Case Report

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Radiologically Presumed Needle-tract Seeding After Radiofrequency Ablation for Hepatocellular Carcinoma: A Case Report

Hepatoselüler Karsinomda Radyofrekans Ablasyon Sonrası Radyolojik Olarak Düşünülen İğne Traktı Tümör Ekimi: Olgu Sunumu

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ABSTRACT

Radiofrequency ablation (RFA) is an effective and widely used percutaneous treatment for hepatocellular carcinoma (HCC), particularly in patients awaiting liver transplantation. However, despite technological advances, tumor seeding along the needle tract remains a rare but clinically significant complication. A 59-year-old male patient with Child-Pugh A cirrhosis secondary to hepatitis B virus/hepatitis D virus infection and a prior diagnosis of HCC was found to have a newly developed 18×12 mm subcapsular lesion in segment VI of the liver on follow-up magnetic resonance imaging (MRI). RFA was performed prior biopsy. Three months later, MRI demonstrated newly developed nodular lesions along the ablation tract surrounding the ablation zone, highly suggestive of needle-tract seeding. The patient received systemic therapy including lenvatinib, sorafenib, and regorafenib, as well as repeated RFA and transarterial chemoembolization procedures. However, liver transplantation could not be performed because a suitable donor was unavailable, and the patient remains under ongoing oncologic follow-up. Although the overall incidence of neoplastic seeding after RFA is low (0.6-1.4%), several factors—including subcapsular tumor location, poor differentiation, large tumor size, elevated alpha-fetoprotein levels, and pre-ablation biopsy—have been associated with increased risk. Needle tract ablation and

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Radyofrekans ablasyon (RFA), özellikle karaciğer nakli bekleyen hastalarda hepatoselüler karsinomun (HCC) tedavisinde etkili ve yaygın olarak kullanılan perkütan bir yöntemdir. Ancak, teknolojideki ilerlemelere rağmen, iğne traktı boyunca tümör ekilmesi nadir görülen fakat klinik olarak önemli bir komplikasyon olmaya devam etmektedir. Hepatit B virüsü/hepatit D virüsü ilişkili Child-Pugh A sirozu olan, daha önce HCC tanısı almış 59 yaşındaki erkek hastada takip manyetik rezonans görüntülemesinde (MRG) karaciğerin VI. segmentinde, subkapsüler yerleşimli 18×12 mm boyutunda yeni gelişen bir lezyon saptanmıştır. Biyopsi yapılmaksızın RFA uygulanmıştır. Üç ay sonra yapılan MRG'de ablatif zon çevresinde iğne traktı boyunca yeni gelişen ve iğne traktı ekimini düşündüren nodüler lezyonlar izlenmiştir. Hasta lenvatinib, sorafenib ve regorafenib içeren sistemik tedaviler ile tekrar RFA ve transarteriyel kemoembolizasyon uygulamaları almıştır; ancak uygun verici bulunamadığı için karaciğer transplantasyonu gerçekleşememiştir. Hastanın onkolojik takibi RFA sonrası neoplastik ekilme oranı genel olarak düşük (%0,6-1,4) olmakla birlikte; subkapsüler yerleşim, kötü diferansiasyon, büyük tümör boyutu, yüksek alfa-fetoprotein düzeyi ve ablasyon öncesi biyopsi gibi faktörlerin artmış risk ile ilişkili olduğu bildirilmiştir. İğne traktı ablasyonu ve dikkatli hasta seçiminin bu riski azaltabildiği gösterilmiştir. Ayrıca indosiyanin yeşili

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ABSTRACT

careful patient selection have been shown to reduce this risk. Additionally, novel imaging modalities such as indocyanine green near-infrared fluorescence may facilitate intraoperative detection and complete excision of seeded foci. This case suggests that tumor seeding may occur after RFA even in the absence of pre-procedural biopsy. In patients with subcapsular lesions, meticulous procedural technique, careful evaluation of risk factors, and close post-procedural surveillance are essential for optimizing clinical outcomes.

