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Blood supply of viable tumor area of hepatocellular carcinoma after transcatheter arterial chemoembolization

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Abstract: **To evaluate the blood supply of viable tumor area (VTA) of hepatocellular carcinoma(HCC)after transcatheter arterial chemoembolization using lipiodol (LP-TACE) by dual-phase multislice computed tomography (MSCT)scanning. Thirty-eight patients with 55 HCCs after LP-TACE treatment were examined by plain scanning and hepatic dual-phase MSCT. The performance of VTA on plain scanning and the enhancement patterns on dynamic contrast-enhanced scanning were observed. In contrast-enhanced CT scans, the blood supply of VTA was classified into four types: arterial blood supply, portal blood supply, arterial together with portal blood supply and poor blood supply. Atthe same time, the attribution of portal venous blood supply to VTA was compared with that before LP-TACE. The VTA appear as a hypoattenuation lesion on unenhanced images, and the CT value of VTA was (37.71±7.78) Hu. In contrast-enhanced CT scans, the blood supply of VTA was classified into four types: arterial blood supply (29 cases), portal blood supply (2 cases), arterial together with portal blood supply (22 cases) and poor blood supply (4 cases). The attribution of portal venous blood supply to VTA was significantly increased after LP-TACE. Arterial blood supply and arterial together with portal blood supply are the two main types of the blood supply with VTA. The attribution of portal venous blood supply to VTA was significantly increased after LP-TACE.**

Keywords: Liver neoplasms; Tomography; X-ray computed; Blood supply; Iodized oil

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1. Introduction

Hepatocellular carcinoma (HCC) is one of the most common malignant tumors in the world. HCC has highly malignant and poor progresses, most of patients is medium when diagnosed. The total surgical removal rate is 9.0% ~ 13.5% only, and postoperative three-year recurrence rate was 70% [1]. Nonsurgical procedures for HCC are numerous, including transcatheter arterial chemoembolization using lipiodol（LP - TACE）, radiofrequency ablation, microwave coagulation, Laser treatment, cryotherapy, injection of intronomous drugs, high intensity ultrasonic focus Treatment, biological treatment, traditional Chinese medicine, etc. The LP - TACE has been widely used in clinical [2-5].

Due to chemical therapy and iodized oil double action, the tumor tissue has a series of complex pathological change including degeneration and some residual tumor will continue to grow. The complete necrosis rate of the excision specimen was 11.5% ~ 100% [6].There are also changes in the blood flow dynamics of the tumor tissue, including the blood supply of the parasitic artery, blood supply from the lateral branch, and the blood supply from the portal vein [7], etc. The choice of post-operative treatment options and approaches after LP – TACE depends on the blood of the viable tumor area (VTA). Therefore, the blood supply of VTA is studied for choosing of retreatment options.

We will use multilayer spiral CT scan and enhancement to study postoperative blood supply characteristics of the VTA in HCC after LP-TACE,and to again with valuable information for the choice of treatment plan and way. About this research at abroad is less and did not see its blood supply at parting.

2. Material and methods

2.1. Clinical Material

42 cases patients with primary hepatocellular carcinoma of hepatic artery perfusion were selected from the third affiliated hospital of sun yat-sen university.The diagnostic criteria are in accordance with a revised and approved standard formulated by the Chinese cancer society's live [8] .34 patients were boys and 8 patients were girl, 32 ~ 80 years of age, 65 of the patients were given LP -TACE.

2.2. LP - TACE

Used the Seldinger method for intubation, via the femoral artery, 4F or 5F hepatic artery catheter was carried intor the tumor supplying blood vessels and irrigation after the injection of 2-3 chemotherapy drugs, the catheter was inserted into the natural artery of the liver.The hepatic artery, or even the hepatic segment artery was injected with a moderate amount of iodine under the X-ray fluoroscopy .The amount of iodized oil is determined by the size of the tumor and the blood supply.

2.3. MSCT

All patients were given 16-layer spiral CT scan and enhanced dual scan after lp-tace for 1-6 months. CT machine was Subsensation 16, scanning voltage were 120KV, current were 140mAs, The collimator were 0.75mm, the reconstructed image layer was 7 mm. 800~ 1000 ml of water oral before check.First liver CT scan, then (300 mgI/ml), 80~100ml of contrast agent iodohydride or uevin were injected through forearm vein .The rate of injection is 3ml/s. Delay scan time: the hepatic artery of 25s, silent Pulse period of 70s.

