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Uncommon muscle metastatic sites of renal cell carcinoma

Мишићне метастазе карцинома бубрежних ћелија

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SUMMARY

Introduction Renal cell carcinoma (RCC) is the most common malignant renal tumor. It has a tendency for spreading to unusual and distant sites, such as: orbit, paranasal sinuses, thyroid gland, heart, skin and muscles. Skeletal muscle metastases are accounting for only 0.4% of all metastatic localizations. Following the CT, they may be presented in five different radiology types of lesions.

The aim of our case was CT evaluation of rare skeletal muscle metastatic localizations of RCC, following the time interval of their occurrence in relation to the appearance of the primary tumor, with emphasis on metastases in levator ani muscle, since this metastatic localization of RCC has not been recorded in the previous literature.

Case outline We present a 66-year-old man after partial nephrectomy, due to a primary diagnosis of RCC. Three years after the initial diagnosis, multiple distant metastases were verified at typical localizations as well as rare localizations such as in muscles, including levator ani.

Conclusion Advanced metastases in uncommon locations are most often accompanied by a poor prognosis, therefore the further algorithm includes monitoring the whole clinical and radiological status. Metastases in the levator ani muscle were recorded for the first time in this report. Taking into account that this muscle has very important functions, such as supporting and raising the pelvic visceral structures, as well as having control of the flow of urine and defecation, it is of great importance to include this localization in the CT evaluation.

Keywords: muscle neoplasms; kidney neoplasms; computed tomography; levator ani muscle

САЖЕТАК

Увод Карцином бубрежних ћелија (RCC) је најзаступљенији малигни тумор бубрега. Осим ширења на уобичајене локализације - супротан бубрег, надбубрежне жлезде, плућа, јетру, мозак, коштани систем, показује тенденцију ка појави удаљених метастаза на ретким местима, као што су: орбита, параназални синуси, штитаста жлезда, срце, кожа и мишићи. Појава метастаза у скелетним мишићима је изузетно ретка, чинећи свега 0,4% свих метастатских локализација. Метастазе у скелетним мишићима, праћене на компјутеризованој томографији (CT), могу се презентовати у пет радиолошких типова лезија, а у нашем раду најзаступљенија лезија је по другом типу - „интрамускуларна лезија налик апсцесу“. Циљ нашег рада је била CT евалуација ретких локализација метастатских лезија RCC-а у скелетним мишићима, пратећи временски интервал њиховог настанка у односу на појаву примарног тумора, са акцентом на метастазе лоциране у *m. levator ani*, будући да ова метастатска локализација RCC-а није евидентирана у досадашњој литератури.

Приказ болесника У овом раду представили смо мушкарца, у доби од 66 година, са карциномом бубрежних ћелија десног бубрега. Три године после поставке иницијалне дијагнозе, евидентиране су удаљене метастазе, на типичним, али и на ретким локализацијама - скелетним мишићима, укључујући и *m. levator ani*.

Закључак Уснапредовале метастазе на нетипичним локализацијама најчешће су праћене лошом прогнозом, па је битно у наставку лечења вршити како дијагностичку, тако и клиничку евалуацију. У овом приказу је први пут евидентиран *musculus levator ani* као ретка метастатска локализација. С обзиром на важне физиолошке функције овог мишића, као што су контрола мокрења и дефекације и подржавање пелвичних висцералних структура, ова локализација би требало увек да буде обухваћена CT евалуацијом.

Кључне речи: мишићне метастазе; неоплазма бубрега; компјутеризована томографија; *musculus levator ani*

INTRODUCTION

Renal cell carcinoma (RCC) is the most common malignant renal tumor with common metastatic spreading to: lymph nodes, lungs, liver, opposite kidney, adrenal glands, brain, and bones. Nevertheless, it was noticed that the RCC may expose unusual and distant sites of metastases, such as orbit, paranasal sinuses, thyroid gland, heart, skin, and muscles [1].

However, skeletal muscle metastases (SMM) occur extremely rare, accounting for 0.4% of all metastatic sites [2]. According to literature data, the average interval between the primary diagnosis of RCC and the first SMM is 32 months [3].

