Long Term Follow-up Results of Ablation Treatment for Patients with Small Renal Mass

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Abstract

Objective: The aim of this study is to evaluate the outcome of ablation therapy in our clinic for the treatment of patients with small renal mass Materials and Methods: We retrospectively evaluated the technic and follow-up data of 30 patients with 36 tumors who underwent Radiofrequency Ablation (RFA) and Microwave Ablation (MWA) in our clinic. Demographic data, ablation type, tumor characteristics, peroperative and postoperative complications and treatment success of the patients were evaluated. Results: A total of 36 tumors who underwent ablation treatments, 23 were treated with RFA, 13 with MWA. The mean tumor size was 28.9 ± 6.92 mm in RFA and 29.3 ± 7.70 mm in MWA. 12 (52.1%) of the RFA procedures were applied to the right kidney while 11 (47.8%) were applied to the left kidney. 6 (46.1%) of the MWA procedures were performed on the right kidney and 7 (53.8%) on the left kidney. Of the 36 tumors, 4 (11.1%) were located central and 32 (88.8%) were peripheral. Complications occurred in 2 patients. In one of these patients, acute renal failure and urea creatinine were found to be elevated. In the other patient, local pain was found in the ablation side and minor bleeding was detected at the ablation site in USG. The mean follow-up period was 49.6 ± 24.7 months in patients with RFA and mean follow-up was 16 ± 8,05 months in MWA treatments. The overall success in MWA administration was calculated as 76.9%, while the overall success in RFA was 80%. Conclusion: Long-term oncologic efficacy of RFA appears to be successful in the treatment of T1a renal carcinomas. Further studies can be conducted to elucidate the influence of MWA on long-term oncological outcomes.

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Conclusion: Long-term oncologic efficacy of RFA appears to be successful in the treatment of T1a renal carcinomas. Further studies can be conducted to elucidate the influence of MWA on long-term oncological outcomes.

Keywords: Minimal invasive surgery, renal cell cancer, radiofrequency ablation, thermal ablation, tumor ablation

What is already known about this topic? What does this article add?

Urology guidelines offer active surveillance, radiofrequency ablation and cryoablation to elderly and comorbid patients with small renal masses. However, there is no recommendation for MWA. When we revieweded the literature, there was no comprehensive study comparing RFA and MWA. In this article, we discussed the differences of these methods.

Introduction

Renal cancer constitutes 2-3% of adult cancers. It is the seventh most common cancer type in males and the ninth most common type of cancer in females (1). Today, the incidence of small renal masses (SRMs) is increasing with the development of imaging modalities and with the increase in the public awareness (2). In current practice, Nephron-sparing surgery(NSS) is the new gold standard in the treatment of SRMs (2).

Current minimal invasive ablative treatments including radiofrequency ablation (RFA), microwave ablation (MWA) and high intensity focused ultrasound ablation (HIFU) are alternative teratments for SRMs, especially for T1a renal tumors (3). These treatments have some advantages, such as less complication rate, shorter recovery and hospital stay and less ischemic injury to the kidney than surgical treatments. (4, 5) Another advantage of ablative therapies is the ability to provide curative and nephron-sparing treatment for patients who are inappropriate for the surgical treatments (4-7). EAU guideline offer active surveillance, radiofrequency ablation and cryoablation to elderly and comorbid patients with small renal masses. However, there is no recommendation for RFA and cryoablation due to the inadequacy of existing data. In the AUA guideline, thermal ablation may be preferred in small renal masses with a T1a stage of 3 cm. (8, 9) In this study, we aimed to evaluate the operative and long-term oncological outcomes of RFA and MWA.

