Microwave ablation of a solitary colorectal liver metastasis complicated by stomach perforation and gastrocutaneous fistula – a case report

Mikrovlnná ablace solitární jaterní metastázy kolorektálního karcinomu komplikované perforací žaludku a gastrokutánní píštělí – kazuistika

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Summary

Background: Organ perforation secondary to thermal ablation is a rare but severe complication that can occur in certain patients, in whom tissue dissection and preservation cannot be adequately achieved. ***Case description:*** A 69-year-old man presented with a gastrocutaneous fistula 20 days after a microwave ablation of liver metastases from colorectal cancer. Besides skin rash, local tenderness, and gastric content discharge from a wound where the probe had been placed, no other signs or symptoms were present. The patient was treated surgically, and a wedge-shaped gastric resection was performed. His postoperative course was uneventful. After 8 months, the patient underwent the same procedure for local progression of the same lesion, using a pulsed MW antenna and a dedicated hydrodissection needle, without complications. ***Conclusions:*** A gastrocutaneous fistula is a rare complication of microwave ablation. However, adequate hydrodissection can minimize the risk for the development of these complications. Proper treatment of these complications does not preclude repeated usage of microwave ablation in the future.

Key words

microwave ablation – liver – thermal injury – gastrocutaneous fistula – gastric perforation

Souhrn

Východiska: U některých pacientů, u nichž nelze dosáhnout dostatečné disekce a konzervace tkáně, může dojít k perforaci orgánů sekundárně po termální ablaci, což je vzácná, ale závažná komplikace. ***Popis případu:*** U 69letého muže se 20 dní po mikrovlnné ablaci jaterních metastáz kolorektálního karcinomu objevila gastrokutánní píštěl. Kromě kožní vyrážky, lokální citlivosti a výtoku žaludečního obsahu z rány, kam byla umístěna sonda, nebyly přítomny žádné další příznaky ani symptomy. Pacient byl léčen chirurgicky a byla provedena klínovitá resekce žaludku. Pooperační průběh léčby byl bez komplikací. Po 8 měsících pacient podstoupil stejný zákrok pro lokální progresi stejné léze s použitím pulzní mikrovlnné antény a jehly určené k hydrodisekci. ***Závěr:*** Gastrokutánní píštěl je vzácnou komplikací mikrovlnné ablace, nicméně adekvátní hydrodisekce může minimalizovat riziko vzniku těchto komplikací. Správná léčba těchto komplikací nevylučuje opětovné použití mikrovlnné ablace.

Klíčová slova

mikrovlnná ablace – játra – termické poškození – gastrokutánní píštěl – perforace žaludku

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Introduction

Microwave ablation is a technique that is increasingly used for malignant tumors, primary or metastatic. Large ablation areas can be accessed with one or more probes ("antennas") in a shorter time than other thermal ablation techniques. The procedure is performed under conscious sedation or general anesthesia. Despite its minimally invasive character and increased efficacy, physicians and interventional radiologists should be aware of a series of rare but potentially devastating complications [1].

The complications can be classified as puncture-related (pneumothorax, tumor seeding, etc.) or thermal-related (pain at the site of ablation, bowel perforation, liver abscesses, etc.). Major complications can occur in 2.2–3.1% of cases [1]. Organ perforation is a rare but severe complication that can occur in certain patients, in whom tissue dissection and preservation cannot be achieved.

We present a case of gastric perforation leading to gastrocutaneous fistula in a patient with liver colorectal metastasis treated with microwave ablation. This case report has been elaborated in accordance with the SCARE criteria for case reports publication [2].

Case description

A 69-year-old man was operated for right colon cancer in 2017. At primary surgery, right colectomy was performed for grade II adenocarcinoma. After appropriate investigation, no metastasis was identified at that time. From his past medical history, the patient suffered from arterial hypertension, benign prostate hyperplasia, hyperuricemia, and dyslipidemia. The patient's follow-up included a series of CT examinations. Two years after the primary surgery, the patient underwent surgical removal of the liver segment VI with free resection margins for solitary liver metastasis. One year later, two new colorectal liver metastases in segments II (max. diameter 1.3 cm) and VIII (max. diameter 3 cm) were identified. A multidisciplinary team reviewed his case, and the patient was offered open surgical resection of the liver metastases or their microwave ablation, as his lesions were also considered eligible for ablation. However, his poor American Society of Anesthesiology (ASA) score (= 4) and the unavailability of intensive care facilities due to COVID-19 pandemic at that time would have impeded immediate action. The patient could not tolerate any delays and concluded on thermal ablation. Recent data suggested that microwave ablation may achieve an extended ablation area with minimal damage to the surrounding liver parenchyma [3].

