Progress of Research on Early Bed Mobility after Hepatectomy in Patients with Hepatocellular Carcinoma

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Abstract: Early getting out of bed after hepatectomy in hepatocellular carcinoma patients can promote blood circulation, facilitate the recovery of intestinal function, weaken the level of inflammatory response, and reduce the incidence of complications. The article summarizes the overview of early getting out of bed after hepatectomy in patients with hepatocellular carcinoma, the current situation, the importance of this, the physiological mechanism, the influencing factors, and the progress of the related research in clinical practice, which is meant to provide the clinical healthcare personnel with safe and efficient guidance for patients with hepatectomy for hepatocellular carcinoma, and gives reference to related research. The purpose of this study is to provide clinical health care personnel with the opportunity to safely and efficiently guide hepatocellular carcinoma hepatectomized patients to get out of bed as early as possible after surgery.

***Keywords*:** hepatocellular carcinoma, hepatectomy, postoperative, early bed mobilization, review

1. Introduction

Hepatocellular carcinoma is a common malignant tumor in clinical practice, ranking fourth in incidence rate and second in mortality rate in China, with high morbidity and mortality rates, seriously threatening patients' lives [1]. Currently, surgical resection of tumors is a common and effective treatment for liver cancer [2,3]. However, hepatectomy is invasive, has a long postoperative recovery process, and is prone to complications. The concept of Accelerated Recovery After Surgery (ERAS) is based on evidence-based, multi-modal, multi-disciplinary team dynamic management, optimization, and combination of perioperative care measures to reduce the patient's surgical stress response, reduce complications, and promote rapid recovery [4]. With the application of accelerated rehabilitation surgery in hepatobiliary surgery in recent years, early postoperative bed mobility is considered one of the basic and important measures, emphasizing the key significance of early postoperative bed mobility. Early getting out of bed activities can not only promote the recovery of various system functions such as motor, digestive and respiratory functions, but also shorten the recovery time, reduce the hospitalization time, and decrease the complication rate [5]. This study will review the research progress of early out-of-bed activities after hepatectomy for hepatocellular carcinoma, including overview, current status, importance, physiological mechanisms, influencing factors and clinical practice.

2. Overview of early postoperative bed mobility

The definition of early postoperative bed activities has not yet formed a unified standard. China's Clinical Practice Guidelines for Accelerated Rehabilitation Surgery (Version 2021) clearly states [6] that patients can take a semi-recumbent position or carry out adaptive activities in bed after awakening, and it is recommended that they start to get out of bed on the first postoperative day. Although the China Clinical Practice Guidelines for Accelerated Rehabilitation Surgery [4] and the Hunan Expert Consensus on Clinical Pathways for Accelerated Rehabilitation Surgery for Hepatobiliary and Pancreatic Surgical Diseases [7] both recommend the implementation of early postoperative out-of-bed activities, due to the different surgical methods, individual differences, and surgical sites of the patients, especially the ambiguity of the definition of “early”, the effectiveness of the implementation of the activities is also somewhat different. Hjort Jakobsen et al [8] considered that patients getting out of bed on the same day after surgery and remaining seated in a chair for more than 2 hours was called early postoperative activity. Yan Xiaoxia et al [9] concluded that early postoperative activity out of bed was defined as starting to get out of bed and walking at 6 hours postoperatively. Song Jianping et al [10] recommended through evidence-based that postoperative patients after hepatectomy can be moderately active in bed after waking up, and that they should get out of bed 2 to 4 times on the first postoperative day, with a daily activity time of 2 hours. He Ningning et al [11] defined early postoperative activity as functional exercise in bed 6 h after patients were awake from anesthesia, and standing and walking at the bedside with a distance of no more than 50 m 24 h postoperatively.Xie Yanyun et al [12] believed that early postoperative activity was defined as getting out of bed 24 h postoperatively. Wang Hu et al [13] constructed

a postoperative ultra-early rehabilitation training program in which patients began to move 0-6 hours after surgery, and gradually transitioned from lying to standing, and verified the safety and effectiveness of their program.

