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Case Report

Development and management of iatrogenic biloma post microwave ablation of solitary metastatic breast cancer lesion in the liver ^{☆,☆☆}

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ABSTRACT

Thermal ablation is used to treat liver metastasis including those from breast cancer. The ablation is associated with pain, hemorrhage, and biliary structure damage leading to bilomas. Biloma is a collection of bile that can occur inside or outside the biliary system, which could happen as a rare complication of surgery (from procedures like abdominal surgery or diagnostic procedures), trauma, or spontaneously. We report a case of biloma development after microwave ablation (MWA) of a metastatic lesion in the liver. We present a 66-year-old female diagnosed with stage 4 intraductal carcinoma of the right breast with metastasis to the liver. She developed biloma and infarction of the left lobe of the liver following MWA, which was treated with percutaneous internal/external biliary drain placement. Her symptoms and liver function tests were completely resolved after 3 months, and her left hepatic lobe completely atrophied in the same period. Biloma is a rare but concerning complication of MWA, therefore high suspicion should be maintained in patients presenting with cholestatic symptoms and fever postprocedure. When identified, drainage with antibiotic therapy can effectively treat biloma and resolve the symptoms.

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Introduction

Breast cancer can metastasize to different organs in advanced stages, such as the liver. While hepatectomy combined with systemic chemotherapy has proven to benefit patient survival in other metastatic diseases, hepatectomy for breast cancer liver metastases (BCLM) has not been studied as extensively. Thermal ablation (TA) like radiofrequency ablation (RFA) has shown to be comparable to surgical resection for solitary tumors smaller than 3 cm [1]. Overall survival in patients with metastasis to the liver has a median survival of up to 20 months [2]. Median survival of breast cancer patients with oligometastatic (mean of 2.6 tumors per patient) liver metastasis treated with TA has been about 58.6 months [3]. TA can be done with RFA, cryoablation, or microwave ablation (MWA).

MWA is a commonly used modality for the treatment of primary and secondary liver malignancies [4]. It is reserved for patients who are not surgical candidates or have failed other therapies. MWA can be used to ablate multiple hepatic tumors, reaching up to 11 in a retrospective review in patients with malignant liver tumors who underwent MWA with and without liver resection [5]. The indications for application of MWA in hepatic metastases include tumor size less than 3 cm, but can reach up to 5 cm if not abutting major hepatic vasculature to avoid complications and residual tumor tissue [6].

While a curative treatment modality, TA could result in various forms of complications such as pain, peritoneal hemorrhage, hepatic infarction, infection, fistulas, and biliary tree disruption or bilomas [7,8]. Biloma is defined as a bile collection from rupture of the bile-duct collection system external to the biliary tree secondary to trauma or iatrogenic etiologies including interventional radiology (IR) procedures such as transarterial chemoembolization (TACE), percutaneous biliary drainage, and TA [9–12]. While development of bilomas have been reported in up to 3.3% of patients undergoing RFA [13], no prior studies have specifically investigated the rate of bilomas following MWA.

Herein, we present a 66-year-old female with breast cancer who developed a severe biloma and hepatic infarction after MWA of segment 4 metastatic liver lesion.

Case presentation

Initial diagnosis

A 66-year-old female was initially diagnosed with stage 4 intraductal carcinoma of the right breast which was estrogen and progesterone receptor-positive and HER-2 negative. PET/CT scan identified a solitary liver metastasis. Two months later, a CT of the abdomen and pelvis ruled out hepatic cyst and hemangioma and confirmed the lesion was in segment 4.

Neo-adjuvant chemotherapy

She was started on neo-adjuvant chemotherapy with adriamycin and cyclophosphamide for 4 cycles and Taxol for 12 weeks. Three months later, liver biopsy confirmed metastatic carcinoma consistent with the primary breast cancer. After a month, she completed her neo-adjuvant chemotherapy and underwent a bilateral mastectomy. Surgery revealed a right grade 2.4 cm invasive ductal carcinoma, left atypical lobular hyperplasia, and 2 positive lymph nodes.

Postsurgery follow-up

One month after her bilateral mastectomy, her liver metastasis was treated with RFA. Three years after the initial ablation, a restaging CT scan showed interval growth of the ablation cavity (2.6×1.8 cm growth in segment 4) compatible with tumor recurrence (Fig. 1). She was referred to IR for liver-directed therapies.