For the first time, according to former literature data, we noticed metastases in the levator ani muscle (Figure 1). The levator ani muscle consists of the confluence of three muscles: pubococcygeus, puborectalis, and iliococcygeus muscles. The function of levator ani is to support and raise the pelvic visceral structures. Furthermore, it helps to manage mechanical pressures during movement and assists during respiration. Besides, the levator ani muscle through the pubococcygeal muscle, as its inferior medial part, controls the flow of urine, as well as defecation and proper sexual functioning [4, 5, 6].

Following computed tomography (CT), SMM may be presented in five different radiological types of lesions [1, 7]. In our case, type II is the most common, presented as central low attenuation with rim enhancement as it occurs in levator ani (Figure 1).

The aim of this report was CT evaluation of unusual localisations of metastatic lesions of RCC, such as those in skeletal muscles, due to the interval of their appearance in regard to the occurrence of the primary tumor, with an accent on metastases located in levator ani muscle, since this metastatic site of RCC, was not noticed in former literature data.

CASE REPORT

We present the 66-year-old male with a primary diagnosis of clear cell renal cell carcinoma (ccRCC, Fuhrman grade II–III), initially verified four years ago. The patient underwent a partial nephrectomy of the right kidney. Three years after the initial diagnosis, the patient manifested clinical exacerbations: dizziness, headaches, vomiting, and postural instability, as a consequence of brain metastases. Consequently, body CT and head CT exams verified distant metastases for the first time, in the left adrenal gland, left kidney, lung, brain, and in muscles (Table 1): left levator ani muscle, right thyrohyoid muscle, erector spine muscle [at the level of sixth and seventh cervical vertebrae; at the level of eight thoracic vertebrae; at the level of the first lumbar vertebrae, as well as fourth lumbar vertebrae and near the right sacroiliac joint (Figure 2a)]; left iliac muscle, right adductor magnus muscle and in right gluteus maximus muscle.

Due to the brain metastases, the patient underwent osteoplastic decompressive craniotomy occipitally left, toward tumor extirpation. Therapy continued with radiosurgery procedures (gamma knife).

The multidisciplinary tumor board determined targeted therapy treatment of *pazopanib* due to metastatic disease of RCC.

From that time, CT exams were performed every three months. After nine months, next to the ninth targeted therapy treatment, additional CT was done and new sites of muscle metastases were detected: in the erector spine muscle, at the level of the fifth lumbar vertebra, and in the costal part of the right diaphragm. Besides, all earlier metastases persisted, with the sign of progression in size (Figure 1a).

The last CT exam was done next to twelve targeted therapy treatment when the new sites of metastases were reported: one more lesion in the right thyrohyoid muscle and one lesion in the right erector spine muscle at the level of the ninth thoracic vertebrae. Above and beyond, all earlier verified lesions exhibited progression in size (Table 1, Figures 1b, 1c, 2b).

Magnetic resonance imaging was not performed, due to the patient's metallic foreign body. The multidisciplinary tumor board did not determine the biopsy of muscle metastases, taking into account the synchronic appearance of other distant metastases, as well as small sizes of muscle lesions, which manifested neither compressive effects nor clinical manifestations.

The authors declare that the article has been written in accordance with ethical standards of the Serbian Archives of Medicine as well as ethical standards of medical facilities for each author involved. No personal data of the patient were presented in the manuscript.

DISCUSSION

This case report presents rare distant skeletal metastases of RCC, including those in the levator ani muscle, which are shown for the first time.

At the time of discovery, about 16% of patients with RCC had distant metastases; around 25% of patients with localized RCC ended up having distant metastases after the nephrectomy, while skeletal muscles are extremely rare, accounting for 0.4% in all metastatic sites [1, 2]. In our case, distant metastases, including those in skeletal muscles, occurred 43 months after primary diagnosis and partial nephrectomy, which is more than the previously described average time of appearance of the first SMM, which was 32 months [3].

SMM from carcinomas are commonly located in the axial region of the body. This is of particular importance to distinguish these lesions in muscles from primary soft-tissue neoplasms [8]. We reported spinal erectors, iliac muscle, adductor magnus muscle, gluteus maximus muscle, and levator ani muscle, as the most often localizations of muscle metastases, which is in accordance with previous data [3].

Although skeletal muscles represent 50% of total body mass, metastasis to these sites is very rare due to some homeostatic conditions, such as high concentration of lactate, which prevents neovascularization of metastatic deposits [8, 9].

