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Nutrición Hospitalaria

Trabajo Original

Otros

Individualized nutritional intervention improves the nutritional status of liver cancer patients after transcatheter arterial chemoembolization

La intervención nutricional individualizada mejora el estado nutricional de los pacientes con cáncer de hígado después de la quimioembolización arterial transcatéter

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Abstract

Introduction: to explore the effect of individualized nutritional intervention on the nutritional status of patients with liver cancer after transcatheter arterial chemoembolization (TACE).

Methods: 56 patients who underwent TACE in our hospital from March 2022 to March 2023 were selected as the study subjects. The patients were randomly divided into a control group (28 cases) and an intervention group (28 cases). The control group received routine dietary intervention, while the intervention group received individualized nutritional intervention. We analyzed the body mass index (BMI), nutritional risk screening 2002 (NRS 2002), nutritional status, liver function status, and incidence of complications in two groups of patients before TACE, 3 days after TACE, and 1 month after TACE.

Results: on the third day after TACE, the nutritional related indicators of both groups of patients showed a significantly decrease compared to those before TACE ($p < 0.05$), while the majority of liver function indicators significantly increased ($p < 0.05$). Compared with those at 3 days after TACE, the nutritional status of the intervention group patients significantly improved ($p < 0.05$) and liver function indicators significantly decreased ($p < 0.05$) 1 month after TACE. One month after TACE, all nutritional indicators in the intervention group were significantly higher than those in the control group ($p < 0.05$), and AST was significantly lower than that in the control group ($p < 0.05$). The incidence of gastrointestinal complications and electrolyte disorders in the intervention group were significantly lower than that in the control group ($p < 0.05$).

Conclusion: individualized nutritional intervention can effectively improve nutritional status, improve liver function, and reduce the incidence of postoperative complications in liver cancer patients after TACE. It was worth promoting.

Keywords:

Liver cancer. TACE. Individualized nutrition intervention. Nutritional status. Liver function.

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Resumen

Introducción: explorar el efecto de la intervención nutricional individualizada sobre el estado nutricional de los pacientes con cáncer de hígado después de la quimioembolización arterial (TACE).

Métodos: se seleccionaron como sujetos de estudio 56 pacientes sometidos a TACE en nuestro hospital entre marzo de 2022 y marzo de 2023. Los pacientes se dividieron aleatoriamente en un grupo de control (28 casos) y un grupo de intervención (28 casos). El grupo de control recibió una intervención dietética rutinaria, mientras que el grupo de intervención recibió una intervención nutricional individualizada. Se analizó el índice de masa corporal (IMC), el cribado del riesgo nutricional 2002 (NRS 2002), el estado nutricional, el estado de la función hepática y la incidencia de complicaciones en dos grupos de pacientes antes de la TACE, 3 días después de la TACE y 1 mes después de la TACE.

Resultados: al tercer día después de la TACE, los indicadores relacionados con la nutrición de ambos grupos de pacientes mostraron una disminución significativa en comparación con los de antes de la TACE ($p < 0.05$), mientras que la mayoría de los indicadores de la función hepática aumentaron significativamente ($p < 0.05$). En comparación con los 3 días después de la TACE, el estado nutricional de los pacientes del grupo de intervención mejoró significativamente ($p < 0.05$) y los indicadores de la función hepática disminuyeron significativamente ($p < 0.05$) 1 mes después de la TACE. Un mes después de la TACE, todos los indicadores nutricionales del grupo de intervención fueron significativamente superiores a los del grupo de control ($p < 0.05$), y la AST fue significativamente inferior a la del grupo de control ($p < 0.05$). La incidencia de complicaciones gastrointestinales y trastornos electrolíticos en el grupo de intervención fue significativamente inferior a la del grupo de control ($p < 0.05$).

Conclusión: la intervención nutricional individualizada puede mejorar eficazmente el estado nutricional, mejorar la función hepática y reducir la incidencia de complicaciones postoperatorias en pacientes con cáncer de hígado tras TACE. Merece la pena promoverlo.

Palabras clave:

Cáncer. TACE. Intervención nutricional individualizad. Estado nutricional. Función hepática.

