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Novel Approach to Recurrent Cavoatrial Renal Cell Carcinoma

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Abstract

Renal cell carcinoma with cavoatrial extension is a rare and complex problem. Complete resection is difficult, but correlates with favorable patient outcomes. We present two cases of successful reoperative resections of recurrent renal cell carcinoma in patients with level III–IV cavoatrial involvement through a thoracoabdominal approach, using peripheral cannulation and hypothermic circulatory arrest. To our knowledge we are the first to report this approach and advocate it as a successful means of avoiding a more difficult reoperation.

Keywords

Hypothermia/circulatory arrest; Cancer; renal cell

Background

Level III–IV involvement of renal cell carcinoma (RCC) into the inferior vena cava (IVC) and right atrium (RA) frequently requires complex surgical intervention. There are a number of established surgical approaches to primary tumors. However, patients with recurrent or residual caval or atrial tumors present a difficult problem and may not be offered surgical re-intervention. We report two cases of successful resection of recurrent or residual RCC with IVC extension via a thoracoabdominal approach with peripheral cannulation and hypothermic circulatory arrest.

Case One

A 50-year-old male presented with recurrent RCC of the IVC at the level of the hepatic veins. Seven months previously he had undergone a left radical nephrectomy with IVC and RA thrombectomy via a median sternotomy and bilateral subcostal incision. Routine follow up CT scan showed tumor recurrence with recurrent invasion of the IVC and RA (Figure 1).

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The patient was placed in left lateral decubitus position with his right hip abducted to facilitate a right thoracoabdominal exposure and peripheral cannulation through the right groin. The right internal jugular vein was cannulated with a 15Fr arterial cannula and the right femoral artery and vein were exposed. A thoracotomy was made in the eighth intercostal space and extended into the abdomen. After extensive adhesiolysis, the IVC was exposed along its length. The right side of the liver was mobilized to expose the entire right side of the retrohepatic cava. Transesophageal echocardiogram revealed tumor in the RA (Figure 2). An 8mm Hemashield chimney graft was sewn to the femoral artery to facilitate arterial cannulation with a 23Fr venous cannula in the right femoral vein. The patient was heparinized, placed on cardiopulmonary bypass with vacuum assisted drainage, and cooled. At 22 degrees Celsius, circulation was arrested and the patient drained. The IVC was opened at the level of the hepatic veins revealing a tumor that was densely adherent to the caval wall, necessitating an endarterectomy of the intima (Figure 3). All gross tumor was removed. The hepatic veins were well visualized. There were no hepatic or intracardiac adhesions. The IVC was reconstructed in two layers with running 4-0 Prolene. Circulation was restarted and the patient was gradually rewarmed. The patient separated easily from bypass and was taken to the ICU in stable condition. Cardiopulmonary bypass time was 170 minutes and hypothermic circulatory arrest time was 27 minutes. He was discharged uneventfully on postoperative day 5. The patient is currently two years status post resection without recurrence.

Case Two

A 55-year-old male presented with recurrent RCC nine months status post right radical nephrectomy, and IVC and RA thrombectomy. CT scan showed recurrence of tumor thrombus with extension into the right hepatic vein as well as new thrombus of the infrarenal IVC, proximal left renal vein, right common iliac vein, right external iliac vein, and right common femoral vein (Figure 4).

The patient was placed in the left lateral decubitus position for a thoracoabdominal incision. A 15Fr superior vena cava cannula was placed through the right internal jugular vein and the right groin was exposed to facilitate peripheral cannulation. A thoracotomy was performed through the eighth intercostal space and deepened to open the chest and the abdomen. After extensive abdominal adhesiolysis and lateral incision of the diaphragm, the IVC was exposed along its length. The retrohepatic cava was exposed by mobilizing the right lobe of the liver and reflecting it to the left. After heparinization, the right common iliac artery was cannulated through an 8 mm Hemashield chimney graft anastomosed to the common iliac artery. The right femoral vein was cannulated with a 23Fr venous cannula and cardiopulmonary bypass with vacuum assisted drainage was initiated. The patient was cooled to 18 degrees Celsius and circulation was arrested. The IVC was opened from the confluence of the hepatic veins down to the left renal vein and into the iliacs to reveal the tumor. This was removed completely without any gross residual tumor. To facilitate closure, the IVC was transected below the left renal vein and the cavotomy was closed with a running 3-0 Prolene in a single layer. Due to chronic thrombosis of the iliac veins and the lack of patient symptoms, the IVC was not reconstructed and the confluence of the iliac

veins was oversewn. Circulation was restarted and the patient rewarmed. Cardiopulmonary bypass time was 174 minutes with 24 minutes of hypothermic circulatory arrest.

The patient was discharged uneventfully on postoperative day 11. Six months postoperatively, there is no evidence of local recurrence.

Discussion

We present two cases of recurrent RCC with cavoatrial involvement after prior sternotomy that were resected via a thoracoabdominal incision with peripheral cannulation and hypothermic circulatory arrest. To our knowledge, we are the first to report a thoracoabdominal approach for this type of cancer [1–7]. Stage III and IV levels of disease present the greatest challenges in surgical resection of cavoatrial tumors due to the varying amounts of penetration into the walls of the IVC and cardiac structures [3]. There is no standard procedure for this operation in the literature but we have found the above-described approach to be successful.

Since both patients had previous sternotomies, we utilized a thoracoabdominal incision to avoid redo-sternotomy and the challenges of extensive adhesiolysis needed to access the retrohepatic cava. We also used peripheral cannulation to institute cardiopulmonary bypass with vacuum assisted drainage. Circulatory arrest facilitates a bloodless field, optimizing visibility for complete resection [7]. Patients with recurrent tumors may be offered safe reoperative resection. Peripheral cannulation, hypothermic circulatory arrest, and a thoracoabdominal retrohepatic exposure allow for complete resection of tumor.

Conclusion

Selected patients with recurrent renal cell CA in the retrohepatic vena cava can be offered safe surgical reoperation.

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Figure 1.
Coronal computed tomography image demonstrating tumor in the IVC (white arrow).

Figure 2.
Intraoperative transesophageal echo demonstrating RA tumor (white arrow).

Figure 3.
Intraoperative photograph demonstrating caval tumor after cavotomy.

Figure 4.
Coronal computed tomography image demonstrating recurrent tumor (white arrows).