Materials and Methods

We retrospectively evaluated the operative and follow-up data of 30 patients (total 36 tumors)

who underwent RFA and MWA in our clinic between January 2009 and September 2017. All of the patients who were diagnosed with SRMs by computerized tomography (CT) or magnetic resonance imaging (MRI) and planned operation with pre-diagnosis of renal tumor. The reasons for the use of ablation therapy were high surgical and anesthetic risk due to factors such as the presence of accompanying comorbidities, presence of tumors in the solitary kidney, comorbidities and advanced age and the preference of the patient. Before the operation, general information about the procedure, possible complications and alternative treatment methods were explained. Informed consent form of patients was obtained. Ablation treatment was performed by a single interventional radiologist. As a general approach, laparoscopic coagulation (L-RFA) was performed on more medial resected tumors, while ultrasonographic guidance (USG-RFA) or CT guidance (CT-RFA) was applied to posterior or posterolateral tumors. Biopsy was performed by interventional radiology using a coaxial system percutaneously before the procedure in biopsied patients. Samples were separated for pathological examination. Patients who did not undergo biopsy consisted of patients who had a risk of injury in intraperitoneal organs and seeding due to tumor placement and were referred to as radiologically typical RCC by an experienced radiologist.

RFA application was performed using RF Ablation Generator with Cool-tip Technology, Covidien, Massachusetts, USA model RFA generator. In MWA, the Emprint Ablation Generator with Thermosphere Technology, Covidien, Massachusetts, USA. generator was used. Sufficient ablation on the tumor tissue was allowed to reach a threshold temperature of 50-60 oC for cell death. The ablation time was a maximum of 12 minutes for a single cycle and the ablation cycle was repeated when the target temperature remained suboptimal. In the USG-RFA procedure, the patient was taken to the modified lateral decubitus position adjusted for localization of the tumor. Sedation was achieved by intravenous 3-5 mg midazolam hydrochloride and 100-300 µg fentanyl citrate. In addition, local anesthesia with lidocaine was given to the area where the RFA needle was to be delivered. The RFA needle selected according to the size of the tumor was placed in the tumor and the tumor was completely ablated.

L-RFA was performed under general anesthesia for a 2 cm tumor in which only one patient had a kidney lower pole medially located. The tumor which was radiologically typical RCC could not be reached with a biopsy needle from outside. It was seen that the outer surface of the tumor was ablated after the procedure.

All patients were checked with dynamic CT or MRI techniques at the 1st, 3rd, 6th, 12th months and then once a year. Patients who underwent dynamic CT before ablation were followed up with CT, patients with dynamic MR were followed up with MR. Presence of

contrast-enhanced tumor area and presence of residual tumor at first month control has been accepted as incomplete ablation. The success rate of tumor ablation is accepted that the ablation tumor tissue is lost or the tumor size is %50 more regression. Contrast enhancement in the ablated region during imaging at the 3rd month and later controls in RFA applications was assessed as disease recurrence. Patients were followed for complications that may occur during and after the procedure.

Since our study was organized retrospectively, the local ethics committee approval was not received. The data of our study was evaluated using the function calculations of Microsoft Excel program. The table was formed with the results obtained.

Results

The demographic data of the patients are given in Table 1. According to the R.E.N.A.L. nephrometry score, 3 of the patients (8.3%) were medium risk, while the remaining 33 patients (91.7%) were at low risk. 21 (91.3%) of the RFA applications were performed under the USG guidance, 1 patient was performed under CT guidance (4.3%), RFA was performed in one patient (4.3%) under laparoscopy using retroperitoneal technique. MWA applications were performed in 2 CT guidance (15.3%) and 11 (84.6%) USG guidance.

3 patients with solitary renal disease who underwent nephrectomy due to renal mass.

The mean duration of ablation was 28.4 ± 5.3 minutes for MWA and 31.9 ± 6.3 for RFA. No biopsy was performed in 14 patients (42.4%) while 19 (52.7%) of 36 tumors treated with ablative therapy were biopsied. Pathological evaluation of the entire renal biopsies taken prior to RFA administration resulted in Clear cell renal cell carcinoma. (CCRCC) In only 2 (6%) of the cases complications were encountered after ablation. In one patient, acute renal failure and serum creatinine level were found to be elevated, in the other patient local pain was found in the ablation loom, and in the USG, minor bleeding was detected at the ablation site.