Keywords: Tumor seeding, hepatocellular carcinoma, radiofrequency ablation

ÖZ

yakın kızılötesi floresan görüntüleme gibi yeni görüntüleme yöntemleri, ekilmiş odakların intraoperatif tespitine ve tam rezeksiyonuna olanak sağlamaktadır. Bu olgu, biyopsi yapılmamış olgularda dahi RFA sonrası iğne traktı ekiminin gelişebileceğini düşündürmektedir. Özellikle subkapsüler lezyonlarda işlem tekniğine dikkat edilmesi, risk faktörlerinin değerlendirilmesi ve yakın takip, klinik sonuçların iyileştirilmesi açısından büyük öneme sahiptir.

Anahtar Kelimeler: Tümör ekimi, hepatosellüler karsinom, radyofrekans ablasyon

Introduction

The use of percutaneous ablative techniques for the treatment of liver tumors has increased substantially over the past decades. Percutaneous ethanol injection (PEI), radiofrequency ablation (RFA), and microwave ablation (MWA) are viable curative techniques for hepatocellular carcinoma (HCC) (1).

Studies have shown that percutaneous treatment of HCC is a cost-effective bridging strategy in patients whose expected waiting time for liver transplantation exceeds six months (2).

However, when tumors are located in specific anatomical regions, such as beneath Glisson's capsule, in an exophytic position, or adjacent to critical structures, percutaneous treatment may be associated with complications including incomplete ablation, hemorrhage, injury to adjacent organs, and needle-tract seeding (3). Subcapsular location, poor tumor differentiation, tumor size greater than 3 cm, elevated serum alpha-fetoprotein (AFP) levels, and diagnostic biopsy before ablation have been reported as risk factors for needle-tract seeding (4-6).

Case Report

A 59-year-old male patient had been under follow-up since 2002 for HBV, HDV, and chronic liver disease. The patient progressed to Child-Pugh class A cirrhosis, and he was diagnosed with HCC 6.5 years ago. The patient had previously undergone transarterial chemoembolization and systemic therapy for HCC. He was subsequently followed with serial magnetic resonance imaging (MRI) examinations. His laboratory tests were carcinoembryonic antigen, 10 ng/mL; carbohydrate-related antigen 19-9, 28 U/mL; and AFP, 2411 ng/mL.

During follow-up MRI, a subcapsular lesion measuring approximately 18×12 mm was detected in segment VI of the right hepatic lobe. The lesion was considered suspicious for a new HCC lesion in a patient with a known history of HCC and markedly elevated AFP levels. Positron emission tomography/computed tomography was performed as part of the pre-transplant evaluation and to further characterize the lesion. Because no significant FDG uptake was observed, histopathological confirmation or further imaging studies were recommended, considering that well-differentiated HCC may demonstrate low FDG avidity. Despite the recommendation for further diagnostic evaluation, RFA was subsequently performed for the segment VI lesion at another medical center. No biopsy was performed either before or after the ablative procedures.

Three months after the RFA, MRI demonstrated a 27×22 mm ablation zone in segment VI, accompanied by changes consistent with post-procedural hemorrhage (Figure 1). No significant residual or recurrent tumor was detected. One month later, newly developed nodular lesions measuring 10 mm along the capsular surface and 11 mm within the adjacent superior adipose tissue were detected near the RFA zone. Based on their anatomical continuity with the ablation tract and interval growth on serial MRI examinations, these lesions were considered radiologically suspicious for needle-tract seeding (Figure 2). A significant increase in lesion size was observed on subsequent MRI examinations.

The patient was subsequently referred to the oncology department, and systemic treatment with lenvatinib with pembrolizumab was initiated. As the lesion progressed, sorafenib was started, then switched to regorafenib. Subsequently, repeat RFA and transarterial chemoembolization were performed, resulting in partial regression of the lesions. Following these interventions, the AFP level decreased to 1400 ng/mL, and treatment with regorafenib was continued. Liver transplantation could not be performed because a suitable donor was not available. The patient remains under ongoing clinical and radiological follow-up.

Written informed consent was obtained from the patient for the publication of this case report and any accompanying images.

