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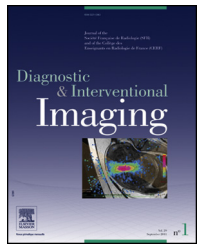

ORIGINAL ARTICLE /*Genito-urinary imaging*

Microaneurysms in renal angiomyolipomas: Can clinical and computed tomography features predict their presence and size?

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KEYWORDS
Renal angiomyolipoma;
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Abstract
Purpose: To evaluate clinical and multidetector computed tomography (MDCT) features associated with the presence and size of microaneurysms in renal angiomyolipomas (AMLs).
Materials and methods: The MDCTs and digital subtraction angiographies (DSAs) of 31 patients who had further percutaneous arterial embolization of AMLs were retrospectively reviewed. They were 22 women and 9 men (mean age, 47.7 ± 27.7 years). The medical files of the included patients were reviewed for age, gender and clinical features. MDCT and DSA images were analyzed by two readers working in consensus.
Results: Of the 31 patients, 15 had tuberous sclerosis complex (TSC) or lymphangioleiomyomatosis (LAM). In total, the 31 patients had 54 AMLs (5 ruptured). On DSA, 28 clusters of microaneurysms were found in 17 patients (21 AMLs). Four of the five ruptured AMLs had microaneurysms. None of the 12 AMLs ≤ 40 mm and 21 of the 42 AMLs > 40 mm had microaneurysms. Among AMLs > 40 mm, history of TSC/LAM ($P = 0.5$), RENAL score ($P = 0.7$) and relative volume

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of fat ($P = 0.11$) did not significantly predict the presence of microaneurysms. Microaneurysms were significantly larger in ruptured (9.5 ± 5.7 mm) than non-ruptured (3.9 ± 1.9 mm, $P = 0.02$) AMLs. No associations were found between the size of microaneurysms and the size of AMLs. *Conclusion:* Microaneurysms were found in no AML ≤ 40 mm and in 50%of AMLs > 40 mm. In AMLs > 40 mm, history of TSC/LAM, RENAL score and relative volume of fat did not significantly predict the presence of microaneurysms.

Renal angiomyolipomas (AMLs) are benign mesenchymal tumors composed of a variable proportion of adipose tissue, spindle and epithelioid smooth muscle cells and abnormal blood vessels. They are believed to belong to a family of lesions characterized by a proliferation of perivascular epithelioid cells [1—5]. They are either sporadic or associated with tuberous sclerosis complex (TSC) or pulmonary lymphangioleiomyomatosis (LAM). TSC/LAM-associated AMLs tend to be larger and more often multifocal and bilateral than sporadic AMLs. AML vessels have poor elastic layers and are prone to microaneurysm formation and spontaneous bleeding. The severity of these hemorrhagic events is variable and ranges from spontaneously resolving bleeding to life-threatening hypovolemic shock [1—3]. There is currently no clear consensus concerning the assessment of the risk of bleeding and its prophylactic management. Because the risk of bleeding increases with the size of the AML, it is usually recommended to preventively treat by surgery or embolization sporadic AMLs that are larger than 40 mm [2,3,6,7]. TSC/LAM-associated AMLs have been reported to bleed more frequently and 30 or 35 mm thresholds have been proposed for intervention in TSC/LAM patients [8,9]. However, the mean diameter of bleeding AMLs is approximately 70—80 mm [10—12], and it may not be necessary to treat all AMLs larger than 40 mm, even in TSC/LAM patients [13—15].

The presence of intratumoral microaneurysms larger than 5 mm has been shown to be a better predictor of bleeding than tumor size [12]. Taking into account the presence and size of microaneurysms, along with the size of the tumour could therefore improve the assessment of the bleeding risk and the management of the patient. Unfortunately, microaneurysms are currently visible only on digital subtraction angiography (DSA). As a result, the presence of microaneurysms is seldom assessed in patients with AMLs, and the natural history of these microaneurysms remains largely unknown.

To better assess the risk of bleeding in patients with AMLs, it becomes necessary to develop a noninvasive imaging technique that can show the presence of microaneurysms and/or to define features that are associated with microaneurysms and could be used as surrogates for their presence.

The goal of this study was to evaluate clinical and multidetector computed tomography (MDCT) features associated with the presence and size of microaneurysms in renal angiomyolipomas (AMLs). Accordingly, we retrospectively studied patients who had MDCT and DSA prior to AML embolization in order to define clinical and MDCT features that could be used as surrogates for the presence of microaneurysms in renal AMLs.

Materials and methods

Study population

The study was compliant with the principles of the declaration of Helsinki and with our national laws that do not require Ethics Committee approval nor informed consent for retrospective studies.

We retrospectively queried the Information System database of two different hospitals (Hôpital Edouard Herriot, Lyon; Centre hospitalier de Valence) for patients who:

- underwent renal arterial embolization for AML between January 2005 and February 2015, and;
- had preoperative renal MDCT examinations available for review.

Thirty-one patients (22 women, 9 men) with a mean age of 47.7 ± 27.7 (SD) years (range, 18—82 years) were included in the study. Fifteen (48.4%) patients had TSC and/or LAM. Fourteen patients (12 with TSC/LAM) had multiple bilateral AMLs and 17 had a single lesion. Five patients (2 with TSC/LAM) had been referred for urgent embolization because of acute bleeding of an AML. The others had been referred for prophylactic embolization.

The medical files of the included patients were reviewed for age, gender and clinical features. Results were recorded and tabulated.

Image analysis

DSA and MDCT images were reviewed by two readers (JC, OR) working in consensus. First, the readers reviewed the MDCT images. The diagnosis of AML was based on the presence of macroscopic intratumoral fat without calcifications or necrosis [3]. The readers noted the size of all AMLs larger than 10 mm, and characterized their location using the RENAL nephrometry score [16]. The AMLs were then manually delineated using an Advantage Windows® workstation (GE Medical Systems, Milwaukee, WI, USA) and their relative volume of fat was estimated as the cumulated volume of the intratumoral voxels with an attenuation value ranging between −190 HU and −30 HU.

Second, DSA images were reviewed by the same two readers. Only kidneys with selective angiograms were taken