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Correlation between CT and anatomopathological staging of kidney cancer

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ABSTRACT

Our Moroccan context is experiencing an increase in the frequency of renal tumors. This trend can be explained by the generalization of the use of imaging, in particular abdominal ultrasound, which has become almost systematic among general practitioners (Godley and Ataga, 2000 [1]).

The specificity of kidney cancer is anatomopathological heterogenicity: histological type, nuclear grade, tumor stage, these elements constitute the most important prognostic factors.

Renal biopsy appears to be a safe and reliable solution with a low risk of tumor seeding and complications, however it cannot provide all the detailed histological information needed. Hence the interest in the abdominal scanner.

The abdominal scanner is the reference examination for the evaluation of renal tumors, it diagnoses the tumor, specifies these characteristics, it assesses the loco regional, venous extension.

The objective of our study is to correlate pathological and CT findings of 70 kidney cancer in order to determine the reliability of CT in kidney cancer and its extension.

1. Material and methods

This is a descriptive and analytical retrospective study, carried out at the Casablanca University Hospital over a period of 5 years from 2015 to 2019. 70 files were collected from patients with kidney cancer who had undergone an enlarged total nephrectomy, or partial nephrectomy.

All of our patients underwent a CT scan of the thoraco-abdomino-pelvic region. The CT acquisitions were analyzed by an experienced radiologist in relation to the histological type.

An operating sheet enabled us to collect the following data: age, sex, history, risk factors, symptoms, paraclinical examinations, and anatomopathological results. The histological types were evaluated according to the 2004 WHO classification, histological grade according to the Führman classification, and the TNM classification according to that of AJCC 2009.

All data were included in the Excel spreadsheet, the comparative study of the data was done by Student's *t*-test. The qualitative variables were compared by the chi2 test. The results were considered statistically significant for a $p < 0.05$.

work was reported according to SCARE 2020 criteria [19]

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2. Results

Between January 2015 and June 2019 we identified 70 cases. The extreme ages were between 40 and 80 years old with an average of 56 years old. The following table describes the general characteristics (Table 1).

The ultrasound was performed on all of our patients and revealed the kidney tumor in 100% of cases. It revealed the presence of liver metastases in two patients. Six patients had suspected vascular invasion.

A CT scan was performed in all our patients; two patients did not receive an injection of contrast product because of renal failure. The CT scan confirmed the diagnosis in 100% of cases.

Clear cell carcinoma was the most common histological type (63%). The most represented nuclear grades are Führman grade 3 and 4 with 42.3% and 48.9% of cases, respectively.

The comparison between the size of the tumor on CT imaging and the pathology showed a non-significant difference $p = 0.368$ (Table 2).

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Table 1
General characteristics.

	Effective	Percentage
Sex		
-Man	46	66%
-Women	24	34%
Risk factors		
-Smoking	26	37%
-Diabetes	10	14%
-Obesity	12	17%
-Professional exhibition	6	8.5%
-Hemodialysis	4	5.7%
-No risk factor	12	17%
Clinical picture		
-Lumbalgia	42	60%
-Hematuria	32	45%
- Palpable mass	20	28%
-AEG	28	40%
-Fever	10	14%
-HTA	12	17%
-Anemia	18	26%

We subdivided the cases into 4 groups according to tumor size and then compared the results between pathology and CT scan. The results are given in the following table (Table 3).

Linear regression analysis of tumor size on CT versus pathology shows that CT significantly predicts tumor size ($r^2 = 0.984$, $p < 0.0001$)

Restaging after surgical excision showed over-staging on CT in 2 cases and under-staging in 2 cases as well. That is a total of 11.42% of cases.

Predictive value of tumor size compared to pathological characteristics:

The comparison between the mean CT size and the histological type showed that clear cell carcinoma have a larger size (average height 11.02 cm) than the rest of the histological types (average height 6.4 cm).

