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Effect of CT-Guided Microwave Ablation Combined with TACE on Liver Function and Survival of Patients with Primary Liver Cancer

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Abstract: *Objective:* To explore the effect of transarterial chemoembolization (TACE) + CT-guided microwave ablation (MWA) on treating patients with primary liver cancer. *Methods:* 78 primary liver cancer cases were enrolled and divided into groups according to their assigned surgical plans. The control group was treated with TACE alone, and the observation group was treated with TACE + CT-guided MWA. The efficacy of the treatment and the liver function indicators and follow-up results of the patients of the two groups were compared. *Results:* The efficacy of the treatment received by the observation group was higher than that of the control group. Besides, the patients in the observation group exhibited better improvement in liver function indicators after 3 months of treatment. Furthermore, the survival rates of 1 and 2 years after surgery of the observation group were all higher than those of the control group ($P < 0.05$). *Conclusion:* TACE combined with CT-guided MWA is more effective in treating primary liver cancer compared to TACE alone. Besides, it resulted in better improvement of liver function and long-term survival rate. Therefore, this treatment regime should be popularized.

Keywords: CT guidance; Microwave ablation; TACE; Primary liver cancer; Liver function; Survival status

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1. Introduction

Primary liver cancer is a type of malignant tumor with a high incidence rate. It is the fourth most common malignant tumor, but its mortality rate ranks second [1]. Arterial chemoembolization (TACE) and CT-guided microwave ablation (MWA) are currently the primary non-surgical treatment options for this disease. The TACE method kills tumor cells by injecting anti-cancer drugs into the parent artery, but it requires repeated operations. It can cause drug resistance and may even restore the blood supply to the lesion, thereby reducing the therapeutic effect. As for the MWA method, the lesion can be accurately ablated under the guidance of CT, which is less likely to damage adjacent organs and tissues. However, this method requires a high level of skill, and there is a major risk of liver surface lesion bleeding, so relevant hemostatic measures need to be taken [2,3]. Relevant studies have suggested that these two treatments complement each other when used together. However, more data is still needed to verify the effect of the combined treatment. In this study, 78 primary

liver cancer patients were used as samples to study the advantage of CT-guided MWA combined with TACE treatment.

2. Materials and methods

2.1. Material

A total of 78 primary liver cancer cases were selected, all of which were admitted between August 2018 and September 2021. The clinical data of the above-mentioned patients were retrospectively analyzed and grouped according to their treatment plans. Those who chose monotherapy entered the control group. The control group consisted of 39 cases, including 23 males and 16 females, aged 38–66 years old, with a mean of 52.52 ± 9.98 years old. The Child-Pugh Class A to Class B ratio of the patients was 18:21. Those who chose the combined treatment entered the observation group, totaling up to 39 cases, including 24 males and 15 females. The patients in this group aged between 39 and 65 years, with a mean of 52.19 ± 9.89 years. The Child-Pugh Class A to Class B ratio of the patients was 19:20. There were no significant differences in the baseline data between the two groups ($P > 0.05$). Inclusion criteria: (1) Patients who were diagnosed with liver cancer based on the "Standards for Diagnosis and Treatment of Primary Liver Cancer (2019 Edition)" [4]; (2) patients who underwent imaging, laboratory, biopsy cytology, histopathology, and other examinations; (3) patients with an expected survival of ≥ 3 months; (4) patients who met TACE and MWA-related indications; (5) patients with complete medical records; (6) patients with no history of cognitive, psychological, or psychiatric diseases; (7) patients who signed informed consent. Exclusion criteria: (1) Patients with contraindications to TACE and MWA treatment; (2) patients with coagulation disorders, immune system diseases, or severe organ failure such as lung, brain, and kidney failure; (3) patients who have received radiotherapy, chemotherapy, MWA, or other treatments; (4) Child-Pugh Class C patients; (5) patients who had a history of distant metastasis; (5) patients who dropped out of the study midway.

