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Optimizing Liver Perfusion and Vascular access during machine perfusion with PerLife®



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Introduction

Machine perfusion is revolutionizing the liver transplant panorama, offering new opportunities to enhance transplant quality and safety. Compared to static cold storage, dynamic perfusion reduces ischemia-reperfusion injury, improves cellular metabolism, facilitates toxin clearance, and allows pre-transplant functional assessment. In particular, ex situ hypothermic oxygenated perfusion (HOPE) has demonstrated significant benefits in preserving marginal or complex livers.

Methods

Thanks to the PerLife device developed by Aferetica, the liver is positioned in an organ chamber that is easily accessible, fully visible, and not submerged in perfusate. In this approach, initially, it is separated the hepatic artery and portal vein from connective tissue and the inferior vena cava.

Perfusion is initially started via the portal vein, enabling early organ stabilization.

Dissection and preparation of the portal vein then continue up to the hepatic hilum. Once portal vein preparation is completed, dissection of the artery is initiated at the level of the celiac trunk, allowing initiation of dual perfusion (DHOPE).

This design provides optimal anatomical exposure, allowing the surgeon to perform hepatic artery reconstruction in cases of anatomical variants or complex vascular architecture, allowing control of leaks. Preparation of the liver graft ends with dissection and preparation of the retrohepatic vena cava and supra-hepatic veins.

Results

This operative strategy has shown a significant reduction in cold ischemia time, as the organ remains perfused from the early stages of preparation. Moreover, the ability to perform real-time arterial reconstruction improves graft suitability and reduces the risk of post-transplant thrombosis or malperfusion. Adoption of machine perfusion has also led to a higher utilization rate of organs previously considered marginal and successfully transplanted.

Conclusion

Machine perfusion, combined with direct and continuous access to the organ during treatment, represents a significant advancement in transplant medicine. The HOPE technique, initiated via the portal vein, followed by DHOPE after arterial preparation, not only reduces ischemic injury but also optimizes organ preparation. Notably, PerLife stands out for its design, which keeps the liver visible and not submerged in perfusate, providing the surgeon with excellent exposure to perform vascular reconstruction directly during perfusion, enhancing both precision and timing of the procedure.