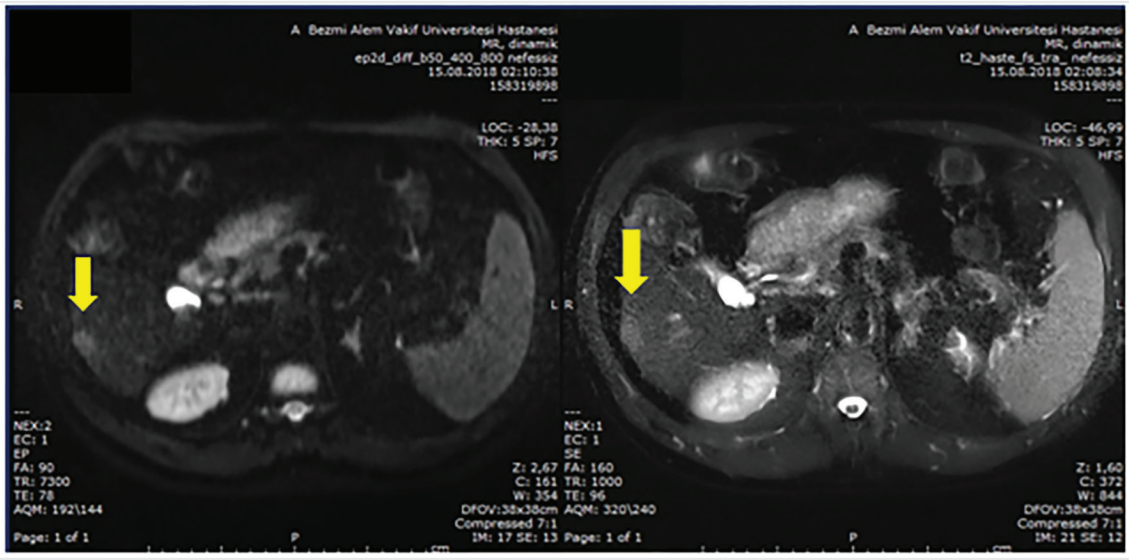


Figure 1. Axial magnetic resonance imaging demonstrating a 27×22 mm lesion located peripherally in segment VI of the right hepatic lobe, consistent with the post-ablation zone following radiofrequency ablation

