

Inferior Vena Cava Encirclement by Caudate Lobe Hypertrophy: Evaluation by MRI and CT and its impact on Caval Preservation During Orthotopic Liver Transplantation

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Purpose:

The traditional technique of orthotopic liver transplantation (OLT) entails hepatectomy with resection of the retrohepatic inferior vena cava (IVC) and bicaval anastomosis. An alternative technique utilizing a single suprahepatic cavo-caval anastomosis ("piggyback," end-to-end, and side-to-side) allows for preservation of the IVC, leading to reduced fluid resuscitation requirements, maintenance of core body temperature, and improved cardiac hemodynamic stability, and has become the preferred technique at many centers. In cases involving living liver donors preservation of the IVC is required. The presence of a dorsal sector of liver (consisting of segments I and IX) that completely encircles the liver, a phenomenon seen in cirrhotics with caudate lobe hypertrophy as well as non-cirrhotics with variant anatomy, is often found intraoperatively and may cause difficulty in preserving an intact IVC. This may lead to increased operative time, need for blood product transfusions, and increased cost and may result in abandonment of the IVC preservation for retrohepatic IVC resection. Preoperative knowledge of this phenomenon may allow advanced planning of operative technique and may decrease operative time and complexity. In this study we sought to evaluate the incidence of IVC encirclement by hepatic parenchyma using preoperative MRI and CT, routinely obtained for preoperative assessment, and its effect on surgical technique.

Methods:

The original study group consisted of 117 patients who had undergone orthotopic liver transplantation between 1995 and 2002, and who had preoperative imaging with either CT or MRI of the abdomen. Twenty-three patients were excluded because their medical records and/or imaging studies were not available for review, leaving the study group with 94 patients. Two radiologists reviewed each CT or MRI of the abdomen, and determined if there was complete encirclement of the inferior vena cava by dorsal sector hepatic parenchyma. If complete encirclement was not present, the degree of encirclement was noted and classified as less than 180 degrees, 180 to 270 degrees, or 270 to 360 degrees. The shortest distance between non-encircling tissue was noted. Patient medical records were reviewed to determine the type of surgical technique utilized, including IVC resection versus preservation and institution of venovenous bypass. Cases in which there was difficulty encountered in dissection of the IVC from the liver (i.e. iatrogenic tear of the IVC or its tributaries or inability to visualize the IVC) were noted. The incidence of complete IVC encirclement was calculated. The rates of IVC preservation, IVC resection, and institution of venovenous bypass, and the association with complete IVC encirclement were calculated. Interobserver variability was also determined using the intraclass correlation coefficient as described by Shrout and Fleiss.

Results:

Incidence of complete encirclement was found to be 17% on average (15/94 by reader 1 and 17/94 by reader 2). Interobserver variability for classification of complete encirclement was 0.79. Resection of the recipient IVC was required in three out of 94 patients, two of whom demonstrated complete encirclement of the IVC by hepatic tissue, and the third of whom demonstrated near complete encirclement (only a 2 mm circumference of IVC was not encircled). The correlation of IVC encirclement with choice of IVC resection produced an area under the ROC curve of 0.752 with a probability level of 0.0088. Venovenous bypass was required in four out of 94 cases, three of which involved complete encirclement of the IVC, producing an area under the ROC curve of 0.668 with a probability level of 0.0272. A difficult dissection was encountered in thirteen of 94 cases, of which seven were due to complete encirclement of the IVC by hepatic parenchyma.

Conclusion:

Routine pretransplant assessment of IVC encirclement by dorsal sector hepatic tissue using MRI and CT may be helpful in identifying patients in whom preservation of the IVC will be difficult, and help plan operative technique.

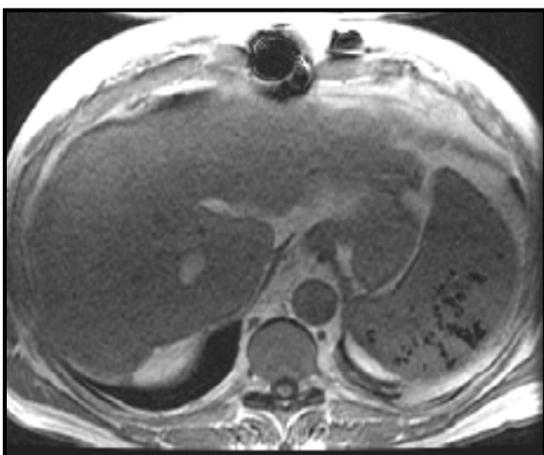


Figure 1: IVC encirclement by caudate lobe hypertrophy, depicted on a T1-weighted axial image obtained during routine preoperative MRI of the abdomen.