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REVIEW PAPER

Piotr Przyczyna [1(ABDFG)], David Aebisher [2(ABDFG)], Joanna Gustalik [3(ABDFG)], Sabina Galiniak [4(ABDFG)], Dorota Bartusik-Aebisher [4(ABDFG)], Ewa Kaznowska [3(ABDFG)]

Imaging studies of kidney cancer

[1] Clinical Department of Pathomorphology, Clinical Hospital No. 2, Faculty of Medicine, University of Rzeszów, Rzeszów, Poland
[2] Department of Photomedicine and Physical Chemistry, Faculty of Medicine, University of Rzeszów, Rzeszów, Poland
[3] Clinical Department of Pathomorphology, Clinical Hospital No. 1, Faculty of Medicine, University of Rzeszów, Rzeszów, Poland
[4] Department of Biochemistry and General Chemistry, Faculty of Medicine, University of Rzeszów, Rzeszów, Poland

ABSTRACT

Introduction. In 2017 in the USA about 5% in men and 3% in women newly diagnosed cases of malignant tumors were kidney and renal pelvis cancer.

Aim. Kidney cancer in adults includes malignant tumors derived from kidney parenchyma and renal pelvis. The dominating types are kidney parenchyma, and mainly renal cell carcinomas

Material and methods. This review was performed according to systematic literature search of three major bibliographic databases (Scopus, PubMed, and Cochran).

Results. Imaging studies play a very important role in kidney cancer. They allow one to assess the clinical stage, justify the extent of surgery and have an impact on the prognosis.

Conclusion. The field for research involves the use of magnetic resonance and positron emission tomography in diagnosing kidney changes.

Keywords. Kidney cancer, MRI, PET.

Introduction

The neoplasms of the calyx - pyelone system originating from the transitional epithelium constitute less than 10% of all kidney cancers.[1] The majority of kidney cancers in children are germline (Wilms' tumor), and its frequency is around 1.1%.[2] Small papillary adenomas of the renal cortex (less than 0.5 cm), found in 40% of people, have no clinical significance.[3] It is estimated that in 2017 in the USA about 5% in men (40,610 cases) and 3% in women (23,380) newly diagnosed cases of malignant

Corresponding author: David Aebisher, e-mail: daebisher@ur.edu.pl

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tumors were kidney and renal pelvis cancer.[4] Kidney cancer is characterized by a triad of symptoms: hematuria, palpable mass and pain in the side. Some patients may also experience anemia, weight loss, fever and varicocele.[5] Renal cell carcinoma in patients under 46 may indicate hereditary origins.[6] Due to the prevalence of imaging methods (especially computed tomography of the abdominal cavity and pelvis as well as ultrasound examination), the frequency of incidental detection of kidney cancer has increased.[7,8]

Material and methods

This article is based on an analysis of articles posted on three major bibliographic databases (Scopus, PubMed, and Cochran) and books.