3. Physiologic mechanisms of early bed mobility after hepatectomy for hepatocellular carcinoma

3.1 Improvement of blood circulation

After liver resection for hepatocellular carcinoma, the blood circulation system of patients will be changed to different degrees due to trauma caused by surgery, anesthesia agents and postoperative bed rest, etc. Early getting out of bed is regarded as an effective means of rehabilitation, which can significantly improve the blood circulation level of patients. The study of Zhang Yiman et al [14] showed that post-partial nephrectomy patients can get out of bed to promote the contraction and diastole of lower limb muscles, which can promote venous blood return, reduce the accumulation of blood in lower limb veins, and then reduce the incidence of deep vein thrombosis (DVT). Early activity can increase the venous blood flow rate of the lower extremities and reduce the resistance of blood circulation, which is significant for the prevention of postoperative thrombosis, and early activity can also improve the function of the heart, Spinelli et al. [15] pointed out that prolonged postoperative bed rest will cause an increase in the cardiac load, and moderate bed rest can enhance the contractility of the myocardial muscle and improve the efficiency of the heart's pumping, thus improving the function of the heart. Moderate activity in bed can enhance myocardial contractility and increase the efficiency of cardiac pumping, thus improving the level of cardiac function. Early bed rest also promotes the function of vascular endothelial cells and reduces the release of inflammatory mediators, thus reducing the occurrence of hypertension and atherosclerosis after surgery. Early bed rest improves the blood circulation of postoperative patients with the help of multiple mechanisms, such as promoting venous return and enhancing cardiac function, thus laying a solid physiological foundation for their rapid recovery.

3.2 Accelerated recovery of gastrointestinal function

Recovery of gastrointestinal function is crucial for postoperative recovery of hepatic resection patients.Early bed down activity can promote gastrointestinal peristalsis and emptying with the help of multiple mechanisms, which can significantly reduce the time of postoperative intestinal paralysis. Relevant studies have shown [16] that getting out of bed can stimulate intestinal smooth muscle contraction and enhance the peristaltic power of the gastrointestinal tract, and patients who start getting out of bed within 24 hours after surgery have their intestinal peristalsis recovery time shortened dramatically, and the time of the first postoperative venting is advanced by about 1-2 days.Wiesenberger et al. [17] proposed that, by virtue of regulating the neuroendocrine system, early activity can lead to the secretion of gastrointestinal hormones, which is the key to postoperative recovery. It can promote the secretion of gastrointestinal hormone, get out of bed activity can promote the secretion of gastric motility, and then increase the contraction of gastrointestinal smooth muscle, help to accelerate the emptying of food, activity can also reduce the stress response after surgery, reduce the secretion of cortisol and this kind of stress hormone, so as to alleviate the inhibitory effect on the gastrointestinal tract, early get out of bed activity by virtue of enhancing intestinal peristalsis, promote the secretion of hormone and improve the metabolic state and other ways to significantly promote the liver cancer liver resection. Early bedtime activities, by enhancing intestinal peristalsis, promoting hormone secretion and improving metabolic state, have significantly promoted the recovery of gastrointestinal function in patients after hepatectomy for hepatocellular carcinoma, and provided key support for rapid recovery.

3.3 Reducing the inflammatory response

A series of inflammatory reactions caused by a variety of conditions such as liver cancer after hepatectomy greatly interferes with the prognostic results of patients, and early getting out of bed activities can significantly reduce the inflammatory reactions and promote the rapid recovery of patients. Ma Wenting et al [18] showed that exercise can promote blood circulation flow, accelerate the discharge of inflammatory mediators, enhance the phagocytosis ability of macrophages, and further strengthen the immunoregulatory function.Wagoner et al [19] concluded that early exercise can help regulate the immune function of the body and reduce the inflammatory reaction faced by the body, and reasonable exercise can activate the NK cells and improve the ability to block infection, and exercise can also inhibit the inflammatory response of IL-1, which is a key factor in the prevention and treatment of liver cancer. Reasonable exercise can activate NK cells and improve the body's ability to block infection, and exercise can also inhibit the secretion activity of pro-inflammatory factors, such as IL-6 and TNF-α, and reduce postoperative fever and systemic inflammatory reaction. Early getting out of bed can effectively reduce the inflammation level of liver cancer hepatectomy patients, providing important support for their rapid postoperative recovery, and understanding the mechanism of its role can provide a theoretical basis for the improvement of postoperative care.