Fig. 1 – An enlarging ill-defined hypodense lesion involving the inferior left hepatic lobe medial segment, represents a breast metastasis to the liver.

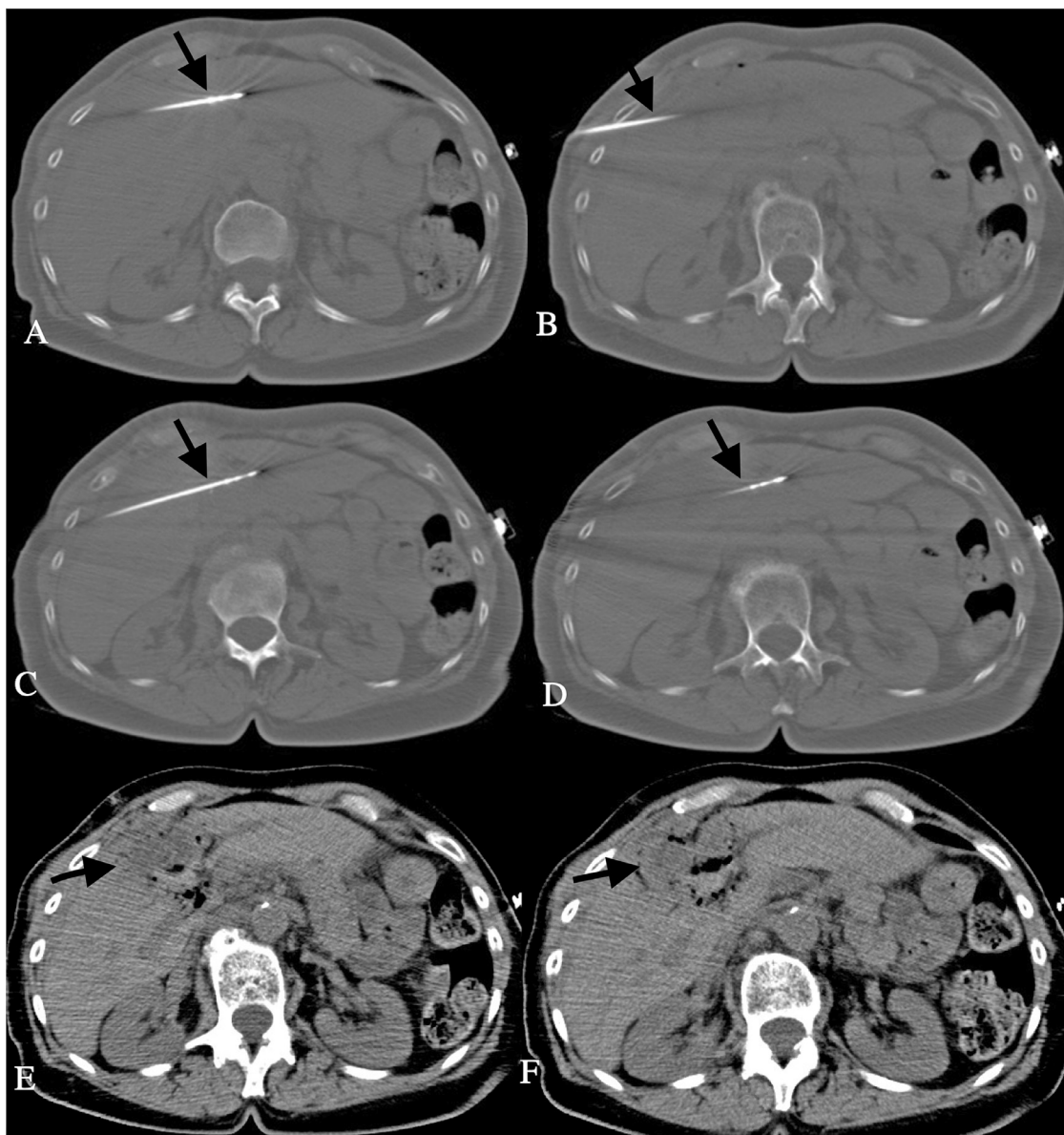


Fig. 2 – Placement and results of MWA. (A and B) First needle placement for MWA, using 17gauge, 15 cm PR-15 (NeuWave, Johnson and Johnson, New Brunswick, NJ). (C and D) Second needle placement for MWA using 17-gauge, 15 cm PR-15 (NeuWave, Johnson and Johnson, New Brunswick, NJ). (E and F) Axial CT scans show the large ablation zones immediately after MWA.

