

**2070** has been shown to reduce waiting list mortality, to reduce waiting time prior to transplantation, to be the best predictor of pretransplantation mortality, to satisfy the prevailing view that medical need should be the decisive determinant, and to eliminate both the subjectivity inherent in the CTP scoring system (presence and degree of ascites and hepatic encephalopathy) and the differences in waiting times among different regions of the country. Recent data indicate that liver recipients with MELD scores <15 experienced higher posttransplantation mortality rates than similarly classified patients who remained on the wait list. This observation led to the modification of UNOS policy to allocate donor organs to candidates with MELD scores exceeding 15 within the local or regional procurement organization before offering the organ to local patients whose scores are <15. In addition, serum sodium, another important predictor of survival in liver transplantation candidates, is taken into consideration in allocating donor livers.

The highest priority (status 1) continues to be reserved for patients with fulminant hepatic failure or primary graft nonfunction. Because candidates for liver transplantation who have HCC may not be sufficiently decompensated to compete for donor organs based on urgency criteria alone, and because protracted waiting for cadaver donor organs often results in tumor growth beyond acceptable limits for transplantation, such patients are assigned disease-specific MELD points (Table 368-3). Other disease-specific MELD exceptions include portopulmonary hypertension, hepatopulmonary syndrome, familial amyloid polyneuropathy, primary hyperoxaluria (necessitating liver-kidney transplantation), cystic fibrosis liver disease, and highly selected cases of hilar cholangiocarcinoma.

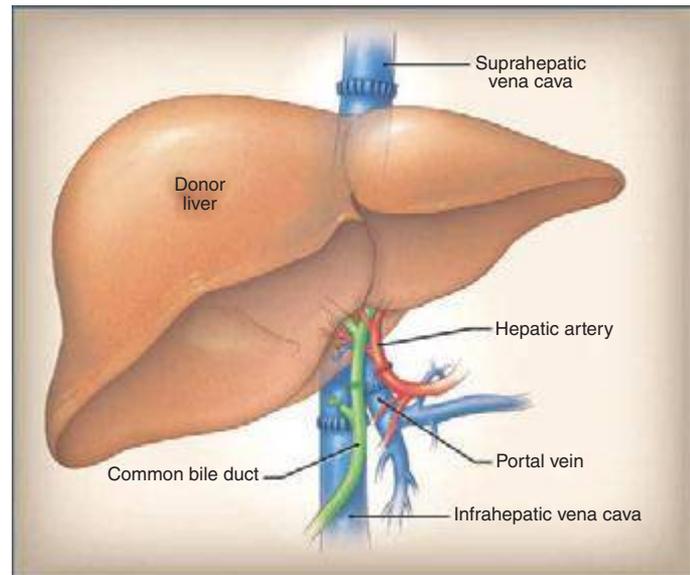
#### LIVING DONOR TRANSPLANTATION

Occasionally, especially for liver transplantation in children, one cadaver organ can be split between two recipients (one adult and one child). A more viable alternative, transplantation of the right lobe of the liver from a healthy adult donor into an adult recipient, has gained increased popularity. Living donor transplantation of the left lobe (left lateral segment), introduced in the early 1990s to alleviate the extreme shortage of donor organs for small children, accounts currently for approximately one-third of all liver transplantation procedures in children. Driven by the shortage of cadaver organs, living donor transplantation involving the more sizable right lobe is being considered with increasing frequency in adults; however, living donor liver transplantation cannot be expected to solve the donor organ shortage; 246 such procedures were done in 2012, representing only about 4% of all liver transplant operations done in the United States.

Living donor transplantation can reduce waiting time and cold-ischemia time; is done under elective, rather than emergency, circumstances; and may be lifesaving in recipients who cannot afford to wait for a cadaver donor. The downside, of course, is the risk to the healthy donor (a mean of 10 weeks of medical disability; biliary complications in ~5%; postoperative complications such as wound infection, small-bowel obstruction, and incisional hernias in 9-19%; and even, in 0.2-0.4%, death) as well as the increased frequency of biliary (15-32%) and vascular (10%) complications in the recipient. Potential donors must participate voluntarily without coercion, and transplantation teams should go to great lengths to exclude subtle coercive or inappropriate psychological factors as well as outline carefully to both donor and recipient the potential benefits and risks of the procedure. Donors for the procedure should be 18-60 years old; have a compatible blood type with the recipient; have no chronic medical problems or history of major abdominal surgery; be related genetically or emotionally to the recipient; and pass an exhaustive series of clinical, biochemical, and serologic evaluations to unearth disqualifying medical disorders. The recipient should meet the same UNOS criteria for liver transplantation as recipients of a cadaver donor allograft. Comprehensive outcome data on adult-to-adult living donor liver transplantation are being collected ([www.nih-a2all.org](http://www.nih-a2all.org)).

#### SURGICAL TECHNIQUE

Removal of the recipient's native liver is technically difficult, particularly in the presence of portal hypertension with its associated



**FIGURE 368-1** The anastomoses in orthotopic liver transplantation. The anastomoses are performed in the following sequence: (1) suprahepatic and infrahepatic vena cava, (2) portal vein, (3) hepatic artery, and (4) common bile duct-to-duct anastomosis. (Adapted from JL Dienstag, AB Cosimi: *N Engl J Med* 367:1483, 2012.)

collateral circulation and extensive varices and especially in the presence of scarring from previous abdominal operations. The combination of portal hypertension and coagulopathy (elevated prothrombin time and thrombocytopenia) may translate into large blood product transfusion requirements. After the portal vein and infrahepatic and suprahepatic inferior vena cavae are dissected, the hepatic artery and common bile duct are dissected. Then the native liver is removed and the donor organ inserted. During the anhepatic phase, coagulopathy, hypoglycemia, hypocalcemia, and hypothermia are encountered and must be managed by the anesthesiology team. Caval, portal vein, hepatic artery, and bile duct anastomoses are performed in succession, the last by end-to-end suturing of the donor and recipient common bile ducts (Fig. 368-1) or by choledochojejunostomy to a Roux-en-Y loop if the recipient common bile duct cannot be used for reconstruction (e.g., in sclerosing cholangitis). A typical transplant operation lasts 8 h, with a range of 6-18 h. Because of excessive bleeding, large volumes of blood, blood products, and volume expanders may be required during surgery; however, blood requirements have fallen sharply with improvements in surgical technique, blood-salvage interventions, and experience.

As noted above, emerging alternatives to orthotopic liver transplantation include split-liver grafts, in which one donor organ is divided and inserted into two recipients; and living donor procedures, in which part of the left (for children), the left (for children or small adults), or the right (for adults) lobe of the liver is harvested from a living donor for transplantation into the recipient. In the adult procedure, once the right lobe is removed from the donor, the donor right hepatic vein is anastomosed to the recipient right hepatic vein remnant, followed by donor-to-recipient anastomoses of the portal vein and then the hepatic artery. Finally, the biliary anastomosis is performed, duct-to-duct if practical or via Roux-en-Y anastomosis. Heterotopic liver transplantation, in which the donor liver is inserted without removal of the native liver, has met with very limited success and acceptance, except in a very small number of centers. In attempts to support desperately ill patients until a suitable donor organ can be identified, several transplantation centers are studying extracorporeal perfusion with bioartificial liver cartridges constructed from hepatocytes bound to hollow fiber systems and used as temporary hepatic-assist devices, but their efficacy remains to be established. Areas of research with the potential to overcome the shortage of donor organs include hepatocyte transplantation and