Percutaneous thermal segmentectomy using balloon-occluded microwave ablation followed by balloon-occluded transarterial chemoembolization

Perkutánní termální segmentektomie pomocí mikrovlnné ablace s balonkovou okluzí následovaná transarteriální chemoembolizací s balonkovou okluzí

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Summary

Background: Solitary hepatocellular carcinoma (HCC) with a diameter of 3–5 cm represents a challenging clinical entity, especially for non-surgical candidates due to comorbidities. ***Case:*** A 74-year-old man with previous history of renal cell carcinoma presented with a new incidental solitary 5 cm liver lesion on MRI. Due to his age and a high risk for post-surgical complications, after multidisciplinary tumor board review the treatment plan consisted of percutaneous thermal segmentectomy using balloon-occluded microwave ablation (b-MWA) followed by balloon-occluded transarterial chemoembolization (b-TACE) with complete tumor necrosis, as evident in subsequent follow-up imaging. This case demonstrates that b-MWA plus b-TACE could be a safe and effective combined therapy for unresectable large HCC lesions, even for those exceeding 3 cm in size. ***Conclusion:*** Although the presented case is anecdotal and naturally without comparisons or control, it highlights the potential value of percutaneous thermal segmentectomy with a single session combined b-MWA followed by b-TACE for the treatment of large unresectable solitary HCC lesions.

Key words

hepatocellular carcinoma – balloon occluded chemoembolization – balloon occluded thermal ablation – case report

Souhrn

Východiska: Solitární hepatocelulární karcinom (hepatocellular carcinoma – HCC) o průměru 3–5 cm představuje náročnou klinickou výzvu, zejména u pacientů, u kterých není kvůli komorbiditám vhodná chirurgická léčba. ***Případ:*** U 74letého muže s renálním karcinomem v anamnéze byla na MR zjištěna nová náhodná solitární léze jater o velikosti 5 cm. Po přezkoumání multidisciplinární komisí a vzhledem k věku a vysokému riziku pooperačních komplikací se léčebný plán skládal z perkutánní termické segmentektomie pomocí mikrovlnné ablace s balonkovou okluzí (baloon-occluded microwave abblation – b-MWA) a následné transarteriální chemoembolizace s balonkovou okluzí (balloon-occluded transarterial chemoembolization – b-TACE), přičemž došlo ke kompletní nekróze nádoru, jak ukázaly následných kontrolní snímky. Tento případ ukazuje, že b-MWA a b-TACE by mohly být bezpečnou a účinnou kombinovanou léčbou velkých neresekabilních lézí HCC, a to i u lézí s velikostí nad 3 cm. ***Závěr:*** Ačkoli se jedná o nepodložený případ, kterému přirozeně chybí srovnání nebo kontroly, zdůrazňuje potenciální hodnotu jednoho zákroku v podobě perkutánní termické segmentektomie pomocí b-MWA s následnou b-TACE při léčbě velkých neresekabilních solitárních lézí HCC.

Klíčová slova

hepatocelulární karcinom – chemoembolizace s balonkovou okluzí – termální ablace s balonkovou okluzí – kazuistika

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Introduction

Solitary hepatocellular carcinoma tumor with a diameter between of 3–5 cm represents a challenging clinical entity, especially for non-surgical candidates due to comorbidities. Loco-regional treatments in this patient population could include combined approaches of percutaneous ablation and transarterial chemoembolization, multi-apparatus thermal ablation, or yttrium-90 radioembolization. Therapeutic choice should provide the patient with an effective treatment option, which should be governed by low complexity and low financial cost, whenever possible. The present report describes a case of a non-operable (due to co-morbidities) hepatocellular carcinoma of 5 cm in diameter treated with percutaneous thermal segmentectomy (balloon-occluded microwave ablation (b-MWA) followed by balloon-occluded transarterial chemoembolization (b-TACE)).

Case description

A 74-year-old man with previous history of hepatocellular carcinoma (treated with wedge resection at 2014) and renal cell carcinoma (treated with right nephrectomy in 2016) presented with a new solitary 5 cm liver lesion in segment VIII after evaluation with magnetic resonance imaging (Fig. 1). Initial percutaneous CT-guided needle biopsy confirmed the diagnosis of primary hepatocellular carcinoma (HCC). Due to medical record and co-morbidities (including arterial hypertension, diabetes mellitus, and cardiac insufficiency) patient was not a surgical candidate, and multidisciplinary board comprising of oncologists, surgeons and interventional radiologists opted for a combined percutaneous and trans-arterial approach. Aiming to create a large enough necrotic ablation zone, percutaneous segmentectomy was chosen, performed in March 2023.

