Somatostatin receptor PET/CT scan as a helpful diagnostic tool for optic nerve sheath meningioma

K. Mairot, N. Sahakian, B. Salgues, N. Levy, P. Gascon, D. Denis

Journal Français d'Ophtalmologie

Somatostatin Receptor PET/CT scan as a helpful diagnosis tool of optic nerve sheath meningioma

--Projet de manuscrit--

Numéro du manuscrit:	JFO-D-20-00794R1
Type d'article:	Lettre à l'éditeur
Auteur correspondant:	Kevin Philippe Mairot Marseille, FRANCE
Premier auteur:	Kevin Philippe Mairot
Ordre des auteurs:	Kevin Philippe Mairot
	Nicolas Sahakian
	Betty Salgues
	Natanael Levy
	Pierre Gascon
	Danièle Denis
Évaluateurs suggérés:	
Réponse aux évaluateurs:	

Figure 1

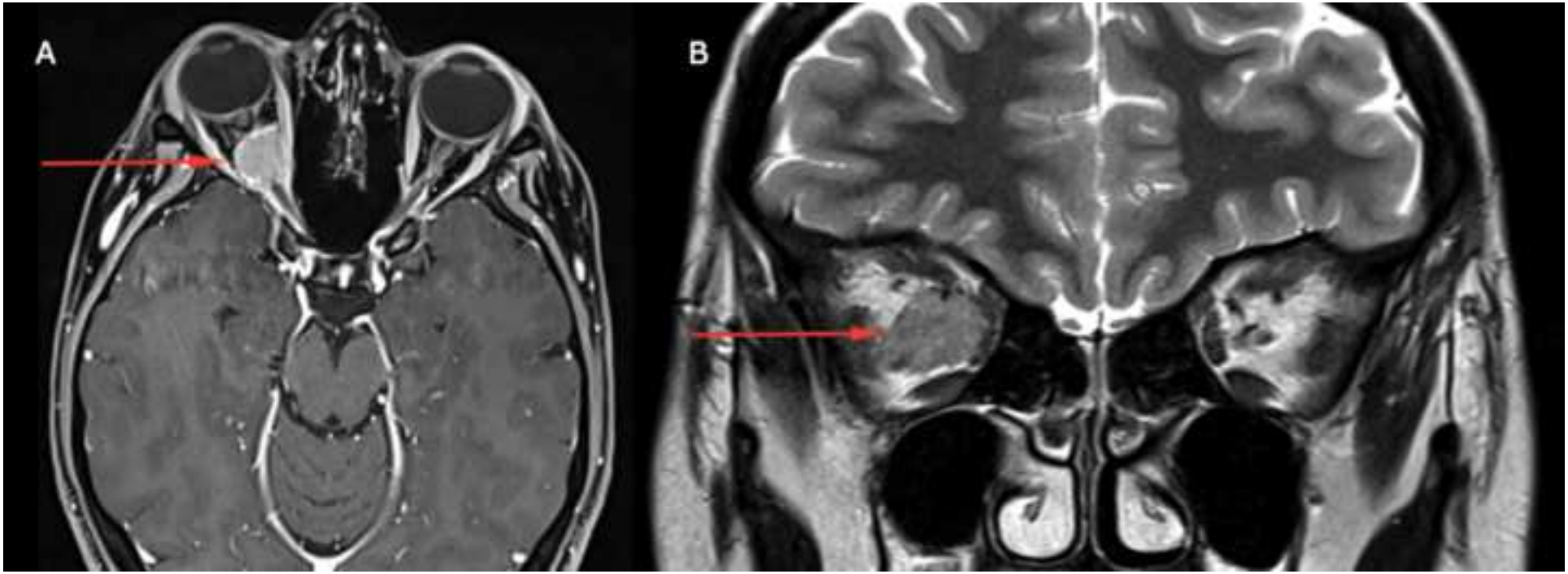
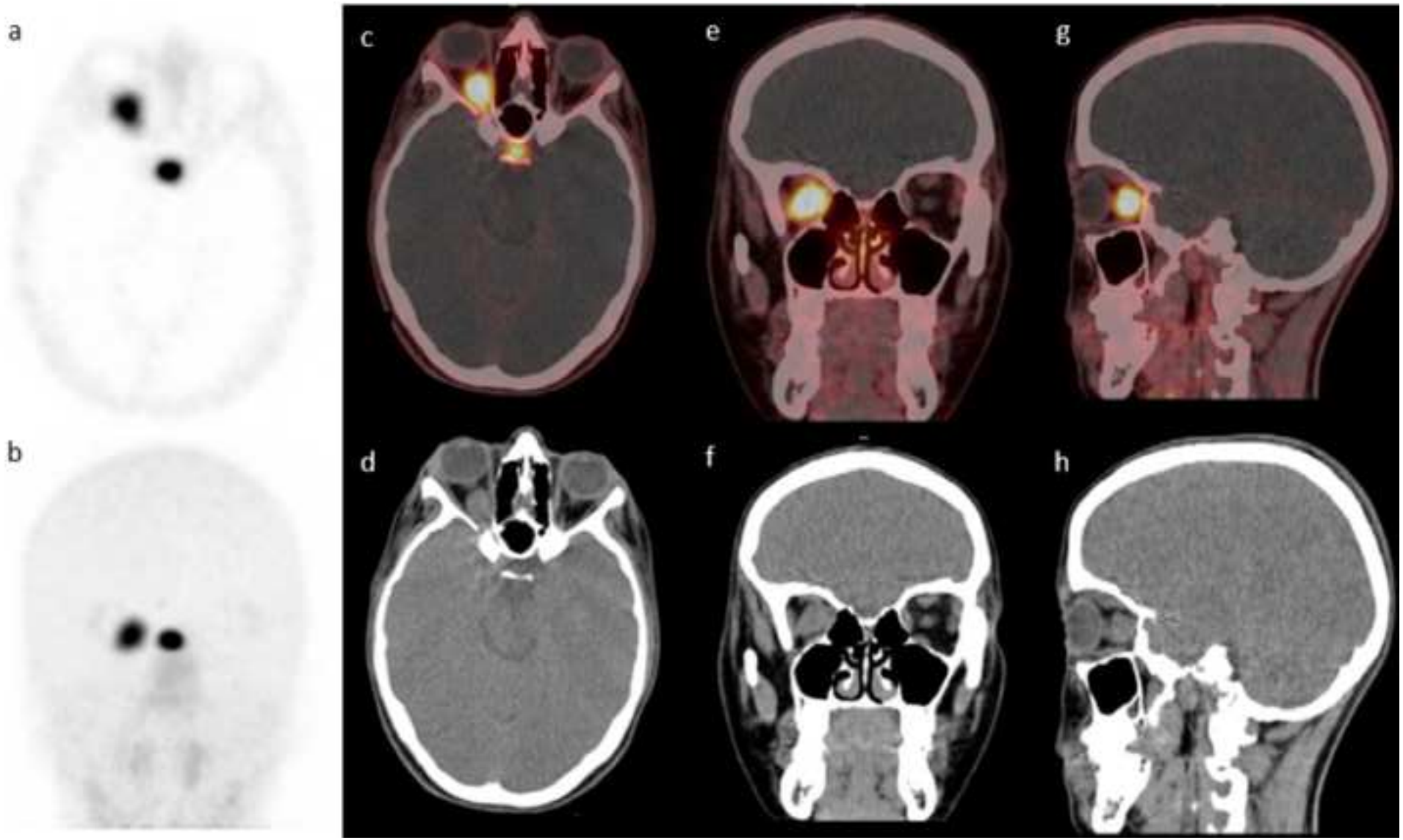