Microwave ablation

Microwave ablation is proven to be comparable to surgery in lesions up to 3 cm [14] and superior to radiofrequency ablation in treating hepatic tumors less than 5 cm [15]. Therefore, the decision was made to proceed with MWA. On the day of the procedure, her lab values were all normal: total bilirubin was 0.5, albumin 4.5, alanine aminotransferase (ALT) 18, aspartate aminotransferase (AST) 19, Alkaline phosphatase 60, and WBC 5.3. She was placed under general anesthesia and sterilely prepared on the CT table. Two needles were placed for the MWA (Figs. 2A-D), and the lesion was ablated for 10 minutes at 65W. On immediate postablation imaging, there was a large abla-

tion zone (Figs. 2E and F). The patient was discharged 3 hours after the procedure when she was deemed stable.

Complication

A week later, she was referred from the hematology/oncology clinic to the emergency department with jaundice, fever, chills, and abdominal pain. She complained of poor appetite, occasional disorientation, and excessive fatigue before arrival. Her lab values were markedly deteriorated from her first presentation to the IR suite: total bilirubin was 20.9, AST 105, ALT 830, Alkaline phosphatase 393, and WBC 14.8, with ammonia 86 (normal 16-53). The abdominal CT scan revealed extensive

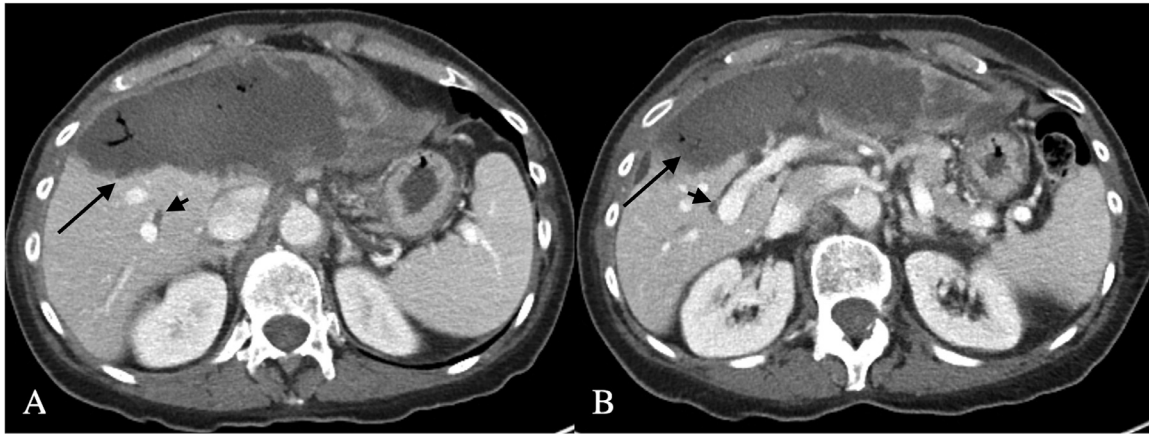


Fig. 3 – (A and B) 1 week after MWA, 2 axial views of contrast CT of Abdomen and Pelvis at different level reveals the extensive hypodensity and hypoperfusion of the left hepatic lobe, including segment 4, compatible with hepatic infarction. Additionally, there was moderate intra-hepatic biliary ductal dilation in the right hepatic lobe.

hypodensity and hypoperfusion of the whole left hepatic lobe including segment 4 (Fig. 3). Additionally, there was moderate intrahepatic biliary ductal dilation in the right hepatic lobe.

Management

Patient was started on antibiotics, and percutaneous transhepatic cholangiogram with a biliary drain placement was performed (Fig. 4). The central duct was difficult to opacify or access, despite numerous attempts. Additionally, significant amount of contrast was extravasated out of the biliary tree in globular fashion concerning for biloma. To maximize biliary drainage, an 8.5 French (Fr.) external drain was placed on June 8, 2018. Again, areas of contrast pooling were found throughout the liver concerning for biloma (Fig. 4). She was admitted to the hospital and 2 days later, a second peripheral duct was successfully accessed (Fig. 4). A 12 Fr. internal-external biliary drain catheter was then placed along with the external drain, and the patient was discharged 2 days later due to symptomatic improvement and a 50% reduction in her bilirubin (Fig. 4).