Recurrence was seen in 7 (30.4%) of the 23 tumors treated with RFA, and 3 (23%) of the tumors were recurred after MWA application in 13 tumors. Re-RFA was applied to 4 (40%) of recurrent tumors, MWA to 3 (30%) and targeted therapy at medical oncology clinic to 2 (20%) and active surveillance was applied to 1 (10%). The overall success in MWA administration was calculated as 76.9%, while the overall success in RFA was 80%. (Table 2)

In the follow-up period, only 1 of our patients is exitus due to illness. The patient who underwent RFA was previously treated with left radical nephrectomy and right partial nephrectomy.

Discussion

RCC mortality is still increasing despite increased incidence of renal cell carcinoma, incidental early diagnosis, localized staging and improvement in surgical techniques of radical

or partial nephrectomy. (10). The fact that ablative procedures are performed in the imaging guideline significantly reduces the mortality and morbidity rates. In addition, the advantages of these ablative treatment modalities compared to surgical treatments, such as less complication rate, shorter recovery time, no ischemic damage to the kidney, and curative and nephron sparing treatment, increase their use in routine practice (8,11). We performed total 36 ablation applications due to the reasons of high surgical and anesthesia risk such as the presence of accompanying diseases, presence of tumor in solitary kidney, elderly patients with comorbidities.

Factors that may affect the results of RFA application include; tumor size and localization, tissue resistance, ablation time, amount of energy applied and surface area of the used probe. In RFA application, approximately 85% ablation rate has been reported in renal masses of 3 cm and smaller (11, 12). Of 17 tumors [?]3 cm, 12 were performed RFA and 5 were performed MWA. Recurrence occured in 10 (7 RFA and 3 MWA) of these 17 tumors. Therefore, recurrence did not ocur in any tumors $<$ 3cm in our study and the success rate were 100%. The results of our study show that tumor size is an important point to decide RFA or MWA for treatment of SRMs. Thus, high recurrence rates of RFA and MWA should be consider in patients with renal tumor $>$ 3cm. In addition to assessing the effect of tumor size, we also invesitigated the effect of tumor localization on the reccurence rates of RFA and MWA. Of 3 patients with recurrent tumor after MWA, only one (33.3%) had endophytic tumor. Of 7 patients with recurrent tumor after RFA, 4 (57.1%) had endophytic tumor. Thus the outcomes of our study show that tumor localisation (endophytic or exophytic) is the other important factor for recurrent disease.

Significant studies have recently taken place in the international literature on the long-term oncologic efficacy of RFA administration in small renal masses. In a study that evaluated the long-term oncologic efficacy of RFA, Psutka et al noticed the long-term (6.5 years) outcomes of RFA in 185 renal cancers with T1a (30). They reported that the median mass size was 3 cm and the local recurrence rate was 6.5%. 5-year recurrence-free, metastasis free, diseasespecific and overall survival rates were 95.2%, 99.4%, 99.4% and 74%, respectively. The authors suggested that RFA treatment in the high-risk group of patients provides local control at long-term acceptable rates of renal cancer at T1a and low risk of metastasis. In our study, seven of the 20 tumors (35%) who underwent RFA had recurrence in 3 (23%) tumors after 13 MWA application. When recurrent tumors were examined within themselves, it was observed that 3 tumors in MWA applications had tumor recurrence of the same patient. The tumor size of the patient was measured as 4 cm, 3.4 cm and 2.7 cm, respectively. The tumor was endophytic in the posterior middle pole. Although the patient's tumor size was regressive, the

procedure was considered ineffective. In RFA applications, the tumor size of [?]3 cm and the size of 1 tumor were measured as <3 cm in 6 patients with recurrent 7 patients. In four patients, the tumor localization was endophytic, while three patients were exophyticly localised. When evaluated in this respect, it was thought that tumor size was a more dominant factor than localization in terms of full ablation in RFA application.

