ACTA RADIOLÓGICA PORTUGUESA
May-August 2028 | Vol 40 nº 2|e45627 https://doi.org/10.25748/arp.45627

Images of Interest / Imagens de Interesse

Tumoral Seeding of Hepatocellular Carcinoma after Microwave Ablation

Seeding Tumoral de Hepatocarcinoma Após Termo-Ablação por Microondas

Lourenço Resende[1], Francisco Carvalho[1], Diogo Castelo[1], Tiago Pereira[1]

[1]Serviço de Imagiologia, Unidade Local de Saúde Gaia e Espinho

Address
Lourenço Resende
Serviço de Imagiologia
Unidade Local de Saúde Gaia e Espinho
R. Conceição Fernandes
4434-502 Vila Nova de Gaia
e-mail: lourenco.martins@ulsge.min-saude.pt

Received: 21/02/2026
Accepted: 19/05/2026
Published: 03/07/2026

Abstract

Tumoral seeding is defined as the implantation of viable tumor cells along the needle tract used in percutaneous diagnostic or therapeutic procedures. We present the case of a 75-year-old man who underwent microwave thermal ablation of a 35 mm hepatocellular carcinoma. Follow-up imaging at three months demonstrated complete necrosis of the treated lesion, with no evidence of residual or recurrent disease. In subsequent follow-up studies, tumor recurrence was detected, as well as a nodule within the right lower thoracic wall. The lesion was biopsied, confirming tumoral seeding along the needle tract.

Keywords

Carcinoma hepatocellular; Ablation techniques; Neoplasm seeding; Biopsy.

Resumo

O *seeding* tumoral é definido como a implantação de células tumorais viáveis no trajecto de agulha utilizado em procedimentos percutâneos com intuito diagnóstico ou terapêutico. Apresenta-se o caso de um homem de 75 anos submetido a termo-ablação por microondas de um hepatocarcinoma de 35 mm localizado no segmento hepático VIII. Exames de controlo aos três meses demonstraram necrose lesional completa, sem sinais de recidiva ou persistência tumoral. Em estudos subsequentes de follow-up, foi detetada uma recidiva tumoral, assim como um nódulo na espessura da parede torácica inferior direita, o qual foi submetido a biópsia, confirmando-se o seeding tumoral no trajecto da agulha.

Palavras-chave

Carcinoma hepatocelular; Técnicas de ablação; *Neoplasm seeding*; Biópsia.

Case Report

Baseline MRI of a 75-year-old man showed a 35 mm nodule in hepatic segment VIII with heterogeneous arterial enhancement, portal venous washout, and pseudocapsule, compatible with hepatocellular carcinoma (HCC) (Figure 1). The patient underwent microwave ablation (MWA) and, three months after ablation (Figure 2), CT demonstrated complete necrosis of the tumoral bed. MR at 12 months revealed stable post-ablation changes; however, a subtle 10 mm enhancing nodule along the right lateral thoracic wall was missed (Figure 3). 9 months after, a new recurrence occurred (Figure 4) and the patient was again referred for MWA for disease control. The thoracic wall nodule was identified at the pre-procedural ultrasound (Figure 5) and was submitted to biopsy, confirming HCC tumoral seeding along the ablation needle tract.

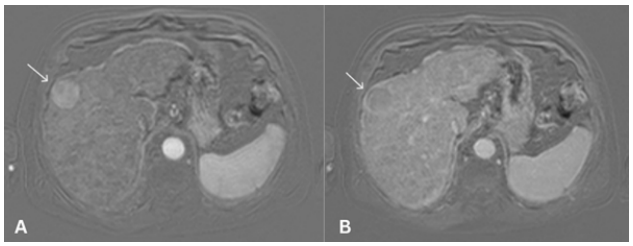


Figure 1 – (A) T1-weighted image post-contrast with subtraction showing a 35 mm nodule in the hepatic segment VIII with heterogenous arterial enhancement (arrow). (B) T1-weighted image post-contrast with subtraction showing the same nodule with portal venous washout and pseudocapsule (arrow), findings that are compatible with HCC.



