Application of CEUS in Early Diagnosis and Radiofrequency Ablation Treatment of Hepatocellular Carcinoma

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Abstract
Due to the limitation of many factors in the implementation of surgical treatment for hepatocellular carcinoma, many non-surgical treatment methods have emerged. Radiofrequency ablation (RFA) has been rapidly developed and widely used in clinic due to its minimally invasive, safety and effective characteristics. With the progress and development of ultrasound instruments and contrast agents, the clinical value of contrast-enhanced ultrasound (CEUS) has been widely recognized. It has become an imaging test system compared to enhanced CT (CECT) and enhanced magnetic resonance (CEMTI). On the basis of routine ultrasonography, CEUS enhanced blood flow signals and real-time observation of tissue and microvascular perfusion information by intravenous injection of contrast agent in order to improve the detection rate of lesions and identify benign and malignant lesions by enhanced imaging. To verify the role of conventional ultrasound and enhanced ultrasound in the early diagnosis and radiofrequency ablation of hepatocellular carcinoma, we compared the results of conventional color Doppler ultrasound and contrast-enhanced ultrasound in the diagnosis and treatment of hepatocellular carcinoma. It is concluded that enhanced ultrasound has higher diagnostic rate and higher cure rate than conventional ultrasound, indicating that enhanced ultrasound plays an increasingly important role in the diagnosis and treatment of hepatocellular carcinoma; on the contrary, it provided a reliable guarantee for the diagnosis and treatment of hepatocellular carcinoma.

Aplicación de CEUS en el Diagnóstico Precoz y el Tratamiento de la Ablación por Radiofrecuencia del Carcinoma Hepatocelular

Resumen
Debido a que el tratamiento quirúrgico del carcinoma hepatocelular está limitado por varios factores, ha surgido una variedad de tratamientos no quirúrgicos. La ablación de radiofrecuencia (RFA) tiene características minúsculas, seguras y eficaces, y se ha desarrollado rápidamente y se ha aplicado ampliamente en la clínica. Con el desarrollo y progreso de los instrumentos de ultrasonido y los agentes de contraste, el valor clínico de ultrasonido (CEUS) ha sido ampliamente reconocido. Se ha convertido en UN sistema de prueba de imagen comparado con el CT mejorado (CECT) y el mri mejorado (CEMTI). CEUS aumenta la señal de flujo sanguíneo mediante la inyección intravenosa de contraste, observa en tiempo real la información sobre la
Liver is an important digestive organ of human body, and liver tumor is a common tumor of digestive tract. Since BCLC put forward the diagnosis of liver tumor [1] and the treatment process, liver ultrasound, especially CEUS contrast enhanced ultrasound, is attracting more and more attention. Primary liver cancer (PLC) [2] is the fifth largest tumor factor endangering human health and ranks third among the global death population. It is estimated that in the next few years, the number of deaths from liver cancer in the world will reach 65300 a year, second only to lung cancer in China. It ranks second, seriously endangering the health of the people, and the population tends to be younger. In the treatment of liver cancer, it is currently considered to be a surgical treatment, supplemented by interventional embolism, radiofrequency ablation, immunogen therapy and traditional Chinese medicine treatment. According to the tumor stage and general situation of the patients, a reasonable individualized plan was established, but only 9 cases of liver cancer patients were suitable for surgical treatment. In particular, patients with chronic diseases such as cardiopulmonary insufficiency, diabetic hypertension and severe liver cirrhosis cannot undergo surgery. At the same time, there are many problems, such as intraoperative and postoperative bleeding, liver function damage, long recovery time, and easy recurrence after operation. With the improvement of economic level, the screening of diseases has become more and more important, and the early diagnosis rate of liver cancer, especially small liver cancer, has also been significantly improved. The vast majority of patients with small liver cancer are often found in health examinations without obvious symptoms and signs.