The lack of contrast image in ablated live tumor tissue at the follow-up in the first postoperative month was considered non-tumor recurrence and non-residual tumor. Patients undergoing Re-RFA were not routinely biopsied. Because of the difficulties of routine biopsy in terms of confirming the absence of recurrence following RFA follow-up in cases with normal radiological findings, it does not appear to be an effective application for reasons such as possible biopsy complications and significant cost increase. It should also be kept in mind that the pathology reports, which are not rare, can not yield clear results (14). However, the recurrence of a confirmed biopsy in the event of doubt cannot be ignored. Of 10 patients with recurrent tumors, 4 (40%) were performed RFA, 3 (30%) were performed, 2 (20%) were given targeted therapy and 1 (10%) was applied active surveliance. Although RFA and MWA are less invasive than other surgical treatments, some complications of RFA and MWA (such as perirenal hematoma, macroscopic hematuria, haemorrhage, infection, stenosis due to renal collecting system damage or fistula formation, adjacent organ damage) were reported (15, 16).In our study, only 2 (6%) of the cases had complications after ablation. One of them was a table of acute renal failure with oliguria and uremia symptoms on postoperative 5th day after RFA administration. Nephrologic treatment was applied to the patient. Urea creatinine levels returned to normal values at postoperative first month. The other complication was local pain on the postoperative first day after MWA application and minor bleeding on ablation site in USG. Clinical follow-up of the patient showed that the bleeding was limited by itself. No additional treatment was needed and no hematuria was observed in clinical follow-up.

The overall success in MWA administration was calculated as 76.9%, while the overall success in RFA was 80%. One of the reasons for the low success rate of the procedure in comparison with the studies in the literature is that in a patient with high comorbidities, R.E.N.A.L. Classification was 7p and RFA was performed on the mass of 4 cm in the posterior pole of the left kidney. After the RFA, the size of the mass was regressed to 3.4 cm, but the procedure was considered unsuccessful and MWA application was performed 3 times in total. The final post-administration mass size of the patient decreased to 2.5 cm. This situation is considered to be a process failure.

Atwell et al. reported that percutaneous RFA (n = 222), which they applied to the renal mass

of <3cm size, had a local recurrence-free survival rate of 98% after 5 years of follow-up. Major complication rates were reported to be 4.5%. The authors reported that effective minimally invasive treatment modalities with low complication rates in the treatment of renal masses <3 cm in size (17). In our study, disease-specific survival was 95% and overall survival was 60%, while disease-specific survival was 100% and overall survival was 84.7% in MWA treatment Mershon et al. reported that slightly higher rates of local recurrence rates (˜1-10%) with thermal ablation are offset by lower complication rates and reduced morbidity, and equivalent or better renal function outcomes compared to surgery. The established modalities of radiofrequency, and microwave ablation offer equivalent outcomes with similar complication rates; technique choice is primarily based on tumor characteristics and operator preference. (18)

Conclusion

RFA has been shown to provide oncologically effective cancer control in the presence of international literature and in our series, with short, medium and long follow-up studies. MWA-related studies will take place more in the literature in the near future. Today, extirpative treatments (partial nephrectomy, radical nephrectomy) are the gold standard method for the treatment of T1a renal cancer. However, for this treatment approach to be used more frequently in routine practice, more comprehensive, long-term results and prospective design studies are needed. As the long-term consequences of these methods arise, the location of ablative techniques in the treatment of renal tumors will become even clearer.

References

1. Ljunberg B, Bensalah K, Bex A, Canfield S, Dabestani S, Hofmann F et al. Guidelines on renal cell carcinoma. EAU Guidelines, 2014.

