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OPIS PRZYPADKU
CASE REPORT

Detection of liver metastases by abbreviated MRI protocol in patient with pNET and severe chronic kidney disease

Wykrywanie przerzutów do wątroby za pomocą skróconego protokołu MRI u pacjentki z pNET i ciężką przewlekłą chorobą nerek

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ABSTRACT

The detection of liver metastases at an early stage is crucial to improve patients' survival. Pancreatic neuroendocrine tumors (pNETs) and their metastases usually present as early and vividly enhancing tumors on contrast enhanced computed tomography (CECT). However, the use of contrast agents is a contraindication in patients with severely impaired kidney function. The incidence of chronic kidney disease (CKD) and malignancies increase with age, making both the treatment and imaging diagnostics a complicated process in an oncological setting among elderly patients.
This case report presents the diagnostic path of an elderly patient with a long history of pNET, who developed severe CKD during treatment. The patient was diagnosed with metastatic liver disease in PET/CT and it was confirmed by an abbreviated magnetic resonance imaging (AMRI) protocol without contrast enhancement, while CECT did not show the presence of metastases. AMRI protocols without contrast enhancement can provide sufficient information about the presence of metastatic liver disease in oncological patients with comorbid CKD.

KEYWORDS

abbreviated MRI, cancer, pancreatic neuroendocrine tumor, liver metastases, metastases surveillance

STRESZCZENIE

Wykrycie przerzutów do wątroby we wczesnym stadium choroby ma kluczowe znaczenie dla poprawy przeżycia pacjentów. Guzy neuroendokrynne trzustki (*pancreatic neuroendocrine tumors* – pNETs) i ich przerzuty zwykle ujawniają się jako wcześnie i silnie wzmacniające się zmiany ogniskowe w tomografii komputerowej z kontrastem (*contrast enhanced computed tomography* – CECT). Jednak stosowanie dożylnych środków kontrastowych jest przeciwwskazane u pacjentów z ciężkimi zaburzeniami czynności nerek. Częstość występowania przewlekłej choroby nerek (*chronic kidney disease* – CKD) i nowotworów złośliwych wzrasta z wiekiem, co sprawia, że zarówno leczenie, jak i diagnostyka obrazowa są skomplikowanym procesem u starszych pacjentów chorych onkologicznie.

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W niniejszym opisie przypadku przedstawiono ścieżkę diagnostyczną starszej pacjentki z długą historią pNET, u której w trakcie leczenia rozwinęła się ciężka CKD. U pacjentki rozpoznano przerzuty do wątroby w badaniu PET/CT, co potwierdzono skróconym protokołem rezonansu magnetycznego (*abbreviated magnetic resonance imaging* – AMRI) bez wzmocnienia kontrastowego, natomiast CECT nie wykazała przerzutów. Protokoły AMRI bez wzmocnienia kontrastowego mogą dostarczyć wystarczających informacji na temat obecności choroby przerzutowej wątroby u pacjentów leczonych onkologicznie ze współistniejącą CKD.

SŁOWA KLUCZOWE

skrócony protokół MRI, rak, guz neuroendokrynny trzustki, przerzuty do wątroby, diagnostyka przerzutów

INTRODUCTION

Choosing the right cancer therapy requires careful assessment of the presence of metastases. Their effective detection at an early stage is crucial to improve patients' survival by adjusting the treatment to the stage of the disease [1]. The liver is the second organ most frequently affected by metastases, which also are the most common hepatic malignancy [2]. Periodic liver imaging, e.g. with ultrasound (US) or contrast enhanced computed tomography (CECT), facilitates the early detection of metastases. However, in some cases metastatic disease might not be seen as morphologically evident focal lesions, especially in hypovascular tumors. Magnetic resonance imaging (MRI) is highly sensitive in detecting malignancies without exposing the patient to X-rays, but due to the lengthy image acquisition process, it has limited availability [3]. Abbreviated MRI (AMRI) protocols save time without sacrificing diagnostic sensitivity, while the lack of intravenous contrast allows patients with contraindications to contrast agents to be examined, including those with severe chronic kidney disease (CKD) [3].