2.4. CT image measurement and analysis

2.4.1. CT image measurement

The CT image approximately 5-10 mm^3 is measured in regions of inter, avoiding small blood vessels and iodized oil deposits. In the area, the image of the flat scan, the arterial period, and the portal vein of the same lesion were taken. All CT images were performed by three attending physicians. The senior imaging focus on its reinforcement analysis and determination of blood supply of type and consensus.

2.4.2. VTA

CT scan for low density astropathy, and enhanced scanning in arterial and/or portal vein increases [9], if not strong, the VTA was either enlarged or pathologically confirmed by follow-up lesions.

2.4.3. The blood supply type

According to the multilayer spiral CT showed that there were four types of blood supply for tumor survival area: ① the hepatic artery blood type: Flat sweep is low density, and arterial period is strengthened (CT increases >20Hu), it become to the density or irregular patches, spots, and bars or the abnormal hepatic artery, which is irregular in size and irregular cavity size into low density area, low density of portal vein too. ②The portal vein blood type. The hepatic artery stage was not significantly enhanced, and the boundary of the portal vein was circumferential and irregular flap enhancement (CT increases >20Hu). ③The hepatic artery and the portal vein double for blood type. The arterial stage strengthens or appears the tumor blood vessel, the blood vessel Increased, vascular staining, etc., the CT of the portal is not reduced or continued rise, whether it is relatively normal liver essence. Due to the enhancement of normal liver parenchyma in portal vein is significant, even if VTA is continued to rise in intraportal CT values, but were still low density compared to normal liver parenchyma. ④ Lower blood supply. It's a low density, and there was no significant strengthening of the portal vein, and the follow-up lesions were enlarged or the presence of VTA is confirmed by pathology to eliminate necrosis or other Non-tumor low density range.

2.5. Statistical

Using the SPSS19.0 statistical software, the comparison of four table qualitative data was verified by the χ^2 ,and it was statistically significant difference in when $P < 0.05$.

3. Result

3.1. MSCT scan in tumor survive the area

After LP–TACE treatment, CT scan show that the tumor are visible in different levels and different shapes of iodized oil deposition, tumor survival area are characterized by low density, boundary is not clear, and have different forms. The CT value of the tumor survival area was (37.71 + + 7.78) Hu.

3.2. MSCT enhanced performance and blood supply type in Cancer survival aera:

On MSCT enhanced scan images, most of the tumor survival area characterized by irregular patchy, punctate, strips, nodular and peripheral, relative to the surrounding normal liver tissue, its density changes in different periods are shown in Table 1.

Table 1 Change of MSCT enhanced scan images in tumor survival area

scan period	MSCT		
	High or equidensity density	Low density	Mixture density
HAP	42	12	11
PVP	21	37	7

3.3. CT scan

According to the same lesion of the scan, arterial and portal venous phase images, the tumor survival area in different periods have improved

the results of the statistics Table 2.

Table 2 The different phase of CT images in the tumor survival area

MSCT image	HAP enhanced	HAP no enhanced	Total
PVP enhanced	25	2	27
PVP no enhanced	33	5	38
Total	58	7	65

3.4. Four types of blood supply before and after LP – TACE

According to the VTA performance in different periods of strengthening, blood supply can be divided into four types: (Figure 1 ~ 4) hepatic artery for blood group are 33 cases (50.77%), portal vein for blood type were 3 cases (4.62%), double for blood type were 23 cases (35.38%), less blood supply type were 6 cases (9.23%).According to the same judgment method for 42 cases of patients with LP – TACE, preoperative blood supply with conventional way as: for 37cases for hepatic artery blood type, 2 cases for portal vein blood type, double for blood type were 1 cases, type less blood supply were 2 patients Table 3.

