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REVIEW ARTICLE

Hyperbaric oxygen therapy and liver transplantation

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Abstract
Liver transplantation is the treatment of choice for end stage liver disease and is often used for primary liver malignancies. The main limitation of its wider application is the availability of suitable donor organs. The use of marginal donor organs, split-liver transplantation and living-related liver transplantation techniques contribute to increase the donor pool. However, the use of these techniques is associated with a higher risk of post transplantation organ dysfunction, predominantly due to ischaemia, preservation and reperfusion injury (IPRI). A number of studies have demonstrated that hyperbaric oxygen (HBO) therapy influences IPRI and consequential acute cellular rejection. This article reviews the rationale of HBO therapy in the field of transplantation with particular emphasis on liver transplantation.

Key Words: *acute rejection, ischaemia reperfusion injury, hyperbaric oxygen, liver failure, liver support*

Introduction

Liver transplantation is an established therapeutic modality for acute and chronic liver diseases. The improvement in outcome of liver transplantation is related to advances in patient selection criteria, organ preservation, operative techniques, perioperative care and efficacy of immunosuppressive agents. The resultant increase in demand for donor organs, widely estimated to be between 15 and 80 per million population, has led to the development of many strategies [1]. These include the use of split-liver transplantation [2,3], living-related transplantation [4,5], domino transplantation [6], non-heart beating donor transplantation and the use of marginal donor organs. These techniques result in the procurement of an organ that potentially has suboptimal function compared with normal organs, either due to the reduction in mass or the functional quality of the tissue [7]. Such organs are more susceptible to ischaemia, preservation and reperfusion injury (IPRI), which accounts for the majority of graft loss.

A further cause for donor organ damage is acute cellular rejection (ACR), which affects approximately 30–40% of patients after transplantation. Although ACR is effectively treated with modern immunosuppressive agents, this adds significantly to the postoperative morbidity and overall cost of transplantation. Recent evidence suggests a correlation between the severity of IPRI and ACR. Limiting the severity of IPRI may reduce the incidence of primary non-function (PNF) as well as ACR after liver transplantation. Hyperbaric oxygen (HBO) therapy has been shown to reduce the severity of IPRI as well as modulate both humoral and cellular immune response. This paper provides an overview of the relationship between IPRI and ACR and the potential therapeutic implications of HBO therapy in liver transplantation.

Pathophysiology of the interaction of IPRI and ACR

The cumulative effect of warm ischaemia and cold preservation is an energy deficiency within the Kupffer and endothelial cells leading to intracellular oedema [8]. The early stages of reperfusion are characterized by a depletion of L-arginine, a precursor of the potent vasodilator nitric oxide (NO) and an elevation of endothlin-1 (ET-1). The latter stimulates hepatic stellate cell contraction, leading to sinusoidal narrowing, congestion and impaired flow. The low velocity within the sinusoids progressively promotes leucostasis, further hindering sinusoidal blood flow

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