Figure 2

Click here to access/download;Figure;figure 2.tiff



Somatostatin receptor PET/CT scan as a helpful diagnostic tool for optic nerve sheath meningioma

La TEP des récepteurs à la somatostatine : une aide au diagnostic des méningiomes de la gaine du nerf optique

K. Mairot*[a], N. Sahakian[b], B. Salgues[c], N. Levy[a], P. Gascon[a], D. Denis[a]

[a]Service d'ophtalmologie, centre hospitalier universitaire de l'hôpital Nord, Chemin des Bourrely, 13015 Marseille, France.

[b]Médecine nucléaire, centre hospitalier universitaire de l'hôpital Nord, Chemin des Bourrely, 13015 Marseille, France.

[c]Médecine nucléaire, groupe hospitalier Pitié-Salpêtrière-Charles Foix, Sorbonne université, Paris, France.

*Corresponding author.

E-mail address: kevinmairot@gmail.com (K. Mairot).

Titre courant : Somatostatin receptor PET scan as a helpful diagnostic tool for ONSM

Somatostatin receptor PET/CT scan as a helpful diagnostic tool for optic nerve sheath meningioma

La TEP des récepteurs à la somatostatine : une aide au diagnostic des méningiomes de la gaine du nerf optique

Introduction

Meningiomas represent one third of brain tumors and occur commonly in middle-aged and elderly female patients [1]. Optic nerve sheath meningiomas (ONSMs) account for 3% of meningiomas and 30% of all primary optic nerve tumors [2]. Varied diagnostic methods have been used to aid in the diagnosis of orbital tumors. Usually MRI and scan are sufficient to make the final diagnosis, and no further tests are needed. It remains difficult to make the diagnosis in some cases, and alternative diagnostic strategies are needed to avoid an invasive orbital biopsy.

Here we present a case of use of a somatostatin receptor PET/CT scan (^{68}Ga-DOTATOC PET/CT scan) for non-invasive diagnosis of an orbital tumor.

Case presentation

A 17-year-old girl was referred for a painless progressive loss of vision in the right eye (OD). Her past medical history included surgery for appendicitis and scoliosis. She had no treatment.

Best corrected visual acuity was 20/25 OD and 20/20 OS. The pupil exam showed a right relative afferent pupillary defect. Extraocular eye movements, saccades and pursuit were normal with no nystagmus. The anterior segment was normal. The right fundus examination revealed a marked optic disc edema. The left eye was normal. The kinetic visual field charting showed right-sided inferonasal scotoma while the left eye was normal.