INTRODUCTION

Liver cancer usually refers to primary liver cancer (PLC), which is one of the common cancers in China. Radical resection is the first choice for the early treatment of primary liver cancer, but the postoperative recurrence rate is high, and the disease will deteriorate rapidly once metastasis occurs, shortening the survival time of patients in the later stage (1,2). Because liver cancer was not easily recognized by patients, more than 80 % of patients have been classified as middle or advanced stage when they were treated (3). At present, transcatheter arterial chemoembolization (TACE) is the main treatment for advanced liver cancer. TACE has the advantages of causing less trauma, being simple to perform, and having a low cost and quick recovery (4,5). Because TACE is characterized by repeated and multiple operations, there are a variety of adverse reactions, such as postoperative liver and kidney function impairment, post-embolization syndrome, nutrient absorption disorders and metabolic abnormalities in the body, nausea and appetite loss caused by chemotherapy drugs. Therefore, reasonable nutritional support is particularly important to improve the quality of life of liver cancer patients receiving TACE procedure. Relevant studies (6) have confirmed that patients with advanced liver disease can benefit from long-term nutritional intervention. Nutritional support is not limited to short-term nutritional support in the hospital, but long-term nutritional guidance after discharge is more important, and nutritional intervention should be carried out throughout the treatment period of TACE for patients with advanced liver cancer. In this study, individualized nutritional intervention was administered to patients with liver cancer after TACE to observe the changes of nutrition-related indicators and evaluate the effect of the intervention. The specific intervention methods and main research results were reported as follows.

METHODS

GENERAL INFORMATION

A total of 56 patients with primary liver cancer who received TACE procedure within a limited period and were admitted to the Department of Interventional Medicine of our hospital from March 2022 to March 2023 were included in the study, and the patients were divided into a control group and an intervention group according to the random number table method. There were 28 patients in the control group, including 5 females and 23 males, aged 59.64 ± 10.50 years. There were 28 patients in the intervention group, including 5 females and 23 males, aged 55.82 ± 13.65 years. The sex distribution and age were comparable between the two groups, and there was no statistically significant difference in the basic data. This study protocol has been approved by the Ethics Committee of Biomedical Research Involving Humans of The Second Affiliated Hospital and Yuying Children's Hospital of Wenzhou Medical University (2022-K-250-02) and complies with the Declaration of Helsinki. Both the investigator and the patient or their entrustment provided signed informed consent.

INCLUSION AND EXCLUSION CRITERIA

The inclusion criteria for patients were as follows: 1) Middle-late clinical diagnosis of liver cancer. 2) The expression was clear, and the consciousness was clear. 3) All patients were treated with TACE. 4) Patients had no other major organ diseases or poorly controlled chronic diseases or metabolic diseases. 5) The physical activity status (PS) was 0-2 points, and the liver function Child classification was Grade A or B. 6) Barcelona Clinic Liver Cancer (BCLC) is stage B or C. 7) Patients who are able to adhere to nutritional therapy and intervention for a long time, follow the guidance of nutritionists, and maintain long-term followers. 8) Patients who volunteered to join the study and provided informed consent. The exclusion criteria for patients were as follows: 1) Complicated with heart, lung, kidney or other serious organ dysfunction. 2) Treatments cannot be tolerated after TACE and serious complications occur. 3) Patients with other malignant tumors.

TREATMENT METHODS

All patients in the 2 groups received TACE within a limited time after admission. All TACE procedures were performed by

the same interventional medicine doctor. After local anesthesia, the right femoral artery or right radial artery was punctured, and a catheter was inserted into the proper hepatic artery using the modified Seldingers method. After angiography confirmed the tumor-supplying artery, a microcatheter was superselectively advanced to the target vessel, and chemotherapy drugs "Oxaliplatin + Raltitrexed" (the specific dosage was determined based on the body surface area and overall condition of the patient) were infused. Then, embolization of the tumor-supplying artery was performed using a mixture of epirubicin and iodized oil until the tumor was completely stained.

Control group nutrition

Patients were given routine nutritional intervention during the period of treatment, and nurses conducted nutritional risk screening within 24 hours of admission. The screening was conducted according to the Nutrition Risk Screening 2002 (NRS 2002) scale (7). If the NRS-2002 score was < 3, the review was conducted weekly; If NRS-2002 score was ≥ 3, the doctor provided dietary guidance and treatment to the patient, and the nutritional intervention followed the five-step method (8). The responsible nurse provided health education and guidance once a week, explained dietary principles and misunderstandings, etc., and was followed up for 30 days.

