

Application of hyperbaric oxygen in liver transplantation

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Abstract

In recent years, hyperbaric oxygen (HBO) has been used in the treatment of a lot of diseases such as decompression sickness, arterial gas embolism, carbon dioxide poisoning, soft tissue infection, refractory osteomyelitis, and problematic wound, but little is known about its application in liver transplantation. Although several studies have been conducted to investigate the protective effects of HBO on liver transplantation and liver preservation, there are still some controversies on this issue, especially its immunomodulatory effect. In this short review, we briefly summarize the findings supporting the application of HBO during liver transplantation (including donors and recipients).

Key words: hyperbaric oxygen; liver transplantation; liver ischemia/reperfusion; oxidative stress; pre-conditioning; immunomodulation; liver regeneration; organ preservation

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Introduction

Hyperbaric oxygen (HBO) therapy is defined as the inhalation of 100% oxygen under elevated atmospheric pressure, that is, at a pressure higher than the pressure found on the surface of the earth at sea level, which is defined to be 100 kPa (Camporesi and Bosco, 2014). In 1937, Dr. Albert Behnke serving in the U.S. Navy first suggested the use of oxygen at elevated pressures during recompression therapy for the bends (now known as decompression sickness, DCS). With the improvement of understanding of HBO, it has been widely used as an adjunctive treatment for various pathological states, predominantly related to hypoxic and/or ischemic conditions, including arterial gas embolism, carbon dioxide poisoning, soft tissue infection, refractory osteomyelitis, and problematic wound, and the indications to HBO treatment are still increasing (Wang et al., 2014; Fife et al., 2016). For example, it is also applied in the treatment of cluster headache, post-traumatic stress disorder and autism spectrum disorder (Petersen et al., 2014; Eve et al., 2016; Xiong et al., 2016).

As compared to pharmacotherapy, HBO seems to be safe for patients because its side effects are rare and oxygen toxicity appears primarily when it is used at very high doses and for a longer duration than recommended (Camporesi, 2014).

Liver transplantation is widely accepted as the definitive treatment in end-stage liver disease, selected liver malignancies and acute liver failure (Zarrinpar and Busuttil, 2013). The advances in patient selection criteria, organ preservation, operative techniques, perioperative care and efficacy of immunosuppressive agents significantly improve the outcome of liver transplantation. However, ischemia, preservation and reperfusion injury (IPRI) and immune rejection are two major problems causing transplantation failure (Zarrinpar and Busuttil, 2013). Studies have shown that HBO is protective against organ ischemia/reperfusion (I/R) injury (Zhai et al., 2016) and has the immunomodulatory effects (Feldmeier et al., 2003). Thus, some investigators have attempted to investigate the application of HBO in liver transplantation. In this paper, we briefly summarized