Ultrasound

Incidentally detected kidney cancers are generally smaller, and are associated with a better prognosis than symptomatic tumors, regardless of grading and clinical stage.[9-10] Therefore, in recent times, interest in screening programs for this disease has increased.[11] In addition, the establishment of a screening program for abdominal aortic aneurysm in the United Kingdom, for men over 65 years, gave ideal conditions to verify the validity of this study. This is possible due to the fact that the risk factors and methods for detecting both diseases are similar.[12] Current data of the National Cancer Intelligence Network indicate that only 44% of patients with RCC are diagnosed in the first stage. About 10% of patients are diagnosed in stage II. Metastasis at diagnosis occurs in up to 25% of patients.[13] Meta-analysis suggests a positive shift in the severity of the population covered by the screening study.[14] Only 2% of patients had metastases or lymph node involvement at diagnosis. As many as 84.4% of tumors were detected in the T1-T2N0 stage and 13.7% in the T3-T4N0 stage. Ultrasound examination also has a dark side in the form of false positives. In one study, among 6,678 cases, 22 cases of kidney masses suspected of renal cell carcinoma were detected. However, despite additional CT examinations, only 15 of them had a positive histological diagnosis.[12] In addition, there are differences in the detection of kidney cancer depending on the geographical region.[15] Autopsy examinations of organ donors after the age of 65 showed renal cell carcinoma in 0.7-0.9%, which is more than in meta-analyzes.[14, 16, 17] Therefore, the incidence and histological evidence of kidney cancer may be underestimated. According to data among 1,000 patients examined, masses in the kidney will be detected in 4, of which at least one of them will be diagnosed with renal cell carcinoma.[12] For comparison, the NHS screening program of the abdominal aortic aneurysm shows 10 patients per 1000 examined patients with a change in size of 3 cm or more, of which only two undergo elective surgery.[18] The Bowel Cancer Screening Program in England shows 1.6 patients with colorectal cancer per 1000 people in the study[19] , and the Breast Cancer Screening Program has 8.3 patients with breast cancer per 1,000 women.[20] These numbers are much higher than in the screening project of kidney cancer, however, it is estimated that 15-25% of positive results in breast cancer screening are diagnosed.[21]

Computed tomography

Renal changes can be easily diagnosed by imaging tests and in many cases do not require histopathological verification.[22] However, complex cysts and cysts with a fixed component require more detailed characterization allowing for differential diagnosis, and then developing a therapeutic plan and prognosis.[23-26] In response to the above demand, in 1986, Bosniak developed a classification based on computed tomography. During the assessment, the following are taken into account: contours of change, content, presence of partitions and calcifications, as well as enhancement after giving contrast.[27-28] Changes in the kidneys are classified in terms of increasing malignancy as follows:

a) Bosniak I simple - the majority of changes detected in the kidneys. The changes qualified for this group are always mild, without the possibility of malignancy and do not require further diagnosis[27]

b) Bosniak II minimally complicated - these changes, like in the first category, are considered to be mild, but may have some disturbing features. However, during histopathological examination, changes in this category have been included in the group of potentially malignant or malicious changes.[29-30]

c) Bosniak IIF - minimally complicated follow-up - included in the classification in 1993.[31,32] These changes do not meet the criteria for inclusion in Group III, and at the same time are more complex than in Group II. Their differentiation is subtle and difficult, and also has a high degree of variability between the described research. However, taking into account variability in the clinical process, it is clinically relevant.[33-34]

d) Bosniak III indeterminate - this group contains lesions with mild and malignant differentiation, which cannot be reliably assessed by imaging. Therefore, there is a significant risk of malignancy. The histopathologically corrected lesions are classified as malignant in 31% to 100% of cases.[34]

e) Bosniak IV cystic neoplasm - the percentage of malignant tumors of these lesions ranges from 95% to 100%. Differentiation between categories III and IV can be difficult but is not essential, as both of these categories require surgical removal.[35]

Magnetic Resonance Imaging

In clinical practice, magnetic resonance imaging is used to assess lower vena cava infiltrate and clinical stage in contrast-sensitized patients with renal failure or metas-

tases.[36-37] The problem of using magnetic resonance imaging in kidney changes is the use of the Bosniak scale by radiologists, which was created to describe computed tomography images. In this test, additional baffles may be visible, otherwise reinforced with contrast, and the thickness of the walls may be different than in tomography. In some cases this leads to overstating the scale and differences in the proceedings[35]

Positron emission tomography

Currently, positron emission tomography alone is not normally used to assess the clinical stage or to look for recurrences in renal cancer.[38] Post-operative surveillance is also controversial because there is no level 1 evidence that early intervention improves survival.[39] On the other hand, it was shown that the initial value of F-18 fludeoxyglucose (FDG) uptake correlates with the forecast.[40-41]

Conclusion

The field for research involves the use of magnetic resonance and positron emission tomography in diagnosing kidney changes.

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