Innovative approach in the diagnosis of medulloblastoma in which the $^{123}$I-metaiodobenzylguanidine single-photon emission computerized tomography technique is used

Case illustration

TOSHI SASAJIMA, M.D., Ph.D., HIROYUKI KINOUCHI, M.D., Ph.D., NORIAKI TOMURA, M.D., JIRO WATARAI, M.D., and KAZUO MIZOI, M.D.

Neurosurgical Service and Department of Radiology, Akita University School of Medicine, Akita, Japan

The authors report on a 9-year-old boy with a medulloblastoma who received postoperative radiotherapy and high-dose chemotherapy using carboplatin, etoposide, and ranimustine with peripheral blood stem-cell transplantation. Twelve months after the boy had completed these therapies, magnetic resonance (MR) imaging demonstrated a new solid and cystic mass lesion with extensive perifocal edema in the right frontal lobe, indicating a metastatic tumor (Fig. 1). Single-photon emission tomography (SPECT) scans, obtained 30 minutes after an intravenous injection of $^{123}$I-metaiodobenzylguanidine (MIBG) at a dose of 111 MBq (3 mCi), revealed marked accumulation of $^{123}$I-MIBG in the area corresponding to the enhancing lesion on MR imaging. Using the contralateral frontal lobe as representative of the nontumoral region, the ratio of tumor to nontumor, as an indicator of selective uptake of tracer into the tumor, was 2.6. However, $^{123}$I-MIBG did not accumulate in the frontal white matter, which appeared hyperintense on T2-weighted MR imaging (Fig. 2). The patient underwent an uneventful extirpation of the metastatic tumor. With the aid of a microscope, we observed that the resected solid specimens contained round tumor cells forming Homer–Wright rosettes. The histological findings corresponded to those of a medulloblastoma. The area of hyperintensity observed on the T2-weighted MR images, in which the tracer had not accumulated, was markedly diminished on follow-up MR imaging performed 1 month after the surgery, suggesting edema without tumor infiltration.

To our knowledge, this is the first report in which $^{123}$I-MIBG SPECT scanning has been successfully used for detection of a medulloblastoma. The diagnostic value of MIBG, a physiological analog of norepinephrine used in scintigraphy, has been well documented in a variety of extracranial neural crest tumors, most notably neuroblastomas, pheochromocytomas, and paragangliomas on the basis of its high sensitivity and specificity. Strickland and colleagues hypothesized that medulloblastomas may be derived from a common germinal neuroepithelial cell as neural crest tissue, and demonstrated the uptake capacity of human medulloblastoma cell lines for $^{123}$I-MIBG in vitro. However, the high uptake of $^{123}$I-MIBG has not been clinically evaluated for identifying medulloblastoma, the most common malignant brain tumor present during childhood. Although we currently report the use of the $^{123}$I-MIBG SPECT technique to assist in the diagnosis of metastatic medulloblastoma in the frontal lobe, the potential value of $^{123}$I-MIBG SPECT scanning would lie in the differential diagnosis of medulloblastoma from other posterior fossa tumors. The $^{123}$I-MIBG SPECT technique may provide valuable information on the differential diagnosis and assessment of radiochemotherapeutic effects in treating medulloblastomas. Although one case does not provide evidence of the general effectiveness of this technique, we hope it will encourage future study of $^{123}$I-MIBG SPECT scanning in a larger series of patients.

References


Manuscript received October 13, 1999; accepted in final form March 6, 2000.

Address reprint requests to: Toshio Sasajima, M.D., Ph.D., Neurosurgical Service, Akita University School of Medicine, 1-1-1 Hondo, Akita City, Akita 010-8543, Japan.