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Revolutionizing Liver Transplantation with Machine Perfusion Technology

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Introduction

Liver transplantation has long been a critical life-saving procedure for patients with end-stage liver disease, acute liver failure, and certain types of liver cancers. However, the demand for liver transplants has consistently outpaced the supply of donor organs, creating a significant gap between those in need of a transplant and the availability of suitable livers. Over the coming decades, several factors are expected to influence both the demand for liver transplants and the supply of donor organs. Understanding these trends is essential for addressing the challenges associated with liver transplantation, improving patient outcomes, and optimizing healthcare resources. The rising rates of obesity and diabetes worldwide are leading to an increase in NAFLD, a condition that is closely linked to metabolic syndrome. NAFLD can progress to non-alcoholic steatohepatitis (NASH), cirrhosis, and ultimately liver failure, which often requires a transplant. In fact, NASH is expected to surpass alcohol-related liver disease as the leading indication for liver transplants within the next decade [1].

Description

Liver transplantation has long been a life-saving procedure for patients suffering from end-stage liver disease or acute liver failure. However, one of the major limitations of liver transplants has been the shortage of viable donor organs, which often results in patients waiting years for a suitable liver. Traditional cold storage methods for donor livers have further limited the viability of organs, reducing the window for successful transplantation. However, recent advances in machine perfusion technology are revolutionizing the field of liver transplantation, offering new hope for both patients and healthcare providers. These innovative systems are increasing the number of viable donor livers, enhancing organ preservation, and ultimately driving significant growth in liver transplantation. Machine perfusion is a method of preserving organs outside the body by continuously supplying oxygen, nutrients, and other vital fluids to the organ. Unlike traditional cold storage, where the liver is placed in a preservation solution and cooled, machine perfusion keeps the organ functioning in a near-physiological state. This process involves pumping oxygenated and nutrient-rich fluids through the liver's blood vessels, essentially "reviving" the organ outside the body and providing a much longer window for transplantation [2].

This involves cooling the liver to low temperatures (usually around 4°C) while maintaining perfusion. It helps preserve the liver for extended periods compared to traditional cold storage, reducing the risk of ischemic damage and improving organ quality. This technique involves keeping the liver at body temperature (37°C), essentially maintaining the organ in a state as close to its natural function as possible. NMP has been shown to improve liver function, and researchers are investigating its potential to assess organ viability in real time before transplantation. One of the key limitations of traditional cold storage is the short window for organ preservation. Livers stored in ice can only be preserved for about 12-18 hours, after which they begin to degrade. Machine perfusion, however, significantly extends this time. With HMP, livers can be preserved for up to 24-36 hours, and NMP can extend the preservation period even further. This longer preservation window increases the chances of matching suitable organs to patients and allows for more time to transport organs across longer distances [3]. Machine perfusion helps reduce ischemic damage that occurs when blood flow is interrupted during the organ retrieval process. This is particularly important for livers, which are highly sensitive to ischemia. By keeping the liver oxygenated and nourished during the preservation process, machine perfusion improves the quality of the organ and its overall function after transplantation. This leads to better post-transplant outcomes, including fewer complications such as graft dysfunction or rejection. With increasing rates of alcohol consumption in many parts of the world, Alcohol-related Liver Disease (ALD) continues to be a significant cause of liver failure, contributing to rising demand for liver transplants [4].

Machine perfusion technology has the potential to significantly increase the pool of available donor organs. Traditionally, livers from older donors, donors with a history of alcohol use, or those with fatty liver disease were often discarded because they were deemed "marginal" or at higher risk of failing post-transplant. With machine perfusion, these organs can be better preserved and assessed for viability before transplantation. In some cases, previously discarded organs are now being successfully transplanted, leading to an increase in the number of viable livers available for transplantation. One of the most exciting aspects of machine perfusion technology, particularly with norm thermic perfusion, is its ability to allow real-time monitoring of liver function. By maintaining the liver at physiological temperatures and perfusing it with oxygen and nutrients, it is possible to assess the organ's viability before transplantation. Surgeons and physicians can evaluate key metrics such as bile production, glucose metabolism, and overall liver function, ensuring that only the best organs are transplanted. This reduces the risk of transplanting an organ that might otherwise fail shortly after transplantation. As machine perfusion technology becomes more widely used, its integration into global transplant networks will be crucial. This means creating efficient systems for organ transportation, matching, and assessing donor organs using machine perfusion to ensure that all potential organs are optimally preserved and assessed [5].

Conclusion

One of the barriers to widespread adoption is the cost of machine perfusion systems, which can be expensive for hospitals and transplant centers to implement. As the technology matures and becomes more widespread, the hope is that costs will decrease, making it more accessible to hospitals around the world. We analyzed data from the Standard Transplant Analysis and Research (STAR) datafile, covering the period from January 2010 to July 2023, to examine Cardiovascular (CV) changes following the implementation of Machine Perfusion (MP). Centers were categorized into three groups: nonusers, low MP users, and high MP (HMP) users. To assess the impact of MP implementation, we employed an interrupted time series analysis to

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evaluate CV trends before and after January 2016, marking the first use of MP. Additionally, high-volume institutions from 2015 were compared to their counterparts in 2022, stratified by MP usage status, using the Wilcoxon rank sum test to identify any significant differences in CV outcomes.

Acknowledgement

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Conflict of Interest

None.

References

1. Mehta, Neil, Prashant Bhangui, Francis Y. Yao and Vincenzo Mazzaferro, et al. "Liver transplantation for hepatocellular carcinoma. Working group report from the ILTS transplant oncology consensus conference." Transplan 104 (2020): 1136-1142.

2. Mazzaferro, Vincenzo, Enrico Regalia, Roberto Doci and Salvatore Andreola, et al. "Liver transplantation for the treatment of small hepatocellular carcinomas in patients with cirrhosis." *New Eng J Med* 334 (1996): 693-700.

3. Wehrle, Chase J., Roma Raj, Marianna Maspero and Sangeeta Satish, et al. "Risk assessment in liver transplantation for hepatocellular carcinoma: long-term follow-up of a two-centre experience." *Int J Surg* 110 (2024): 2818-2831.

4. Facciuto, Marcelo E., Manoj K. Singh, Umadevi Katta and Susana Samaniego, et al. "Liver transplantation for hepatocellular carcinoma: defining the impact of using extended criteria liver allografts." *Transplan* 92 (2011): 446-452.

5. Dueland, Svein, Trygve Syversveen, Jon Magnus Solheim and Steinar Solberg, et al. "Survival following liver transplantation for patients with nonresectable liver-only colorectal metastases." *Ann Surg* 271 (2020): 212-218.

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