The procedure is a single-step treatment, with appropriate antibiotic prophylaxis and continuous patient monitoring, performed in the angiographic suite. Under local anesthesia (10 cm^3 of 2% lidocaine hydrochloric) on skin and subcutaneous tissues and intravenous analgesia (30 min prior to ablation, 2 mL of tramadol 100 mg) selective hepatic digital subtraction angiography via femoral route was performed to visualize the tumors vasculature (Fig. 2a) and select the optimal position (proximal to all the tumor's feeders) to inflate the balloon microcatheter (Fig. 2b). Subsequent selective coaxial catheterization of the segmental branch for segment VIII was performed by advancing a 0.014-inch hydrophilic guidewire (GT angled, Terumo Tokyo Japan) and a 2.8-Fr microcatheter with an occlusion-balloon on the tip (OcclusafeTM, Terumo Tokyo, Japan). Once the balloon was placed in the desired location, it was inflated under continuous arterial pressure measurement at the tip of the microcatheter until there was a pressure drop. Following, ultrasound-guided percutaneous place-

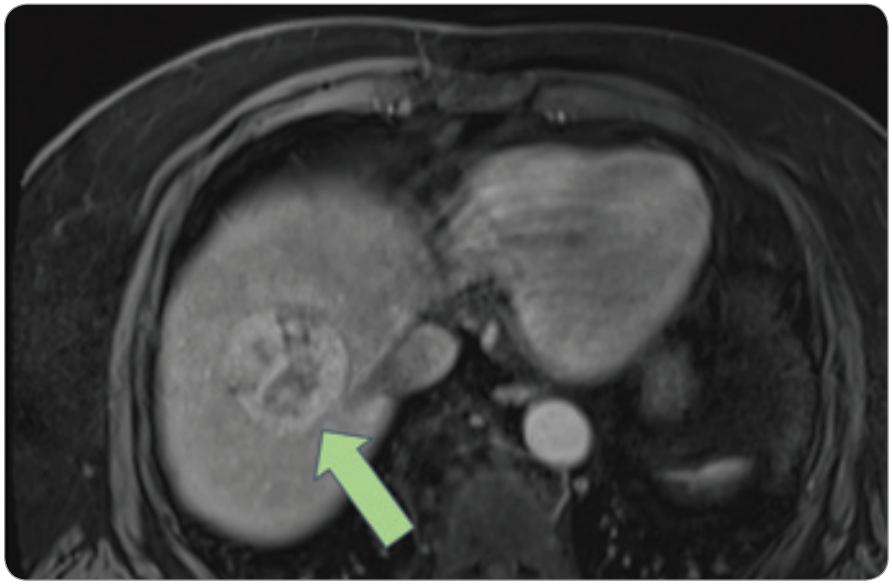

Fig. 1. Initial MRI revealing an incidental solitary 5 cm liver lesion (green arrow) in segment VIII.

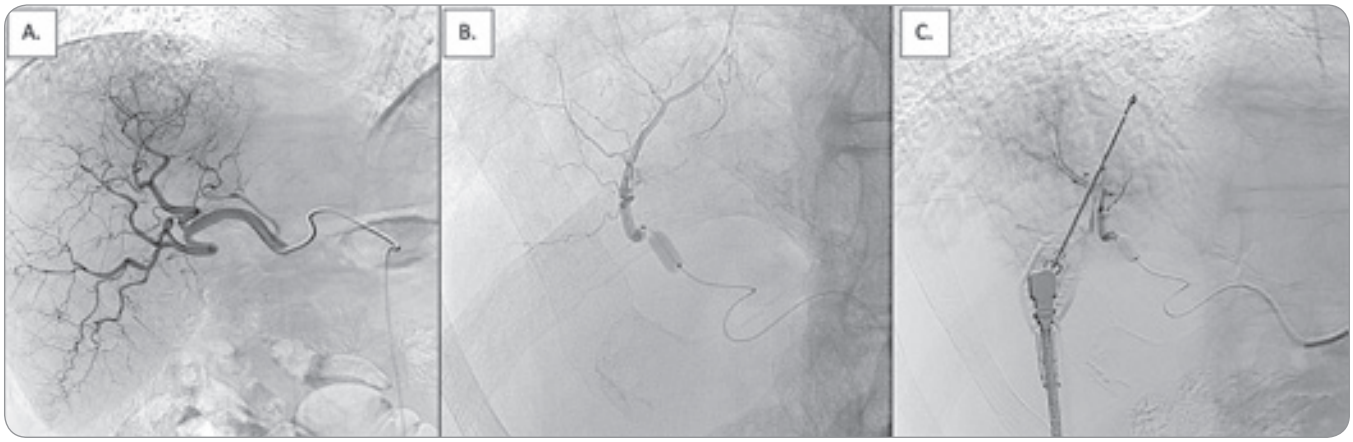

Fig. 2. (A) Selective hepatic digital subtraction angiography visualizing the tumor vasculature; (B) a 2.8-Fr microcatheter with an occlusion-balloon tip inflated; (C) microwave antenna placement visualization.

