Viewpoint on Nutrition

Actively implementing enteral nutrition to reduce parenteral nutrition-associated liver disease

Shuifang Jin[1], Ronglin Jiang[1], Weibin Ma[2]

[1]Intensive Care Unit, [2]Department of Pharmacy, First Affiliated Hospital, Zhejiang Chinese Medical University, Hangzhou 310006, China
Correspondence to: Weibin Ma. Department of Pharmacy, First Affiliated Hospital, Zhejiang Chinese Medical University, Hangzhou 310006, China. Email: maweibin96519@126.com.

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For critically ill patients whose vital signs have been basically stable, especially those who have already suffered from malnutrition, the need to provide nutritional support has become the consensus of the medical community at present. It improves the survival rate and reduces the complications.

Nutritional support includes parenteral nutrition and enteral nutrition. Parenteral nutrition can significantly improve the nutritional status of critically ill patients, thereby improving the clinical prognosis. However, long-term parenteral nutrition, especially total parenteral nutrition, is prone to parenteral nutrition-associated liver disease, including cholestasis, abnormal liver function, liver fat infiltration, liver fibrosis, and even cirrhosis (1). Because these diseases often occur in patients with intestinal failure requiring long-term application of parenteral nutrition, they are also known as intestinal failure-related liver diseases. Possible mechanisms of its occurrence include: (I) lipid injuries. Lipids administered through the intestines are absorbed into the intestinal epithelium and converted into chylomicrons for normal metabolism. Lipids administered parenterally (intravenously) contain mainly ω-6 polyunsaturated fatty acids and triacylglycerols but lack cholesterol. Due to the lack of cholesterol, the liver's lipolysis is reduced. That will result in fat accumulation in the liver (2). On the other hand, only 5–10% of plant sterols in lipids are absorbed by enteral nutrition. The soybean oil commonly used in parenteral nutrition lipids is rich in phytosterols, making livers prone to parenteral nutrition-associated liver disease (3). Phytosterols antagonizes the effect of farnesoid derivative X receptor, which reduces bile acid synthesis by inhibiting 7-alpha hydroxylase. Therefore, more phytosterols at parenteral nutrition increase the synthesis of bile acids and cause liver damage, resulting in parenteral nutrition-associated liver disease (4); (II) intestinal injury. Firstly, in the absence of enteral nutrition, due to the lack of effective stimulation of the intestinal mucosa by food, intestinal secretion is reduced, intestinal peristalsis is weakened, gastrointestinal hormone levels are decreased, and release of cholecystokinin and gastrin is reduced. The secretion, emptying and circulation of bile are all affected. The nutrients cannot be converted in time. All of these factors lead to cholestasis and hepatic steatosis (5). Long-term fasting leads to serious damage to the barrier functions of the intestinal tract; the intestinal bacteria and toxins can easily penetrate the intestinal mucosa and cause bacteremia and toxemia, which in turn cause liver damage (6); (III) nutrient imbalance. Patients with long-term total parenteral nutrition often lack plasma carnitine, choline and taurine. These factors affect fatty acid metabolism and bile secretion, and cause hepatic steatosis and cholestasis (7). Excessive sugar and amino acids in parenteral nutrition also cause hepatopathy. Furthermore, overloaded glucose converts to triacylglycerol which accumulates in the liver and causes non-alcoholic fatty liver disease. While excessive amino acid acts on liver cells and causes excessive bile secretion, which causes cholestasis (8).

Gastrointestinal barrier functions include mechanical barriers, biological barriers, chemical barriers, and immune barriers. These barriers constitute a complete gastrointestinal defense system. They play a key role in preventing the translocation of bacteria and toxins in the gastrointestinal tract, maintaining the proper absorption of nutrients and avoiding liver damage. Gastrointestinal

barrier function is dependent on the maintenance of enteral nutrition. It is well-known that the nutrients required for the microbiota in the gut lumen that make up the biological barrier come from enteral nutrition (9). Seventy percent of the energy sources of the intestinal mucosal epithelial cells are from the enteral nutrient. The lymphocytes in intestinal mucosa and submucosal that make up the immune barrier are metabolically intensive, and their energy sources are also closely related to enteral nutrition. Enteral nutrition meets the physiological and metabolic characteristics of the human body. It not only meets the needs of liver metabolism, but also improves gastrointestinal function, including gastrointestinal barrier function. It is conducive to the promotion of bile excretion. Shores *et al.* (10) reported that active enteral nutrition in children after intestinal surgery significantly reduces blood bilirubin concentrations, and mitigates the incidence of parenteral nutrition-associated liver disease and its severity. Furthermore, a recent study (11) suggested that parenteral nutrition in Crohn's patients caused severe liver damage, but the liver function can be gradually and significantly improved after the application of enteral nutrition. Some studies (12,13) have found that increasing the supply of enteral nutrition in critically ill patients, especially those at high-risk of malnutrition (NUTRIC score 6–9), reduces the 28-day mortality. Therefore, in the case of critically ill patients with the permission of general conditions and gastrointestinal function, enteral nutrition should be actively implemented and parenteral nutrition should be limited. Enteral nutrition has important implications for maintaining the intestinal barrier function and preventing parenteral nutrition-associated liver disease, thereby improving the patient clinical prognosis.

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Footnote

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