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Microwave Ablation in the Thermal Treatment of Hepactocellular Carcinoma: Case Report

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Abstract **Case Report**

Hepatocellular carcinoma (HCC) stands as one of the most prevalent malignant tumors [1], and is the cause of over one million deaths annually worldwide [2]. While surgical resection remains the preferred treatment for early-stage hepatocellular carcinoma (HCC) in well-compensated cirrhosis patients, thermal ablation techniques offer a credible non-surgical option. Their minimal invasiveness, high tolerability, safety, established efficacy in local disease control, virtually unlimited repeatability, and cost-effectiveness render them valuable alternatives. Microwave ablation (MWA) of HCC appears to be a safe and effective treatment. Here we report a case of 53-year-old male, followed for hepatitis C complicated by compensated cirrhosis, During the follow up, Laboratory tests found liver function tests were eleveted, α-fetoprotein (AFP) was normal. Abdominal ultrasound showed a focal hepatic mass straddling segments VI and VIII, rounded, well-limited, with heterogeneous hyperechoic echostructure, and splenomegaly. Contrast-enhanced abdominal computed tomography showed a chronic liver desease with a focal lesion straddling segments VI and VIII, oval, tissue-like, hypodense in the center, measuring 50x41mm, with signs of early arterial enhancement consistent with HCC characteristics and signs of portal hypertension and a multicystic kidney. Hepatic MRI revealed a chronic liver disease straddling segments VII and VIII of a hepatic lesion measuring 23x 22mm classified as Li-RADS 4 with signs of portal hypertension and splenomegaly. Based on these results, the patient was diagnosed as HCC with well compensated cirrhosis, and in view of the fact that he had only a single lesion and was in functional grade A of Child-Pugh classification and staged as BCLC-A in the Barcelona Clinic Liver Cancer (BCLC) staging system, the patient benefited from microwave ablation for his HCC, with good clinical, biological and radiological evolution. Microwave Ablation (MWA) emerges as a promising loco-ablative treatment option, demonstrating efficacy and safety in cirrhotic hepatocellular carcinoma (HCC) patients. Typically, smaller HCCs exhibit higher response and complete ablation rates.

Keywords: Microwave Ablation, Thermal Treatment, Hepactocellular Carcinoma, Hepatocellular carcinoma (HCC).

INTRODUCTION

HCC is the sixth most common cancer worldwide and a frequent cause of cancer-related death. The most prevalent primary liver tumor is hepatocellular carcinoma (HCC), which may start as a single tumor that grows or as a series of small cancer nodules forming throughout the liver. [3-4] In recent decades, its prevalence has been rising globally [5, 6], with an estimated annual occurrence ranging from 500,000 to 1,000,000 cases [7, 8].

The majority of hepatocellular carcinoma cases are caused by either viral hepatitis (hepatitis B, C) or alcoholic cirrhosis. Patients with cirrhosis should be checked every six months to detect the tumor when it is asymptomatic since they are more at risk of developing HCC [9, 10].

In most solid malignancies, tumour stage at presentation determines prognosis and treatment management.

The optimum course of therapy for hepatocellular carcinoma (HCC) is determined by taking into account a number of factors due to the complex nature of this deases, such as the location and size of the tumor, the underlying liver function, the presence or absence of extra-hepatic disease, patient performance status, and co-morbidities. Because of this, wherever feasible, all potentially curative therapy for HCC (such

as ablation, resection, and transplantation) should be used as first-line treatments [11].

Table 1: BCLC staging system in patients diagnosed with HCC [12-14]

Very early stage	PS 0, Child–Pugh A, single HCC <2 cm
Early stage	PS 0, Child–Pugh A–B, single HCC or 3 nodules <3 cm
Intermediate stage	PS 0, Child–Pugh A–B, multinodular HCC
Advanced stage	PS 1–2, Child–Pugh A–B, portal neoplastic invasion, nodal metastases, distant metastases
Terminal stage	PS >2, Child–Pugh C

HCC, hepatocellular carcinoma; PS, performance status.

Patients with very early-stage (BCLC-0) and early-stage (BCLC-A) HCC have option for resection, transplantation, or ablation depending on status of the liver, portal pressure, bilirubin, and comorbidities. Liver transplantation (LT) is the preferred treatment option due to its ability to cure HCC and prevent other cirrhosis-related complications. However, its accessibility is often hindered by a shortage of suitable living donors and the high associated costs.

Although surgical resection is the gold standard treatment of HCC, only a limited number of HCC patients are surgical candidates because of their lack of hepatic reserve, resulting from coexisting advanced cirrhosis, widespread intrahepatic involvement, and concomitant diseases [15]. Furthermore, the shortage of donors and the high cost of liver transplantation, limit its use.