Liver cancer is the most common tumor in clinic and ranks third in the global cancer mortality rate. In China, due to the high incidence of chronic hepatitis B [3], the incidence of liver cancer is higher. Statistics show that the incidence of liver cancer in the population infected with hepatitis B virus is 100 times higher than that in the normal population [4]. In China, 555 deaths from liver cancer worldwide lose the opportunity for surgical treatment every year. Imaging examination is very important in the early diagnosis of liver cancer, because the early detection of small liver cancer lesions is of great significance for the treatment and rehabilitation of patients. In the context of chronic liver disease or liver cirrhosis, the occurrence of liver cancer is a gradual process: regenerated lesions, mild atypical hyperplasia, highly atypical hyperplasia, early liver cancer, advanced liver cancer, is a series of liver cirrhosis lesions caused by a variety of genetic changes, this process is to increase the cell structure, new blood vessels and lesion size, and gradually understand this progress may contribute to the early diagnosis of liver cancer. Enhanced CT and magnetic resonance imaging (MRI) have always been the gold criteria for the diagnosis of liver cancer [5]. It is widely used in clinical practice, which is helpful to improve the diagnostic confidence of diagnosis and gradually change the diagnostic criteria of liver cancer.

In recent years, with the rapid development of ultrasound imaging technology [6] and the continuous development of new contrast agents [7], contrast-enhanced ultrasound imaging CEUS technology [8] has made a breakthrough. The application of CEUS in liver imaging has become more mature and extensive [9]. It also has great guiding significance for other cancers, such as thyroid, breast and other superficial organs, kidney, pancreas and other internal organs. Contrast enhanced ultrasound is a rapidly developing ultrasound frontier technology, which greatly improves the diagnosis and differential diagnosis of liver tumors on the basis of conventional ultrasound. The third-generation ultrasound contrast agent SonoVue is a good blood pool tracer with microbubble diameter less than 8 microns. The average diameter is about 2 μm. The new ultrasound technology is combined with the application of new ultrasound contrast agent, which improves the ability to distinguish fine structure from blood flow display sensitivity. It also shows blood perfusion in tissues and organs.

In order to achieve ideal therapeutic effect and reduce the occurrence of complications, it is very important to screen cases before treatment, make treatment plan, and evaluate post-treatment effect and long-term follow-up. Therefore, image examination is essential. In the past, enhanced CT (CECT) and enhanced MRI (CEMRI) played an important role in these aspects. CECT / CEMRI are considered to be the gold standard for evaluating...
the local therapeutic effect of liver cancer, but because of its high cost and inconvenient examination, it is not suitable for immediate examination after radiofrequency ablation. And CT has a certain degree of radiation and is limited in use. At present, ultrasound has become the most commonly used guidance and monitoring tool for the treatment of liver cancer with Radiofrequency ablation (RFA), because it has the advantages of low cost, convenience, real-time, no radiation and so on. Therefore, ultrasound examination of lesions and evaluation of the efficacy of RFA treatment is very important. Conventional ultrasound can detect lesions before RFA treatment, guide needles in treatment, and monitor the whole treatment process in real time. However, there are still main limitations in the qualitative diagnosis of lesions, the judgment of invasion and the evaluation of therapeutic effect. Although energy / color Doppler [10] can show the blood flow distribution of liver cancer to a certain extent, it is lack of sensitivity and specificity for the detection of micro vessels in lesions.

CEUS can significantly enhance the harmonic signal of blood pool and obtain rich hepatic blood supply and microvascular perfusion information so as to improve the detection rate and diagnosis rate of liver cancer. In addition, the boundary of lesion and the distribution of blood flow can be clearly shown, which provides an important basis for the development of RFA treatment plan. In addition, CEUS is more sensitive to microvascular blood flow than energy / color Doppler, and even reports that the detection rate and diagnostic accuracy of micro lesions are higher than those of CECT. Therefore, CEUS is also of great significance in evaluating the efficacy and long-term follow-up of liver cancer after RFA treatment. It ensures that patients with liver cancer can get timely and targeted treatment, accurately determine the number and size of tumors before microwave ablation, and whether they invade large blood vessels. Microwave ablation of hepatocellular carcinoma (HCC) is based on the effect of tumor heating. The effect of tumor ablation depends on the integrity of tumor necrosis. It is affected by many factors, such as tumor number, tumor size, lesion boundary, extent of invasion and overall stage. Previous reports have shown that extending ablation beyond the safe range of tumors from 05 cm to 1.0 cm can reduce the risk of tumor recurrence. Therefore, it is very important to accurately measure the tumor size and determine the tumor boundary before operation.