The most common way of SMM dissemination is hematogenous. Nevertheless, spreading also has been described to occur through venous vessels, e.g. the paravertebral venous plexus, intramuscular aberrant lymph nodes as well as through perineural spread [10]. Accordingly, the occurrence of metastases in paravertebral muscles could be explained by dissemination through the paravertebral venous plexus.

Contrary to the previous explanation, alteration of the normal protective environment, such as trauma, can make these sites suitable for developing metastatic deposits. Trauma is thought to cause focal hyperemia, with an increase in blood flow and releasing growth-promoting factors, that can trap circulating tumor cells and induce metastatic seeding [11].

By literature data, there are presented five types of muscle metastases: focal intramuscular masses (type I), abscess-like intramuscular lesions (type II), diffuse metastatic muscle infiltration (type III), multifocal intramuscular calcification (type IV), and intramuscular bleeding (type V) [7]. In up to 83% of cases, the most common CT presentation occurs as a discrete rim-enhancing lesion with a central hypodense area, which matches with type II [12]. In our case, this is the most common type of CT presentation as well, with the exception of oval-shaped lesions, with homogenous enhancement in the right adductor magnus muscle and in the right gluteus maximus muscle, which correspond with type I (Figure 3a). In the left iliac muscle, the lesion exhibits characteristics of both type II and III, abscess-like intramuscular lesion combined with muscle swelling (Figure 3b).

The pubococcygeal muscles form the inferior medial part of the levator ani muscle and control the flow of urine, as well as defecation and proper sexual functioning [4, 5, 6]. In our case, in the left pubococcygeal muscle is a rim-enhanced lesion, which looks like other lesions with radiology type II (Figure 1). Taking into account all previous stated functions of the

levator ani muscle, we regard that it is of great importance to include this localization in consideration during the CT monitoring of metastases of RCC.

Due to the rarity of muscle metastases, it is important to notice the value of MRI, in the order to distinguish primary soft tissue tumors from metastatic tumors, as it is reported previously [7]. Nevertheless, biopsy still remains the gold standard to diagnose and differentiate RCC metastasis from other soft tissue tumors [2].

Taking into account that the metastases in the skeletal muscles are usually painless and have a small size, they can remain asymptomatic for a long time and often be detected when they reach a large size [13]. Nonetheless, in our case, all muscle metastases were reported as accidental and asymptomatic, probably due to their small size and absence of compressive effects on the nearest structures, except recurrent rectal pain and hemorrhoids likely resulted from the compressive effect of the mass on the levator ani muscle.

Patients with RCC with metastasis to rare sites most often have advanced cancers with poor prognoses [1]. At the moment when the muscle metastases were verified initially in our case, other distant metastases, including those in the brain, already existed. Especially, we would like to underline the significance of the appearance of levator ani muscle metastases, reported for the first time according to literature, due to its important physiological functions and to include this localization in consideration during the CT evaluation.

The further algorithm includes monitoring the whole clinical and radiological status, due to administrated targeted therapy, along with the size and possible occurrence of new muscle metastases.

Conflict of interest: None declared.

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Table 1. Localization of skeletal muscle metastases of renal cell carcinoma with the size of the lesions during a one-year period between CT when muscle metastases were discovered for the first time (October 2021) and at the newest CT exam (October 2022)

Site	Size of the lesion (October 2021)*	Size of the lesion (October 2022)*	Increasing volume of the lesion (Oct. 2021 – Oct. 2022)
Levator ani ^Ψ	17 × 11 × 13 mm	26 × 18 × 22 mm	4.23 its size
Thyrohyoid	10 × 8 × 10 mm 7 × 6 × 5 mm / ^λ	11 × 13 × 19 mm 16 × 13 × 16 mm 12 × 8 × 10 mm	3.39 its size 15.85 its size / ^λ
Erector spine			
C6–C7:	25 × 14 × 30 mm	35 × 32 × 41 mm	4.37 its size
Th8–Th9:	10 × 10 × 38 mm	23 × 14 × 55 mm	4.66 its size
Th9:	/ ^λ	8 × 6 × 15 mm	/ ^λ
L1:	9 × 13 × 14 mm	15 × 18 × 31 mm	5.11 its size
L4:	5 × 7 × 4 mm	10 × 13 × 19 mm	17.64 its size
L5:	/ ^λ	12 × 19 × 20 mm	/ ^λ
Sacroiliac joint:	8 × 17 × 26 mm	24 × 37 × 53 mm	13.3 its size
Diaphragm	/ ^λ	14 × 15 × 14 mm	/ ^λ
Iliacus	16 × 10 × 15 mm	20 × 10 × 16 mm	1.33 its size
Adductor magnus	17 × 15 × 23 mm	29 × 24 × 37 mm	4.39 its size
Gluteus maximus	11 × 5 × 12 mm	12 × 25 × 13 mm	5.91 its size