CASE REPORT

A 74-year-old woman was diagnosed with a G2 pancreatic neuroendocrine tumor (pNET) in 2007. The patient had a radical resection of the body and tail of the pancreas with splenectomy the same year. Since the diagnosis the patient had had hormonal, biochemical and imaging examinations performed periodically, including ^{68}Ga DOTA-TATE positron emission tomography (PET), CT and MRI. In 2010 PET/CT revealed the presence of foci with increased somatostatin receptor expression in the liver and lymph nodes, suggestive of metastatic disease. She received 4 cycles of radioisotope treatment with ^{90}Y/^{177}Lu-DOTA-TATE in 2010, followed by 2 additional cycles in 2016 after second progression and continuously received somatostatin analogs. The patient also had a history of diabetes type 2 and in 2017 she developed stage 3 CKD that further deteriorated to stage 4 in 2021. Decreased renal function may have resulted from diabetes as well as the oncological treatment and previous intravenous use of iodinated contrast. The liver metastases remained stable until 2021 when multiple new foci were seen in PET. CTs performed throughout the investigation time, with contrast enhancement until 2018 and without contrast since 2019, did not show signs of metastatic lesions. US examinations were inconclusive. The first abdominal MRI was performed in 2021 as an alternative to non-contrast-enhanced CT (NCECT). The AMRI results corresponded to all the PET/CT findings. Figure 1 presents the sensitivity in detecting the metastases by different imaging modalities on a time axis since the diagnosis.

The abbreviated MRI protocol took 16 minutes and consisted of T1 (with in-phase and opposed-phase), T2 half-Fourier single-shot turbo spin-echo (HASTE), T2 HASTE short tau inversion recovery (STIR) as well as diffusion-weighted imaging (DWI) and apparent diffusion coefficient (ADC) sequences. It showed several focal lesions in the liver with low signal intensity in T1 weighted images (T1W), heterogeneously increased signal intensity in T2W and significant diffusion restriction. Figure 2 shows two lesions of different size in all the AMRI sequences. The location of the largest of the lesions is visible on the NCECT and PET/CT examinations in Figure 3.

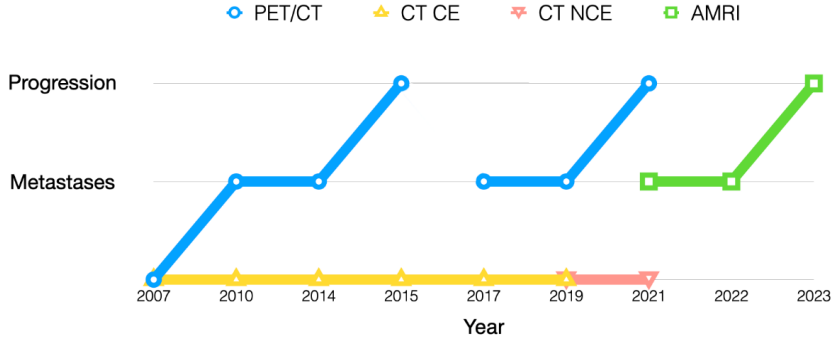

Fig. 1. Sensitivity of different imaging modalities in detecting liver metastases and their progression.

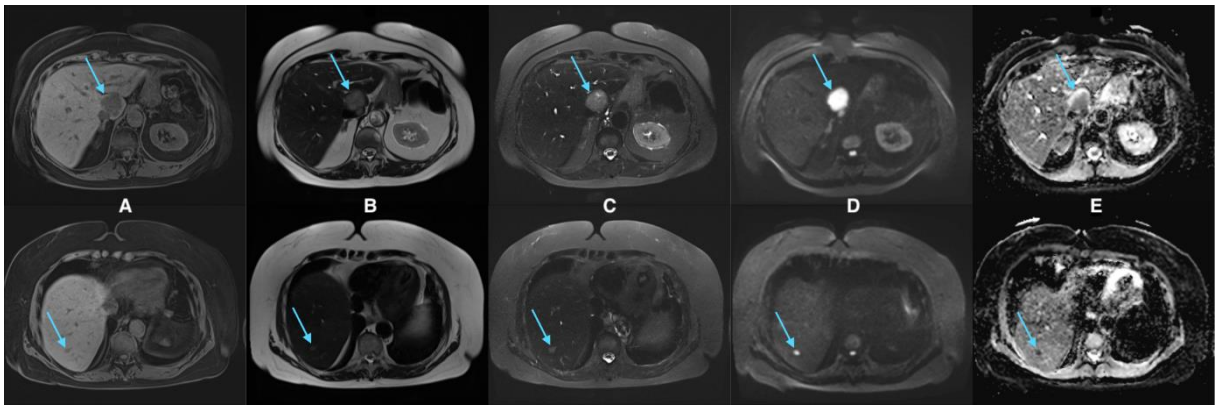

Fig. 2. AMRI protocol presenting liver metastasis (blue arrow) characteristics seen in T1 (A), T2 (B), T2 STIR (C), DWI b800 (D) and ADC (E) sequences.