Nutritional measures in the intervention group

Individualized nutritional intervention was added on the basis of the control group. A nutritional management group was established, which included the director of the interventional therapy department, the interventional therapy department manager, the nutritionists, and the nutrition specialist nurses. The director of the interventional therapy was responsible for training the team members. The tube bed doctor was responsible for patient selection and treatment. The nutritionists investigated the patients' dietary status (dietary requirements and actual intake). Patient-generated subjective global assessment (PG-SGA) was used to evaluate the nutritional status of the patients. According to the current nutritional status and usual dietary preferences of patients, the selection of individualized nutrition intervention programs and nutritional pathways was formulated. At the same time, the patients were responsible for dietary guidelines during treatment, and if necessary, oral nutrition solution was given to supplement energy or intravenous nutritional supplemental energy. The nutritional program was dynamically adjusted according to the blood test indices of the patients. The nutritionists adjusted the patients' diet according to the surgical nutrition guidelines of the European Society for Parenteral Nutrition and the Clinical Guidelines for Parenteral Nutrition of the Chinese Society of Parenteral Nutrition (9,10). Nutrition specialist nurses were responsible for post-admission nutritional risk screening, bedside dietary education, monitoring changes in electrolytes and patient adverse reactions, and supervising the implementation of nutrition programs. After the patient was discharged from the hospital, the nutritionist was responsible for the nutritional management of the patient. After one-on-one telephone follow-up was adopted, the nutritional intervention plan was adjusted according to the recovery after TACE and diet of the patient, the wrong eating habits were corrected, dietary guidance was provided, and the patient was reminded to return to the doctor regularly. After discharge, in order to ensure patient compliance, at least 1 patient and his family member were added to the WeChat group, the patient's eating content was recorded every day, and the patient was added to the WeChat group. Nutritionists provided reasonable guidance according to the patients' eating conditions, and regularly promoted health-related knowledge after TACE to improve patients' self-management and nursing ability.

OBSERVATION INDICES

BMI

When hospitalized patients were admitted, their height and weight were measured by fasting in the morning, and body mass index (BMI) was calculated according to their height and weight.

Nutritional risk screening

The nutritional risk screening scale (NRS 2002) was used to assess the nutritional risk of the patients before TACE, 3 days after TACE and 1 month after TACE. The screening scale consisted of 3 parts, and the total score was the sum of the 3 parts, with a total score of 7 points: impaired nutritional status score (0-3 points), disease severity score (0-3 points) and age score (total score plus 1 point for those older than 70 years old). The total score of screening ≥ 3 indicates nutritional risk, and nutritional programs need to be provided by a tube physician or nutritionist. A total score of < 3 indicated no nutritional risk and the date were reviewed one week later.

Nutritional and liver function related indicators

The electronic medical record system was used to query the blood test results of patients before TACE, 3 days after TACE, and 1 month after TACE, including hemoglobin (Hb), prealbumin (PA), total protein (TP), albumin (ALB), glutamic-pyruvic transaminase (ALT), glutamic oxaloacetic transaminase (AST), alkaline phosphatase (ALP), glutamyl transpeptidase (GGT), total bilirubin (TBil) and prothrombin time (PT), etc.

Incidence of complications

These complications included electrolyte disturbances (low potassium concentration, low sodium concentration, low chlorine

concentration), gastrointestinal complications (nausea, vomiting, diarrhea, bloating, constipation), metabolic related complications (hyperglycemia, low blood sugar), and abdominal or pleural effusion.

Child-Pugh grading

Child-Pugh classification is based on clinical biochemical indicators such as hepatic encephalopathy, ascites, TBil, albumin, prolonged prothrombin time, etc., and scores of 5-6 are classified as grade A, 7-9 as grade B, and 10-15 as grade C.

STATISTICAL ANALYSIS

The SPSS 22.0 statistical software was used. The measurement data of normal distribution were presented as ($\bar{x}\pm$ s). The t test of two independent samples was used for comparison between groups. The repeated measurement data were analyzed by A one-way analysis of variance (ANOVA) with replicate measurements. Counting data were shown as cases (%), and the χ^2 test was used for inter-group comparison. The Wilcoxon rank sum test was used for rank information. $p < 0.05$ was considered to be statistically significant.

RESULTS

COMPARISON OF RELEVANT INDICATORS BEFORE INTERVENTION BETWEEN THE 2 GROUPS

There were no statistically significant differences in age, BMI, NRS or Child-Pugh score between the control group and the intervention group before intervention, as shown in table I.