In the first line, orbital MRI with contrast showed widening and winding of the right optic nerve and a mass lesion with iso-signal on T2 sequences and T1-weighted images. The lesion enhanced after gadolinium injection with no white matter lesion (Fig. 1). Gadolinium enhancement of the lesion was not typical of a meningioma, and a glioma of the optic nerve could not be formally ruled out. Secondary, a ^{68}Ga-DOTATOC PET/CT scan was performed, and showed an intense radionuclide uptake in the orbit tumor, greater than the liver, indicating high expression of somatostatin receptors in this tumor. No other pathological uptake areas were observed (Fig. 2). In view of the morphological aspect of the tumor and the intense expression of somatostatin receptors, the patient was diagnosed with optic nerve sheath meningioma.

Discussion

ONSMs are a rare cause of loss of vision, which means the diagnosis without delay can be challenging. Common initial misdiagnoses include optic neuritis, or clinician assessment failures, attributing the loss of vision to a coexisting ocular disease. Another cause is a misinterpretation of MRI results, either because the radiologists were not trained in neuroradiology or because the requested tests did not include orbital images [3]. Although MRI findings are sensitive and specific, histopathology remains the gold standard. However, optic nerve biopsy may lead to a considerable visual morbidity [4] and is commonly avoided. Somatostatin (SST) is a neuropeptide acting through five somatostatin receptors subtypes (SSTR1–SSTR5). Meningiomas have a high SSTR2 density and can be targeted and visualized with radiolabeled SST analogs. Somatostatin receptor scintigraphy using ^{111}In-DTPA-pentetreotide (^{111}In-octreotide) has already been shown to be helpful for detecting

ONSMs, with 97% specificity and 100% sensitivity [5]. However, it has limitations related to unfavorable patient dosimetry and low-resolution images.

Accordingly, higher-affinity somatostatin analogs binding to SSTR are designed, labeled with radioisotopes presenting a more favorable dosimetry such as 68-gallium, a positron emitter, offering higher resolution when using PET/CT technology. Three ^{68}Ga-DOTA-conjugated SST analogs have been mostly described: ^{68}Ga-DOTA0-[Tyr3]-octreotide (^{68}Ga-DOTATOC), ^{68}Ga-DOTA0-1-NaI_3-octreotide (^{68}Ga-DOTANOC) and ^{68}Ga-DOTA0-[Tyr3]-octreotate (^{68}Ga-DOTATATE). They all bind with high affinity to SSTR2. A study showed that ^{68}Ga-DOTATATE PET/CT scan demonstrated both a sensitivity and specificity of 100% for detecting ONSMs [6]. Also, ^{68}Ga-DOTA-SSTa PET/CT scan has a higher sensitivity than MRI for the detection of active tumor tissue in untreated and recurrent meningioma. This sensitivity improves the diagnosis of recurrence and the precision of the target volume delineation for radiation treatment planning [1].

Conclusion

This case demonstrates that ^{68}Ga-DOTATOC PET/CT scan is a useful diagnostic tool for the correct diagnosis of equivocal tumors of the optic nerve.

Disclosure of interest

The authors declare that they have no competing interest.

References

[1] Galldiks N, Albert NL, Sommerauer M, Grosu AL, Ganswindt U, Law I, et al. PET imaging in patients with meningioma – Report of the RANO/PET Group. Neuro-Oncol 2017;19:1576–87.

[2] Dutton JJ. Optic nerve sheath meningiomas. Surv Ophthalmol 1992;37:167–83.

[3] Kahraman-Koytak P, Bruce BB, Peragallo JH, Newman NJ, Biousse V. Diagnostic errors in initial misdiagnosis of optic nerve sheath meningiomas. JAMA Neurol 2019;76:326–32.

[4] Levin MH, Ney JJ, Venneti S, Moster ML, Balcer LJ, Volpe NJ, et al. Optic nerve biopsy in the management of progressive optic neuropathy. J Neuroophthalmol 2012;32:313–20.

[5] Saeed P, Tanck MWT, Freling N, Baldeschi L, Mourits MP, Bennink RJ. Somatostatin receptor scintigraphy for optic nerve sheath meningiomas. Ophthalmology 2009;116:1581–6.

[6] Klingenstein A, Haug AR, Miller C, Hintschich C. Ga-68-DOTA-TATE PET/CT for discrimination of tumors of the optic pathway. Orbit Amst Neth 2015;34:16–22.

Figure Legends

Figure 1. A,B: MRI; large well-defined mass lesion surrounds the right optic nerve (red arrow). The lesion displays an avid enhancement after contrast administration (T1-weighted with gadolinium) (A) and isointense signal T2 (B).

Figure 2. a–h: ^{68}Ga-DOTATOC PET/CT scan showing intense radionuclide uptake by the orbital tumor and corresponding CT scan: transaxial PET (a); brain MIP (maximum intensity projection) (b); transaxial PET/CT (c); transaxial CT (d); coronal PET/CT (e); coronal CT (f); sagittal PET/CT (g); sagittal CT (h); physiological uptake in the pituitary gland.