Similarly, we note that 86.36% of tumors larger than 7 cm are clear cell carcinomas, against 23.07% for tumors smaller than 7 cm. The possibility of having clear cell carcinoma increases with increasing tumor size with a significant p value of $p < 0.0001$.The Führman stage also increases with increasing tumor size with a significant P value of $p < 0.0001$.

However, our study did not show a correlation between tumor size and distance extension. In fact, the distance extension was noted for tumors less than 7 cm in 45.45% of cases and 20.8% for tumors greater than 7 cm without being significant $p = 0.621$.

3. Discussion

The male predominance has been found in various studies [2]. The average age varies between 49 and 62 years in the different series [2,3]. The most frequently described risk factors are smoking, professional exposure, hemodialysis and the carrier of multi-cystic dysplasia [4]. The typical symptomatology encountered is summarized in a triad: lumbalgia + tumor mass + hematuria [5].

The role of imaging in kidney cancer is to differentiate between malignant and benign tumor, and to establish an extension imaging. Due to the size of the tumor, CT becomes a predictor of survival [5].

The increased use of modern imaging has led to an increased incidence of kidney tumors. We see more and more asymptomatic or small tumors. On the other hand the histological orientation can influence the therapeutic choice, a patient carrying a histological type with a poor metastatic capacity and recurrence may not need an in-depth search for metastases and a large resection can be avoided, avoiding the morbidity and mortality [6].

The aim of our study was to clearly define the place of CT in the preoperative evaluation of kidney cancer.

Ultrasound is the first-line examination for any suspicion of a kidney tumor. In addition to detecting the kidney tumor, it helps to assess the vascular pedicle and a possible atypical image. The ultrasound has a sensitivity of 70% for tumors of small sizes <3 cm and 92% for tumors >3 cm [7,8]. In our series, the ultrasound revealed the tumor in 100% of cases, in this perspective Mucksavage et al. published a series comparing ultrasound with CT and MRI and found no difference in mean height in the 3 imaging modalities [9].

The CT scan is the gold standard for detecting a kidney mass. It is evident that currently no type of imaging can predict the histological type; nevertheless certain CT characteristics may point to a precise diagnosis [10]. In this sense, the study by Z.SHEIR demonstrated a correlation between the degree of enhancement of contrast product and the histological type. In fact, the enhancement was higher for clear cell carcinomas in 48.6% of cases against 15.4% of cases for papillary carcinomas and 4.2% of cases for chromophobic carcinomas ($p = 0.0001$) [11].

The benefit of tumor size is of primary importance in kidney cancer because it determines the TNM classification and modifies the type of surgical management (partial or total nephrectomy). We compared the sizes described by the CT scans and the final results of the anatomopathology: in our series, the CT underestimated the average tumor size compared to the anatomopathology without being significant; these results join the data of the literature, in particular the study by Mucksavage et al. [9]. The average size of the tumors nevertheless remains higher than the results of the literature, which can be explained by the delay in treatment.

Table 2
Comparison between tumor size on CT scan and pathology.

N	Average height on scanner (cm)	Average height in anatomopathology (cm)	Medium difference	Percentage of difference (%)	P
70	9.31	9.42	−0.11	−1.16	0.368

Table 3
Distribution of tumor size.

Taille	N	Height N Average height at CT (cm)	Average height in anatomopathology (cm)	Medium difference	Percentage of difference (%)	P
< 4cm	8	2.27	1.92	0.35	18.2	0.012
Between 4 and 7 cm	14	5.60	5.44	0.16	2.94	0.101
Between 7 and 10 cm	18	8.23	8.55	−0.32	−3.74	.0.85
>10 cm	30	13.56	13.80	−0.24	−1.73	0.375

In our study we performed a correlation between tumor size and histological type and we found that a larger size points to clear cell carcinoma, other studies [12,13] have found the same results, in particular the study by Zhang et al. which in addition showed that certain tumor characteristics revealed by CT could point to a histological type, for example the presence of hemorrhage or necrosis is in favor of a chromophobic carcinoma ($p < 0.05$), or the absence of Cystic degeneration would increase the probability of finding a papillary or chromophobic carcinoma ($p < 0.05$).

