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

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We detected a regional defect in the pons with ipsilateral cerebellar hypoperfusion in a patient
with acoustic neuroma by brain SPECT with 99mTc 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 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 123I-IMP study,
Minoshima 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 ischemia. 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 99mTc HMPAO. 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 correspon-

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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 pons. 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 pons. On the other hand, Perani et al. reported a case of cerebellar diaschisis in pontine ischemia. 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 PET. In any

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

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.

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

In this 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\(^9,10\). The fact that a regional defect in the pons due to brain perfusion SPECT 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.

REFERENCES

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