2.2. Method

The patients in the control group underwent TACE treatment alone. In this procedure, local anesthesia was first administered with the patient lying in a supine position. When the anesthesia had completely taken effect, the most obvious pulsation point of the right inguinal femoral artery was selected as the puncture site. A catheter was inserted and digitally subtracted. The condition of the tumor is observed through digital subtraction angiography (DSA), and a microcatheter was then inserted into the artery nourishing the tumor. Chemotherapy drugs were then injected into the tumor. These drugs include 30 mg nedaplatin (National Drug Approval Number: H20051482, manufacturer: Jilin Hengjin Pharmaceutical Co., Ltd. Co., Ltd.), 40 mg pirarubicin (National Pharmaceutical Approval Number: H10930105, manufacturer: Shenzhen Main Luck Pharmaceuticals Co., Ltd.), super liquefied lipiodol (National Pharmaceutical Approval Number: H2016334, manufacturer: Jiangsu Hengrui Pharmaceuticals Co., Ltd.). The drugs were injected slowly at a constant speed until the blood flow of the parent artery slowed down significantly. After surgery, drugs such as reduced glutathione, magnesium isoglycyrrhizinate, and butanedisulfonic acid were administered for liver protection, and 200 mg of tislelizumab was administered via intravenous infusion once every 3 weeks. Furthermore, based on the patient's condition, TACE treatment could be repeated 1–2 times, with an interval of 1 month between each session.

The observation group underwent a combined treatment plan: CT-guided MWA treatment 2 weeks after TACE treatment. The patients were positioned according to the tumor's location, and local anesthesia was administered. Once the anesthesia had taken effect, CT-guided MWA was performed. After a clear understanding of the tumor and determining the needle insertion path, the MWA needle equipped with the

Kangyou KY-2000 MWA therapy device (Registration Certificate Number: State Food and Drug Administration [Approval number: 3250570]) was accurately inserted into the tumor tissue. The power of the microwave was adjusted to 40–60 W and microwaves were transmitted for 5–8 minutes. The ablation was performed based on the principle of "deep to shallow" and multi-point principle at 0.5–1.0 cm from the edge of the tumor. For tumors that were adjacent to important organs, precautions were taken to not damage the adjacent organs. The lesions were ablated as much as possible with careful attention to withdrawing the needle during ablation and closely monitoring relevant signs. Lastly, the needle tract was effectively ablated to prevent needle tract transfer, and relevant hemostasis measures was taken. After the operation, hepatoprotective, analgesic, antipyretic, and other interventions were initiated. The patients underwent a CT scan 3–4 weeks after the operation. TACE or CT-guided MWA treatment was performed if residual lesions were found.

2.3. Observation indicators

(1) Clinical treatment effectiveness

(i) Complete remission (CR): Complete disappearance of lesions observed on CT scan one week after treatment, maintained for more than four weeks, with a reduction of 1 cm or more in the short diameter of pathological lymph nodes. (ii) Partial remission (PR): Significant shrinkage of lesions (≥ 30%), maintained for more than 4 weeks. (iii) Stable disease (SD): The growth rate of the target lesion was less than 20%, with no new lesions observed, or the shrinkage rate was less than 30%. (iv) Progressive disease (PD): Presence of new lesions or a diameter increase rate of target lesions equal to or greater than 20% [5].

(2) Liver function indicators

4 mL of fasting venous blood was collected from the patients before treatment and 3 months after treatment. The blood samples were used to measure serum albumin (ALB), alanine aminotransferase (ALT), aspartate aminotransferase (AST), and total bilirubin (TBIL). The value of these indicators was compared between the two groups of patients.

(3) Follow-up results

The patients were followed up for 2 years, and their survival rates at 1 and 2 years after surgery were statistically compared.

2.4. Statistical analysis

The data were processed using SPSS 25.0. The measurement data were displayed as (mean ± standard deviation) and analyzed by a *t*-test. The count data were displayed as *n* (%) and analyzed using a chi-square test. A *P-value* of less than 0.05 indicated a statistically significant difference.

3. Results

3.1. Treatment efficacy

Table 1 shows that the efficacy of the treatment received by the observation group was 74.36%, which was significantly higher than that of the control group. The difference was statistically significant ($P < 0.05$).

Table 1. Comparison of clinical treatment effectiveness observation results (*n* [%]]

Group name	Number of cases	CR	PR	SD	PD	Total efficacy
Control group	*n* = 39	2 (5.13)	5 (12.82)	10 (25.64)	22 (56.41)	17 (43.59)
Observation group	*n* = 39	5 (12.82)	8 (20.51)	16 (41.03)	10 (25.64)	29 (74.36)
χ^2	-	-	-	-	-	7.630
P	-	-	-	-	-	0.006

3.2. Liver function indicators

As shown in **Table 2**, the difference in liver function index levels between the groups was not statistically significant before treatment ($P > 0.05$). After three months of treatment, the observation group exhibited a higher ALB level than the control group, and the levels of ALT, AST, and TBIL were all lower than those in the control group ($P < 0.05$).