A week later, the internal-external drain was changed to a 7 Fr. and her external drain was removed. After 2 weeks, her internal-external drain was upsized to 12 Fr. She presented for multiple drain checks and upsizing approximately every 2–4 weeks as an outpatient. She had her 12 Fr. internal-external biliary drain replaced with a regular 12 French internal-external biliary drain (with no extended side holes) after 6 weeks at the end of August. At 3 months after drain placement, the necrotic core was completely resolved, with an atrophic left hepatic lobe on CT scan, and her liver function tests had normalized (Fig. 5). The internal-external biliary drain was switched to a 12 Fr. external anchor. Additionally, no biloma was seen on cholangiography or CT images. After a trial of externalization of the biliary, there was complete improvement and extravasation of normal contrast flow into the bile duct without evidence of obstruction (Figs. 6A and B).

Outcome

Eight months after her first drain placement, the patient was deemed fit to have her biliary drain removed. However, the external biliary drain was converted to an internal-external biliary drain in response to a rise in her bilirubin from chemotherapy in response to her metastatic breast cancer.

Discussion

In the event of iatrogenic biliary injury, as time progresses, a collection forms in the liver or tumor space. This patient's biloma presented 2.5 weeks after treatment with MWA, which is the typical timeline of biloma presentation after procedures [16]. Patients usually present similar to this patient with symptoms that can include anorexia [17]. Patients should be assessed with CT scans that show “discrete fluid collections” that can have a surrounding peripheral capsule with density slightly less than 20 Hounsfield units [18]. In this patient, the bilomas were masked by the large left hepatic infarction.

Biloma is a rare complication of percutaneous TA, including MWA [9]. They can occur as a result of ablation zones near bile ducts, and in this patient, the left biliary duct. The ablation leads to necrotic tissue sloughing and bile leakage into the cavity [19]. MWA has been reported to have higher complication rates compared to RFA due to the heating of the shaft, larger burn zone, and higher temperatures [20]. Studies have compared the efficacy and complications of MWA vs. RFA in hepatocellular carcinoma (HCC) and liver metastasis from colorectal cancer. Poulou et al. found that MWA had a “more predictable ablation zone” for HCC; however, van Tilborg et al. concluded that MWA did not have a higher efficacy rate compared to RFA for liver metastasis from colorectal cancer, (efficacy rate defined as percentage of lesions with no recurrence) [21,22]. There is no data that assesses the superiority of MWA in treating liver metastasis from breast cancer, as seen in this