COMPARISON OF NUTRITIONAL RISK SCREENING BEFORE AND AFTER INTERVENTION BETWEEN 2 GROUPS

There were 6 patients (21.43 %) with NRS scores ≥ 3 in the intervention group and 5 patients (17.86 %) in the control group before the TACE, and there was no significant difference between the two groups ($\chi^2 = 0.113$, $p = 0.737$). One month after TACE, there were 5 patients (17.86 %) with NRS ≥ 3 in the intervention group and 7 patients (25.0 %) with NRS ≥ 3 scores in the control group, and there was no significant difference between the two groups ($c^2 = 0.424$, $p = 0.515$).

COMPARISON OF RELATED INDICES OF NUTRITION IN THE 2 GROUPS BEFORE AND AFTER INTERVENTION

According to the overall analysis (two-factor repeated-measures ANOVA), the difference in the time effect of each index was statistically significant ($p < 0.05$). Pound-wise comparison was combined with the main data analysis: Intra-group comparison: the nutrition-related indexes of patients in the control group and intervention group decreased first and then increased with the progress of treatment time, and significantly decreased 3 days after TACE compared with before TACE ($p < 0.05$); The nutritional indexes of the intervention group were significantly increased 1 month after TACE compared with 3 days after TACE ($p < 0.05$). Comparison between groups: The indexes of the intervention group were similar to those of the control group before TACE, and significantly improved compared with those of the control group 1 month after TACE ($p < 0.05$). The detailed comparison results are shown in table II.

COMPARISON OF LIVER FUNCTION INDICES BEFORE AND AFTER INTERVENTION IN THE 2 GROUPS

According to the overall analysis (two-factor repeated-measures ANOVA), the difference in the time effect of each index was statistically significant ($p < 0.05$). Pound-wise comparisons were combined with the main data analysis: Intragroup comparisons: the liver function indexes of patients in the control group and the intervention group increased first and then decreased with the progress of intervention time, and showed a significant increase 3 days after TACE compared with before TACE, with statistical significance for most of the indexes ($p < 0.05$). The relevant indexes of liver function in the intervention group were significantly decreased 1 month after TACE compared with 3 days after TACE ($p < 0.05$). Intergroup comparisons: All the indexes of the intervention group were similar to those of the control group before TACE; the ALT level in the intervention group decreased significantly compared that in the control group at 3 days after TACE ($p < 0.05$).

Table I. Comparison of the basic conditions of patients in the 2 groups before TACE

Group	*n*	Age ($\bar{x}\pm$ s, year)	BMI ($\bar{x}\pm$ s, kg/m^2)	NRS ≥ 3 [*n* (%)]	Child-Pugh A [*n* (%)]	Child-Pugh B [*n* (%)]
Control group	28	59.64 ± 10.50	22.81 ± 2.70	5 (17.86)	25 (89.29)	3 (10.71)
Intervention group	28	55.82 ± 13.65	22.37 ± 3.64	6 (21.43)	25 (89.29)	3 (10.71)

Table II. Comparison of nutrition-related indexes in 2 groups of patients with liver cancer who underwent TACE before and after procedure ($\bar{x}$± s)

Group	Time	Hb (g/L)	PA (mg/L)	TP (g/L)	ALB (g/L)
Control group	preoperative	123.61 ± 15.40	166.71 ± 63.30	66.58 ± 7.31	37.63 ± 4.71
	3 days later	109.36 ± 15.82[a]	124.25 ± 53.27[a]	62.29 ± 6.00[a]	33.95 ± 5.93[a]
	1 month later	117.14 ± 20.64	180.29 ± 59.65[b]	68.12 ± 9.09[b]	37.39 ± 5.40[b]
Intervention group	preoperative	128.04 ± 21.61	174.82 ± 54.26	66.49 ± 5.83	38.07 ± 4.62
	3 days later	114.25 ± 21.02[a]	130.82 ± 43.71[a]	61.04 ± 4.58[a]	34.61 ± 4.46[a]
	1 month later	132.18 ± 19.00[b]*	224.07 ± 58.45[ab]*	73.13 ± 5.02[ab*]	40.94 ± 3.80[ab*]
Group	F, P	3.405, 0.07	2.294, 0.136	0.718, 0.4	100.905, 2.049
Time	F, P	141.575, < 0.001	152.461, < 0.001	123.154, < 0.001	79.369, < 0.001
Time x Group	F, P	1.912, 0.158	2.857, 0.066	6.842, 0.002	2.645, 0.08

*[a]Compared with the same group before TACE, p < 0.05; [b]Compared with the same group 3 days after TACE, p < 0.05. *Compared with control group, p < 0.05.*

The AST level in the intervention group was significantly improved compared with the control group, with statistical significance at 1 month after TACE ($p < 0.05$). The detailed comparison results are shown in table III.