The size, morphology and echo of HCC tumors after Microwave ablation (MWA) could be observed by gray scale ultrasound, but the tumor necrosis after MWA was similar to the residual acoustic characteristics. The degree of inactivation cannot be distinguished only by tissue echo. Color Doppler ultrasound can determine the distribution of color blood flow in tumors, because the sensitivity of color Doppler ultrasound to low speed blood flow is limited. It can only be preliminarily judged whether the lesion is completely inactivated or not, and the degree of tumor inactivation cannot be reversed accurately after MWA. Therefore, CECT and MR are the main imaging methods for clinical evaluation of HCC after MWA. In recent years, with the development and application of new ultrasound contrast agents, the new development of ultrasonic instruments and the development of CEUS technology, CEUS is more and more widely used in HCC ablation. Targeted supplementary treatment can also be carried out in advance in order to achieve better results.

Ultrasound imaging is considered to be the third revolution of medical ultrasound, which is a rapidly developing ultrasound frontier technology in recent years. On the basis of conventional ultrasound, the ability of diagnosis and differential diagnosis of liver tumors is greatly improved. The third-generation ultrasound contrast agent SonoVue is a good tracer in blood pool, and its microbubble diameter is less than 8 μ m. The average diameter is about 2 μ m. The new ultrasound technology is combined with the application of new ultrasound contrast agent, which improves the ability to distinguish fine structure from blood flow display sensitivity. In addition, it can also show blood perfusion in tissues and organs. In this paper, by comparing the cure rate and recurrence rate of conventional ultrasound and contrast-enhanced ultrasound in the diagnosis and treatment of liver cancer, the experiment proves that contrast-enhanced ultrasound is of great help to the early diagnosis and treatment of liver cancer.

2. The Basic Introduction of the Treatment of Liver Cancer

2.1. Surgical Resection and Radiofrequency Therapy

Liver cancer is one of the most common malignant tumors in the world, and the mortality rate ranks third among cancer mortality. In recent years, the incidence and mortality rate has increased year by year, and the mortality rate in China has risen to the second place. China has the highest incidence of liver cancer, that is to say, the most common causes include hepatitis B and hepatitis C. Primary liver cancer mainly includes HCC and bile duct carcinoma. Surgical resection is the first choice of treatment, liver transplantation is becoming more and more mature, but most patients have reached advanced tumors. Moreover, patients with HCC have chronic toxic hepatitis and liver cirrhosis, and the liver function reserve is poor, so the resection rate is very low. A variety of non-surgical and palliative treatments have emerged. At present, non-surgical methods used in clinic include transcatheter arterial chemical embolism, percutaneous ethanol injection, radiofrequency ablation, microwave ablation, laser ablation and argon-Helium condensation. In recent years, the technique of thermal ablation [11] has developed rapidly, the therapeutic effect has been improved, the complications have been
gradually reduced, and great progress has been made in the non-surgical treatment of HCC. Thermal ablation techniques mainly include microwave ablation, radiofrequency ablation, laser, cryotherapy and high intensity focused ultrasound. Microwave ablation technology has the advantages of high thermal efficiency, small pain, uniform high temperature thermal field and complete necrosis of coagulation area. The characteristics of narrow hyperemia area and the small factors affecting blood flow have great advantages in local hyperthermia.

**Figure 1.** Main methods of treatment of liver cancer at present

At present, the main treatment methods of small liver cancer include surgical resection, liver transplantation, interventional embolism and local ablation, traditional Chinese medicine immunotherapy, radiotherapy and chemotherapy. Surgical resection is considered to be the first choice for the treatment of primary hepatocellular carcinoma. High cost and high surgical risk have some limitations in the current treatment of liver cancer. Surgery is the first choice and the most effective method, including local tumor resection and anatomical hepatectomy (right hepatectomy, left hepatectomy, middle hepatectomy, tail nucleus resection, right tricuspid valve resection, left resection, etc.).

