRACT

In recent years, there has been a significant rise in the number of cases of renal cell carcinoma (RCC) that include venous extension to the inferior vena cava (IVC). This is mostly attributable to the development of several diagnostic techniques. Vascular invasion indicates an increased biological activity and poses a surgical difficulty during treatment. Renal cell carcinoma accounts for around 3-4% of all solid neoplasms. 4-10% of patients with renal cell carcinoma exhibit the presence of IVC thrombus. Among such patients, extension to the right is observed in 1-3% of cases. Surgical resection is the established method used to treat such cases.

KEYWORDS : Cardiopulmonary Bypass, Deep Hypothermic Circulatory Arrest, IVC Tumor Thrombus

Case Details- 1

A 55-year-old male presented with a history of painless Haematuria for 2 months and a mass in the abdomen on the right side. He was diagnosed as a case of renal cell carcinoma. He was investigated thoroughly with an initial ultrasound, followed by an MRI and PET CT scan.

The MRI revealed renal cell carcinoma along with a tumor thrombus that extended from the IVC to the Cavoatrial junction. There was no evidence of distant metastases in a PET CT scan.

The urologist, the cardiac surgery team, and the interventional radiologist were all members of the multidisciplinary team that was formed for the procedure.

Embolism of the renal artery was performed the day before the surgical procedure.

A bilateral subcostal incision was made. The right kidney was mobilized for radical nephrectomy. The renal artery was ligated. Median sternotomy was done and the patient was placed on cardiopulmonary bypass with aortic and right atrial cannulation. A second venous cannula was placed in the infrarenal part of the IVC. Intraoperative tee showed the IVC tumor thrombus extending just above the cavoatrial junction.

The patient was cooled to 18°C, the heart was arrested with cardioplegia, and total circulatory arrest was done.

The infrarenal part of the IVC was clamped. As the cavoatrial junction could not be clamped. The right atrium was opened along with IVC, and tumor thrombectomy was done under direct visualization.

The right radical nephrectomy was done and the specimen was removed enbloc with the tumor thrombus. The right atrium was closed and IVC was closed directly with 5-0 Prolene sutures.

The patient was rewarmed and gradually weaned off cardiopulmonary bypass. Tee showed no residual tumor thrombus. He was extubated on the 1st postoperative day and discharged on the 8th postoperative day.

The MRI was done after 2 weeks and showed no residual tumor thrombus. He was followed up for 1 year and was symptom-free.



Figure 1: [CASE 1] - PET CT showing uptake of right kidney renal cell carcinoma and IVC tumor thrombus



Figure 2: [CASE 1] - MRI showing tumor of the right kidney and IVC tumor thrombus



Figure 3: [CASE 1] – Specimen of right radical Nephrectomy and IVC tumor thrombus

Case Details- 2

A patient who was 63 years old was brought in with a mass appearing on the right flank. He had a history of painless Hematocytosis that lasted for two months. He was investigated thoroughly.

A right renal mass with IVC tumor thrombus and right atrial emboli which was not in continuity with the IVC tumor thrombus was noted. A biopsy was done and he was diagnosed with a right renal cell carcinoma with IVC tumor thrombus extending up to the right atrium.

A multidisciplinary team was formed including the urologist, cardiac surgeon, and cardiac anaesthetist to strategize an action plan.

The patient was taken up for surgery and Chevron incision was made and the right kidney was mobilized. The right renal artery was ligated.

The median sternotomy was done and the patient was placed on a cardiopulmonary bypass with a standard approach. Intraoperative tee confirmed the IVC tumor thrombus extending to the subdiaphragmatic level and tumor emboli in the right atrium.

The right atrium was opened and tumor emboli were removed. IVC was opened involved of the right side of the IVC was seen. Tumor thrombectomy along with partial resection of the IVC was done. Right radical nephrectomy was done and the whole specimen was removed en bloc. The right atrium was closed and IVC was repaired using a bovine pericardial patch.