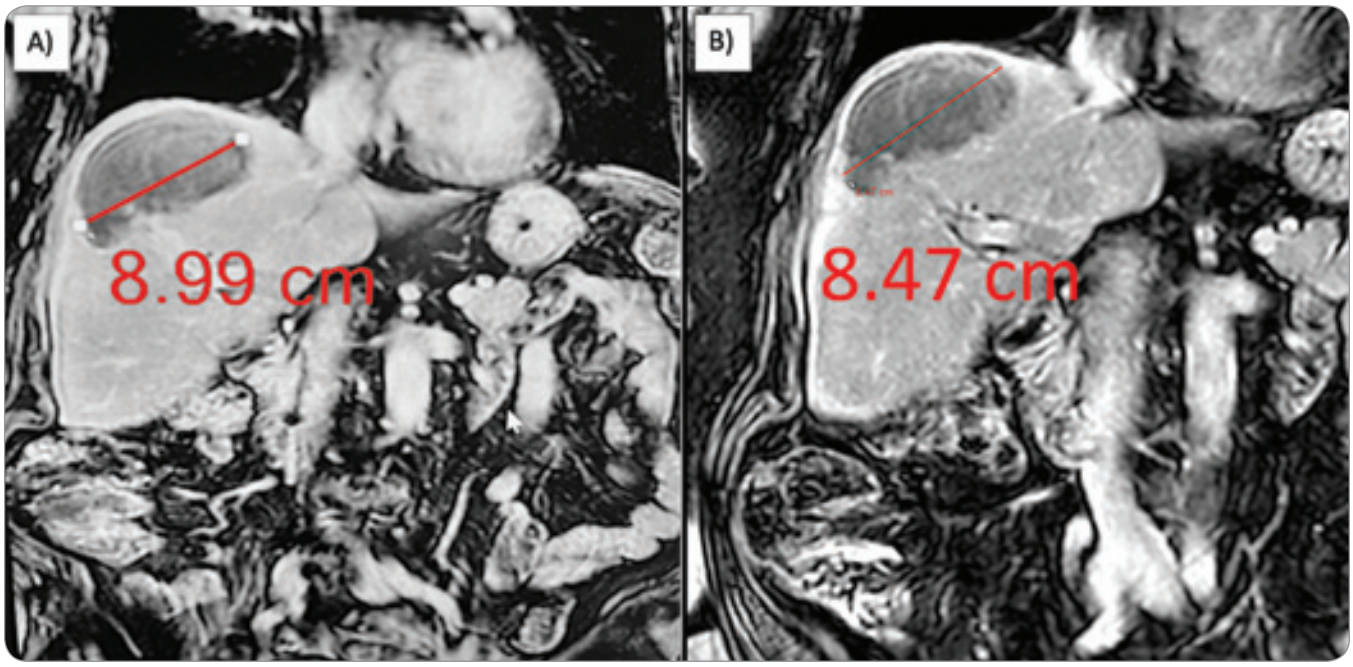

Fig. 3. Post-procedural follow-up imaging in 3-month (A) and 6-month MRI evaluations (B) indicating complete response.

ment of the microwave ablation antenna (EMPRINTTM HP Ablation system with ThermosphereTM technology, Medtronic) in the center of the lesion was performed. Subsequent ablation, with the balloon still inflated, using 150 W of applied power for 8 min ensued (Fig. 2c). At the end of the ablation session with the balloon still inflated, b-TACE was performed using 2 mL of 100-µm drug-eluting microspheres loaded with 50 mg doxorubicin. There were no procedural complications from treatment to follow-up of 6 months. The patient was discharged home from the hospital 24 hours post-intervention with instructions concerning a follow-up imaging which revealed no signs of viable tumor, based on the m-RECIST criteria (Fig. 3).

Discussion

The first reported cases of liver ablation performed during temporary balloon occlusion date back in 2002 (temporary occlusion of hepatic or portal vein branch) by deBaere et al. [1]. In 2020 Iezzi et al. published a technical note upon this combined single-step therapy reporting 5 cases of solitary unresectable large (> 5 cm in diameter) HCC; authors reported no residual tumor or local recurrence registered at a 6-month CT follow-up [2]. In 2022 Lucatelli et al. provided the proof of concept for thermal segmentectomy; this is the largest multicenter study that evaluated the technical efficacy of the necrotic area, safety, and oncological results of b-MWA followed by b-TACE in patients with liver malignancies of the size exceeding 3 cm [3]. In this retrospective study including 23 patients with primary HCC treated with this technique, the authors commented on the technical success in 22 of 23 cases with the mean volume of the necrotic area 75 cm^3 and no noted complications. The complete response was seen in 85.7% of patients (18/21) with only one patient exhibiting extrahepatic progression at 6 months, highlighting its usage in disease control [3].

The preliminary data upon percutaneous segmentectomy report similar and even larger necrotic ablation volume of those achieved by using multiple thermal ablation antennas simultaneously; this advantage is particularly noteworthy since it mitigates the risk of unsatisfactory placed antennas requiring repositioning, increasing the potential risk for periprocedural complications. However, until now there has been no comparative trial evaluating potential superiority of one technique over the other. Yttrium-90 radiation segmentectomy has also been recently proposed as another endovascular local therapeutic option for solitary HCC lesions [4]. Nevertheless, percutaneous segmentectomy is characterized by lower complexity and lower direct cost, although comparable data are required to confirm this hypothesis.

Conclusion

In summary, although the present case is anecdotal and naturally without comparisons or control, it highlights the potential value of percutaneous thermal segmentectomy with a single session combined b-MWA followed by b-TACE for the treatment of large unresectable solitary HCC lesions.

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