4. Factors affecting early bed mobility after hepatectomy for hepatocellular carcinoma

4.1 Surgical Procedures

Surgical approach is an important factor that affects early postoperative activities out of bed, and a study showed [20] that the use of minimally invasive surgery for children's hepatopancreatobiliary surgery greatly reduced postoperative pain as well as length of hospitalization, which provided favorable support for the early implementation of activities out of bed. Lulu Bai et al [21] demonstrated that the combination of minimally invasive surgery and ERAS concepts could further improve patients' postoperative recovery and reduce the occurrence of postoperative complications through their work on the modified multidisciplinary collaborative accelerated rehabilitation surgical model.Tariq et al [22] found that patients' reliance on medication after minimally invasive surgery was relatively low by comparing the application of intravenous and oral acetaminophen after hepato-pancreatic surgery. This accelerated the initiation and development of early activities, traditional open surgery due to traumatic bias, early postoperative activities will probably be constrained, the time required for patients to recover is relatively long, the choice of surgical methods is directly related to the feasibility and effect of early postoperative activities out of bed.

4.2 Age

Children have strong tissue repair ability, higher metabolic rate and other physiological favorable characteristics, postoperative recovery speed is faster, while the elderly patients due to aging and accompanied by various body functions, and often accompanied by coronary heart disease, hypertension, diabetes mellitus and other chronic underlying diseases, coupled with surgical trauma induced by the stress reaction, the elderly patients' body regulation ability decreased significantly, which slowed down the process of postoperative recovery [23,24]. In addition, the decline of body organ function, catheter slippage, fear of falling, and the traditional concept of sedation all reduce the adherence of elderly patients to early postoperative bed activities. In view of the fact that many elderly patients have underlying diseases and their health conditions vary greatly, it is difficult to apply a standardized early bed rest program to all elderly patients. Therefore, it is recommended that clinical staff develop individualized bed rest programs based on the specific conditions of the patients.

4.3 Individual patient differences

Recovery of postoperative obese patients is slow and early activities out of bed are constrained because of the greater metabolic burden of adipose tissue [25]. In a comparative study of robotic versus laparoscopic left hemihepatectomy performed in the context of ERAS, Cao Hui [26] mentioned that the patient's underlying health condition directly influences the postoperative recovery process, and that older patients or those with co-morbid cardiovascular disease need to be evaluated with greater caution.Conticchio M et al [27] further suggested in this study of robotic liver surgery that the size of the patient and the complexity of the anatomy can also affect the postoperative activities, and that individualized rehabilitation programs can be used for patients with obesity. complexity of the patient's body size and anatomical structure also affect the postoperative activities, and that the development of a personalized rehabilitation program and the individuality of the patient are of crucial importance in the early postoperative activities.

5. Conclusion

Early postoperative activities can promote the rehabilitation of gastrointestinal function, accelerate blood circulation, relieve inflammation, reduce the incidence of complications, shorten the length of hospitalization, and improve the quality of life of patients with liver cancer undergoing hepatic resection. However, there are fewer studies on the postoperative activities of different types of patients undergoing liver surgery, and there are large individual differences among patients, with different physiological and psychological health status and tolerance of rehabilitation exercises. Therefore, in the future, clinics can formulate a program of early postoperative activities after liver surgery in accordance with the concept of ERAS according to different types of diseases and different surgical procedures, in order to promote the accelerated recovery of patients.

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