Table 4 types of blood supply before and after LP – TACE

Blood supply way	portal vein+ double blood type	hepatic artery blood type	total	Rate of portal vein
Before LP – TACE	3	37	40	5.0%
After LP – TACE	26	33	59	44.07%
total				

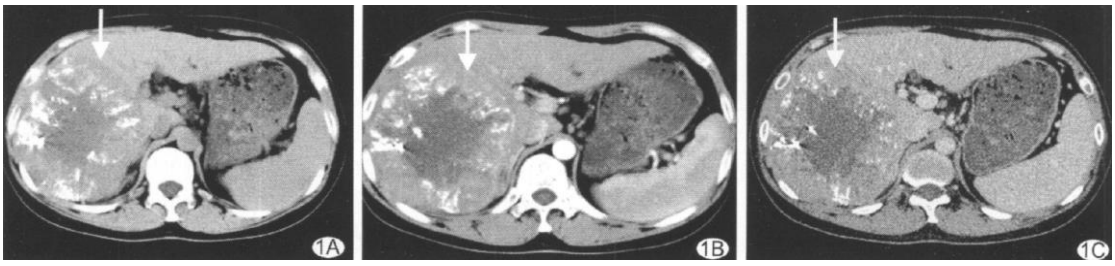

Figure 1. Hepatic artery for blood type a. flat scan saw the deposit of iodized oil in the lump of the tumor, the surrounding large ring of low density shadow was the tumor survival area, and the central area was necrosis.B: The focal lesion of the artery was clearly intensified high density; C: The density of the lesion in the venous stage of the portal was rapidly decreased, and was typical of "low - high - low" mode.

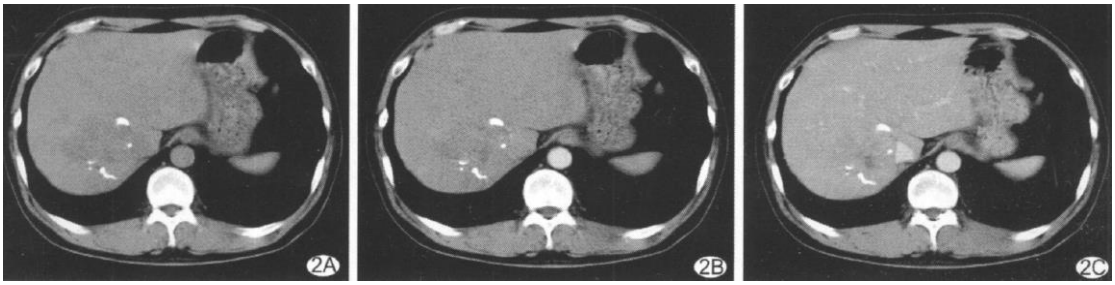

Figure 2. Portal vein for blood type a. flat scan of large low-density tumor survival area, surrounded by iodized oil deposits; B:No apparent reinforcement was seen in the arterial lesions; C: The focal point of the lesion of the portal is a marked plaque strengthening.

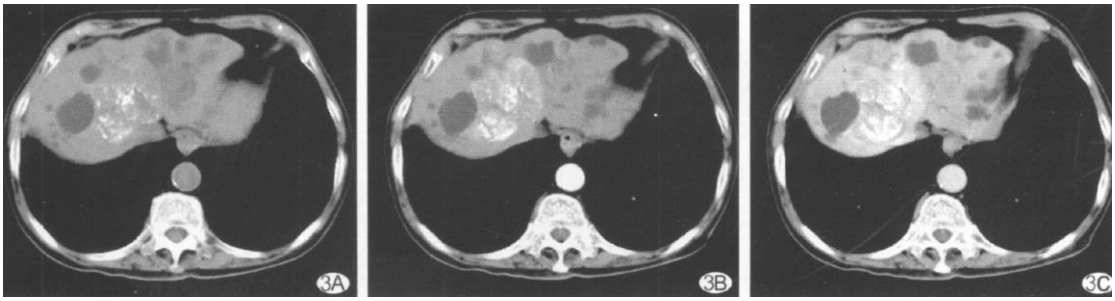

Figure 3. Double blood type A:. CT scan of the iodized oil and the surrounding area of low density tumor. B:The tumor survival area was significantly enhanced in the arterial stage (CT was 98Hu); C. portal intravenous liver parenchyma, and increased tumor survival area (112 Hu).