Figure 2 – Abdominal CT in the portal venous phase three months after ablation, showing complete necrosis of the tumoral bed (arrow).

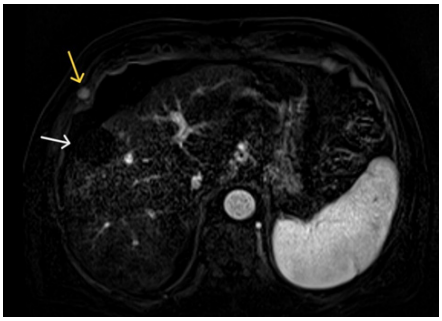


Figure 3 – T1-weighted image post-contrast with subtraction with stable post-ablation changes (white arrow). A small thoracic wall nodule was overlooked (yellow arrow).

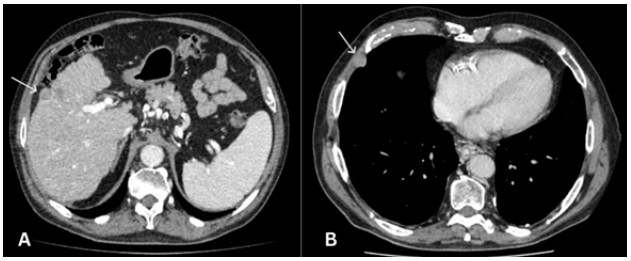


Figure 4 – (A) CT after 9 months demonstrating a new recurrence site near the original ablation zone, with a nodule with portal venous washout (arrow). (B) Growth of the previously missed nodule (arrow).

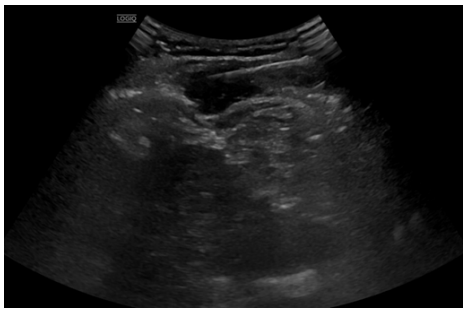


Figure 5 – Pre-procedural ultrasound guided biopsy of the thoracic wall.

Discussion

Tumoral seeding is defined as the implantation of viable tumor cells along the needle tract or adjacent tissues following percutaneous diagnostic or therapeutic procedures. In hepatocellular carcinoma (HCC), this complication has been described after biopsy, radiofrequency ablation, and microwave ablation (MWA). Although MWA is considered safe and effective, needle tract seeding remains a recognized but uncommon late complication, with reported incidences below 1%.[1,2,3]

Needle tract seeding usually presents months to years after the initial procedure as a slow-growing subcutaneous, muscular, or peritoneal nodule along the access route. Lesions are frequently asymptomatic and may be overlooked during routine follow-up, as it occurred in this case. Early detection is clinically relevant because seeding can be successfully treated when localized, while delayed diagnosis may prolong disease course or complicate management.

Imaging plays a central role in detecting tumoral seeding. On CT and MRI, seeded nodules typically reproduce the enhancement pattern of intrahepatic HCC, showing arterial phase hyperenhancement and portal venous washout. Their location along the needle trajectory is a key diagnostic clue. Careful inspection of the abdominal wall, intercostal spaces, and pleura on follow-up imaging is essential.[4] Retrospective identification of previously missed nodules, as in this patient, highlights the importance of systematic tract evaluation during post-ablation surveillance.

