Case Report
J Liver Cancer Aug 24 [online ahead of print]
pISSN 2288-8128 • eISSN 2383-5001
https://doi.org/10.17998/jlc.2022.08.03

Novel management of expected post-radiotherapy complications in hepatocellular carcinoma patients: a case report

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Received Apr. 28, 2022
Revised Jul. 1, 2022
Accepted Aug. 3, 2022

Keywords: Carcinoma, hepatocellular; Radiotherapy, intensity-modulated; Case report

INTRODUCTION

Hepatocellular carcinoma (HCC) is one of the most common primary cancers, and is the sixth most common cancer both worldwide and in South Korea.1,2 Several treatment options are available for managing patients with HCC, but curative modalities are limited as most cases are diagnosed at an intermediate or advanced stage.3 Although many treatment options exist for HCC patients, and each treatment modality has advanced in the past decades, the 5-year overall survival rate continues to be less than 20%.2 In the past, radiotherapy (RT) has been used as a salvage or palliative treatment, and only a few guidelines refer to the role of RT. The use of RT is complicated as it is difficult to avoid radiation exposure to normal hepatocytes and adjacent organs. In the modern era, RT has emerged as a treatment for HCC.4 As RT techniques have improved, intensity-modulated radiotherapy (IMRT), stereotactic ablative body radiotherapy, and charged particle therapy have been used to treat HCC. However, radiation-induced gastric damage (RIGD) commonly occurs as a side effect of upper abdominal RT.5 Most cases of RIGD are mild and self-limiting; however, late toxicities, including ulcerative bleeding, perforation, and stenosis, are potentially life threatening. Here, we report the case of a 53-year-old male patient with HCC who was treated with a gas foaming agent before RT to prevent RIGD due to radiation toxicity. This case report is described in accordance with the CARE guidelines (available at https://www.care-statement.org/).

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CASE REPORT

A 53-year-old male with a history of alcoholic liver cirrhosis was transferred for computed tomography (CT) to further evaluate suspected HCCs in segment 3 and segment 8 of the liver (Fig. 1). On the CT image, the S8 mass showed a rim enhancement pattern and central hypo-enhancement in the arterial phase, and insufficient washout in the portal/delayed phase. The subcapsular portion of the S3 liver segment showed insufficient enhancement to diagnose HCC. Magnetic resonance imaging to diagnose HCC was unsuccessful due to lack of patient cooperation. In the initial laboratory tests, the alpha-fetoprotein level was 5.7 ng/mL and the protein level induced by vitamin K absence II was 41.04 mAU/mL. A platelet count of 147,000/µL, prothrombin time of 11.9 sec, albumin level of 3.8 g/dL, total bilirubin level of 0.8 mg/dL, alanine aminotransferase level of 27 IU/L and aspartate aminotransferase level of 37 IU/L were obtained. The patient had no history of hepatic encephalopathy or ascites. Therefore, his liver function was considered good, with a Child-Pugh score of 5 (Class A). The performance status was also good, with an Eastern Cooperative Oncology Group

![Figure 1](image1.png)

**Figure 1.** (A) Liver dynamic computed tomography (CT) showing a hepatocellular carcinoma (HCC) in segment 8 at initial visit, and (B) follow-up after 1 month. (C) Liver dynamic CT showing HCC in segment 3 at initial visit, and (D) follow-up after 1 month.

![Figure 2](image2.png)

**Figure 2.** (A, B) Esophagogastroduodenoscopy after radiation therapy reveals a gastric ulcer.
status of 0. The patient had Modified Union for International Cancer Control (UICC) stage II, T2N0M0, and the Barcelona Clinic Liver Cancer (BCLC) stage was BCLC A. Based on the modified UICC and BCLC staging systems, embolization, ablation, and liver transplantation were considered as treatments for HCC. After a multidisciplinary approach, transarterial chemoembolization (TACE) was performed for diagnostic or therapeutic purposes, considering patient compliance, socioeconomic status, and reluctance to undergo surgery.

Angiography revealed hypervascular tumor staining, and chemoembolization was performed for the S3 and S8 lesions. A follow-up CT scan after 1 month showed insufficient lipiodol uptake in the S3 lesion. RT of the S3 lesion comprising 10 fractions totaling 62 Gy was performed. However, 1 month later, the patient complained of dyspepsia and epigastric pain. Esophagogastroduodenoscopy revealed an acute gastric ulcer in the anterior wall of the antrum (Fig. 2). The patient was given ulcer medication and his symptoms improved.

Nine months later, the size of the enhanced lesion (S3) increased slightly because the radiation dose was insufficient for the tumor location: the lesion was close to the edge of the stomach. Since it was not possible to attempt high-dose RT due to the risk of gastric ulcer, TACE was considered an alternative method. However, this approach failed when the patient was unable to cooperate. Although RT was considered as an option, the risk of complications such as gastric ulcers was a limitation. Radiation directly to the tumor in S3, as was performed in the previous RT round, could worsen the gastric ulcer. To this end, sodium bicarbonate/tartaric acid (a gas-foaming agent) was used in order to prevent a radiation-induced gastric ulcer. A second RT of 46 Gy/23 fx was performed for the S3 lesion. For each RT, 4.0 g of the gas-foaming agent was used for the patient who weighed 65 kg. In addition, scopolamine was applied to suppress intestinal movement 1 hours before treatment. We also performed cone-beam CT before and after all radiation treatments, and an insignificant change was confirmed compared to the

![Figure 3](http://e-jlc.org)

**Figure 3.** (A, B) Simulation computed tomography before secondary radiotherapy using gas-foaming agents. Compared to a previously shrunk stomach, an air-filled stomach induces movement of the included radiation area.

![Figure 4](http://e-jlc.org)

**Figure 4.** (A-C) After approximately 1 year of radiation therapy, a decrease in the size of hepatocellular carcinoma (circle) is observed on follow-up computed tomography.
planned target volume (Fig. 3). The patient’s prior symptoms of dyspepsia and epigastric pain did not recur after RT with the gas-foaming agent. A recent CT scan showed that the S3 lesion had decreased markedly, without any viable portion (Fig. 4).

**DISCUSSION**

Here we report a case in which we introduced an alternative method to prevent complications during RT for HCC. After multidisciplinary consultation, TACE was performed as the second treatment option. As TACE failed, with no uptake into the tumor lesion, RT was performed next. The S3 lesion did not improve on follow-up CT; therefore, additional RT was considered. To address gastric ulcer complications associated with RT, a gas-foaming agent was used.

Considering the BCLC/TNM stage, surgery was recommended; however, the second option (TACE) was chosen because of the patient’s socioeconomic status and preferences. In a study by Kim et al.,

Conflicts of Interest

The authors have no conflicts of interest to disclose.

Ethics Statement

The Institutional Review Board (IRB) of the Kangwon National University Hospital waived the requirement for ethics approval and informed consent (IRB No. KNUH-2022-06-009).

Funding Statement

This study was supported by the Research Grant from Institute of Medical Sciences, Kangwon National University 2021.

Data Availability

Data sharing is not applicable to this article as no datasets were generated or analyzed for this case report.
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