Irreversible Electroporation for Biliary Cystadenoma: A Case Report

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Background

- Mucious cystic neoplasms of the liver (MCN-L), previously reported as biliary cystadenoma (BCA) until reclassification by WHO in 2010.
- MCN-Ls are rare cystic lesions comprising less that 5% of all hepatic cysts, carrying a 20%-30% risk of malignant transformation.
- Few reports describe successful treatment of MCN-Ls using microwave ablation (MWA), however thermal ablation techniques carry inherent limitations, such as collateral damage and "heat sink" effects
- Irreversible electroporation (IRE) represents a non-thermal ablation modality that utilizes high-voltage, short electrical pulses to induce permanent nanopores in cell membranes, leading to apoptosis while preserving the extracellular matrix and critical surrounding anatomy.

Purpose

- This case report presents the **first documented use of IRE to treat a BCA**, demonstrating the safety and effectiveness of this technique as an alternative to surgical resection.

Patient & Methods

- Comprehensive literature search on Medline and PubMed revealed no previously reported cases of MCN-Ls treated with IRE.
- 64-year-old male who presented with epigastric discomfort, and imaging with CT and MRI demonstrated a lobulated cystic lesion with multiple internal septations in segment 4b of the liver, consistent with BCA **(Figure 1)**.
- A less invasive approach to surgical resection was preferred by the patient and was referred for consideration of ablative therapy.

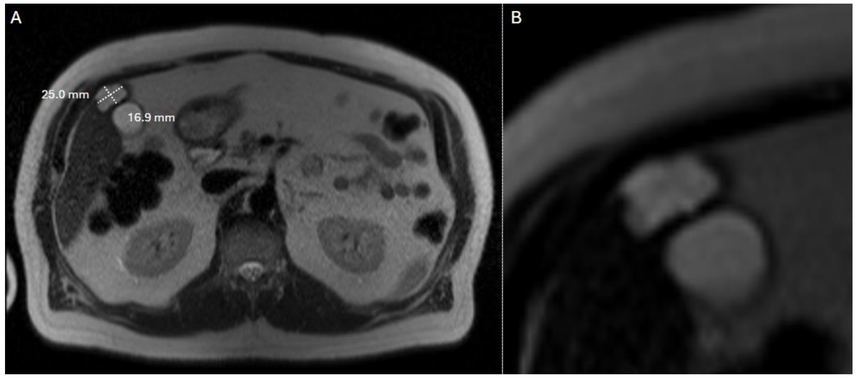

Figure 1. (A) Pre-procedural MR image demonstrating stable lobulated cystic lesion with multiple internal septation in segment 4B, measuring approximately 2.5 x 1.7 cm on T2 without evidence of enhancement or diffusion restriction, consistent with biliary cystadenoma. (B) Magnified MR image further shows multiple internal septations and lobulated appearance.

IRE Procedure

- Under CT guidance, two 19-gauge IRE probes were inserted laterally to bracket the lesion.
- A coaxial needle was advanced in between the two probes to aspirate 4 mL of serosanguineous fluid for cytology.
- A third IRE probe was then placed in the inferior aspect of the lesion.
- 3D reconstruction confirmed appropriate triangular probe spacing.
- IRE was then performed successfully without complications.

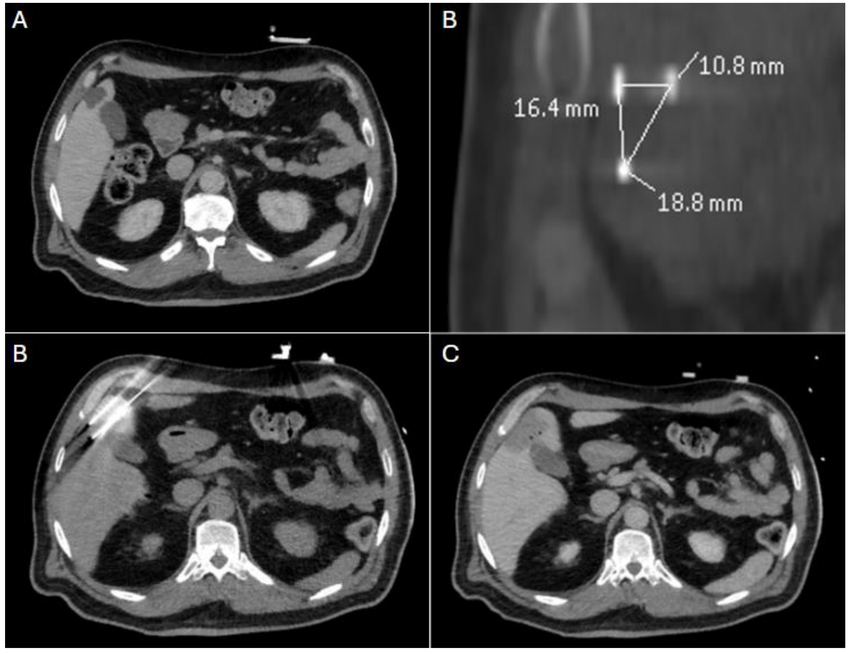

Figure 2. (A) Preprocedural CT demonstrates the 2.5 cm segment 4b cystic lesion. (B) Intraprocedural CT demonstrating intermittent placement of three 19-gauge IRE ablation needles. (C) Post-procedural CT demonstrates adequate coverage of the ablated lesion in 4b with peripheral hyperemia.

Results

- RUQ ultrasound 1-day post-IRE demonstrated some heterogeneity and echogenicity in the right lobe.
- Histopathology of the cyst fluid was benign, consistent with BCA.
- 6-week post-procedural MRI showed the treatment zone with no evidence of local recurrence
- Follow-up MRIs at 3- and 10-months post-ablation showed small hypodensity in the treatment zone with no recurrence.
- The patient recovered uneventfully and remains asymptomatic 15 months post ablation.

Conclusions

- The procedure was performed safely, with **no post-procedural complications**, and serial follow-up imaging demonstrated **durable local control with no evidence of recurrence** at 10 months.
- While surgical resection remains the gold standard for MCN-Ls, this case demonstrates that IRE may serve as a **feasible, safe, and effective alternative to surgery** for select cases of cystic hepatic tumors, particularly those with high surgical risk or lesions in anatomically challenging locations.

References

1. Frenette C, et al. ACG Clinical Guideline: Focal Liver Lesions. Am J Gastroenterol. 2024;119(7):1235-1271.
2. Aziz H, et al. Management of Mucinous Cystic Neoplasms of the Liver. J Gastrointest Surg. 2023;27(9):1963-1970.
3. Lee MH, et al. Mucin-producing Cystic Hepatobiliary Neoplasms: Updated Nomenclature and Clinical, Pathologic, and Imaging Features. Radiographics. 2021;41(6):1592-1610.
4. Karpova RV, et al. Microwave ablation of hepatic cyst: A case report. Ann Med Surg (Lond). 2020;61:13-15. Published 2020 Dec 3
5. Bhatia SS, Arya R, Narayanan G. Niche Applications of Irreversible Electroporation. Tech Vasc Interv Radiol. 2015;18(3):170-175.