**Figure 2.** The advantages and disadvantages of the operation in the treatment of liver cancer

Surgical resection of small liver cancer has the following advantages: 1. the tumor clearance was thorough. In this study, all small liver cancer was treated with radical resection. 2. During the operation, other parts of the liver and abdominal cavity can be further explored, and ultrasound and other means can be used. Further clarify the location, diameter, number and adjacent condition of the tumor in order to achieve a more accurate and reasonable surgical method; 3. The tumor stage and pathological type can be evaluated by complete pathological section after operation. However, there are also shortcomings in the operation: for example, the tumor is located in the liver parenchyma and is deeper, especially in the right posterior lobe of the liver (parts VII and VIII). Close to important blood vessels, it cannot reach the safe range of surgical resection; the liver function damage is greater, especially in the patients with liver cirrhosis, the liver function level is poor, coupled with the low compensation ability of the residual liver after operation, it is easy to cause liver function disorder. At the same time, due to the specific biological characteristics of HCC, multicenter growth, accompanied by intrahepatic and extrahepatic metastasis, as well as the background of liver cirrhosis, the poor liver function
reserve leads to a low complete resection rate of HCC (less than 30). At present, it is controversial to use anatomical hepatectomy and non-anatomical hepatectomy to reduce liver trauma in radical tumor resection. Related studies have shown that anatomical hepatectomy has significant advantages in reducing intrahepatic recurrence and improving tumor-free survival after hepatectomy. Non-anatomical hepatectomy can improve the tumor resection rate and reduce the incidence of postoperative liver failure, but there is no significant difference in overall survival rate. Due to the lack of comparative analysis of big data, further data research and analysis are needed to predict the factors affecting small liver cancer.

2.2. Radiofrequency Ablation Treatment Protocol Guided by B-ultrasound

Radiofrequency ablation is a safe, effective and minimally invasive method for the treatment of liver cancer. However, the related factors affecting the long-term survival of liver tumors after radiofrequency ablation include: tumor number, tumor size, tumor differentiation, primary metastases and other distant metastases, safe range of ablation, BCLC grade of liver cancer, liver function grade, which can be classified as background of liver disease, tumor status and treatment. Radiofrequency ablation can be used as an alternative to radical resection of small liver cancer.

Due to the limitations of radiofrequency ablation, lesions are more likely to occur in the treatment area, and too many or scattered lesions make it difficult to completely destroy each lesion. Because there are too many puncture points, it can also increase the pain of the patient. For small liver tumors, due to the limitation of ultrasound guidance, it is difficult to display the tumors located at the top of liver sputum, which leads to the treatment of relative "blind area". At the same time, due to radiofrequency ablation, high temperature of 70 °C - 110 °C will be produced. Even in the case of artificial ascitic fluid and water capsule, non-free radical therapy can be caused to avoid damage to the above organs.

There are still many problems to be solved in the treatment of liver tumors by radiofrequency ablation: (1) How to reasonably select radiofrequency ablation electrodes and make treatment methods. (2) How to combine radiofrequency ablation with radiotherapy, chemotherapy or other treatments in order to maximize its curative effect. (3) How to increase the range of radiofrequency ablation so that radiofrequency ablation can cure tumors with large lesions. There was no excessive injury to the normal tissue around the tumor focus. (4) How to combine organically with image guidance to avoid the "blind area" of the liver [12]. Compared with B-ultrasound guided radiofrequency ablation, ultrasound guided radiofrequency ablation has the advantages of simple operation, less trauma and faster recovery. The advantages of less complication, to a certain extent, greatly reduce the economic burden of patients, in the case of older patients, poor cardiopulmonary function or accompanied by liver cirrhosis and other conditions that do not meet the surgical indications or cannot accept surgery, can replace some of the traditional open surgery treatment.