The procedure was performed under general anesthesia with the patient in a supine position. Dual image guidance with the combination of a CT scanner and an ultrasound machine was used for precise needle placement and avoidance of any possible complications. A microwave antenna 16G 15 cm (Amica System, Italy) was used for the treatment of both lesions in the same session. For the largest lesion, a 60 W 5 min protocol was used and for the smallest one, a 3 min 60 W protocol. Because of the close proximity of the lesion in segment II to the stomach, an attempt was made for hydrodissection to displace the stomach. For hydrodissection, a spinal 21G needle was used and approx. 100 cm^3 of dextrose mixed with 2 cm^3 of contrast medium were infused in the anatomical space between the liver and the stomach. Our attempts were not completely successful, probably because of the dilation of the stomach, previous adhesions, and the quick dissipation of the fluid from the targeted area. The microwave antenna was placed more laterally to avoid any contact with the gastric wall. The procedure was completed successfully with complete ablation of both lesions and no immediate complications in the final CT scan check (Fig. 1). The patient was discharged home on the following day with no clinical symptoms.

In accordance with our protocol, the patient was due to be examined using CT a month later after the procedure. However, 20 days later, the patient noted skin rash, local tenderness, and gastric content discharge from a wound where the electrodes had been placed. Perforation of the gastrointestinal tract was suspected and the patient was admitted to our institution. On admission, he had a normal leukocyte count and normal inflammatory markers. Fistulography showed passage of contrast material from the abdominal skin wound through a fistulous tract to the stomach. CT examination of the abdomen showed no abscess cavity (Fig. 1). The internal opening of the fistula was identified by gastroscopy. Microbiologic examination of the secretion from the fistula tested positive for *Streptococcus spp.* The patient was moved to the operation theatre, where a wedge-shaped gastric resection was performed under general anesthesia. Abdominal fistula edge was removed at healthy borders and the wound was closed with primary closure. The patient was covered with intravenous antibiotics (piperacillin-tazobactam) and anti-fungal medications (anidulafungin). The postoperative course was uneventful and the patient was discharged home after 7 days.

Eight months after the treatment, there was local progression at the lesion in segment II. The lesion was treated again with microwave ablation using a 14G 15 cm antenna (Amica System, Italy). This time, a pulsed microwave ablation protocol was used (100 W, 10 min) in order to create a larger, more spherical ablation zone with significantly less procedural pain. A 17G Gangi-Hydroguard needle (AprioMed AB, Uppsala, Sweden) was used to dissect the stomach from the liver in order to avoid any similar complication. The hydrodissection was successful and a total of 300 mL of dextrose mixed with contrast medium were injected into the anatomical space between liver and the stomach. The whole procedure was done under mild sedation and the patient had no complications. After a 6-month follow up, there is no sign of local progression or residual disease in the treated liver area (Fig. 2).

Discussion

In our case, a 69-year-old patient developed a gastrocutaneous fistula after a microwave ablation of liver metastases for his metastatic colorectal cancer. This rare complication was treated surgically, and the post-operative course of the patient was uneventful. Later, the