Table 2. Comparison of observed values of liver function indicators (mean ± standard deviation)

Group	Time	ALB (g/L)	ALT (U/L)	AST (U/L)	TBIL (μmol/L)
Control group	Before treatment	24.95 ± 8.77	390.84 ± 51.42	361.74 ± 48.75	54.19 ± 11.42
n = 39	After 3 months of treatment	30.24 ± 10.25	167.88 ± 31.25	162.24 ± 30.05	35.82 ± 13.05
Observation group	Before treatment	24.99 ± 8.79	389.98 ± 51.01	360.98 ± 47.92	53.98 ± 11.08
n = 39	After 3 months of treatment	37.71 ± 13.54	91.24 ± 15.42	84.87 ± 14.75	24.24 ± 8.41
t	Before treatment	0.020	0.074	0.069	0.082
	After 3 months of treatment	2.747	13.735	14.434	4.658
P	Before treatment	0.984	0.941	0.945	0.935
	After 3 months of treatment	0.001	0.001	0.001	0.001

3.3. Follow-up results

Table 3 shows that the 1-year and 2-year survival rates of the observation group were higher than those of the control group ($P < 0.05$).

Table 3. Comparison of long-term survival rates (*n* [%])

Group	Number of cases	1 year after surgery	2 years after surgery
Control group	*n* = 39	27 (69.23)	18 (46.15)
Observation group	*n* = 39	35 (89.74)	27 (69.23)
χ^2	-	5.032	4.255
P	-	0.025	0.039

4. Discussion

Primary liver cancer mainly affects middle-aged people aged 40–50 years old, with a higher prevalence among men. Patients mostly present with pain in the liver area as the first symptom. As the disease progresses, systemic and digestive tract symptoms such as fatigue, abdominal distension, weight loss, loss of appetite, nausea and

vomiting, fever, diarrhea, and even anemia, jaundice, ascites, cachexia, etc. would occur. If the lesions begin to metastasize extensively, other organs like the heart, liver, and bones might be affected, leading to other symptoms [6]. Considering the commonality of primary liver cancer, its rapid progression, and poor prognosis, surgical treatment emerges as the optimal choice. This approach allows for the direct removal of lesions and offers better prevention against disease recurrence. However, as the symptoms appear at the later stages of the disease, the optimum period for surgery is often missed. In this case, the lesions can only be inactivated through non-surgical methods like TACE and MWA. However, both treatment options come with their own advantages and disadvantages, and the effect of either treatment method alone is limited. Therefore, combined treatment options are recommended in clinical practice [7].

TACE mainly works by puncturing the parent artery and injecting chemotherapy drugs to inhibit the activity of the lesion and promote tumor cells to accelerate shrinkage and apoptosis. This approach can not only extend the local action time of chemotherapy drugs but also reduce the probability of related adverse reactions. However, the effectiveness of a single treatment method alone is limited, with minimal elimination of lesions, and repeated punctures may cause stenosis of blood vessels such as the hepatic artery and superior mesenteric artery. In turn, the parent blood vessels are induced to rebuild collateral circulation, which increases the risk of disease metastasis [8]. The results of this study show that the combination of TACE and CT-guided MWA was far more effective in treating primary liver cancer, and the patients who underwent this treatment regime showed better liver function and survival. This is because after TACE effectively blocks the blood supply of the tumor, combined with CT-guided MWA treatment, the lesions can be further eliminated by creating a hypoxic environment, which accelerates atrophy and apoptosis. In addition, TACE increases the thermal sensitivity of tumor cells, which means that excessive temperatures are not required during MWA surgery. This prevents the destruction of adjacent physiological structures due to high temperatures, which helps protect the liver function. This in turn leads to lesser complications [9,10].

5. Conclusion

In short, liver cancer is a life-threatening malignant tumor. TACE combined with CT-guided MWA treatment of primary liver cancer patients can further improve the clinical treatment efficiency, better protect liver function, and improve patient survival. Therefore, this treatment regime should be further popularized in clinical practice.

Disclosure statement

The authors declare no conflict of interest.

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