Most cases of needle tract seeding can be managed effectively with surgical excision or local therapies, achieving good local control. Prognosis is generally favorable when seeding is isolated and intrahepatic disease remains controlled. Preventive strategies include minimizing the number of punctures, avoiding unnecessary biopsies, and performing tract ablation during antenna withdrawal, which has been shown to reduce the risk of tumor implantation.[1,2,3,4,5,6,7]

Conclusion

Needle tract seeding after microwave ablation of HCC is rare but clinically significant. Radiologists must carefully evaluate the entire puncture pathway during follow-up imaging. Awareness of this complication and adherence to preventive technical measures are essential to reduce its occurrence and ensure timely diagnosis.

Ethical Disclosures / Divulgações Éticas

Conflicts of interest: The authors have no conflicts of interest to declare.

Conflitos de interesse: Os autores declaram não possuir conflitos de interesse.

Financing Support: This work has not received any contribution, grant or scholarship.

Suporte financeiro: O presente trabalho não foi suportado por nenhum subsídio ou bolsa.

Confidentiality of data: The authors declare that they have followed the protocols of their work center on the publication of data from patients.

Confidencialidade dos dados: Os autores declaram ter seguido os protocolos do seu centro de trabalho acerca da publicação dos dados de doentes.

Protection of human and animal subjects: The authors declare that the procedures followed were in accordance with the regulations of the relevant clinical research ethics committee and with those of the Code of Ethics of the World Medical Association (Declaration of Helsinki).

Protecção de pessoas e animais: Os autores declaram que os procedimentos seguidos estavam de acordo com os regulamentos estabelecidos pelos responsáveis da Comissão de Investigação Clínica e Ética e de acordo com a Declaração de Helsínquia da Associação Médica Mundial.

References

1. De Muzio F, Cutolo C, Dell'Aversana F, Grassi F, Ravo L, Ferrante M, Danti G, Flammia F, Simonetti I, Palumbo P, Bruno F, Pierpaoli L, Fusco R, Giovagnoni A, Miele V, Barile A, Granata V. Complications after thermal ablation of hepatocellular carcinoma and liver metastases: imaging findings. Diagnostics (Basel). 2022 May 5;12:1151.

2. Francica G, Meloni MF, de Sio I, Smolock AR, Brace CL, Iadevaia MD, Santambrogio R, Sironi S, Scaglione M, Lee FT Jr. Radiofrequency and microwave ablation of subcapsular hepatocellular carcinoma accessed by direct puncture: Safety and efficacy. Eur J Radiol. 2016 Apr;85:739-43.

3. Yu J, Liang P, Yu XL, Cheng ZG, Han ZY, Dong BW. Needle track seeding after percutaneous microwave ablation of malignant liver tumors under ultrasound guidance: analysis of 14-year experience with 1462 patients at a single center. Eur J Radiol. 2012 Oct;81:2495-9.

4. Kumar N, Gaba RC, Knuttinen MG, Omene BO, Martinez BK, Owens CA, Bui JT. Tract seeding following radiofrequency ablation for hepatocellular carcinoma: prevention, detection, and management. Semin Intervent Radiol. 2011 Jun;28(2):187-92.

5. Akahane M, Koga H, Kato N, Yamada H, Uozumi K, Tateishi R, Teratani T, Shiina S, Ohtomo K. Complications of percutaneous radiofrequency ablation for hepato-cellular carcinoma: imaging spectrum and management. Radiographics. 2005 Oct;25 Suppl 1:S57-68.

6. Maturen KE, Nghiem HV, Marrero JA, Hussain HK, Higgins EG, Fox GA, Francis IR. Lack of tumor seeding of hepatocellular carcinoma after percutaneous needle biopsy using coaxial cutting needle technique. AJR Am J Roentgenol. 2006 Nov;187(5):1184-7.

7. Rhim H, Yoon KH, Lee JM, Cho Y, Cho JS, Kim SH, Lee WJ, Lim HK, Nam GJ, Han SS, Kim YH, Park CM, Kim PN, Byun JY. Major complications after radio-frequency thermal ablation of hepatic tumors: spectrum of imaging findings. Radiographics. 2003 Jan-Feb;23(1):123-34.