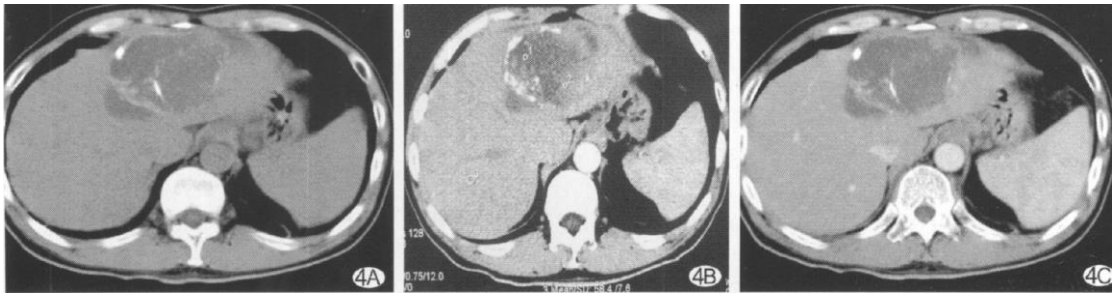

Figure 4. Low blood supply type A. Flat scan show low density range of the left leaf of the liver, and the deposits of iodized oil on the inside and around. B: The enhanced scan arterial lesion was not enhanced and remained low density; C. The portal vein lesion was not significantly enhanced.

4. Discussion

After the treatment of lp-tace, the cancer of the liver was necrotic and the whole cancer was completely necrotic. But due to the variation of liver blood supply, parasitic blood supply, double blood supply, arterial blood supply of liver cancer shows source more blood supply , the establishment of the circulation of the side and hepatic artery embolization not completely [10-12], the swollen after embolization Incomplete necrosis of the tumor or relapse.Tan [6]study found that there are three forms of cancer tissue residue after LP-TACE .The residual carcinoma tissue blood supply will occur some changes, and the accurate evaluation of these changes for liver cancer patients after LP-TACE l has very important significance for further treatment.

Murakami [13] found that the duration of arterial delay in patients with liver cancer was 14.0 ~ 36.0s, an average of 19.4s. Sandstede [14] shows that The CT threshold is 75 Hu, and the optimal arterial image is obtained when the interval is 10 s Wu dong, etc. Wu [15] through the continuous dynamic scanning measurement show that proper tree contrast agent dosage was 2ml/kg body weight, injection rate of 3 ml/s, the average portal vein improved peak/reach time were 208. 6 166.0 Hu/Hu/60s, 65s in normal group and liver cirrhosis respectively; the average liver increases peak/time were 122.3Hu/70s, 99.8Hu/80s respectively. After LP --TACE treatment, arterial delay time was 25 s ,portal venous phase delay time as the 70s, each scan time is 4~6s, It should be able to reflect the hepatic artery and portal vein in survival tumor area.

According to a report [16], this study will be divided into four type: hepatic artery blood type and portal vein blood type, double for blood type and less blood supply. Goseki [17] results showed that HCC did not with the lp-tace treatment may have some blood supply of the portal vein, but it was significantly increased by the LP -TACE treatment group. In our study, 2 cases of hepatic artery blood supply in patients with HCC after several LP - TACE treatment, the survival tumor blood supply from the hepatic artery gradually and translate into the hepatic artery and portal vein dual for blood type. The blood supply of the portal vein in the tumor survival area was increased after the HCC patients after LP – TACE.

To study the blood supply of the tumor survival area after LP- TACE, it has important clinical significance for judging the curative effect and developing the treatment plan. The blood type of the hepatic artery or the portal vein can be treated with hepatic artery or portal intravenous embolization. For the double blood type, it can be

combined with hepatic artery and portal vein injection and embolization therapy; In the case of low blood supply, we can choose the treatment method of non-vascular intervention [18-21]. Depending on the blood supply and the preoperative blood supply, the treatment method, the type of chemotherapy drugs, the dose, and the dose of embolization agent were adjusted.

Because the sample size is too little, we do not make statistical analysis. We will enlarge the sample size for further studies. However, most studies confirmed that this method is feasible, and through the note tracking scan can determine the time.

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