

Purpose

Evaluate differences in efficacy and safety between percutaneous cryoablation (CRA) and microwave ablation (MWA) of renal cell carcinoma (RCC).

Background

- Role of ablation is well-defined in the literature – particularly for T1a renal lesions.
- While ablation of RCC has classically been with radiofrequency ablation or CRA, the utilization of MWA for the treatment of RCC is rapidly increasing.
- Literature evaluating the differences between CRA and MWA, particularly in relation to non-oncologic parameters (e.g. hematoma incidence, # of probes, procedural time), is limited

Methods

- An IRB approved retrospective analysis was conducted in patients with RCC who underwent percutaneous ablation with MWA or CRA between 2013-2017.
- The following baseline characteristics were evaluated:
 - Age, gender, race, BMI, tumor size, renal function, and RENAL-nephrometry score
- The following peri- and post-procedural variables were also evaluated:
 - Number of probes, total CT dose, procedural time
 - Incidence of hematoma, critical-structure involvement, post-op hospitalization, Clavien-Dindo Class ≥ 1 , creatinine increase adverse event (AE) ≥ 1 , and complete-response

Methods (cont.)

- Overall-survival from initial treatment was calculated using Kaplan-Meier estimation and compared using log-rank analysis.
- Differences in variables were assessed with chi-square and student's t-test using JMP statistical software.

Results

- Between 2013 and 2017, 176 patients underwent percutaneous ablation for their RCC
 - 130 underwent CRA
 - 46 underwent MWA

| Variable | Total Cohort | CRA | MWA | P-Value |
|--------------------|---------------|--------------|--------------|---------|
| Age, years | 67.6 \pm 10 | 67.7 \pm 1 | 67.6 \pm 2 | 0.9 |
| Gender, % male | 56 % | 55 % | 61 % | 0.5 |
| Ethnicity, % white | 48 % | 50 % | 39 % | 0.3 |
| BMI | 30.4 \pm 7 | 30 \pm 1 | 31 \pm 1 | 0.9 |

Table 1 – No significant difference in age, gender, ethnicity, or BMI between the CRA and MWA cohorts.

| Variable | Total Cohort | CRA | MWA | P-Value |
|---------------------------------|---------------|---------------|---------------|---------|
| Tumor Size, mm | 25 \pm 11 | 25 \pm 1 | 23 \pm 2 | 0.2 |
| RENAL Nephrometry Score, median | 7.1 \pm 1.6 | 7.1 \pm 0.1 | 6.9 \pm 0.3 | 0.5 |

Table 2 – No significant difference in baseline tumor size or RENAL nephrometry score

Results (cont.)

| Variable | Total Cohort | CRA | MWA | P-Value |
|-----------------------------------|---------------|---------------|---------------|---------|
| Total CT-Dose, Gy*cm | 2.8 \pm 1.9 | 2.9 \pm 0.2 | 2.6 \pm 0.3 | 0.4 |
| Hematoma Incidence, % | 28 % | 30 % | 22 % | 0.4 |
| Critical Structure Involvement, % | 10 % | 12 % | 4 % | 0.06 |

Table 3 – No significant difference in total CT-dose, or incidence of hematoma or critical structure involvement between the CRA and MWA cohorts.

| Variable | Total Cohort | CRA | MWA | P-Value |
|------------------------|---------------|---------------|---------------|----------|
| Number of Probes, mean | 2.1 \pm 1.2 | 2.3 \pm 0.1 | 1.4 \pm 0.2 | <0.0001* |
| Procedural Time, Min | 91 \pm 38 | 94 \pm 3.4 | 79 \pm 6.3 | 0.03* |

Table 4 – Compared to the MWA cohort, CRA cases had longer procedural time and utilized more probes per procedure.

| Variable | Total Cohort | CRA | MWA | P-Value |
|----------------------------------|--------------|---------|---------|---------|
| Post-Op Hospitalization, % | 22 % | 24 % | 14 % | 0.2 |
| Clavien-Dindo Class ≥ 1 , % | 22 % | 25 % | 14 % | 0.2 |
| Complete Response, % | 91 % | 93 % | 90 % | 0.4 |
| Overall-Survival, yrs | 4.2 yrs | 4.1 yrs | 4.7 yrs | 0.8 |

Table 5 – No significant difference in overall-survival, or incidence of post-op hospitalization, Clavien-Dindo Class ≥ 1 , or complete response between the CRA and MWA cohorts

| Any AE ≥ 1 * | Total Cohort | CRA | MWA | P-Value |
|-------------------|--------------|-----|------|---------|
| 3-month Cr, % | 8 % | 6 % | 17 % | 0.1 |
| 6-month Cr, % | 7 % | 5 % | 12 % | 0.3 |
| 12-month Cr, % | 9 % | 6 % | 18 % | 0.2 |

*CTCAE increased Cr definition based on an upper normal limit of 1.2 mg/dL (institution specific)

Table 6 – No significant difference in the incidence of any renal function adverse event ≥ 1 between the CRA and MWA cohorts.

Discussion

- Major limitations:
 - Small, retrospective, single-center study.
 - Relatively short and heterogenous follow up.
 - Cohort is currently too small for propensity score matching.
- Results validate prior work that has shown the comparable safety and efficacy profile of MWA and CRA when used for the ablation of RCCs.

Conclusion

In patients with RCC undergoing ablative therapy, our study suggests:

- Percutaneous CRA and MWA offer similar effectiveness and safety profiles
- CRA is associated with more ablation probes and longer procedural time than MWA

A larger cohort analysis, with propensity score matching, is currently on the works to further evaluate these results.

References

1. National Comprehensive Cancer Network (NCCN) Guidelines Version 2.2023 – Kidney Cancer.
2. Zhou, W. et. al. "Radiofrequency Ablation, Cryoablation, and Microwave Ablation for T1a Renal Cell Carcinoma: A Comparative Evaluation of Therapeutic and Renal Function Outcomes." JVIR (2019).
3. Cobelli, F. et. al. "Percutaneous Microwave Ablation Versus Cryoablation in the Treatment of T1a Renal Tumors." CVIR (2020).
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