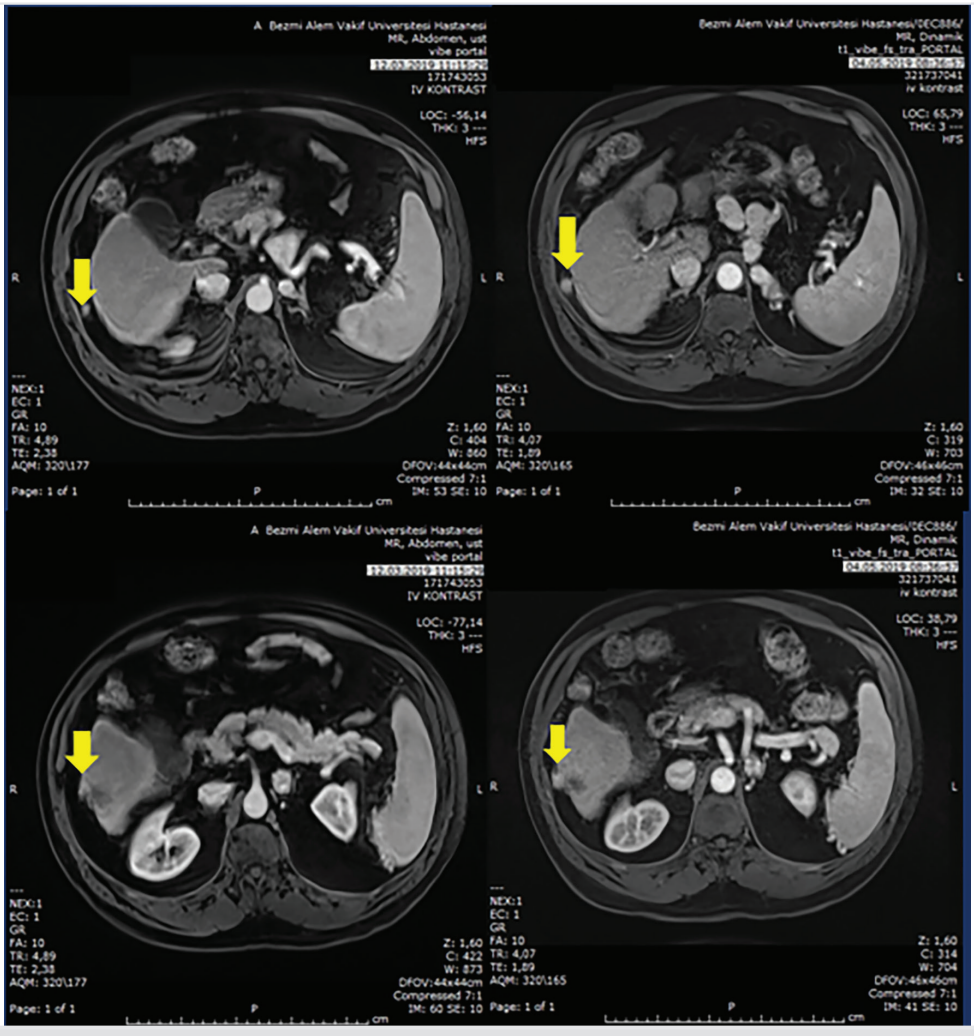


Figure 2. Follow-up magnetic resonance imaging showing newly developed nodular lesions adjacent to the radiofrequency ablation ablation zone: a 10 mm nodule on the capsular surface and an 11 mm lesion within the adjacent adipose tissue, suggestive of neoplastic tract seeding

Discussion

Needle-tract seeding is a recognized complication of biopsy and percutaneous ablative techniques for HCC, including RFA, PEI, and MWA. Although reported rates vary among studies, the overall incidence remains low.

Llovet et al. (3) reported a tumor seeding rate of 12.5% after RFA for HCC, which is considerably higher than that reported in subsequent studies. Takamori et al. (7) reported a seeding rate of 5.1% in patients who underwent diagnostic biopsy before RFA. The overall incidence of tumor seeding after liver biopsy for HCC was reported to be approximately 2.7% (8). Moreover, in a multicenter study involving 1,314 patients, Livraghi et al. (1) reported similar seeding rates among the three participating centers (0.7%, 0.9%, and 1.4%). In another study involving 60 cirrhotic patients with subcapsular HCC treated with RFA or MWA, needle-tract seeding occurred in only one patient, who had undergone biopsy before ablation (9). According to the systematic review by Stigliano et al. (10), reported seeding rates were 2.29% after biopsy alone, 1.4% after PEI combined with biopsy, 0.61% after RFA without biopsy, 0.95% after RFA with biopsy, and 0.72% for biopsied and subsequently ablated liver nodules, including non-HCC lesions.

Studies support that RFA is an effective and safe bridging therapy until transplantation in patients with HCC (2). However, because needle-tract seeding may adversely affect clinical outcomes, careful patient selection and the implementation of preventive measures are warranted (11).

It has been shown in an experimental animal model that needle tract ablation in HCC reduces the seeding rate (12). In another study, when RFA was performed on subcapsular HCC, no tract seeding was observed when needle tract ablation was performed on tumors 4 cm and smaller (13). Intraoperative use of indocyanine green near-infrared fluorescence imaging has enabled the detection of seeded tissues and peritoneal implants along the RFA needle. This technique enables complete surgical excision of all tumor-positive areas, along with histopathological confirmation of HCC in the resected specimens (14).

The present case should be interpreted cautiously because histopathological confirmation of either the treated segment VI lesion or the subsequently developed nodules was unavailable. Nevertheless, the appearance of new nodules along the presumed needle trajectory shortly after RFA and their progressive enlargement on serial imaging strongly suggested radiologically presumed needle-tract seeding. Therefore, the diagnosis in this case remains presumptive and based primarily on imaging findings and temporal association with the intervention.

Although histopathological confirmation was unavailable, alternative diagnoses such as post-ablation inflammatory nodules or hemorrhagic changes were considered less likely because the lesions developed along the presumed needle trajectory and demonstrated progressive enlargement on serial MRI examinations.

Conclusion

Although no diagnostic biopsy was performed, radiologically presumed needle-tract seeding developed in our patient, suggesting that subcapsular tumor location and markedly elevated AFP levels may have contributed to the development of this complication.

Whenever possible, the diagnosis of HCC should rely on established radiological and clinical criteria to avoid unnecessary biopsy and its potential complications. These findings highlight the importance of meticulous procedural technique and careful patient selection in minimizing the risk of tumor dissemination after percutaneous interventions for HCC. The use of adjunctive technologies, such as tract ablation and intraoperative fluorescence imaging, may improve safety and oncologic outcomes in this patient group.