Image-guided percutaneous ablation is currently accepted as the best therapeutic choice for non-surgical patients with early-stage HCC [16, 17]. Many techniques for thermally destroyed tumors or chemical ablation have been developed and tried in clinical settings throughout the last 20 years. These include the injection of ethanol or acetic acid and the administration of localized heating (radiofrequency, microwave, laser ablation) or freezing (cryoablation).

Image-guided local thermal ablation, notably radiofrequency ablation (RFA) and microwave ablation (MWA), stands as the third most impactful radical treatment approach for HCC, following liver transplantation and surgical resection [18, 19]. As a form of minimally invasive therapy for hepatocellular carcinoma (HCC), thermal ablation, has become an important treatment modality.

MWA is a thermal ablation modality based on increasing the temperature above the normal physiological threshold to kill cancer cells with minimal damage to surrounding tissues. MWA has become an effective local thermal ablation technique for treating HCC which exhibits many advantages over other alternatives to resection [20, 21].

CASE REPORT

Therefore, we report a case of HCC treated by microwave ablation in february 2022, a 53-year-old male, presented to our hospital with positive HCV antibodies Incidentally detected. The patient was asymptomatic. His past medical history included left leg fracture treated with surgery in 2021. He has no record of alcohol abuse, tobacco use, or blood transfusions. A splenomegaly was palpated on the physical exam. The abdomen was non-tender and non-distended, no jaundice was seen. Laboratory test found normal white blood cell count of 5100/µL, hemoglobin of 15.1 g/dL and platelets count of 60000/ µL. Prothrombin time of 80%. Other laboratory findings included normal total serum bilirubin of 29 mg/L, with elevated alanine transaminase (145 U/L) aspartate transaminase (235U/L), GGT (199 U/L) and alkaline phosphatase (168 U/L). Albumin level was normal (37g/l). HCV RNA at $1{,}86\times10^6$ IU/mL. Test for hepatitis B surface antigen was negatif. Abdominal ultrasound showed cirrhotic liver, splenomegaly and no liver lesions. Liver stiffness value was 37,7 kPa according to transient elastography (FibroScan). Esophagogastroduodenoscopy (EGD) did not showed esophageal varices.

We started the patient on an IFN-free combination therapy of SOFOSBUVIR (400 mg) and DACLATASVIR (60 mg/d) for 24 weeks. During the follow up and after six months of treatment, liver function tests were elevated, α-fetoprotein (AFP) was normal and viral load was negative. Abdominal ultrasound showed a focal hepatic mass straddling segments VI and VIII, rounded, well-limited, with heterogeneous hyperechoic echostructure, and splenomegaly. Contrast-enhanced abdominal computed tomography showed a chronic liver desease with a focal lesion straddling segments VI and VIII, oval, tissue-like, hypodense in the center, measuring 50x41mm, with signs of early arterial enhancement consistent with HCC characteristics and signs of portal hypertension and a multicystic kidney. Hepatic MRI revealed a chronic liver disease straddling segments VII and VIII of a hepatic lesion measuring 23x 22mm classified as Li-RADS 4 with signs of portal hypertension and splenomegaly.

Based on these results, the patient was diagnosed as HCC with well compensated cirrhosis, and in view of the fact that he had only a single lesion and

was in functional grade A of Child-Pugh classification and staged as BCLC-A in the Barcelona Clinic Liver Cancer (BCLC) staging system, the patient benefited from microwave ablation for his HCC.

During their follow-up, the patient presented excellent clinical status with normal levels of AFP and stable appearance of the lesion on CT with absence of arterial or portal enhancement of the lesion 1 and 6 month after the patient was treated.