2. Campbell SC, Novick AC, Belldegrun A, et al. Guideline for management of the clinical T1 renal mass. J Urol 2009;182(4):1271–9.

3. Wingo MS, Leveillee RJ. Central and deep renal tumors can be effectively ablated: radiofrequency ablation outcomes with fiberoptic peripheral temperature monitoring. J Endourol 2008;22(6):1261–7.

4. Zlotta AR, Wildschutz T, Raviv G, et al. Radiofrequency interstitial tumor ablation (RITA) is a possible new modality for treatment of renal cancer: ex vivo and in vivo experience. J Endourol 1997;11(4):251-8.

5. Gervais DA, McGovern FJ, Arellano RS, et al. Radiofrequency ablation of renal cell carcinoma: part 1, Indications, results, and role in patient management over a 6-year period and ablation of 100 tumors. AJR Am J Roentgenol 2005;185(1):64-71.

6. Matsumoto ED, Johnson DB, Ogan K, et al. Shortterm efficacy of temperature-based radiofrequency ablation of small renal tumors. Urology 2005;65(5):877-81.

7. Park SH, Yoon SK, Cho JH, et al. Radiofrequency ablation treatment for renal cell

carcinoma: early clinical experience. Korean J Radiol 2008;9(4):340-7.

8. Best SL, Park SK, Youssef RF et al: Long-term outcomes of renal tumor radio frequency ablation stratified by tumor diameter: size matters. J Urol 2012; 187: 1183.

9.Leveillee RJ, Castle SM, Gorbatiy V et al: Oncologic outcomes using real-time peripheral thermometry-guided radiofrequency ablation of small renal masses. J Endourol 2013; 27: 480.

10. Hollingsworth JM, Miller DC, Daignault S, Hollenbeck BK. Rising incidence of small renal masses: a need to reassess treatment effect. J Natl Cancer Inst. 2006;98(18):1331-4. Epub 2006/09/21.

11. Wah TM, Irving HC, Gregory W, Cartledge J, Joyce AD, Selby J. Radiofrequency ablation (RFA) of renal cell carcinoma (RCC): experience in 200 tumours. BJU Int. 2014 Mar;113(3):416-28. doi: 10.1111

12. Mylona S, Kokkinaki A, Pomoni M, et al. Percutaneous radiofrequency ablation of renal cell carcinomas in patients with solitary kidney: 6 years experience. Eur J Radiol 2009;69(2):351-6.

13. Psutka SP, Feldman AS, McDougal WS, McGovern FJ, Mueller P, Gervais DA. Longterm oncologic outcomes after radiofrequency ablation for T1 renal cell carcinoma. Eur Urol. 2013 Mar;63(3):486-92. doi: 10.101631.

14. Gontero P, Joniau S, Zitella A, Tailly T, Tizani A, Van Poppel H, et al. Ablative therapies in the treatment of small renal tumors:how far from standard of care? Urologic Oncology Seminars and Original Investigations 28: 251-259, 2010.

15. Aron M, Gill IS. Renal tumor ablation. Curr Opin Urol 2005;15(5):298-305.

16. Kwan KG, Matsumoto ED. Radiofrequency ablation and cryoablation of renal tumours. Curr Oncol 2007;14(1):34-8.

17. Atwell TD, Schmit GD, Boorjian SA, Mandrekar J, Kurup AN, Weisbrod AJ, et al Percutaneous ablation of renal masses measuring 3.0 cm and smaller: comparative local control and complications after radiofrequency ablation and cryoablation. AJR Am J Roentgenol. 2013 Feb;200(2):461-6. doi: 10.2214

18. Mershon JP, Tuong MN, Schenkman NS. Thermal ablation of the small renal mass: a critical analysis of current literature. Minerva Urol Nefrol. 2020 Apr;72(2):123-134. doi: 10.23736/S0393-2249.19.03572-0. Epub 2019 Dec 12.

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