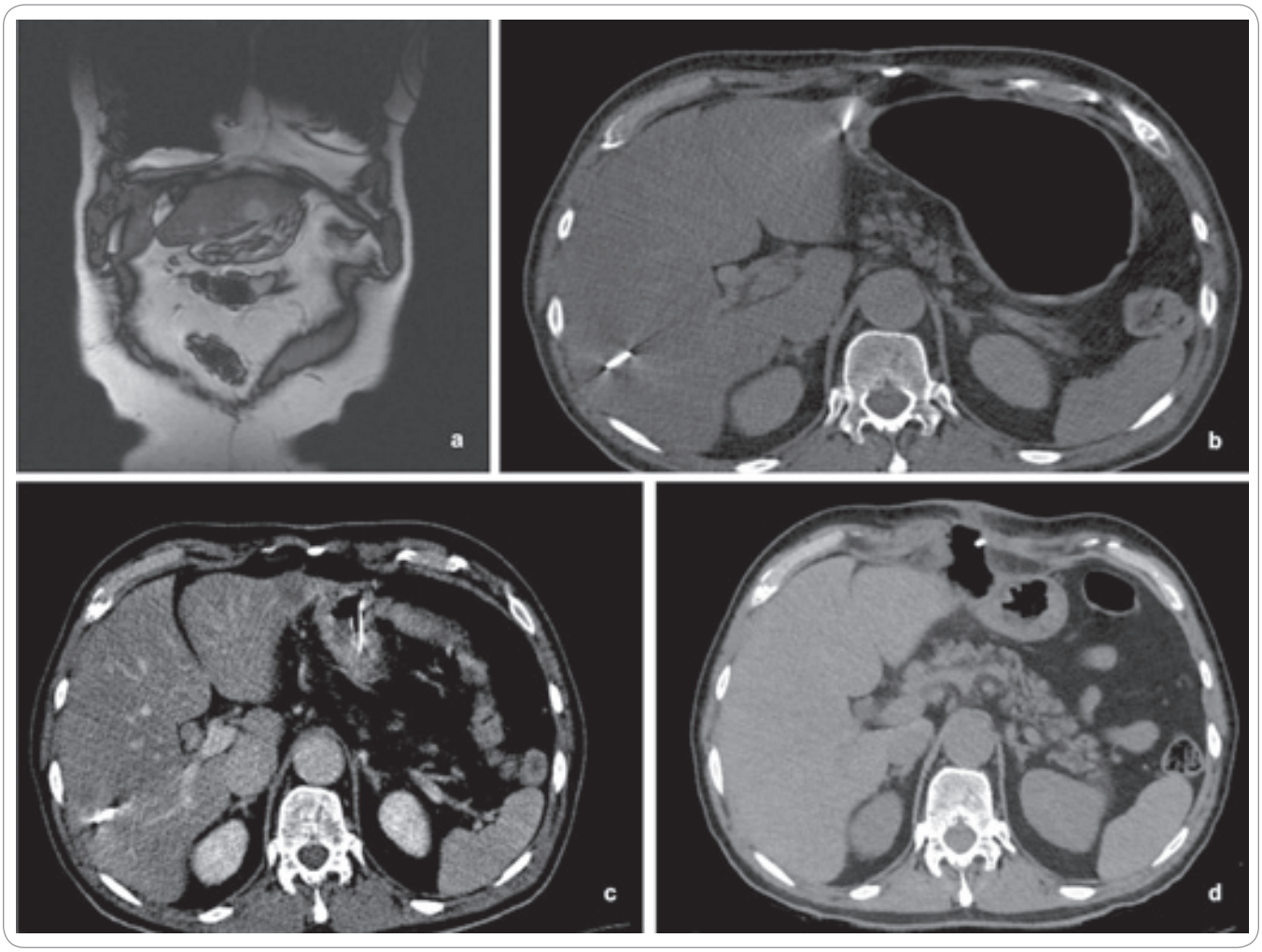

Fig. 1. MRI true fast imaging sequence. Colorectal liver metastasis in segment II adjacent to the stomach (a); microwave antenna placement during the procedure (b); post-procedural CT image after contrast medium injection reveals complete ablation of the lesion and no immediate complications (c); CT examination 20 days after the procedure reveals findings consistent with gastric perforation and gastrocutaneous fistula (d).

patient underwent the same procedure because of tumor progression; however, the second time hydrodissection was performed with a dedicated hydrodissection needle. We want to emphasize that thermal ablation of hepatic lesions is a safe technique; however, proper hydrodissection with an adequate infusion volume must be performed in order to avoid thermal injury to structures in the vicinity of the ablation zone. Major complications are rare but may become clinically evident even after several weeks. Appropriate treatment of these adverse events does not exclude repeated use of microwave ablation in the future.

