

Demonstration of abnormal perfusion in the pons with high resolution SPECT and Technetium-99m HMPAO in a patient with acoustic neuroma

Nobuharu YUI, Takashi TOGAWA, Fujimi KINOSHITA, Hiroki NAMBA,* and Yoshihisa AKIYAMA**

*Division of Nuclear Medicine, *Division of Neurosurgery, ***Division of Radiation Physics, Chiba Cancer Center Hospital*

We detected a regional defect in the pons with ipsilateral cerebellar hypoperfusion in a patient with acoustic neuroma by brain SPECT with ^{99m}Tc HMPAO. A high spatial resolution SPECT system with three detectors equipped with fan-beam collimators was employed. This is the first report of a defect in the brainstem being visualized by perfusion SPECT and this method could make it possible to clarify the cause of a remote effect on the cerebellar perfusion by injury to the brainstem.

Key words: Acoustic neuroma, SPECT, Tc-99m HMPAO, Pons

INTRODUCTION

THERE HAVE BEEN a few reports on perfusion in the brainstem by means of SPECT. In a ^{123}I -IMP study, Minoshima¹ et al. reported that following injury of the cerebrum there was a decrease in pontine density, but the images were not clear enough to make it possible to estimate regional hypoperfusion in the pons. Perani et al. reported crossed cerebellar diaschisis in a case of pontine ischemia². However, the pontine image itself was not obtained. We can now use a new SPECT system with a three-head rotating camera which has excellent spatial resolution and provides a normal pontine image with ^{99m}Tc HMPAO^{3,4}. This paper reports a case in which brain SPECT clearly visualized a regional defect in the pons of a patient with acoustic neuroma and recovery after surgery.

CASE REPORT

A 56-year-old male who had been complaining of vertigo and hypesthesia of the right face correspond-

ing with the right trigeminal nerve, underwent a brain perfusion SPECT study with ^{99m}Tc HMPAO and a three-head rotating gamma-camera (Toshiba GCA 9300A). 740 MBq (20 mCi) of ^{99m}Tc HMPAO was given intravenously and data acquisition was started 15 minutes after the injection and continued for 20 minutes. Twenty projection data from each detector (6° steps, 120° rotation, 60 seconds per angle), 60 projections altogether, were accumulated in a 256 × 256 matrix. Pixel size was 1.8 mm. The accumulated data were converted to parallel-beam projection data in a 128 × 128 format (pixel size = 1.7 mm). The data were then smoothed with a Butterworth filter (order: 8, cut off: 0.13 cycle/pixel) and reconstructed by means of filtered back projections. Transaxial tomographic images showed asymmetric perfusion in the cerebellum with a relative reduction in the right side and a defect in the right half of the pons suggesting hypoperfusion (Fig. 1). MRI performed subsequently revealed a mass with 3 cm in diameter at the right cerebello-pontine angle (Fig. 2). This round mass enhanced by Gd-DTPA was thought to be an acoustic neuroma. MRI angiogram revealed a shifted right vertebral artery. Vascular stenosis was not seen (Fig. 3). Compression of the pons and right cerebellar hemisphere was confirmed. The patient received surgery and the tumor was partially removed. The surgical specimen was histologi-

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For reprints contact: Nobuharu Yui M.D., Division of Nuclear Medicine, Chiba Cancer Center Hospital, 666-2 Nitonacho, Chuo-ku, Chiba 260, JAPAN.