COMPARISON OF COMPLICATION RATES AND CHILD-PUGH RATING BETWEEN THE 2 GROUPS

The results showed that there were statistically significant differences in gastrointestinal complications and electrolyte disorders between the control group and the intervention group ($p < 0.05$), while there were no statistically significant differences in metabolic complications or pleural or peritoneal effusion. The results of Child-Pugh grading showed that there was no significant difference in the intervention effect between the intervention and control groups as shown in table IV.

DISCUSSION

According to statistics, the annual number of new cases of liver cancer in China ranks the fourth among malignant tumors and the number of deaths due to liver cancer ranks the second (11). If liver cancer is not treated in time, multiple metastases may occur in severe cases, and patients may even progress to liver failure and multiple-organ failure (12,13). With the progression of the disease, the gastrointestinal symptoms of patients with liver cancer become increasingly serious, and their nutritional status

Table III. Comparison of liver function related indexes before and after intervention in 2 groups ($\bar{x}$± s)

Group	Time	ALT (U/L)	AST (U/L)	ALP (U/L)	GGT (U/L)	Tbil (μmol/L)
Control group	Preoperative	39.61 ± 12.17	43.32 ± 21.54	129.18 ± 52.30	101.49 ± 32.3	15.41 ± 5.34
	3 days later	179.96 ± 37.02[a]	190.75 ± 26.70[a]	172.93 ± 45.11[a]	134.04 ± 46.73[a]	18.87 ± 5.27[a]
	1 month later	43.96 ± 20.57[b]	60.04 ± 19.48[ab]	131.68 ± 45.93[b]	99.14 ± 28.83[b]	17.94 ± 4.63
Intervention group	Preoperative	42.18 ± 13.27	39.17 ± 16.1	122.57 ± 46.21	105.04 ± 28.19	16.90 ± 5.63
	3 days later	156.36 ± 44.38[a*]	175.89 ± 30.18[a]	156.96 ± 46.72[a]	111.68 ± 50.66	19.73 ± 6.80
	1 month later	39.75 ± 17.20[b]	39.39 ± 17.43[b*]	125.21 ± 53.90[b]	84.00 ± 30.77[ab]	17.67 ± 5.06
Group	F, P	4.166, 0.046	16.335, < 0.001	0.793, 0.377	2.210, 0.143	0.393, 0.533
Time	F, P	248.421, < 0.001	667.334, < 0.001	64.821, < 0.001	10.463, < 0.001	6.976, 0.002
Time x Group	F, P	2.830, 0.068	1.841, 0.167	0.946, 0.395	5.175, 0.009	0.567, 0.556

*[a]Compared with the same group before TACE, p < 0.05; [b]Compared with the same group 3 days after TACE, p < 0.05. *Compared with control group, p < 0.05.*

Table IV. Comparison of complication rate and Child-Pugh rating between 2 groups [*n* (%)]

Index	Control group (*n* = 28)	Intervention group (*n* = 28)	χ^2/Z	*p*
Gastrointestinal complication	24 (85.71)	16 (57.14)	5.6	0.018
Metabolic complication	2 (7.14)	1 (3.57)	0.352	0.553
Electrolyte disturbance	22 (78.57)	9 (32.14)	12.212	< 0.001
Pleural and abdominal fluid	5 (17.86)	3 (10.71)	0.583	0.445
Child-Pugh A B C	 23 (82.14) 5 (17.86) 0 (0.00)	 26 (92.86) 2 (7.14) 0 (0.00)	 -1.201	 0.230

becomes increasingly worse (14). With the continuous decline in liver function, patients experience different degrees of malnutrition, which has adverse effects on the prognosis of the disease (15). Therefore, it is necessary to strengthen nutritional guidance for patients with liver cancer and administer reasonable and effective nutritional treatment. We established a nutritional treatment team, implemented individualized nutritional management, and strengthened discharge nutrition tracking and follow-up, which significantly improved the nutritional status of the patients.

