



Patient and Graft Survival Following Extended Criteria Donor Liver Transplants

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DESCRIPTION

Liver transplantation is a life-saving procedure for patients with end-stage liver disease, acute liver failure and selected hepatic malignancies. The persistent shortage of donor organs in the United States has led to the increased utilization of Extended Criteria Donors (ECDs) to expand the donor pool and provide opportunities for patients who might otherwise die waiting for a transplant. ECDs include organs from donors who deviate from standard ideal criteria, such as older age, history of certain comorbidities, steatosis, prolonged ischemic times, or infection status. The use of these organs has raised important questions about long-term outcomes, graft survival and patient safety, making it a topic of significant clinical interest.

The concept of ECDs emerged as a pragmatic solution to organ scarcity. Historically, donor livers were primarily sourced from young, otherwise healthy individuals with minimal comorbidities. However, the increasing demand for transplantation has made reliance on ideal donors insufficient to meet clinical needs. Extended criteria livers, while carrying potential risks, allow centers to reduce waiting list mortality and offer transplants to higher-risk recipients. In the United States, regulatory frameworks and clinical guidelines have evolved to guide the appropriate use of ECD organs, ensuring that decisions balance the potential benefits against the risks of inferior graft function or complications.

Donor comorbidities such as diabetes, hypertension, or a history of cardiovascular disease may influence the quality of ECD livers. These conditions can affect microvascular integrity, hepatocyte viability and metabolic function, increasing the risk of post-transplant complications. Additionally, donors with certain infectious exposures, such as hepatitis B or C, present specific challenges that require targeted antiviral prophylaxis or monitoring to prevent transmission to recipients. Advances in antiviral therapy and perioperative management have allowed successful use of such organs, contributing to a broader acceptance of ECDs in contemporary practice.

Ischemic time is another variable that significantly impacts outcomes in ECD liver transplantation. Prolonged cold ischemia during organ procurement, preservation and transport can exacerbate injury in vulnerable ECD organs. Warm ischemia during donor circulatory arrest, particularly in Donation after Cardiac Death (DCD) donors, further increases the risk of early allograft dysfunction and biliary complications. Strategies to minimize ischemic injury, including rapid organ retrieval, optimized preservation solutions and machine perfusion techniques, have been developed to improve outcomes in ECD transplantation.

Post-transplant outcomes of ECD liver transplantation have been evaluated through multiple metrics, including patient survival, graft survival, incidence of primary non-function, acute and chronic rejection, biliary complications and overall quality of life. While some studies report slightly higher rates of early allograft dysfunction in ECD recipients, long-term survival at five and ten years often approaches that of standard donor transplants when risk factors are carefully managed. Patient selection, perioperative care and immunosuppressive strategies all play a role in achieving these outcomes, highlighting the importance of multidisciplinary coordination in transplant centers.

Biliary complications remain a notable concern in ECD liver transplantation. Ischemia-reperfusion injury, prolonged cold ischemia and donor-related vascular changes can contribute to strictures, leaks and cholangitis. These complications may necessitate interventional procedures or re-transplantation in severe cases. However, advances in endoscopic and radiologic management, along with improved surgical techniques, have reduced morbidity and allowed most complications to be managed effectively. Studies indicate that while biliary complications may be more frequent with ECD organs, their impact on long-term graft survival can be minimized with vigilant monitoring.

The potential for graft loss or the need for re-transplantation is also increased in certain high-risk ECD scenarios. Although

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long-term survival is generally acceptable, early complications can result in prolonged hospitalization, repeated interventions and increased healthcare costs. Patients must be counseled regarding these risks prior to transplantation and informed consent processes should address both the benefits and limitations of accepting an ECD liver.

In conclusion, liver transplantation using extended criteria donors in the United States presents a balance of advantages and disadvantages. Advantages include expanded access to transplantation, reduced waiting list mortality, opportunities for

clinical innovation and acceptable long-term outcomes with proper management. Disadvantages encompass increased risk of early graft dysfunction, biliary complications, metabolic challenges, resource-intensive monitoring, and potential impact on center outcomes. Careful donor and recipient selection, informed consent, and structured perioperative and postoperative care remain essential to optimizing outcomes. The ongoing study and refinement of ECD utilization continue to inform clinical practice, ensuring that the benefits of expanded donor criteria are realized while minimizing associated risks for transplant recipients.