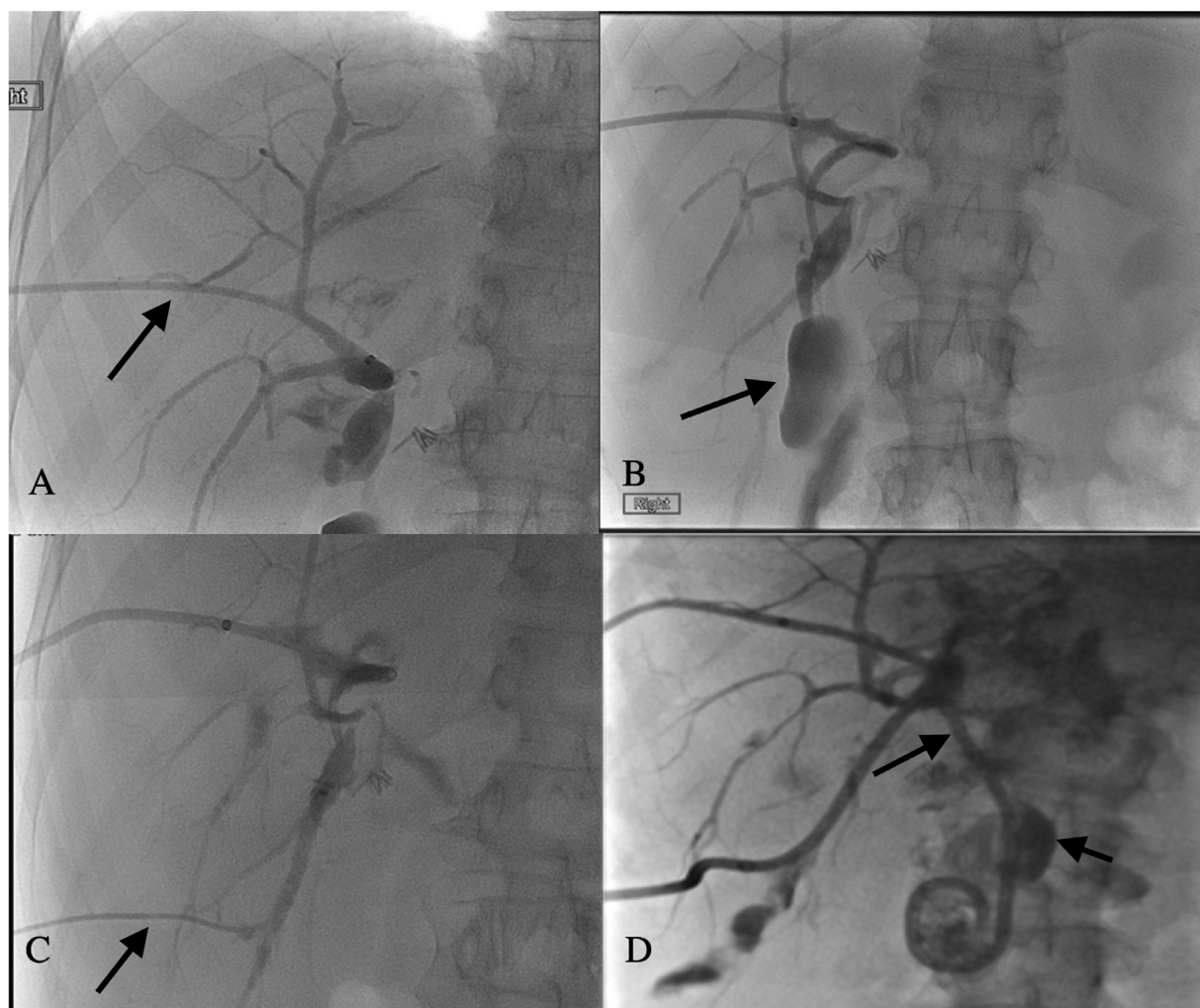


Fig. 4 – (A) First external biliary drain placed, with difficulty and not opacifying the central bile duct. (B) Pools of contrast after injecting drain were found after external drain was placed indicating bilomas. (C) A more peripheral duct was able to be accessed with faint central bile duct opacification. (D) After placing a 12 Fr internal-external catheter, large areas of necrosis and bilomas were better visualized on cholangiography.

patient. Further research should assess the occurrence of biliary injury after MWA procedures in breast cancer metastasized to the liver.

In this case, approach from the left hepatic lobe and tipping toward the right hepatic lobe could have decreased the chance of biloma development by taking advantage of the probe's physics and avoiding placement of the MWA probes shaft close to major biliary ducts. Obtaining contrast enhanced CT after probe placement and immediately before starting ablation could decrease the risk of injury to major bile ducts, by ensuring that the probe is not immediately adjacent to a major bile duct. If it is, adjusting the placement of the probe would lower the risk of biloma.

MRI guided ablation is also an alternative approach with 100% technical success and 98% technique efficacy in a prospective study with 50 MWA procedures and can be used for better visualization, but the comparison of biliary injury occurrence in MRI vs. CT-guided MWA has not been studied [23]. Trans-arterial therapy with conventional TACE followed

by ablation after staining the tumor, is another potential option to decrease the risk of development of biloma. This technique is helpful especially in tumors over 5cm, and trans-arterial therapies can more precisely ablate the tumor [24]. Percutaneous irreversible electroporation (IRE) is a new technique that obviates thermal damage, but needle tract seeding is a major consideration to avoid tumor recurrence [25]. Another study showed that bile duct cooling with endoscopic nasobiliary drainage (ENBD) tube during RFA for HCC near bile ducts resulted in significantly lower biliary complications such as biliary stricture (0% vs. 39%, $P = .02$) [26].

If bilomas occur, they must be drained in conjunction with antibiotic administration [27]. External drain catheters can be used until biliary output ceases. Endoscopic retrograde cholangiopancreatography (ERCP) can be used to localize the bile leak and drainage to guide bile diversion [19]. Additionally, in complicated cases with likely multiple foci of biliary injury such as in this patient, placement of internal/external biliary drainage can decompress the biliary system and bilo-