![Figure 3. Flow chart of radiofrequency ablation under the guidance of B ultrasound](image)

(1) To improve the relevant imaging and laboratory tests before the operation, including B-ultrasound, CT or MR, to determine the size and general position of the tumor, to establish a reasonable puncture, needle and needle ablation procedure; to eliminate the contraindications and the patients with normal blood coagulation; the liver function classification shall be in accordance with Grade A or Class B;
The patients were placed in the supine position or the lateral position before the operation for 8-12 hours, and the operation area was subjected to routine disinfection, covering and local anesthesia of lidocaine;

(3) Performing the B-ultrasonic examination again, determining the position and the size of the tumor, determining the position of the needle in the needle, the angle of the needle and the ablation scheme, to be in accordance with the principle of percutaneous tranhepatic liver;

(4) After confirming the site under B-ultrasound, select the single-pole radio frequency needle, and then open the motor for ablation after the tumor is placed. The time is 15-20 minutes, and the range of the radio-frequency ablation comprises the liver tissue in the tumor and the surrounding 1-2 cm; when the B-ultrasonic examination shows that the blood flow signal in the tumor disappears, the low-echo focus becomes the high-echo range, the ablation is completed; the mode is changed to the needle mode, the needle path is broken, Then pull out the radio-frequency ablation needle and take care not to repeatedly move in and out of the needle. It is strictly forbidden to flip the needle to prevent the surrounding tissue from being damaged, and the non-ablated tumor is spread along the needle channel;

(5) The heart rate and the blood pressure are detected in the operation, the routine fasting is given after the operation, the electrocardiographic monitoring is given, the vital signs are monitored for 4 to 6 hours, the bed is more than 8 hours in the bed, the heart rate and the blood pressure are detected, The appropriate analgesic treatment, postoperative blood routine and liver and kidney function examination were given. Intravenous nutrition fluid replacement, including liver protection, gastric protection, anti-inflammatory and hemostatic treatments.

2.3. Contrast-Enhanced Ultrasound

Compared with contrast enhanced ultrasound, CEUS can continuously observe the enhancement and clearance of hepatic artery, portal vein and liver parenchyma after injection of contrast agent into human body. Therefore, contrast-enhanced ultrasound can display small lesions that cannot be displayed by conventional ultrasound and enhanced CT, and can significantly improve the diagnosis rate of early small liver cancer. In recent years due to the development of new acoustic contrast agents and related technologies ultrasound has been used in small liver cancer (SHCC), especially small liver cancer detection value has been significantly improved the application of ultrasound contrast agent in clinical ultrasound diagnosis has made breakthrough progress. In addition to the traditional contrast harmonic imaging, contrast-enhanced ultrasound imaging also includes intermittent ultrasound imaging, energy contrast harmonic imaging, anti-pulse harmonic imaging, stimulated acoustic emission imaging, low mechanical index imaging, and comparative blasting imaging and so on. Most of the malignant tumors of the liver are dilated or invasive, which easily invades the surrounding cysts and blood vessels, resulting in unclear boundary or no obvious capsule. Conventional ultrasound often has errors in the measurement of tumors with unclear and irregular shapes. It was found that there was a significant difference in the therapeutic effect between invasive and non-invasive tumors so it was necessary to fully understand the malignant degree of liver before operation. Before RFA, the size, boundary and invasion range of the lesion can be determined, which can provide a reliable basis for the operator to determine the number of needle ablation lesions, and formulate a reasonable treatment plan and treatment strategy. The basic flow of contrast-enhanced ultrasound is as follows:

![Figure 4. Flow chart of contrast-enhanced ultrasound](image)

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(1) Configure contrast agent and prepare first-line emergency drugs and equipment (oxygen package, simple respirator, sphygmomanometer, epinephrine, antihistamine drug blocker injection, β 2 receptor agonist inhalation, and anticonvulsant);

(2) Communicate with the patient, inquire about the medical history and the history of drug allergy, and sign the informed consent form;