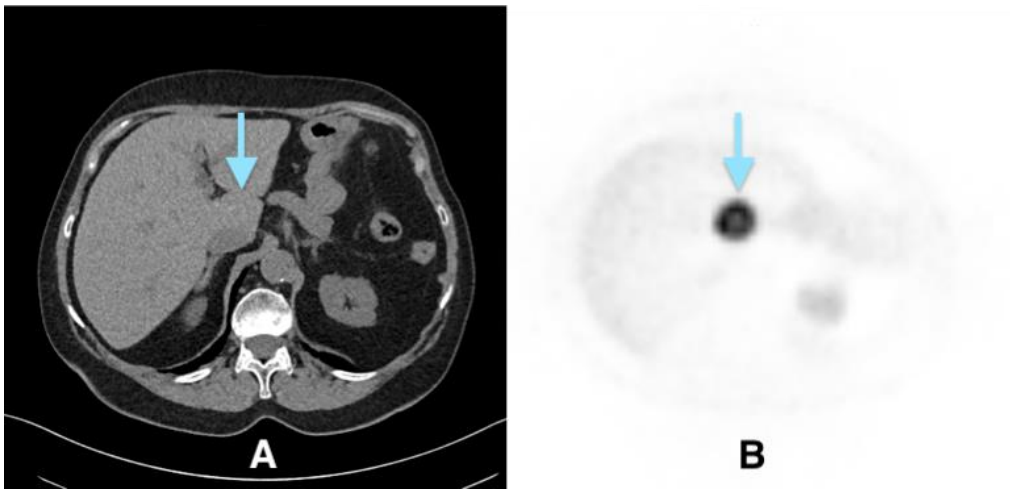

Fig. 3. Patient's NCECT (A) and PET (B) examinations. No morphological signs of metastasis (blue arrow) on NCECT, while significant radiotracer uptake is seen on ^{68}Ga PET/CT.

Three consecutive AMRI examinations revealed no significant changes until progression occurred in February 2023. In May 2023, by the decision of the tumor board the patient received stereotactic radiotherapy targeted on metastatic lesions in the liver and is being supervised to this day.

DISCUSSION

NETs are histopathologically diverse and rare tumors with an incidence of 0.5–1 in 100,000 people per year and only 10% of them have pancreatic origin [4]. The most sensitive and specific method in the detection of NETs is functional imaging with gallium (Ga^{68}) PET. Although CECT and MRI are slightly less sensitive, they provide a detailed anatomic definition, which is necessary to assess their resectability. pNETs and their metastases usually present as early and vividly enhancing tumors, and therefore are best appreciated in arterial phases [4,5]. Nonetheless, in some cases they may be seen as hypovascular lesions, undetectable on CECT, which in this case may have been a result of complex, long-term treatment.

The usefulness of AMRI protocols in the detection of malignant liver lesions has been discussed earlier in detail [6,7]. Apart from its high sensitivity to detect liver metastases and no radiation exposure, AMRI protocol requires an amount of time similar to that of a CT scan. The examination time of the mentioned protocol was 16 minutes compared to 30–40 minutes for a full abdominal MRI protocol, depending on the type of scanner, and could be further reduced by avoiding the acquisition of T1W and T2W sequences in both the transverse and coronal planes. The use of abbreviated protocols in an oncological setting could enable efficient workflow, providing easier access to MRI examinations and making it a good alternative to a less sensitive CT.

The incidence of CKD, like cancer, increases with age. Severe CKD complicates both oncological treatment and diagnostic imaging [8]. This case illustrates the utility of AMRI in oncological patients with concomitant CKD and the possible broader use of this

diagnostic tool while screening for metastases in the treatment planning process or before oncological surgeries. Nevertheless, contraindications to MRI should be kept in mind, including the presence of older electrostimulation devices, such as pacemakers and ferromagnetic metals like orbital metallic foreign bodies or vascular stents in the early period after implantation.

CONCLUSIONS

An abbreviated MRI protocol consisting of T1W, T2W, T2 with fat saturation and DWI sequences, without contrast enhancement, can provide fast and sufficient information about the presence of metastatic liver disease in oncological patients with concomitant CKD.

Conflict of interest

None declared.

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Author's contribution

Study design – M. Winder
Manuscript preparation – M. Winder, K. Steinhof-Radwańska
Literature research – M. Winder
Final approval of the version to be published – M. Winder, K. Steinhof-Radwańska

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