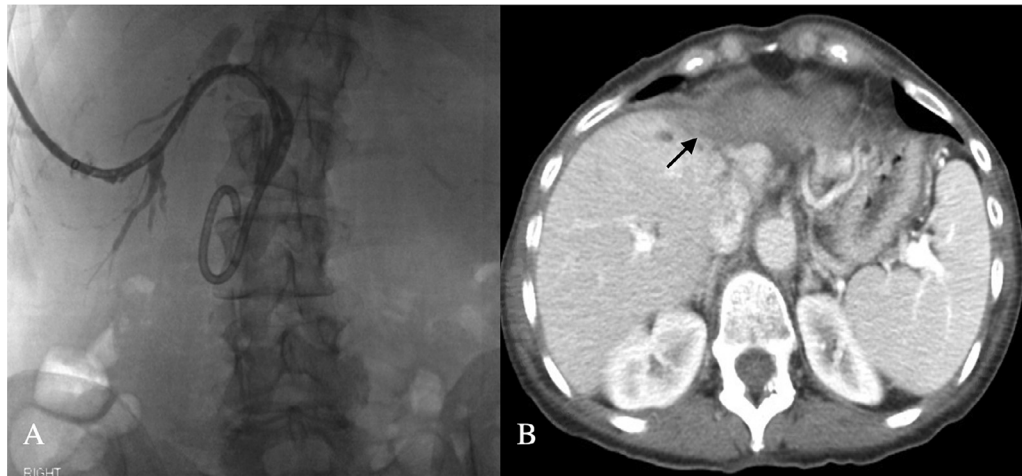


Fig. 5 – (A) Cholangiography through a 14 Fr internal/external biliary drain after 3 months shows complete resolution of biloma and no significant biliary ductal dilation. (B) CT abdomen after 3 month reveals atrophy of left hepatic lobe and hypotrophy (decompression) of right hepatic lobe.

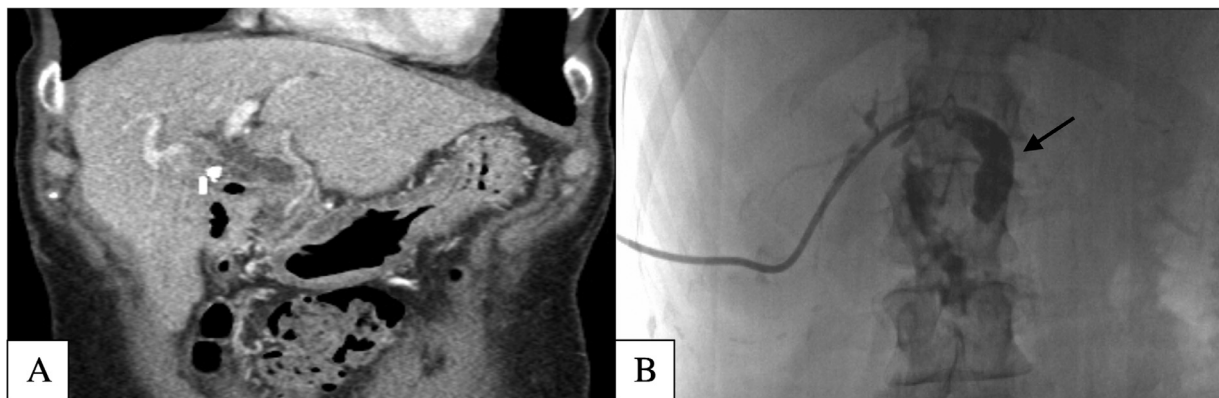


Fig. 6 – (A) Coronal view of the CT abdomen demonstrates no residual biloma. (B) Cholangiography through 10 Fr external biliary drain demonstrating no residual biliary obstruction. The common bile duct is mildly dilated but similar to appearance of baseline images prior to ablation.

mas. In this particular case, the bilomas resolved after adequate biliary drainage and it obviated the need to place additional drains into the bilomas themselves.

Conclusion

Biloma is a rare but concerning complication of MWA of hepatic masses. Proximity of the lesion to the critical structures should be assessed on the preoperative imaging and ablation plans should be set in place based on the anatomical location of the target lesion. High suspicion must be maintained when a patient presents with fever and cholestatic symptoms. Attention to needle placement during MWA, MRI-guided ablation, conventional TACE and ablation, and other technologies like IRE to treat initial liver tumors should be considered to reduce the risk of biloma formation. When a biloma is iden-

tified, drainage and antibiotic therapy should effectively treat the biloma with resolution of symptoms.

Patient consent

I confirm that the patient has provided written, informed consent for the publication of her case. She understood the purpose, potential risks, and agreed to share relevant medical information while maintaining anonymity.

Data availability statement

Data sharing not applicable to this article as no datasets were generated or analyzed during the current study.

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