Needle Tract Seeding after Percutaneous Cryoablation of a Metastatic Hepatic Tumor from Renal Cell Carcinoma: A Case Report

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Abstract

A 61-year-old woman with renal cancer underwent percutaneous cryoablation (PCA) for a metastatic hepatic tumor. Because the tumor was subcapsular and 3.6 cm in diameter, we performed transcatheter arterial embolization before PCA. Three cryoprobes were placed in triangular configuration; one inserted with an interposition of the normal hepatic parenchyma at a short distance. Computed tomography (CT) 2 days after PCA showed no contrast enhancement in the ablation zone with adequate ablation margins. CT after 2 months showed small enhancing foci on the hepatic surface. Tumors were located along previously inserted needle track, confirming diagnosis of needle tract seeding. A laparoscopically extirpated specimen revealed clear cell carcinoma, comparable to metastasis from renal cancer. CT after 6 months found additional seeding tumors, and systemic therapy was administered.

Key words: needle tract seeding, cryoablation, renal cell carcinoma, liver, hepatic tumor

Introduction

Percutaneous cryoablation is a minimally invasive treatment for hepatic tumors, which has been increasingly reported [1, 2]. Although hemorrhage is relatively common in hepatic cryoablation, needle tract seeding is a rare, but serious complication. We report a case of needle tract seeding after cryoablation of a metastatic hepatic tumor from renal cell carcinoma.

Case report

A 61-year-old woman, who underwent left radical nephrectomy for renal cell carcinoma (clear cell renal cell carcinoma: T2bN0M0) 9 months prior, developed three pulmonary and solitary hepatic metastases. Although she received sunitinib treatment for 1 month, the size of the metastatic tumors rapidly increased. Therefore, she was referred to our institution for local treatment. In computed tomography (CT) images, the solitary hepatic tumor was in the subcapsular location and 3.6 cm in diameter, with marked hypervascularity (Fig. 1A). We planned to treat the tumor with transcatheter arterial embolization (TAE) followed by thermal ablation therapy without preceding or simultaneous biopsy. Among several thermal ablation modalities, cryoablation was chosen for the following reasons. First, an adequately large ablation zone could be created with multiple cryoprobes using one setting. Second, the ablation zone could involve the gallbladder wall; therefore, a clearly visible ablation zone during the procedure was an important feature. Finally, severe periprocedural pain was expected during the treatment of the subcapsular tumor. We also planned to treat three pulmonary metastases using radiofre-
frequency ablation (RFA) with no interruption to the hepatic treatment. All treatment strategies were decided upon at the conference of interventional radiology.

After obtaining written informed consent from the patient and institutional review board approval, we performed hepatic arterial embolization selectively to enhance therapeutic efficacy and to reduce the risk of bleeding. The embolization was performed using a mixture of iohexol (Omnipaque, Daiichi-Sankyo, Tokyo, Japan) and ethiodized oil (Lipiodol, Guerbet, Villepinte, France) at a ratio of 1:1 followed by injection of a 1-mm gelatin sponge particle (Gelpart, Nippon Kayaku, Tokyo, Japan), without any anti-cancer drug. Seven days later, cryoablation was performed using an argon-based cryoablation system (Cryo-Hit, Galil Medical, Youknum, Israel). Placement of the 17-gauge cryoprobe (IceRod, Galil Medical) was performed as follows: the probes were inserted with interposition of the normal hepatic parenchyma, whenever possible; the probes were not placed within 1 cm of the nearest gallbladder wall; three cryoprobes were inserted sequentially in a triangle configuration (Fig. 1B) under CT fluoroscopy guidance. One cryoprobe was inserted into the tumor with an interposition of the normal hepatic parenchyma at a short distance, despite our careful procedure. After the placement of three cryoprobes, cryoablation was performed in two 15-minute freeze cycles separated by 2 minutes of thawing. During freezing, the low-density area (i.e., ice-ball) involved the tumor with an adequate (minimum of 6 mm) ablation margin extending circumferentially, keeping at a safe distance from the gallbladder (Fig. 1C). Then, the cryoprobes were removed without tracking ablation; no hemorrhage was noticed. CT images obtained 2 days after cryoablation showed no contrast enhancement in the ablation zone with an adequate ablation margin (Fig. 1D).