A personalized approach to each patient is necessary, with tailored evaluation by a surgical and an interventional radiology team before the procedure. Patients with lesions adjacent to neighbored viscera and with the presence of intra-abdominal adhesions pose a challenge with increased potential risks, rendering open approach the most feasible choice [4]. Early detection of abnormal findings and differential diagnosis from normal post-procedural changes facilitates complication management and follow-up.

The first report of gastric wall perforation with delayed gastrocutaneous fistula formation during radiofrequency ablation of hepatic lesions has been reported by Frich et al in 2004 [5]. The patient was a 67-year-old man treated with percutaneous radiofrequency ablation for two metastatic lesions of liver segment III, in close proximity to the gastric wall of the antrum [5]. Secretion was relatively low, approx. 40 mL/24 hrs, so conservative treatment was selected, with fastening and intravenous antibiotics [5]. Four weeks later, fistula secretion ceased and no recurrences have been noticed during follow up period [5].

Heat delivered to adjacent organs of gastrointestinal tract, such as the stomach and the duodenum, is the mechanism of non-target thermal injury during thermal ablation, a rare but potentially devastating complication, since transmural injury can lead to perforation [6]. Inflammation, abscess formation, and perforation are possible results of gastrointestinal tract perforation [4]. Predisposing factors include proximity of the