In clinical practice, the nutritional status of patients with primary liver cancer cannot be ignored. For liver cancer patients in poor physical condition who cannot undergo surgical resection, percutaneous radiofrequency ablation or liver transplantation, TACE can be considered, and TACE has better therapeutic efficacy and advantages in the treatment of liver cancer (16). Due to the characteristics of TACE treatment, such as minimal invasion and quick recovery, there are few reports on the nutritional status of liver cancer patients after TACE, which is easy for doctors and patients to ignore. However, due to the need for repeatable TACE treatment, we found in clinical work that many liver cancer patients gradually begin to experience a decrease in surgical tolerance after TACE, and problems such as prolonged retreatment intervals, prolonged recovery time, and prolonged hospital stays exist. In this paper, the effects of individualized nutritional intervention on TACE patients were studied.

Prealbumin is a commonly used indicators to evaluate the nutritional status of patients with digestive tract tumors (17) and is synthesized mainly by the liver. Prealbumin is a prerequisite for albumin concentration and is strongly affected by liver function reserve and eating conditions. In this study, statistical analysis of prealbumin before TACE showed no significant difference between the two groups. One month after individual intervention, the prealbumin level in the intervention group was significantly greater than that in the control group, and the difference was statistically significant, indicating that the prealbumin liver function reserve was basically the same between the two groups before intervention. The level prealbumin level increased after individualized intervention, and individualized nutritional intervention improved the prealbumin level ($p < 0.05$), which was consistent with the results reported by Tao Minjie (18). The serum ALB concentration is an important index for the clinical evaluation of protein status. This study revealed that there was no statistically significant difference in the pre-TACE serum ALB concentration between the two groups. After 1 month of individualized intervention, the levels of the nutrition-related indexes albumin and total protein in the intervention group were significantly greater than those in the control group ($p < 0.05$). Individualized intervention was more effective than conventional nutritional intervention was, which can be attributed to the professional guidance of nutritionists, the implementation of plans by nutrition nurses and out-of-hospital tracking, the correction of patients' unhealthy eating habits, the guidance of patients' rational eating, the promotion of nutrient intake and absorption, and the improvement of nutritional status (19). These findings could lead to additional opportunities for follow-up treatment. These findings also suggested that nutritional therapy plays an indispensable role in the treatment of tumors in patients. Three days after TACE, the nutrition-related indexes of patients in both the control group and the intervention group were significantly lower than those before TACE. This finding indicates that although TACE is a minimally invasive procedure, eating can be resumed as soon as possible after TACE, but it can cause different degrees of damage to human nutrition and worsen nutritional status. Although some nutritional indices can be restored to the preoperative state by conventional dietary guidance 1 month after TACE, it is unknown whether the patients can tolerate multiple TACE procedure. After 1 month of individual intervention, the nutritional status of the patients significantly improved compared with that before TACE, which provided additional opportunities for multiple TACE procedure.

The liver is involved in the metabolism and synthesis of nutrients in the human body. Liver cancer causes liver damage, thus affecting the metabolism and absorption of macronutrients (carbohydrates, proteins, fats), vitamins, trace elements and other substances (20). Liver function was mainly assessed by ALT, AST,

GGT and other indices. Understanding liver health status is highly valuable for the diagnosis, treatment, outcome and prognosis of patients with primary liver cancer (21). After TACE, the liver function indexes of the two groups increased significantly, indicating that TACE caused some damage to liver function. The ALT level in the intervention group was significantly lower than that in the control group 3 days after TACE. At 1 month after TACE, the AST level in the intervention group was significantly lower than that in the control group. These findings indicate that individualized nutritional intervention can effectively protect liver function and reduce liver damage caused by TACE.