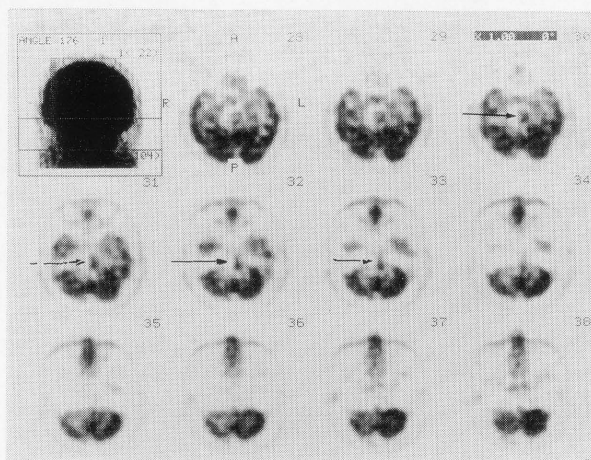
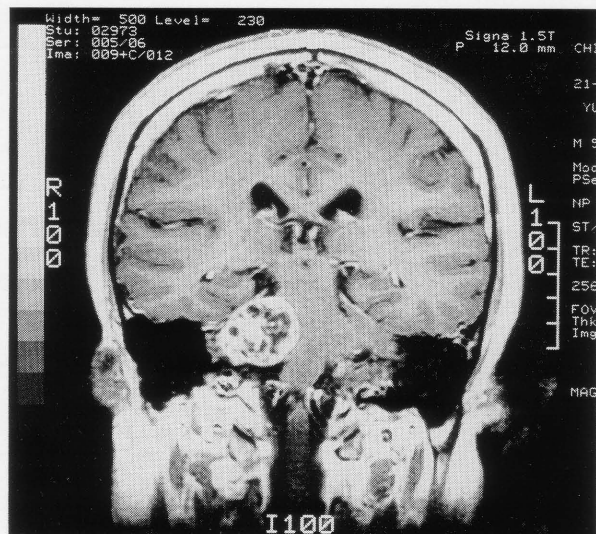


Fig. 1 SPECT transverse images reveal hypoperfusion in the right cerebellar hemisphere and a defect in the right half of the pons (arrows).

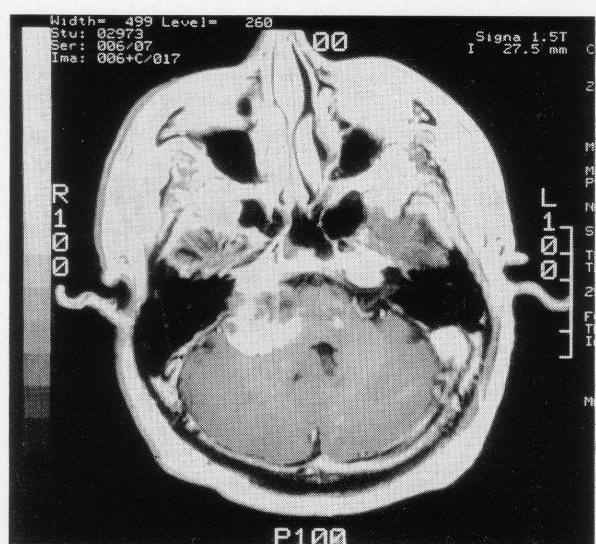
cally diagnosed as acoustic neuroma. The right trigeminal hypesthesia recovered after the surgery and the vertigo improved. MRI taken 6 months later showed a reduced mass with a slight compression of the right cerebellar hemisphere and no compression of the pons (Fig. 4). Brain SPECT at that time demonstrated normal perfusion in the pons and a slight reduction in perfusion in the right cerebellum (Fig. 5). Elimination of the pressure due to the tumor brought recovery of perfusion in the brainstem and cerebellum.

DISCUSSION

Acoustic neuroma is a benign tumor which originates in the internal auditory meatus and extends to the cerebello-pontine angle. Compression of cranial nerves, the cerebellum and brain-stem causes vertigo, facial hypesthesia, hearing loss and facial-nerve paresis. Hypoperfusion in cerebellum and brain-stem also would be caused by these extensions, but there is no report about an image showing hypoperfusion visualized by SPECT as a direct effect of the compression. Tamamoto et al. reported a case of acoustic neuroma which showed hypoperfusion in the cerebellum by means of a single head rotating gamma-camera as a remote effect of compression of the pons⁵. The decreased blood flow in the cerebellum was ipsilateral. No image of the pons was obtained with the camera they used, but MRI demonstrated compression of the pons. No abnormality of the cerebellum was found by X-ray CT, MRI or vertebral angiography. They suggested that the pathway from the pontine nuclei to the cerebellum was affected at the post-crossed level and the remote effect caused a relative reduction in the blood flow in the ipsilateral cerebellar hemisphere of the compressed



a



b

Fig. 2 (a: sagittal, b: transaxial) MRI reveals a round mass enhanced by Gd-DTPA at the cerebello-pontine angle with a compression to the pons and the cerebellum. The compression suggests to cause the hypoperfusion, but does not extend up to the half side of the brainstem and cerebellum.