During the next 3 weeks, the pulmonary metastases were also successfully treated with RFA in 2 sessions. Two months after the treatment of the hepatic tumor, the periodic CT image showed small enhanced foci on the hepatic surface along the previously inserted needle tract (Fig. 2A). We confirmed a diagnosis of needle tract seeding. Addi-
tional treatments were planned. First, we performed TAE with ethiodized oil and a 1-mm gelatin sponge particle again. Angiography indicated that these lesions were fed from the right internal thoracic artery (Fig. 2B), rather than from hepatic arterial branches. In addition, the positional relations of the lesions to the liver and the colon changed compared to the previously acquired images, except for those to the abdominal wall. These lesions were touching the colon; thus, we abandoned additional percutaneous ablation (Fig. 2C). Three weeks later, laparoscopic tumor excision was performed, and the tumors were localized and buried into the abdominal wall, exposing the peritoneal surface. No other seeding lesions were observed in the surgical field of view. The histological specimen indicated clear cell carcinoma, Fuhrman nuclear grade 3, comparable to the metastasis from renal cell carcinoma. Six months after the hepatic cryoablation, a periodic check-up CT image indicated additional lesions around the previously resected seeding tumors, and so, the patient initiated systemic therapy. The patient was still alive and receiving tyrosine kinase inhibitors 12 months after cryoablation.

**Discussion**

Although the incidence rate of tumor seeding after RFA has been reported to be up to 12.5% previously [3], an incidence rate of 0.2-0.5% has been reported in larger series [4, 5]. Compared to RFA, multiple probe insertion is typically required in a cryoablation session. Tumor seeding after cryoablation of hepatic tumors has been reported in only a few case reports, except for one large series, in which the incidence rate was 0.76% (11/1436) per patient [6].

In the current case, the tumor was subcapsular and hypervascular in nature. Additionally, three cryoprobes were inserted sequentially, and one of them was inserted into the tumor with an interposition of the normal hepatic parenchyma at a short distance, although we could not judge which needle tract was responsible for the seeding tumor because of the proximity of the three hepatic insertion sites. The possible mechanisms of tumor seeding are as follows: adherence of viable cancer cells to the needle, blood reflux along the tract, or cancer cells being forced into the tract.
due to increased intratumoral pressure [7]. Tumor seeding typically occurs along the needle tract, but in a few cases, occurred at a distant location in the peritoneal cavity [3, 6]. Various risk factors of tumor seeding after percutaneous hepatic ablation treatments have been reported, including subcapsular location of the tumor, direct subcapsular needle insertion, number of sessions, tumor differentiation, a large needle bore, and tumor size and biopsy prior to ablation [6, 7]. Wang et al. showed, via multivariate analysis, that the only significant risk factor for seeding was direct subcapsular needle insertion in the cryoablation of a hepatic tumor [6]. We believe needle insertion with interposition of the normal hepatic parenchyma, whenever possible, is important, especially in cryoablation.

Cauterization of the needle tract may be effective for the prevention of needle tract seeding, especially in the case of a subcapsular tumor [8, 9]. Regarding RFA and microwave ablation (MWA), cauterization of the needle tract can be performed to reduce the risk of needle tract seeding as well as hemorrhage. Indeed, cryoablation involves a risk of bleeding compared to RFA, which could be a risk of needle tract tumor seeding. Unfortunately, we could not perform cauterization owing to the properties of the cryoablation system, although it is difficult to say that cauterization could have prevented the complication in the current case.

TAE is frequently performed as a combined treatment with percutaneous ablation, although TAE alone is an effective treatment for hepatic tumors. Tumor seeding can be managed with TAE [10]. Theoretically, TAE can provide several beneficial effects to prevent tumor seeding. First, the cell-killing effect can reduce viable cancer cells. Second, reduced intratumoral blood pressure (e.g., due to blocking blood flow) can prevent blood reflux along the needle tract and can extend the size of the ablation zone. In the current case, the lack of administration of an anti-cancer drug and the 1-week interval between the two procedures may have reduced the cell-killing and blood flow-blocking effects. Regarding the combination treatment interval, thermal ablation is rarely delivered on the same day as or on the day after TAE, but instead, is usually administered 2-4 weeks later [11]. In addition, ablative margins were significantly higher when RFA after TAE was performed until 4 weeks compared to RFA alone [12]. One week was an acceptable interval for this combination treatment.

In summary, there were several risk factors for needle tract seeding in the current case. Unfortunately, needle tract seeding occurred, despite implementing several preventative measures, including TAE prior to cryoablation, without preceding or simultaneous biopsy, and indirect subcapsular probe insertion, except for one. We should use ablation modalities such as RFA or MWA, which can be used for cauterization of the needle tract, although the true reasons for needle tract seeding in the current case are unknown. Needle tract seeding after percutaneous cryoablation of a metastatic hepatic tumor from renal cancer is a rare, but serious complication. Extreme caution and attention are required to prevent needle tract seeding because it is difficult to completely treat intraperitoneal seeding tumors.

Conflict of interest: The authors declare that they have no conflicts of interest to report.

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