Intrapericardial control of the inferior vena cava from the abdominal cavity

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Abstract Vascular isolation of the liver is a useful technique in major hepatic surgery that involves hepatic veins and the inferior vena cava. In some patients, exposure of the suprahepatic inferior vena cava is suboptimal from the abdominal cavity, and extension into the chest is required. This report details technical considerations of the control of the inferior vena cava within the pericardium from the abdominal cavity, through a vertical incision in the diaphragm, and without the need for a thoracic incision. We review the clinical situations when a transdiaphragmatic, intrapericardial access of the inferior vena cava should be considered.

Key words Vascular control · Inferior vena cava · Intrapericardial access

Introduction

A basic principle of safe surgical intervention is to achieve control of the major vascular structures. In some situations, hepatic surgery can only be done safely by first achieving control of the portal triad and inferior vena cava (IVC) below and above the liver. Several authors reported their experience of major hepatic surgery under total vascular isolation.1–3

Adequate access of the suprahepatic IVC is difficult to obtain from the abdominal cavity in situations where extensive lesions prevent safe mobilization of the liver, the entrance of the right hepatic vein into the IVC is difficult to see, tumor extends into the intrathoracic IVC, or there are major juxtahepatic caval injuries. In such cases, exposure to the suprahepatic IVC is often accomplished by extending the celiotomy incision into the right thorax or by a median sternotomy.4–9

Here we report our experience with intrapericardial inferior vena cava control, using a vertical incision in the diaphragm and parietal pericardium from an intraabdominal approach, without the need for a thoracic incision.

Technique

The patient is placed supine over a roll to expose the upper abdomen. The left arm is extended at a right angle in case venovenous bypass is needed. The initial incision is a bilateral subcostal with a midline extension. The xiphoid process is removed. Retractors are placed under both costal margins, pulling laterally and anteriorly. After the falciform ligament is divided all the way to the suprahepatic IVC, the subdiaphragmatic aspect of the liver is exposed. When exposure is not possible below the diaphragm, intrathoracic access of the IVC should be considered. To avoid a thoracotomy or even a sternotomy, the parietal pericardium is opened over the subxyphoid area, and the incision is carried down in an anterior-posterior direction, dividing the diaphragm and parietal pericardium down to 2–3 cm proximal to the IVC. The intrapericardial IVC is exposed by gentle cephalad retraction of the heart, and if necessary, a vascular clamp is applied over the IVC in an anterior-posterior direction (Fig. 1). After the surgical intervention is finished, the parietal pericardium and diaphragmatic opening are closed with a running suture, leaving the proximal third of the incision open to the abdominal cavity.

Case reports

Case 1

An 80 year-old man was diagnosed with a 6-cm renal cell carcinoma in the right kidney invading the right
renal vein and extending to the IVC proximally, up to the junction with the right atrium (Fig. 2). Surgery was performed through a bilateral subcostal incision with midline extension. After exploration of the abdomen, the infrarenal IVC and left renal vein were controlled by vessel loops. Mobilization of the right liver from the diaphragm was done by dividing the right triangular ligament, right adrenal vein, and accessory inferior hepatic veins, until there was complete exposure of the retrohepatic vena cava and right hepatic vein. After subdiaphragmatic dissection of the IVC, the tumor thrombus was felt, extending into the intrathoracic segment of the IVC. In order to gain control of the IVC proximal to the end of the tumor thrombus, the IVC was controlled intrapericardially through a vertical incision in the parietal pericardium and diaphragm. Dissection of the right kidney was then begun, leaving the kidney attached only to the right renal vein.

Complete hepatic vascular exclusion was planned. The patient, however, did not tolerate a test of vascular clamping, so he was prepared for venovenous bypass by cannulation of the left saphenous vein, inferior mesenteric vein, and left axillary vein. Vascular clamps were applied to the porta hepatis, infrarenal IVC, left renal vein, and intrapericardial IVC at the junction with the right atrium. Venovenous bypass was started. Right nephrectomy was completed by dividing the right renal vein, and the venotomy was extended longitudinally over the retrohepatic IVC. Then, the lumen of the IVC was explored and the tumor thrombus was manually removed. The venotomy was closed, the vascular clamps were released, and venovenous bypass was discontinued after a total of 10 min of vascular exclusion.

The postoperative course was complicated by a moderate pericardial tamponade, possibly related to tight closure of the pericardial incision. Tamponade was relieved by percutaneous aspiration. The patient has been followed for 6 months without evidence of tumor recurrence.

Case 2
A 50-year-old man was diagnosed with a single massive colorectal liver metastasis 20 cm in diameter. The tumor compromised the right lobe extending to segment 4, and IVC involvement at the junction with the right hepatic vein was suspected from preoperative studies (Fig. 3).

A bilateral subcostal incision with midline extension was carried out. On abdominal exploration, the tumor was found to infiltrate the diaphragm and was hazardous to mobilize. A decision was made to use an anterior approach for right hepatic trisegmentectomy with caudate lobectomy. Due to the proximity of the hepatic lesion to the hepatic veins and inferior vena cava, the porta hepatis and IVC above and below the liver were isolated in preparation for possible total vascular exclu-