pons. On the other hand, Perani et al. reported a case of cerebellar diaschisis in pontine ischemia². In this report, decreased blood flow was seen in the contralateral cerebellum of the pontine ischemic lesion. The explanation was that the pathway from the pontine nuclei to the cerebellum was affected before crossing and a remote effect was contralateral cerebellar hypoperfusion. And no pons image was shown. It has been reported that thalamic tumors which invaded the brain-stem produced crossed cerebellar diaschisis which was demonstrated by PET⁶. In any

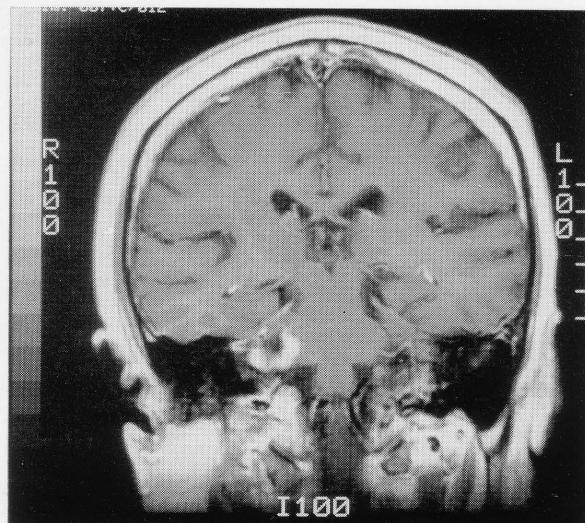


Fig. 3 MRI angiogram reveals the shifted right vertebral artery, but no vascular stenosis or occlusion is seen.

case, these papers failed to report a pons image which would show pons perfusion affected by direct compression by the tumor or ischemia. There were only indirect results in the cerebellum due to the remote effects of the affected pathway from the pons. We detected a defect in the pons which occupied one half of it. This remarkable defect extended over the shift in the brainstem caused by the tumor. The finding was more likely to have been caused by hypoperfusion of the pons than by the shifted brainstem.

The ipsilateral decrease in blood flow in the cerebellum indicated a regional compressions effect by the tumor, but the hypoperfusion covering the whole hemisphere of the right cerebellum even more strongly suggested a remote effect due to the lesion in the brainstem. These findings suggested that the direct compression caused not only the perfusion defect in the pons but also hypoperfusion of the cerebellum and that the remote effect from the post-crossed pathway brought ipsilateral cerebellar hypoperfusion.

The removal of the tumor excluded the compression of the pons, restored the pons blood flow and caused the remote effect on the cerebellar perfusion to disappear. The remaining slight hypoperfusion of the cerebellum was thought to be caused by direct pressure exerted by the residual tumor which was seen on the MRI taken after the surgery. Only PET has been thought to be a means to evaluate metabolism in the brainstem because of its superior spatial resolution compared to SPECT^{7,8}. However, a recently developed high resolution SPECT system enabled the perfusion images of the normal brainstem to be clearly visualized^{3,4}. The fact that a regional defect in the pons due to brain perfusion SPECT



a



b

Fig. 4 (a: sagittal, b: transaxial) MRI taken 6 months after the surgery shows the reduced tumor with a slight compression to the cerebellum and no compression to the pons.

was clearly demonstrated by means of a high resolution three-head rotating gamma-camera indicates a new turn in evaluating the perfusion of the brain including the brainstem.

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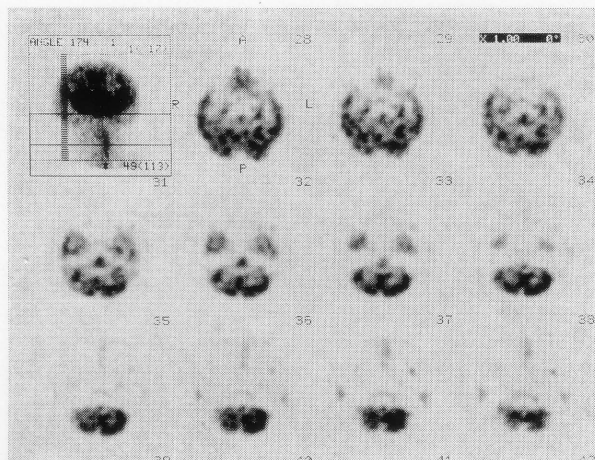


Fig. 5 SPECT after the surgery demonstrates the recovered perfusion in the pons and improved perfusion in the right cerebellar hemisphere.

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