**Signature:** © Pol J Radiol, 2010; 75(3): 68-71



**Received:** 2009.09.29 **Accepted:** 2009.10.26

# Radiofrequency ablation of small symptomatic angiomyolipomas of the kidney: Report of two cases

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# **Summary**

### Background:

The development of more sensitive imaging techniques caused an increase in the number of diagnosed small renal tumors. The small size of the lesions allows for their treatment with minimally invasive nephron-sparing methods. Approximately 2–3% of these lesions are proved to be angiomyolipomas (AML). AML is a rare benign tumor of the kidney, sometimes causing pain and hematuria. The most commonly required approach is observation but in case of recurrent symptoms or larger tumors which may cause bleeding, a more active treatment is needed. This paper demonstrated the evolution of our attitude leading to utilization of radiofrequency ablation (RFA) as a minimally invasive option in the management of small symptomatic AMLs of the kidneys.

# Material/Methods:

We presented clinical data of two cases of symptomatic AML tumors in the kidney, treated with RFA. The tumors were diagnosed on the basis of a contrast-enhanced CT (computed tomography) scan. The probe was inserted into the lesion percutaneously under USG (ultrasonography) guidance.

#### Results:

RFA proved to be an effective and safe method of treatment of renal AMLs. A follow-up carried out after 1.5 and 3 years, basing on contrast-enhanced CT tests, confirmed a complete ablation of the AML and decreased tumor size.

# **Conclusions:**

Promising results of RFA in the management of AML may encourage urologists and radiologists to use this minimally invasive technology and to qualify patients for this treatment more often and thus to prevent potential complications in the future.

# Key words:

angiomyolipoma of the kidney • minimally invasive treatment • RFA

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## **Background**

Angiomyolipoma (AML) is a benign hamartoma consisting of adipose, vascular and smooth muscle tissue. It represents about 3% of renal tumors. Introduction of ultrasonography (USG) and computed tomography (CT) allowed for the tumor to be easily diagnosed because of the characteristic picture of its fat elements. AML is usually asymptomatic. Sometimes it may cause recurrent hematuria, lumbar pain and, occasionally, dramatic, life-threatening bleeding inside the tumor or into the retroperitoneal area. It was confirmed that the occurrence of symptoms depends on the size of the lesion. Tumors causing symptoms can be treated

by a total or partial nephrectomy, but nowadays, selective renal artery embolization seems to be a promising method. However, further effort has been undertaken recently to minimize the invasiveness of the therapy by using radiofrequency ablation (RFA) in the treatment of kidney tumors [1]. The procedure is based on insertion of the needle probe into the tumor and on generation of a zone of heat-induced necrosis by an electric current with 400–500 kHz frequency around it. The probe may be positioned through the skin under imaging control (USG, CT) or laparoscopically. The temperature around the probe exceeds 80°C which leads to coagulative necrosis inside the tumor. In this paper, we presented preliminary results of RFA application in the

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treatment of small symptomatic AMLs with an aim to prevent possible complications. In our opinion, minimal invasiveness of RFA goes perfectly in line with benign features of AMLs and allows for an easier qualification of patients for this type of treatment.

## **Material and Methods**

#### **Patients**

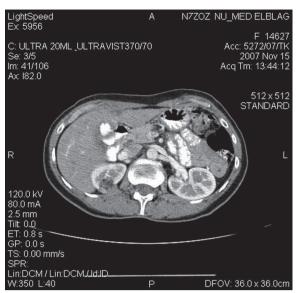
We treated two female patients (58 and 61 years old) with a small (21 and 20 mm, respectively) symptomatic AML in the kidney. Both patients had previous episodes of hematuria. One of them had been under cardiologist's control and presented with hematuria following the administration of aspirin. The other one had a loin pain on the AML side. In both cases the lesions were on the right side. The tumors were diagnosed by a contrast-enhanced CT. Ultrasound was also performed before the procedure in order to confirm that lesions were visible and accessible. The patients were qualified for percutaneous RFA in order to have their symptoms reduced. This was also supposed to counteract potential more significant complications in the future. All patients were informed about the experimental character of the procedure and signed the consent to take part in the study. The protocol was approved by the local bioethical committee of the Medical University of Gdańsk according to the Declaration of Helsinki from 1964.

#### **RFA** treatment

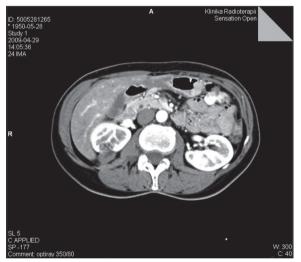
The procedure was performed under epidural anesthesia in the supine position. Patients received a single dose of a third generation cephalosporin antibiotic beforehand. Because of typical radiological features of the AMLs and frequently reported problems with interpretation of the frozen section specimens, we did not perform the biopsy of the tumor. The needle probe was inserted into the tumor under USG guidance (B-K Medical Hawk 2102 EXL, B-K Medical A/S, Copenhagen, Denmark). It was a single probe, with an active uninsulated tip, 3 cm long (Cool-tip RF System, Radionics, Burlington Massachusetts, USA). The end of the probe was protruding slightly beyond the tumor margin in order to cover the whole of it with the necrotic zone. After inserting the probe, the RFA was started. It was performed under temperature and impedance control. The cooling of the needle to 20°C was to prevent a charcoal formation around it. It was switched off for a moment during the treatment to check whether the desired temperature of over 80°C was achieved. Because the RFA evoked changes in the tissue, it led to significant distortions of the ultrasound picture. Therefore, great care was taken to hold the needle in a prefixed location. In case of temperature or impedance increase, the heating was terminated and then restarted after a few minutes to achieve the preset duration. At the end of the procedure the needle was removed after the cooling was turned off, to coagulate the puncture canal.