The nuclear Führman grade is used to determine the prognostic value of cancer. Our study showed that there was a significant relationship between tumor size and nuclear grade, larger tumors had a high nuclear grade and were potentially more aggressive, which is consistent with the results of Western publications [12,13].

Tumor restadification after anatomopathology was noted in 8 cases (11.42% of cases). Comparatively, the Mucksavage study encountered this situation 7.8% of the time. The over-staging of these tumors can be explained by inflammatory phenomena and rearrangements secondary to the neoplasic process.

Tumor diffusion to the peri-renal compartment is difficult to demonstrate, and can be suspected by the presence of a tissue nodule of at least 1 cm satellite of the tumor but located in the fat of the renal compartment, or in front of a thickening of the peri-renal fascia [14], this sign is 98% specific but 46% sensitive, in our study we found a specificity of 100% and a sensitivity of 83%. Extra capsular extension was noted in 83% of tumors greater than 7 cm with a significant p value of 0.02. The study by Catalano et al. finds similar results [15].

The lymphatic invasion is sought in the renal hilum and lumboaortic chains, and evoked in front of lymph nodes larger than 10 mm. Size is the only criterion on which the radiologist relies to confirm or deny lymph node invasion. Above the usual 10 mm, we speak of adenomegaly and suspicion of lymph node invasion in the renal hilum and median retro peritoneum. However, with this type of criterion, there are 5–43% of false positives [16]. On the other hand, the false-negative rate is lower (4–5%). Catalona et al. [15] showed in its study on the place of the multibarette scanner in the preoperative evaluation of kidney cancer that all patients affected synchronous lymphadenopathy at the time of nephrectomy were identified by CT scan; the false positive rate due to reactive hyperplasia was 6.3%. In our series all the lymph nodes, which measured more than 10 mm were considered positive and underwent a dissection. Pathological examination was in favor of lymph node metastases in all cases. In the literature, the reliability of the CT scan in differentiating between N0, N1 and N2 stages in kidney cancer is only 83–89%. It has recently been shown that it is unnecessary to perform lymph node dissection when there is no suspicion of lymph node involvement on CT [17].

The diagnosis of invasion of the renal vein and the inferior vena cava is crucial in developing a treatment strategy. The multibarette scanner, thanks to multiphasic exploration and good spatial resolution, is now the first-line imaging to assess cellar invasion. The sensitivity of the CT scan in detecting renal vein involvement is 78–79% [10].

Autorino et al. [18] performed a study of 192 patients to assess the need for adrenalectomy in these cases. He found that CT had a specificity of 92.9% and a negative predictive value of 99.4%. These data show that a normal appearance of the adrenals on CT scan correlates well with pathologic findings. On the other hand, positive CT results are less reliable with a positive predictive value of 91%.

Note that there were several limitations in this study that deserve to be mentioned. Note that our data represent a retrospective review of the results of a single center. Therefore, our results are subject to the inherent biases of a retrospective study. A prospective randomized study should be considered in order to confirm the results obtained. More importantly, our data represent a group of surgically treated patients; therefore, many patients were not included in the study, namely, cases with generalized metastases, and inoperable tumors.

4. Conclusion

The present study confirms the benefit of CT in renal tumor; it allows predicting the size of the tumor measured by anatomopathology. It proves the existence of a correlation between stage and histological type on the one hand and CT size on the other hand. It has been clearly demonstrated that the performance of the scanner in detecting capsular breaches, loco regional and lymphatic extension are satisfying.

Declaration of Competing Interest

The authors report no declarations of interest.

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Ethical approval

The study is exempt from ethical approval.

Consent

The consent of the patient has been obtained.

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Author contribution

Dr BAI walid, Dr fadil youssef, Dr chadli mohamed achraf: nous avons collaboré ensemble dans la rédaction et la correction de ce document.

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Registration of research studies

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