Ethics

Informed Consent: Written informed consent was obtained from the patient for the publication of this case report and any accompanying images.

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The authors used artificial intelligence tools exclusively for English language editing and grammatical revision of the manuscript. No AI tools were used for data analysis, interpretation of results, or generation of scientific content.

Footnotes

Authorship Contributions

Surgical and Medical Practices: H.K., H.T., A.A., Concept: H.K., H.T., A.A., Design: H.K., H.T., A.A., Data Collection or Processing: H.K., Analysis or Interpretation: H.K., A.A., Literature Search: H.K., Writing: H.K.

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References

1. Livraghi T, Lazzaroni S, Meloni F, Solbiati L. Risk of tumour seeding after percutaneous radiofrequency ablation for hepatocellular carcinoma. Br J Surg. 2005;92:856-8.
2. Fontana RJ, Hamidullah H, Nghiem H, Greenson JK, Hussain H, Marrero J, et al. Percutaneous radiofrequency thermal ablation of hepatocellular carcinoma: a safe and effective bridge to liver transplantation. Liver Transpl. 2002;8:1165-74.
3. Llovet JM, Vilana R, Brú C, Bianchi L, Salmeron JM, Boix L, et al.; Barcelona Clínic Liver Cancer (BCLC) Group. Increased risk of tumor seeding after percutaneous radiofrequency ablation for single hepatocellular carcinoma. Hepatology. 2001;33:1124-9.
4. Imamura J, Tateishi R, Shiina S, Goto E, Sato T, Ohki T, et al. Neoplastic seeding after radiofrequency ablation for hepatocellular carcinoma. Am J Gastroenterol. 2008;103:3057-62.
5. Perkins JD. Seeding risk following percutaneous approach to hepatocellular carcinoma. Liver Transpl. 2007;13:1603.
6. Zhong-Yi Z, Wei Y, Kun Y, Ying D, Wei W, Jung-Chieh L, et al. Needle track seeding after percutaneous radiofrequency ablation of hepatocellular carcinoma: 14-year experience at a single centre. Int J Hyperthermia. 2017;33:454-8.
7. Takamori R, Wong LL, Dang C, Wong L. Needle-tract implantation from hepatocellular cancer: is needle biopsy of the liver always necessary? Liver Transpl. 2000;6:67-72.
8. Silva MA, Hegab B, Hyde C, Guo B, Buckels JA, Mirza DF. Needle track seeding following biopsy of liver lesions in the diagnosis of hepatocellular cancer: a systematic review and meta-analysis. Gut. 2008;57:1592-6.
9. Francica G, Meloni MF, de Sio I, Smolock AR, Brace CL, Iadevaia MD, et al. Radiofrequency and microwave ablation of subcapsular hepatocellular carcinoma accessed by direct puncture: safety and efficacy. Eur J Radiol. 2016;85:739-43.
10. Stigliano R, Marelli L, Yu D, Davies N, Patch D, Burroughs AK. Seeding following percutaneous diagnostic and therapeutic approaches for hepatocellular carcinoma. What is the risk and the outcome? Seeding risk for percutaneous approach of HCC. Cancer Treat Rev. 2007;33:437-47.
11. Shirai K, Tamai H, Shingaki N, Mori Y, Moribata K, Enomoto S, et al. Clinical features and risk factors of extrahepatic seeding after percutaneous radiofrequency ablation for hepatocellular carcinoma. Hepatol Res. 2011;41:738-45.
12. Ham SJ, Choi Y, Kim KW, Cho YC, Woo DC, Lee CW, et al. Tract ablation after radiofrequency ablation to prevent viable tumor cell adhesion to the needle electrode. Int J Hyperthermia. 2020;37:1287-92.
13. Filippousis P, Sotiropoulou E, Manataki A, Konstantinopoulos O, Thanos L. Radiofrequency ablation of subcapsular hepatocellular carcinoma: single center experience. Eur J Radiol. 2011;77:299-304.
14. Nakamura M, Hayami S, Ueno M, Kawai M, Miyamoto A, Suzaki N, et al. Detection of needle tract implantation and peritoneal seeding after radiofrequency ablation using intraoperative near-infrared fluorescence system for recurrent hepatocellular carcinoma: a case report. Surg Case Rep. 2018;4:76.