

Technical Note

Intrapericardial isolation of the inferior vena cava through a transdiaphragmatic pericardial window for tumor resection without sternotomy or thoracotomy

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Abstract

Aims: The prognosis for patients with advanced tumors invading the inferior vena cava (IVC) is dismal and surgical treatments for these tumors are challenging. A surgical approach that avoids sternotomy and thoracotomy for tumors invading the IVC even to the level of the hepatocaval junction would be extremely helpful.

Methods: The intrapericardial IVC was isolated via a transdiaphragmatic pericardial window using a transabdominal approach. Hepatectomy was then applied via an anterior approach until the IVC was seen. Total hepatic vascular exclusion was achieved by clamping the portal triad, intrapericardial IVC and infrahepatic IVC. We removed the primary tumor, the liver portion involved and the tumor thrombi, with segmental resection of the IVC. Vascular continuity was reestablished using a 20-mm-diameter polytetrafluoroethylene graft.

Results: Four patients with tumors invading the IVC were treated with this method. All underwent gross en-bloc tumor resections and all survived.

Conclusion: This method for the resection of IVC tumors could avoid emboli dislodging from the tumor thrombi, prevent the complications of sternotomy, cardiopulmonary bypass and shorten operative times.

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Introduction

Involvement of the inferior vena cava (IVC) has long been considered a limiting factor for the curative resection of advanced tumors; the surgical risks are high and the prognosis for the patient is generally poor because of inadequate tumor-free margins, and the need to consider the possible combinations of multi-organ resection, IVC reconstruction, sternotomy, thoracotomy and cardiopulmonary bypass (CPB). The difficulty of surgery varies according to the tumor type and the region of IVC involved. The

resection of tumors invading the junction of hepatic veins and the IVC (Fig. 1) is especially challenging. When the tumor thrombi extend above the diaphragm, cardiopulmonary bypass with or without hypothermic circulatory arrest is often suggested.^{1,2} Traditionally, sternotomy or thoracotomy is also necessary to perform intrapericardial IVC isolation, achieve adequate tumor-free margin and prevent any emboli forming from the tumor thrombi. Combining these approaches with total hepatic vascular exclusion has made such resection possible. However, the postoperative pain and wound adhesion caused by sternotomy, coagulopathy and central nervous complications inherent to the cardiopulmonary bypass and circulatory arrest^{1,3} have led us to search for an alternative technique.

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Figure 1. Computed tomography image of an adrenocortical carcinoma. The arrow indicates the tumor thrombus extending to the junction of the hepatic vein and the inferior vena cava.

Here we introduce a technique of transdiaphragmatic intrapericardial IVC isolation for the resection of IVC tumors, even those reaching the hepatocaval junction. This method can achieve gross tumor en-bloc resection easily and avoids the need for sternotomy, thoracotomy and CPB.

Patients and methods

Four patients with IVC tumors—two suffering from hepatocellular carcinoma, one with a leiomyosarcoma and one with an adrenocortical carcinoma—underwent surgical resection with the technique “intrapericardial IVC isolation through a transdiaphragmatic pericardial window” without cardiopulmonary or venovenous bypass. All patients had tumors extending near or to the hepatocaval junction and none of them extended above the diaphragm.

Technique

After the induction of general anesthesia, a large-bore central venous line is inserted by the anesthesiologist. A bilateral subcostal incision with upward extension is made and the abdominal cavity is inspected. Transesophageal echocardiography is performed at the same time to delineate the cranial extent of the thrombus.

Intra-pericardial IVC isolation through transdiaphragmatic approach

The left lateral segment of the liver is mobilized first, and then a plane between the liver and the diaphragm is developed carefully. A transdiaphragmatic pericardial

window, about 5×5 cm, is made using an electrocautery pen (Fig. 2A). Through this window, the intrapericardial IVC is isolated with an umbilical tape by blunt and sharp dissection (Fig. 2B).

Hepatectomy

Intraoperative ultrasound is used to define the liver resection line and the line is marked accordingly. Then an anterior approach hepatectomy proceeds using the Pringle maneuver. After separating the liver parenchyma, the IVC is exposed. At this point, rapid blood transfusion pump and inotropic agents are prepared before the next procedure. No autotransfusion device is utilized in fear of tumor seeding. Generally, the central venous pressure will be maintained around 5–10 cm H₂O and the mean arterial pressure kept above 60 mmHg before proceeding total hepatic vascular exclusion (TVE).

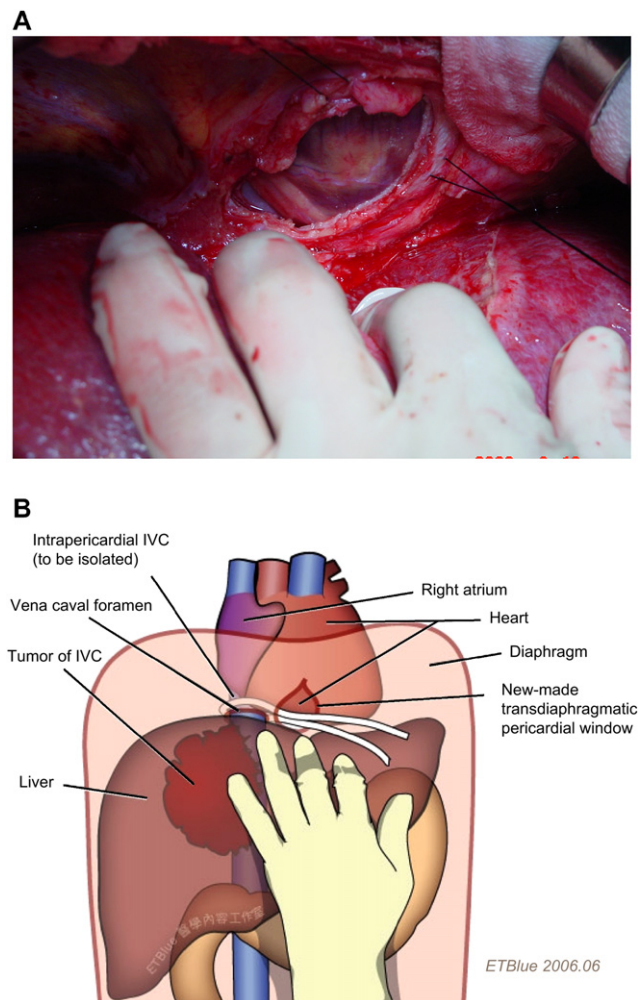


Figure 2. A. Transdiaphragmatic pericardial window approach for intrapericardial isolation of the inferior vena cava. B. Diagram of the transdiaphragmatic intrapericardial isolation technique.

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