The Child-Pugh classification is a commonly used clinical grading standard for assessing liver function reserve, with a total score of 5-15 points, which is categorized into A, B and C according to the scores from low to high, and the higher the score, the worse the liver function reserve. Before the nutritional intervention, 89.29 % of patients in both the control and intervention groups had a Child-Pugh grade A liver function score, and 10.71 % of patients were rated as Child-Pugh grade B. After 1 month of nutritional intervention, the proportion of patients with Child-Pugh A grade increasing as well as the proportion of patients with Child-Pugh B grade decreasing in the intervention group, while the control group was just the opposite, with the proportion of patients with Child-Pugh A grade decreased and the proportion of patients with Child-Pugh B grade increased in the control group, which indicated that TACE had a bad effect on the liver functional reserve of hepatocellular carcinoma patients, although the difference is not yet statistically significant, but the number of Child-Pugh class A accounted for more in the intervention group (92.86 %) than in the control group (82.14 %), which may be related to the rise of albumin and improvement of ascites in some of the patients in the intervention group after the nutritional intervention, and the difference is not significant, which may be related to the shorter intervention time.

In the intervention group, through the implementation of individualized nutritional intervention, several liver function indexes improved significantly and quality of life improved, which could further improve the follow-up treatment efficacy. The results of this study showed that nutritional intervention could significantly improve the nutritional status of patients, but the impact on liver function was relatively small, possibly because the recovery of liver function impairment took a long time.

Although individualized nutritional intervention was adopted in this study, the NRS-2002 scores did not change significantly between the two groups, possibly because the disease and age scores in the evaluation table did not change with the changes in treatment regimen. Complications such as nausea and vomiting gradually resolved 1 month after TACE. Eating resumed, with little change in weight. Therefore, the NRS-2002 can be used as a tool for nutritional risk screening, and other more accurate and sensitive assessment tools are needed to assess the nutritional status of patients. These include the malnutrition universal screening tool (MUST), the Patient Subjective Global Assessment Scale (PG-SGA), and the Global Leadership Initiative on Malnutrition (GLIM).

This study included professional identification and monitoring of complications. Nutritional intervention can be scientific, individual and professional. Nutrition nurses can quickly identify gastrointestinal complications and effectively prevent and control the occurrence of nausea, vomiting, diarrhea, constipation and abdominal distension. Nurses monitored blood glucose fluctuations and electrolyte changes in real time, and performed timely intervention and treatment to reduce the incidence of complications in the intervention group. Therefore, in the treatment of patients with primary liver cancer, in addition to TACE, nutrition nurses should be set up to pay attention to monitoring and preventing the occurrence of nutrition-related complications.

This study has certain limitations, including a relatively small sample size, short observation time, and single nutritional evaluation index, which may lead to partial bias in the results. Follow-up studies should increase the clinical sample size, increase the detection indicators, further analyze and study the effect of individualized nutritional intervention for patients with liver cancer after TACE, and provide more comprehensive data and theoretical support for the treatment and rehabilitation of patients with liver cancer after TACE.

In summary, individualized nutritional intervention can effectively improve the nutritional status of patients after TACE, improve liver function status, and reduce the incidence of complications; thus, this treatment has good clinical application prospects and is worthy of clinical promotion.

REFERENCES

1. Yang WS, Zeng XF, Liu ZN, Zhao QH, Xiang YB. Diet and liver cancer risk: a narrative review of epidemiological evidence. Br J Nutr 2020;124(3):330-40. DOI: 10.1017/S0007114520001208
2. Jin ZC, Zhang Q, Zhu HD, Teng GJ. [Research progress of adjuvant TACE therapy for liver cancer after radical resection]. Zhonghua Gan Zang Bing Za Zhi 2022;30(3):340-4. Chinese. DOI: 10.3760/cma.j.cn501113-20200609-00302
3. Park JW, Chen M, Colombo M, Roberts LR, Schwartz M, Chen PJ, et al. Global patterns of hepatocellular carcinoma management from diagnosis to death: the BRIDGE Study. Liver Int 2015;35(9):2155-66. DOI: 10.1111/liv.12818
4. Yang L, Cai MG, Dai XH, Zhao SS, Cai ZQ, Luqiao School District, et al. Effect of thymosin a1 on prevention and control of infections in primary liver cancer patients treated with transcatheter arterial chemoembolization. Chinese Journal of Nosocomiology 2018;28(5):711-4.
5. Yang X, Lan T, Zhong H, Zhang Z, Xie H, Li Y, et al. To Systematically Evaluate and Analyze the Efficacy and Safety of Transcatheter Arterial Chemoembolization (TACE) in the Treatment of Primary Liver Cancer. J Healthc Eng 2022;2022:8223336. DOI: 10.1155/2022/8223336. Retraction in: J Healthc Eng 2023;2023:9896408
6. Li P, Liu WH, Zhao M, Su GM. Significance of nutritional risk screening before transcatheter arterial chemoembolization for primary liver cancer and the effect of individualized nutritional intervention. Chinese Journal of General Practice 2021;19(07):1087-90. DOI: 10.16766/j.cnki.issn.1674-4152.001991
7. Kondrup J, Allison S P, Elia M, Vellas B, Plauth M. ESPEN guidelines for nutrition screening 2002. Clinical Nutrition 2003;22(4):415-21. DOI: 10.1016/s0261-5614(03)00098-0
8. Arends J, Bachmann P, Baracos V, Barthelemy N, Bertz H, Bozzetti F, et al. ESPEN guidelines on nutrition in cancer patients. Clinical Nutrition 2017;36(1):11-48. DOI: 10.1016/j.clnu.2016.07.015
9. Zhang ZG, Tan SJ, Wu GH. Interpretation of ESPEN Practical Guideline: Clinical Nutrition in Surgery. Electronic Journal of Metabolism and Nutrition of Cancer 2022;9(05):538-48.

