Indium-111 octreotide scintigraphy in neurofibromatosis

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Abstract. Scintigraphy with the radiolabelled somatostatin analogue indium-111-DTPA-D-Phe-1-octreotide has recently been proposed for the imaging of CNS neoplasms expressing somatostatin receptors. While meningiomas are imaged with high sensitivity, neurinomas do not take up octreotide owing to the lack of somatostatin receptors. Neurofibromatosis is a relatively uncommon disorder in which meningiomas and neurinomas often occur in the same patient. Differential diagnosis between these two tumours by computed tomography and magnetic resonance imaging can be difficult. This study reports on 111In-octreotide scintigraphy in four patients with neurofibromatosis. 111In-octreotide scintigraphy was shown to be very helpful in the in vivo differential diagnosis: all four meningiomas showed intense tracer uptake, while all 15 neurinomas were negative (P<0.001 by Fisher’s exact test). It may be concluded that scintigraphy with 111In-octreotide is a useful diagnostic procedure in neurofibromatosis, complementing standard neuroradiological imaging procedures.

Key words: Indium-111 octreotide scintigraphy – Neurofibromatosis – Somatostatin receptors


Introduction

Scintigraphy with the radiolabelled somatostatin analogue indium-111-DTPA-D-Phe-1-octreotide has recently been proposed for the imaging of CNS neoplasms expressing somatostatin receptors [1–3]. While there is controversy over the use of somatostatin receptor scintigraphy for the imaging of gliomas, where the role of blood-brain barrier permeability is still incompletely characterized [2, 4, 5], there is general agreement that all meningiomas can be successfully imaged by this means [2–5]. Neurinomas do not show 111In-octreotide uptake [2, 3] and this finding is concordant with the known absence of somatostatin receptors in these tumours [3, 6].

Neurofibromatosis (NF), also known as von Recklinghausen’s disease, is a relatively uncommon disorder. In approximately 50% of cases it presents with a familial history consistent with an autosomal dominant transmission with variable expression, while the remaining cases represent new mutations [7]. NF can be subdivided into type I or peripheral NF and type II or central NF [7]. Both type II NF and to a lesser extent type I NF are complicated by meningiomas and multiple CNS tumours other than meningiomas, such as gliomas and neurofibromas, these tumours often coexisting in the same patient. Differential diagnosis between meningiomas and neurinomas by conventional neuroradiological imaging procedures such as computed tomography (CT) and magnetic resonance imaging (MRI) can pose problems [8, 9].

This study reports on 111In-octreotide scintigraphy for the differential diagnosis of CNS tumours in a small series of patients with NF.

Materials and methods

Patients. The study included four patients referred to the Neurosurgery Department of the “Regina Elena” National Cancer Institute in Rome between December 1992 and April 1994 and diagnosed as having type I NF (one patient) or type II NF (three patients). Informed consent was obtained from patients or their parents.

Radiopharmaceuticals. The somatostatin analogue DTPA-D-Phe-1-octreotide and ultra-pure 111In-chloride were obtained from Byk-Gulden (Milan, Italy) in a single kit (Octreoscan). 111In-chloride contained 114min to a limited extent (0.5 kBg 114min/MBq 111In at calibration time). Single-step radiolabelling of 10 µg of DTPA-D-Phe-1-octreotide with 111In was performed. Quality control as per the manufacturer’s instructions was carried out prior to administration of the radiopharmaceutical. 111In-DTPA-D-Phe-1-octreotide was given as a bolus intravenous injection.

Scintigraphic imaging. Whole-body and planar images of the brain and of the spinal cord were recorded with a rectangular gamma camera (Toshiba 90/B) equipped with a medium-energy.
parallel-hole collimator using a hardware zoom of x2. The pulse-height analyser windows were centered over both $^{111}$In photon peaks (172 and 245 keV) with window widths of 20% and 15% respectively. Planar images were performed at 2-4 and 24 h with a pre-set time of 20 min and/or a minimum of 800 kcounts and a matrix of 256x256 or 512x512. Whole-body acquisition was performed at 2-4 and 24 h with a scan speed of 10 m/s and a matrix of 128x128.

**Magnetic resonance imaging.** MRI was performed with a super-conductive magnet operating at 1.5 T (Magnetom-Siemens) using a body coil and a matrix of 256x256. Images were obtained with spin-echo techniques including T1-weighted (TR 560 ms, TE 15 ms) and T2-weighted (TR 2500 ms, TE 15/90 ms) sequences with a 6–8 mm slice thickness. Paramagnetic contrast medium, gadolinium-diethylene triamine penta-acetic acid (Gd-DTPA, Shering-AG, Berlin), was administered at a dosage of 0.1 mmol/kg body weight i.v.

**Results**

**Patient no. 1**

Patient no. 1 was a 12-year-old male who in 1984 underwent surgery for a large, right frontoparietal meningioma. Two years later he developed a slowly progressive reduction in visual acuity of the left eye. On admission in October 1992 he presented with amaurosis and vertical and external ophthalmoplegia of the left eye. Left ophthalmals was present. MRI showed an hourglass-shaped tumour consisting of an intraorbital 25-mm-large round mass surrounding the left optic nerve which extended through the optic foramen to the middle cranial fossa as far as the cavum trigeminale (Fig. 1a). The medial aspect of the left temporal lobe was compressed by the tumour. Two 4- to 5-mm-large enhancing tumours were also present bilaterally in the internal acoustic meatus (Fig. 1b). A malacic area representing a sequela of the previous operation was appreciable in the right parietal lobe, with no sign of tumour recurrence. MRI examination of the spine revealed two intrathecal enhancing tumours anteriorly located at the C2 and C6 levels and causing spinal cord compression (Fig. 1c). Other lesions were present in an intra- or extradural location in the distal part of the cervical spine, the largest being at the C7 level on the left. The MRI pattern (isointense signal on T1-weighted images, high signal intensity on T2-weighted images, marked Gd-DTPA enhancement) of the lesions suggested the diagnosis of multiple neurinomas. The absence of skin lesions allowed for a diagnosis of probable type II NF. $^{111}$In-octreotide scintigraphy showed intense tracer uptake only in the left orbit (Fig. 1d). The orbital lesion was then partially removed and...