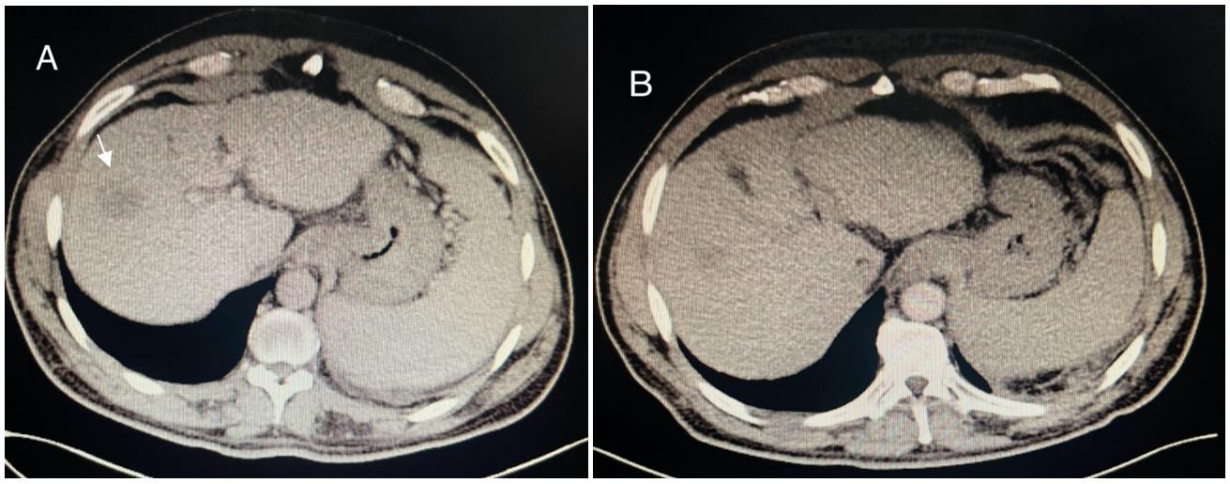

Figure 1: Contrast-enhanced abdominal computed tomography; A- A hypodense lesion of liver measuring 50x41mm straddling segments VI and VIII with signs of early arterial enhancement, consistent with HCC characteristics (white arrow), B: one month after microwave ablation

DISCUSSION

Hepatocellular carcinoma (HCC) is a global health issue and remains the second most common cause of cancer-related deaths [22]. As research in this field progresses, treatment options are expanding and becoming more diverse. Liver resection, thermal ablation, and transplantation provide opportunities for curative treatment in cases of early-stage hepatocellular carcinoma (HCC). Locoregional ablation therapy, including radiofrequency ablation (RFA), microwave ablation (MWA), etc., is a proven cure tactic for early-stage HCC.

Microwave ablation refers to all electromagnetic methods utilized for inducing tumor destruction, employing devices with frequencies equal to or greater than 900 kHz [23]. The movement of dipole molecules primarily contributes to the generation of most of the heat observed during Microwave Ablation (MWA) [24, 25].

Additionally, microwave ablation (MWA) may offer enhanced tumor control compared to radiofrequency ablation (RFA) and other ablation techniques, particularly for individuals with perivascular hepatocellular carcinoma (HCC) [22].

MWA was initially introduced in the Far Eastern clinical practice in the 80s' and 90s' [26].

In recent years, this technique has undergone tremendous progress due to technical advances. Microwave ablation (MWA) shares the inherent benefits of thermal ablation methods, including versatile treatment strategies, favorable tolerability, and the capacity to reliably generate reproducible and predictable areas of necrosis. Thermal ablation procedures are typically conducted under intravenous sedation, accompanied by standard cardiac, blood pressure, and oxygen monitoring. The lesion targeting can be achieved using ultrasound, computed tomography (CT), or magnetic resonance (MR) imaging.

Wang *et al*., publication in Hepatology made a significant contribution to the understanding of solitary hepatocellular carcinoma (HCC). For cases where the tumor diameter is less than 3 cm, ablation therapy has been recommended as a viable alternative, and in some instances, even as a first-line treatment option [27].

The indications for microwave ablation (MWA) are generally broad, with a significant application being the treatment of patients who are not suitable candidates for surgery. This includes individuals with unresectable hepatocellular carcinoma (HCC), HCC located in challenging anatomical sites, and patients who are too medically compromised to undergo surgical resection.

As per the China Liver Cancer Staging (CNLC) system, ablation therapy is primarily recommended for CNLC stage Ia and suitable Ib cases. These include scenarios such as a single tumor with a diameter of 5 cm or less, or 2 to 3 tumors, each with a maximum diameter of 3 cm. Ablation therapy in these cases can achieve a radical therapeutic effect. However, National Comprehensive Cancer Network (NCCN) guidelines recommend that ablation may be curative in treating solitary HCC of 3 cm or less [28].

Initially, Microwave Ablation (MWA) was restricted to treating small hepatocellular carcinoma (HCC). However, advancements in antenna technology and treatment strategies have enabled effective ablation of large HCCs exceeding 5 cm in size [29, 30].

Patients diagnosed with a solitary tumor measuring 4.0 cm or smaller and having Child-Pugh A cirrhosis exhibited a greater likelihood of long-term survival [31].

Microwave ablation (MWA) is recognized as a well-tolerated technique, featuring a satisfactorily low incidence of major complications in the treatment of malignant liver tumors [32]. According to a comprehensive study conducted by Liang *et al.*, spanning a 13-year period, the rate of major complications was reported to be approximately 2.6% [33]. No complications requiring hospitalization or surgical management in our case, only minor complications of which procedure related pain.

CONCLUSION

The use of image-guided tumor ablation with thermal energy for early-stage hepatocellular carcinoma (HCC) has gained widespread acceptance as a curative treatment option across all HCC treatment guidelines. Microwave Ablation (MWA) emerges as a promising loco-ablative treatment option, demonstrating efficacy and safety in cirrhotic hepatocellular carcinoma (HCC) patients.

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