(3) Routine ultrasound examination, multi-section scan, focusing on the overall size and shape of the liver, the size and quality of the parenchyma echo and quality, quantity, location, boundary, internal echo, calcification, liquefaction and blood supply;

(4) 24ml (concentration 5mg / ml.) was injected intravenously after shaking and mixing of the contrast agent. 5 ml saline was injected after tail injection and the whole ultrasound imaging process was recorded for analysis;

(5) The whole process of ultrasound contrast was divided into three stages: arterial phase, 0-30 s after injection of contrast agent, portal vein phase, 30-120 s after injection of contrast agent, and delayed phase, injection of contrast agent until 120 s after angiography. The diagnosis and analysis results of two senior physicians or deputy chief physicians were summarized, and the image features of conventional ultrasound and contrast-enhanced ultrasound were analyzed [13];

(6) After examination, the patient left for 30 minutes without leaving.

Because the liver is supplied with double blood (hepatic artery 25-30, portal vein 70-75), the contrast agent is injected intravenously through the right heart, lung circulation, left heart, aortic, and then enters the liver in two ways: part of the microbubble contrast agent is from the celiac trunk artery to the hepatic artery. The other part of the contrast agent is through the celiac artery-spleen vein-portal vein and superior mesenteric artery-superior mesenteric vein-portal vein, and finally through the portal vein into the hepatic sinus.

CEUS was divided into three phases: (1) Hepatic artery phase (0-40 s): 10-20 seconds after peripheral intravenous injection of contrast agent 10-15 seconds. The blood vessels in the liver parenchyma can be seen quickly, the bright echoes are strong, and the branches of the blood vessels are regular in shape, like a dry tree. When the contrast agent entered the micro vessels and hepatic sinuses (equivalent to hepatic microcirculatory), the echo of liver parenchyma increased gradually. (2) Portal vein phase (40-120s): about 30-45 seconds after injection of contrast agent and 120 seconds after injection of contrast agent, the performance was as follows: the portal vein and its branches were filled with contrast agent, and the blood vessels were striped and strongly echo. (3) Delayed phase (120-360 s): after portal vein phase, the contrast agent continued to be removed from the liver parenchyma as follows: the liver tissue was uniform and strongly enhanced, reaching its peak about 2 minutes after injection of the contrast agent, and the blood vessels were not developed at this time.

3. Experiment

3.1. Experimental Equipment and Consumables

Ultrasonic equipment: using Italian-made BAISHENG EASOTE MYLAB90 [14], CnTI imaging software, Siemens SIMENS S2000 CPS contrast software as contrast-enhanced ultrasound instrument, and equipped with professional puncture stents as ultrasound guidance equipment.

Ultrasound contrast agent: Sonovine Sonove SF659mg freeze-dried powder made in Italy. The contrast agent of Sonor is the second-generation ultrasound contrast agent. SF6 gas is wrapped in the fat shell, and the blood pool contrast agent can be used to monitor the reward of peripheral intravenous injection through cardiopulmonary circulation, and the second harmonic signal of contrast agent can be used to monitor the reward of peripheral intravenous injection. The tracer contrast agent is used to display the characteristics of tumor microcirculatory perfusion. The benign and malignant intrahepatic nodules were diagnosed, and the puncture biopsies were guided by the enhanced area tracer of intrahepatic nodules, and the ablation effect was evaluated by the presence or absence of enhancement of intrahepatic nodules. Contrast agent: sulfur hexafluoride microbubbles for injection, molecular formula: SF6 molecular weight: 146.05. The structural formula of sulfur hexafluoride is as follows:
Composition of freeze-dried powder excipients: Distearyl choline (DSPC), dipalmitoyl glyceride (DPPG. Na), palmitic acid, polyethylene glycol 4000. No preservatives. Sulfur hexafluoride gas is the main active component of Sonovi, which can be discharged rapidly through pulmonary circulation. Almost all Sulphur hexafluoride gases have been discharged 15 minutes after injection. It is well known that all the components of Sonovir are non-toxic and the incidence of adverse reactions is very low, only 0.012.

