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Irreversible Electroporation versus Microwave Ablation as a Treatment Option in Hepatocellular Carcinoma

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Background

In the United States, Hepatocellular Carcinoma (HCC) has an incidence of 7.7 per 100,000.[1] HCC is the most common cause of primary liver cancer worldwide and ranks number four among most cancer-related deaths. The gold-standard treatment for early-stage HCC is surgical resection, however many of these patients are not candidates for surgery. In these patients, the treatment of choice is HCC ablation, with Microwave Ablation (MWA) being a popular choice.[1] Irreversible Electroporation (IRE) is a newer ablation technology that uses a form of low-energy DC, at a high voltage, to disrupt the cell membrane of the HCC lesion by creating nano-pores. This process disrupts the homeostasis of the lesion, leading to apoptosis and eventual cell death.[2] Currently, IRE is only used when thermal ablation techniques are not viable treatment options. The purpose of this research is to compare the 12-month Local Recurrence Free Survival (LRFS), Complete Ablation Rate (CA), and Major Adverse Event Rate (MAE) of IRE and MWA to determine if IRE could replace MWA as a gold standard ablation technique in HCC.

Methods

A literature review was done using the PubMed database to compare the 12-month LRFS, CA, and MAE of IRE to MWA using a 95% CI. MAE was defined as complications that were life-threatening or resulted in hospitalization. CA was defined by complete ablation of the treated HCC lesion. A total of 4 studies were used in this review, with their results compiled and reviewed. Between the 4 studies, a total of 624 cases were compared and reviewed. Of these cases, 105 received IRE, while 519 of the cases received MWA.[3,4,5,6]

Learning Objectives

The purpose of this article is to compare two methods of Hepatocellular Carcinoma ablation, Microwave Ablation (MWA) and Irreversible Electroporation (IRE), to determine whether IRE is a suitable alternative to MWA.

Results/Discussion

MWA had a significantly higher LRFS of 93.9% as compared to 76.9% of lesions treated with IRE ($p<.00001$).[3,4,5,6] IRE had an MAE percentage of 1.9% compared to 20% of MWA treated lesions which had no statistical significance ($p=.32218$).[3,4,5,6] MWA had a significantly better CA of 98.11% compared to 92.04% of IRE treated lesions ($p=.0278$)[3,4,5,6]

Intervention	# of Cases	12-mo LRFS	CA	MAE
MWA	519	93.9%	98.11%	20%
IRE	105	76.9%	92.04%	1.9%

This review indicates that MWA is significantly better at ablating the entire lesion and results in significantly better 12-month LRFS. However, there is no significant difference in the safety of the two procedures.[3,4,5,6] Based on these results, we conclude that IRE should remain as a treatment option only when MWA is not a viable treatment. As IRE is a relatively new technology, more research needs to be done to determine its long-term effectiveness and safety.

References

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Future Directions

We propose that more research should be done with propensity matching of patients and tumors to determine if IRE proves to be equally successful in comparable tumors and patients.