The patient was rewarmed and gradually weaned off CPB. Tee showed no residual tumor thrombus or emboli.

The MRI was done after 4 weeks and showed no residual tumor thrombus. The patient was followed for 18 months and was symptom-free.

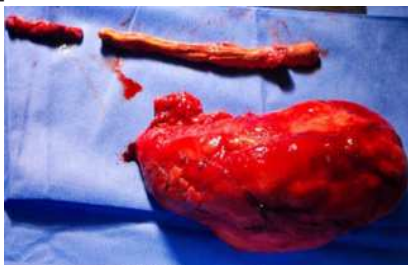


Figure 4: [CASE 2] – Right radical Nephrectomy and IVC tumor thrombus along with Emboli in the right atrium

DISCUSSION

Renal cell carcinoma accompanied by tumor thrombus is linked to more unfavourable characteristics. The prognostic significance of local tumor extension surpasses that of the level of inferior vena caval tumor thrombus. IVC involvement in renal cell carcinoma is seen even in the absence of distant metastasis.¹ IVC extension is seen in about 4-10% of cases. The right atrium is seen in about 1-4% of cases of patients with IVC involvement. radical nephrectomy together with tumor thrombectomy is considered to be the most effective treatment option.² The surgical strategy was determined on the level of IVC tumor thrombus.

the traditional classification of renal cell carcinoma with IVC tumor thrombus, includes venous thrombus in the renal vein, infra hepatic IVC thrombus, tumor thrombus in the intrahepatic or retrohepatic part of IVC not extending to the right atrium, and right atrium thrombi, respectively.³

Ultrasound was the primary imaging modality used to assess

patients. Nevertheless, it has a low level of sensitivity. at present, MRI is considered to be the gold standard for determining the level and extension of the tumor thrombus and the staging of renal cell carcinoma.⁴

It has 96-100% sensitivity in detecting the cephalad level of the tumor thrombus. Recent studies have shown the advantages of using PET-CT imaging in diagnosing renal cell carcinoma, the level of tumor thrombus, and the presence of distant metastasis.⁵

Trans-oesophageal echocardiography (TEE) can be performed pre-operatively and intraoperatively to confirm the cephalad extent of the tumor thrombus.⁶ The renal artery embolization, though controversial is performed 24-72 hours to reduce the intraoperative bleeding.⁷

The surgical principles that are considered are complete resection of the tumor with thrombectomy, prevention of tumor embolization, maintaining a bloodless field for optimal resection, and hemodynamic stability, respectively.⁸ The tumor thrombus extension in level III or level IV poses a significant surgical challenge.⁹ There is some controversy in the management of level III thrombus which can be managed by a veno-venous shunt and hence avoiding the potential sequelae of CPB with DHCA.¹⁰ The level IV thrombus can be successfully managed with CPB and DHCA by providing a bloodless field for the surgeon and ensuring complete tumor resection.¹¹ The prognostic significance of IVC tumor thrombus is controversial. some studies have shown that tumor thrombus has a limited role in the absence of nodal or metastatic disease.¹²

Previous research has indicated that the prognosis of renal cell carcinoma (RCC) with inferior vena cava (IVC) tumor thrombi is characterized by a 5-year survival rate ranging from 25% to 57%.¹³ Renal cell carcinoma with inferior vena cava tumor thrombus presents a significant surgical difficulty.¹⁴ It is advisable to have a multidisciplinary team to form a strategy for the optimal treatment of such patients. The advantages of CPB with DHCA have to be balanced with the potential sequelae.¹⁵ The use of CPB and DHCA in surgery for level III or level IV tumor thrombi is a safe and effective strategy as it provides a bloodless field, ensuring complete resection and stable haemodynamics.

CONCLUSION

When the intravenous catheter (IVC) is involved, renal cell carcinoma presents a surgical challenge. When dealing with some situations, a multidisciplinary approach is necessary. It is possible to do a cardiopulmonary bypass with severe hypothermia and transcranial aortic valve insertion (TCA) successfully in some circumstances.

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