Radiofrequency ablation equipment: RF equipment adopts Valley lab Cool tip (Valley lab, boulder, co., USA) and Olympus Celon (Olympus, Teltow, Germany), standard manufacturer operation mode, guide equipment to adopt The Esaote Mylab90 (ESAOTE S. p. A., Milan, Italy) and ACUSON S2000 Siemens, Erlangen, Germany).

ECG monitoring, special standard intervention room, interventional diagnosis and treatment process and specification, system. Routine examination before and after operation: liver function, blood ammonia, platelet, PT, bilirubin, ascitic fluid, albumin, follow-up before and after AFP, treatment, HBV-DNA copy. Preoperative imaging: all cases were examined by contrast enhanced ultrasound to determine tumor size and boundary.

3.2. Experimental Subject

From January 2016 to April 2017, 110 patients with liver cancer who underwent radiofrequency ablation were divided into two groups (normal color Doppler ultrasound) and B (contrast-enhanced ultrasound) with 55 patients in each group. There were 25 cases in group A, 30 cases in female, 35 years old and 76 years old in group B, 28 cases in group B and 27 cases in group B, the age was 38 times 75 years old. There were 108 primary and 78 metastases, respectively. There was no significant difference in sex ratio and age between the two groups (P > 0.05).

4. Analysis

4.1. Empirical Method

The location, number, size and boundary of intrahepatic tumors were observed by conventional ultrasound in both groups. If the lesion is difficult to show or unclear, you can refer to other tests, such as CT or MRI, to confirm the location.

Ultrasonic angiography was performed before and after RFA in the CEUS group. There was no necrosis in tumor tissue. The depth of liver parenchyma was the same as that of interest. and record the corresponding analysis data.

After treatment, conventional ultrasound, enhanced CT or contrast enhanced imaging were used for regular follow-up, at least 3 months follow-up, and to determine the CT standard for the degree of tumor ablation. In this study, 38 cases of liver cancer in CEUS group were examined by CEUS before and after radiofrequency. After treatment, the number of CEUS was 1-3 times, a total of 47 times.

SPSS 13.0 statistical software was used for statistical analysis. The measured data are represented as the average soil standard deviation (x ±s). The quantitative analysis parameters of the two groups were consistent with the normal analysis. When a ≤ 0.05 was used as the test level, there was significant difference between the two groups (P < 0.05).

4.2. Comparison of Super Imaging and Doppler Ultrasound

The results of focus detection were as follows: 103 lesions were detected in group A, the detection rate was 55.38 (103/186), B group), the detection rate was 96.24 (179/186). According to SPSS analysis, P < 0.05, there was significant difference, which proved that contrast-enhanced ultrasound was more accurate in the diagnosis of liver cancer. The results of the two diagnostic methods are shown in the figure below.

**Figure 6.** Experimental flow chart
Radiofrequency ablation results: there were 85 lesions, 42 complete ablation and 22 partial ablations in one group, the ablation rate was 49.41 (42/85). B group described 78 lesions, 69 complete ablation, 8 partial ablations, the ablation rate was 88.46 (69/78). There was significant difference after T test (P < 0.05). It was proved that contrast-enhanced ultrasound could play a better auxiliary role in radiofrequency ablation, and the cure rate of liver cancer was higher. The comparison of cure rates between the two methods is shown in the figure.

In order to test the feasibility of the above test protocol and treatment methods, the patients with hepatocellular cancer above were followed up to investigate the number of post-effects in their later life. According to the above patients, the data were obtained after the visit survey. The number of patients with the postoperative symptoms after RF ablation in the first group was 24 cases, accounting for 43.63%, and the number of patients with the second group after radiofrequency ablation was 10 cases, accounting for 18.2%. It can be seen from Fig. 9 that the number of postoperative diseases by ultrasound imaging technology is less, which proves that the ultrasound imaging technique is more safety and reliable in treating liver cancer.