^ΨFor the first time reported lesion in this muscle in accordance with the literature;

*(AP × LL × CC, anteroposterior × laterolateral × craniocaudal);

^λlesion was not detectable on the first CT exam (October 2021)



Figure 1. (a) Type II lesion, presented as central low attenuation with rim enhancement, (arrow) in the levator ani muscle, next to the ninth targeted therapy – $20 \times 13 \times 20$ mm ($AP \times LL \times CC$) and progression of the same lesion three months later – $26 \times 18 \times 22$ mm ($AP \times LL \times CC$) in (b) axial (arrow), and (c) coronal plane (arrow)



Figure 2. Coronal contrast-enhanced CT metastatic lesion in erector spine muscle near the right sacroiliac joint **(a)** initial finding (*arrows*) – $8 \times 17 \times 26$ mm (*AP* \times *LL* \times *CC*), and **(b)** same lesion in progression on the last CT – $24 \times 37 \times 53$ mm (*AP* \times *LL* \times *CC*) (*arrows*), which is 13.3 times greater than the initial CT, making it one of the largest progressions among the recorded lesions

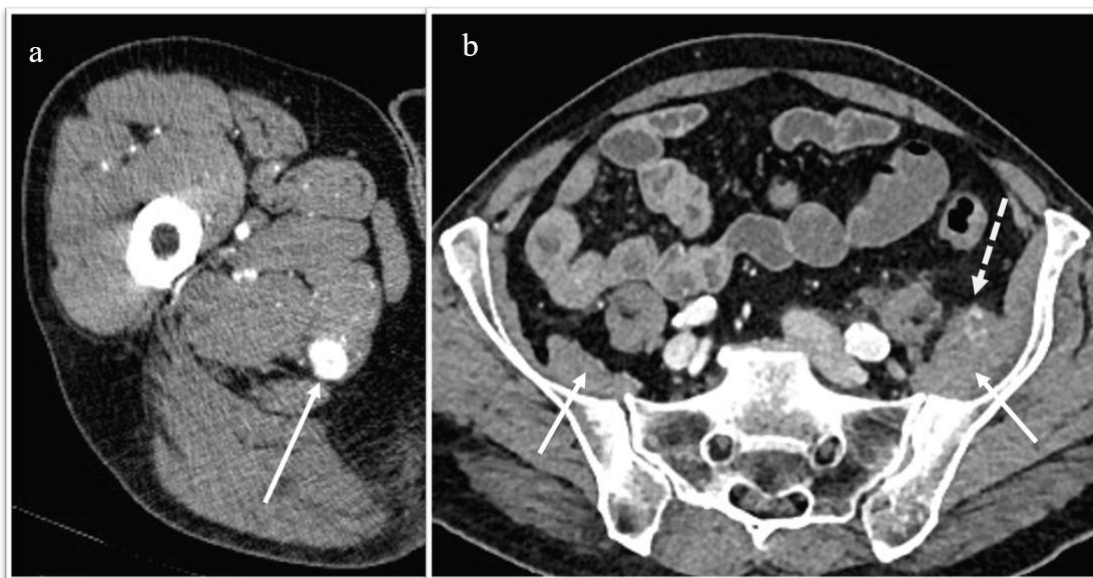


Figure 3. Axial contrast-enhanced CT metastatic type I lesion, presented as oval-shaped lesions, with homogenous enhancement (a) in the right adductor magnus muscle (*arrow*), (b) type II lesion (*dotted arrow*), and type III (*arrow*) in the left iliac muscle; the right iliac muscle without any type of metastases (*arrow*)