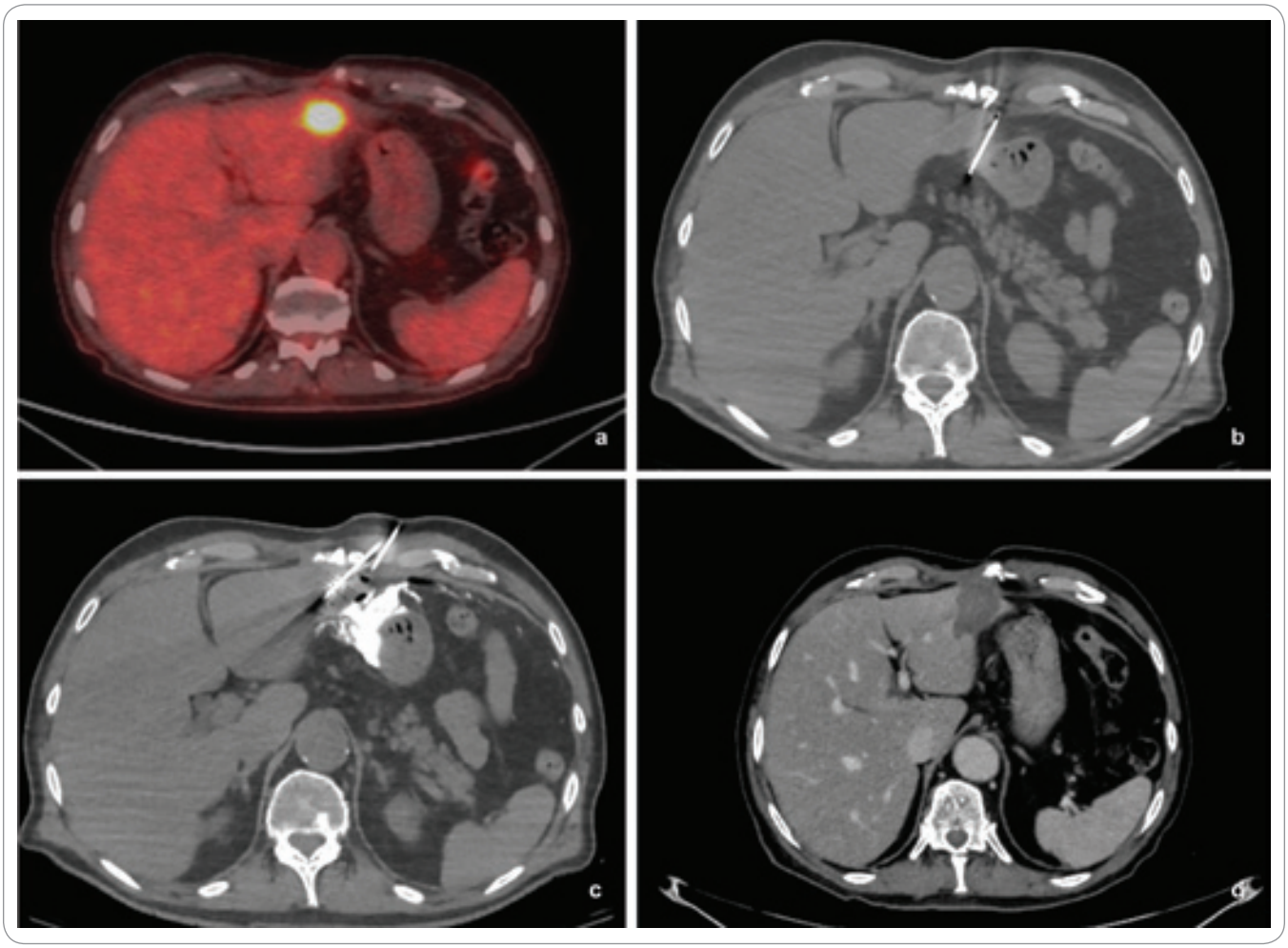

Fig. 2. PET-CT exam. Local progression of the previous treated lesion on segment II (a); a 17G Gangi-Hydroguard needle is advanced in the anatomical space between the stomach and the liver metastasis (b); proper displacement of the stomach with the injection of D5W mixed with contrast media to create a safe ablation procedure with adequate ablation margins. The microwave antenna is positioned properly inside the lesion (c); CT axial image at a 6-month follow up reveals a hypoattenuating ablation zone with no contrast uptake consistent with complete treatment without residual disease (d).

lesion to the gastrointestinal tract and prior abdominal surgeries or intra-abdominal inflammations leading to adhesions [4]. As a general rule, thermal damage risk is increased when the target lesion is located < 1 cm of the liver capsule or is adjacent to other organs at risk [4]. The colon is the most susceptible part of gastrointestinal tract to thermally mediated injury due to limited mobility, while the stomach is more protected due to its thick wall and the absence adhesions along the gastrohepatic ligament and the small bowel is protected by its mobility [7]. Gall bladder, biliary tree, diaphragm, and pleura injuries have also been reported [4]. The usage of straight needlelike electrodes rather than expandable electrodes may reduce non-target thermal damage risk during real-time monitoring of the distance between the electrode and bowel wall [8]. The potential risk of thermal damage to adjacent structures should be assessed against benefits for every patient separately, after careful pre-procedural preparation [4].

It is worth noticing that microwave ablation is still a valid option for these patients, despite the development of complications after the first attempt. Our patient underwent the same procedure 8 months later, without complications.

Protection of the stomach can be achieved with hydrodissection, gas dissection, balloon interposition, and endoluminal cooling [6,9]. Most of them do not provide complete gastric protection [6,9]. In our case, hydrodissection was unsuccessful at the first microwave ablation and played its role in the patient's post-ablation complication. A new technique has been described by Garnon et al, consisting in physical displacing of the stomach using blunt tip spring-loaded needles [6]. This dedicated blunt tip needle for hydrodissection has the advantage of allowing displacement of a critical structure without the danger of causing an injury. In addition, it can be used for infusion of larger fluid volumes and directing the flow of the solution injected [9,10]. The previous surgery also led to resolution of adhesions. It is possible that the use of a dedicated larger diameter needle (17G instead of 21G) with a blunt tip and the

previous surgery resulted in better outcomes after the second ablation.

Conclusion

In conclusion, microwave ablation for liver metastases has some rare but serious complications, such as gastrocutaneous fistula. Adequate hydrodissection can minimize the risk for the development of these complications. Also, proper treatment of these complications does not preclude repeated usage of microwave ablation in the future.

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Informed consent statement

Informed written consent was obtained from the patient for publication of this report and any accompanying images.

SCARE Checklist (2020) statement

The authors have read the SCARE Checklist (2020), and the manuscript was prepared and revised according to the SCARE Checklist (2020).

Authors' contribution statement

All authors made substantial contribution and reviewed the document carefully before submission. CP, GC, PE and AE conceived paper's objective, performed data collection and extraction. SK, BS, SS and LL performed the operations and were responsible for the post-operative course of the patient. All aforementioned authors along with SA performed the authorship of the initial draft. PE, TK and AS offered significantly in revising the present manuscript in order to reach its definitive form.

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