Figure 7. Comparison of the detection rate of lesions

Figure 8. Comparison of cure rate of liver cancer

Figure 9. Comparison of the number of sequelae
Through the above analysis, the satisfaction of the above patients was evaluated in this paper. Among the 110 patients mentioned above, the trust degree of ordinary ultrasound was 23%. The reason was that the difference between individuals led to the difference in the recovery process of the disease, while 78% of the patients were more satisfied with the treatment of liver cancer, indicating that in the future development may be with the continuous updating of contrast agents and ultrasound equipment. Contrast-enhanced ultrasound will become the main means of examination and treatment of liver cancer and even all cancers.

![Comparison of satisfaction between two diagnostic methods](image)

**Figure 10.** Comparison of the satisfaction of the two diagnostic methods


**Advantages:**

1. CEUS can dynamically, real-time and continuously display the whole process of angiography, and the observation of lesions is also real-time and continuous. Minor structural omissions are avoided and can be done by the bedside if necessary.

2. CEUS is highly accurate in describing microvascular perfusion of hepatocellular carcinoma nodules.

3. SonoVue, a contrast agent, has no hepatorenal toxicity and has a low incidence of adverse reactions. SF6 gas is the main component, which is excluded from respiratory tract after entering the human body. It can be reused many times without liver and kidney metabolism, so it is safer than CT and MR contrast agents.

4. The echo of tumor tissue and surrounding liver parenchyma can be objectively analyzed by comparing the parameters of ultrasonic PCT curve, which provides more basis for diagnosis and greatly improves the clinical practical value and accuracy of diagnosis.

**Limitations:**

1. CEUS is that the duration of contrast agent is short, and it is difficult for examiners to observe blood perfusion of multiple lesions of the liver in a short period of time. Especially when routine ultrasound shows unclear or subcostal, axillary and other ultrasound scan blind spots or deep lesions (12cm from the body surface). Artificial pleural effusions or intraoperative contrast-enhanced ultrasound can now be used to make up for these defects..

2. Due to the “cavitation imaging” after RFA treatment, the presence of gas in the treatment area is one of the limitations of CEUS. It is characterized by strong echo, accompanied by sound and shadow, which prevents the examiner from correctly evaluating the trailing edge of the tumor treatment area. Therefore, it is recommended that the patient perform ultrasound imaging 20-40 minutes after ablation treatment.

3. The role of CEUS quantitative analysis in disease diagnosis and evaluation has been gradually demonstrated, but the results obtained by different quantitative analysis software and imaging techniques are different even by the application of different contrast agents, and the quantitative parameters used in different studies are different. It makes the research repeat, difficult to popularize and apply, requiring further standardization. In addition, during ultrasound, the liver can move slightly with the patient's breath, which affects the operator's accurate positioning of the area of interest.

With the advancement in networking and multimedia technologies enables the distribution and sharing of multimedia content widely [15]. In the meantime, piracy becomes increasingly rampant as the customers can easily duplicate and redistribute the received multimedia content to a large audience. Ensuring the copyrighted multimedia content is appropriately used has become increasingly critical.
5. Conclusions

Although conventional ultrasound has been considered to be a guide tool, there are still some limitations in the assessment of qualitative diagnosis and treatment effects. With the progress and development of the ultrasonic instrument and contrast agent, the development of the ultrasound imaging technology (CEUS) has developed rapidly. It is expected to be a comparable image for ECT and CEMRI. On the basis of routine ultrasonic examination, CEUS enhanced the human blood flow signal by intravenous contrast agent, and observed the tissue and micro vessel perfusion information in real time to improve the detection rate of the lesions and to identify benign and malignant lesions. In that paper, the treatment effect of a part of the liver cancer patient follow the detection of different ultrasonic instruments is follow through the follow-up investigation, and the detection result and the detection precision of the early treatment of the cancer are provided by the ultrasonic contrast technology. And provides a better treatment scheme for both the radiofrequency ablation technology and the microwave ablation. The data of this paper show that the ultrasound imaging is the main method for the diagnosis of cancer such as liver cancer in the future.

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