

## **Liver resection combined with inferior vena cava graft replacement**

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Liver resection combined with IVC graft replacement is a complicated surgical procedure.

Today, first I would like to show you a video which shows liver resection combined with IVC graft replacement.

A 49-year-old woman with intrahepatic cholangiocarcinoma (ICC) presented without complaint because a liver tumor was detected on CT scan at another hospital.

Admission laboratory test results were within normal limits. With regard to virus markers, both hepatitis B surface antigen and hepatitis C antibody were negative. The indocyanine green retention rate at 15 minutes was 4%.

Computed tomography showed a hypovascular tumor, 5.5 cm in diameter in the caudate lobe of the liver. The tumor involved the IVC and the confluence of the middle and left hepatic veins, and the tumor was located close to the root of the right hepatic vein. The IVC showed deformation, and therefore, the tumor was considered to invade the wall of the IVC.

IVC venography showed several shunts connecting the inferior right hepatic vein to the right hepatic vein in the right lobe.

Based on the diagnosis, we planed to perform an extended left hepatectomy and caudate lobe resection combined with IVC graft replacement under total vascular exclusion using the bio-pump.

The left femoral part and the left axillary part were sterilized and covered with a sheet.

Laparotomy was done through a reverse T incision. The liver was normal, and the coronary ligament was dissected. In the hepatoduodenal ligament and around the common hepatic artery, lymph node dissection was performed. After cholecystectomy, the left hepatic artery and the left portal vein were ligated and cut. After checking the demarcation line between the left and right liver, the superior and the inferior hepatic parts of the IVC were taped. Liver dissection was done using a Cavitron ultrasonic surgical aspirator (CUSA). The left hepatic bile duct and the ligament were ligated and cut. The middle hepatic veins were ligated and cut between the cutting planes. The caudate lobe was dissected and the anterior wall of the IVC was identified. The tumor did not invade the right hepatic vein; therefore, the IVC just below the right hepatic vein and the IVC just below the tumor were taped. Catheters were inserted into the left femoral vein and the left axillary vein. Then active bypass using a bio-pump was started. The inferior part of the IVC, the

hepatoduodenal ligament and the superior part of the IVC were clamped and total vascular exclusion was performed. The IVC just below the right hepatic vein and the IVC just below the tumor were cut over a length of 5 cm. An expanded polytetrafluoroethylene graft (GORE-TEXFEP ringed vascular graft), with an internal diameter of 20 mm, was used and the IVC and the graft were sutured with 4-0 prolene. After suturing the superior part, saline was injected to the graft and the clamp at the superior part of the IVC was released. After suturing the inferior part of the IVC, the clamp at the hepatoduodenal ligament was released.

Pathological findings showed mass-forming type intrahepatic cholangiocarcinoma which invaded the IVC wall without lymph node metastasis.

The operation time was 375 minutes and the blood loss was 3500 ml. The time of total vascular exclusion was 45 minutes.

The patient's postoperative course was uneventful, and she was discharged 14 days after surgery.

Thirteen patients have undergone hepatectomy combined with graft replacement in our hospital. This table shows the surgical outcomes of these patients. One patient died with lung thrombosis after surgery. One year, 3-year survival rates were 80% and 35%, respectively, with a 50% survival of 25 months.

Liver resection combined with IVC graft replacement is a complicated surgical procedure. However, this procedure is indicated in some selected patients because the procedure was safely performed without severe complication and offers hope for patients with liver cancer invading the IVC which cannot be cured with chemotherapy.

There are several controversial problems. One of these is the indication of IVC resection, because a definite diagnosis of IVC wall invasion is difficult before surgery. Therefore, we would try to detach the tumor from the IVC wall during the operation. However, when a liver tumor involves the IVC over 1/2 of the circumference of the wall, IVC resection and replacement should be considered. When the wall involvement is less than one third of the circumference of the IVC wall, direct suture is preferable. The second problem is using the GORE TEXFE graft, because artificial grafts can cause infection and lung thrombosis just after surgery. Therefore, some investigators recommend reconstruction using an autologous patch graft. The external iliac vein or the left renal vein has been used. A patch graft reconstruction is considered to be one of the options; however, the operation is more complicated than graft replacement. Two of 11 patients in our series had lung thrombosis after

surgery and one patient died with the complication. Therefore, anti-coagulant therapy should be performed after surgery, such as heparin injection.

Total vascular exclusion and active bypass also have pros and cons.

However, in this case, the tumor was located at the hepatic vein confluence and the operation was expected to be complicated; therefore, active bypass under THVE should be considered. The vital signs of the patient were stable during THVE and a safe operation could be achieved.