10. Chinese Society of Parenteral and Enteral Nutrition (CSPEN). [Guideline for clinical application of parenteral and enteral nutrition in adults patients in China (2023 edition)]. Zhonghua Yi Xue Za Zhi 2023;103(13):946-74. Chinese. DOI: 10.3760/cma.j.cn112137-20221116-02407
11. Shi J F, Cao MM, Wang YT, Bai FZ, Lei L, Peng J, et al. Is it possible to halve the incidence of liver cancer in China by 2050? International Journal of Cancer 2021;148(5):1051-65. DOI: 10.1002/ijc.33313
12. Lu Q, Cheng X, Xia ZG, Chen Z. Effect of proteasome subunit beta type 4 on the proliferation and viability of human liver cancer SMMC7721 cells. Journal of Clinical Hepatology 2020,36(03):592-5. DOI: 10.3969/j.issn.1001-5256.2020.03.024
13. Liu H, Lan T, Li H, Xu L, Zeng Y. Circular RNA circDLC1 inhibits MMP1-mediated liver cancer progression via interaction with HuR. Theranostics 2021;11(3):1396-411. DOI: 10.7150/thno.53227
14. Wang LY, Li XN, Zhang W, Yang YX, Meng QY, Wang C, et al. miR24-2 Promotes Malignant Progression of Human Liver Cancer Stem Cells by Enhancing Tyrosine Kinase Src Epigenetically. Molecular Therapy 2020;28(2):572-86. DOI: 10.1016/j.ymthe.2019.10.015
15. Zhu YG, Wu YC, Wang J, Chen TY, Yang Y. Comparison of Application of Two Malnutritional Risk Screening Tools in Primary Liver Cancer Inpatients. Medical Recapitulate 2021;27(8):5.
16. Shao L, Wang XL, Yu YT, Xie JW. Comparative analysis of the efficacy and accuracy of magnetic resonance imaging (MRI) and contrast-enhanced CT for residual and new lesions after transcatheter arterial chemoembolization (TACE) in patients with primary liver cancer. Transl Cancer Res 2021;10(8):3739-47. DOI: 10.21037/tcr-21-831
17. Chen CL, Weng SW, Fu ZM, Zhao JY, Wu M. Influence of perioperative enteral nutrition preparation on postoperative nutrition and recovery in patients with digestive tract tumor. Chinese and Foreign Medical Research 2021;19(04):144-6.
18. Tao MJ, Lei Y, Jin J, Tang GF, Wang L. Effect of individualized dietary guidance on nutritional status and quality of life of liver cancer patients after TACE. Chinese Journal of General Practice 2022;20(03):507-10.
19. Li JY, Ma H. Analysis of the effects of enteral nutrition on nutritional status of patients with esophageal cancer and prognosis factors. Electronic Journal of Metabolism and Nutrition of Cancer 2021,8(03):309-314.
20. Duan ZP, Yang YS. Clinical guidelines on nutrition in end-stage liver disease. Journal of Practical Hepatology 2019;22(05):624-35.
21. Hou W, Jiang ZM, Yang J, Xu JY. Consensus on the clinical nutritional intervention for patients with chronic liver diseases. Journal of Clinical Hepatology 2017;33(07):1236-45. DOI: 10.3969/j.issn.1001-5256.2017.07.006