# Results

Medium time of the treatment session was 24 minutes. The procedure was well tolerated by the patients. Patients stayed in hospital for 24 hours and were discharged after



**Figure 1.** CT in a 57-year-old patient with AML in the kidney before RFA. A lesion of 23 mm, in the right kidney, revealing AML features and a strong contrast enhancement.



**Figure 2.** CT at one year and six months after RFA. The same lesion, presenting no contrast enhancement.

the USG examination had confirmed no complications. Creatinine levels before and after RFA were 0.7, 0.7mg% and 0.9, 0.7mg/%, respectively. One patient was followed up for a year. A CT was carried out six and twelve months after RFA. The second patient was followed up for three years. The CT was performed six, twelve and eighteen months post-op. Afterwards the patient was followed up by ultrasound. All symptoms disappeared at one month after RFA and the first CT in both cases confirmed a complete ablation of AML and decreased tumor size. No recurrences were determined (Figures 1, 2).

#### Discussion

The aim of this paper was to draw the attention of the medical community to new technology that is being constantly developed and is inevitably changing our approach to well-known medical entities.

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We are aware that many urologists would consider a conservative management of the majority of renal AMLs (especially of the size as in the presented cases) as the most appropriate one. In principle, we agree with this view. However, we want to show that in some specific cases there is an easy and safe option that could be offered to patients. This is RFA.

In the last few years, there has been a dynamic development of non-invasive image-guided techniques used in the treatment of renal tumors. One of the most promising technologies is the radio-frequency ablation [2]. It utilizes thermal energy created by the dispersion of radio-frequency current around a needle electrode introduced inside the tumor under CT or ultrasound control. A great advantage of RFA is its minimal invasiveness that allows for the procedure to be conducted in outpatient settings. In case of carcinomas, this method requires a more careful evaluation concerning its oncological effectiveness; but in benign tumors like AML, this aspect is not of such an importance. Moreover, AML is very interesting because in a vast majority of cases the diagnosis can be established merely on such radiological features as the presence of fat tissue [3]. It eliminates the need for a biopsy, and thus reduces the invasiveness of the treatment.

Most AMLs are asymptomatic and the only management is observation. However, some of them may cause symptoms like pain or hematuria and may require treatment. The frequency of symptoms increases with the size of the mass. In 1986, Oesterling et al. [4] presented a study of 602 cases from literature and 13 from own material. They concluded that 90% of symptomatic tumors are larger than 4 cm. Masses of less than 4 cm in size produce symptoms only in 23% of cases. Those data were the basis for creation of recommendations according to which symptomatic AMLs lager than 4 cm should be removed. Asymptomatic masses lager than 4 cm should be checked every 6 months, while the symptomatic tumors of less than 4 cm in size ought to be followed up and removed when symptoms persist. Annual observation was recommended in cases of asymptomatic AMLs of less than 4 cm in size. Steiner et al. [5] published results of a 4.4-year observation without intervention. They reported that 46% of AMLs lager than 4 cm grow and increase their size. In case of AMLs smaller than 4 cm, this was 27%. It shows that a considerable part of small lesions grow as well. Harabayashi et al. [6] presented results of 14 AML cases associated with tuberous sclerosis and concluded that 20% of lesions of less than 4 cm required intervention within 60 months from the initial diagnosis. This is still a minority but it confirms that even small tumors must be observed. In larger AMLs, the incidence of symptoms was far higher and reached 100% in tumors lager than 10 cm.

In relation to that information, the concept of prophylactic management of AML was introduced but radical or partial nephrectomy that was recommended in the past does not meet the criteria of minimally invasive procedures [7]. Nowadays, the most popular treatment option is the selective renal artery embolization. Unfortunately, it is not free of complications. The most serious ones, connected with the injury of big vessels and renal failure, are rare but other, called post-embolization syndrome, meaning pain and elevated temperature, occur in the majority of patients. More importantly, the embolization is not always effective. In the study by Kothary et al. [8], the success rate was 70%, which in the author's opinion can be increased by repeating the procedure. It should also be emphasised that sometimes, when AMLs are multifocal or if there is a serious atheromatosis in the aorta, embolization can be very challenging.

So far, there has been only one paper published specifically on RFA in the treatment of AML. In 2008, Prevoo et al. [1] used CT-guided RFA in the treatment of a small asymptomatic AML, 4.5 cm in size, found in a patient with a solitary kidney. No complications occurred and the patient was discharged home the day after the procedure. During 12 months of follow-up, the function of the solitary kidney was preserved and a contrast-enhanced CT showed a complete tumor ablation with decrease in its size from 4.5 to 2.9 cm.

Having that in mind, we decided to apply RFA percutaneously in the treatment of small symptomatic AMLs. It seemed even less invasive than embolization. There are many reports on the application of RFA in the treatment of malignant tumors of the liver and kidney. Its histological effects on the tissue have also been thoroughly studied. One of its most important functions is the closure of vessels, which is much required in our treatment, for prevention of bleeding in AMLs [9]. Very limited invasiveness of the procedure may allow for a more liberal qualification of patients for this type of treatment.

## **Conclusions**

- In case of symptomatic AML masses in the kidney, RFA seems to be an attractive minimally invasive option of treatment.
- Because of its limited invasiveness, RFA may also constitute an attractive option of so called preventive treatment of AML.
- Application of RFA may allow for an easier qualification of patients for the procedure and consequently may spare them tedious symptoms.

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