

## Late recurrence and salvage therapy of CNS germinomas

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**Abstract** Central nervous system (CNS) germinoma is a curable tumor and its recurrence rate after initial therapy may be approximately 10% or higher. This study elucidates the time-course of recurrence and results of salvage therapy. Twenty-five patients with recurrent germinoma treated at Hokkaido University Hospital were retrospectively reviewed. The median age at initial treatment was 12 years (range: 8–37). All patients had been tumor-free for at least 6 months after the initial treatment. The median follow-up period was 134 months (range: 44–338). The median age at first recurrence was 18 years and the median time to the first recurrence was 50 months. Among the patients, 9 (36%) had the first recurrence at 60 months or later. The latest recurrence in a patient occurred 230 months after the initial treatment. The results of salvage therapy were estimated in all 25 patients. Seventeen patients (68%) were salvaged and were tumor-free at the final observation. The remaining 8 patients died of disease. At first recurrence, 11 patients were treated using radiation therapy with or without surgery and 7 out of the 11 patients died due to the recurrent tumor. On the other hand, 13 patients who received salvage chemotherapy and radiotherapy were tumor-free at the last follow-up. In conclusion, late recurrence is not a rare event in patients with CNS germinoma. To identify a true cure rate of this disease, a 10-year or longer observation period may be required. As a salvage

therapy, platinum-based chemotherapy followed by wide-field low-dose radiation therapy appears to be effective.

**Keywords** Central nervous system · Germinoma · Intracranial · Recurrence · Salvage therapy

### Introduction

It has been reported in large series that in patients with gonadal germinoma (seminomas), a counterpart of central nervous system (CNS) germinomas, late recurrences are relatively rare [7, 14, 29], and thus, follow-up for detecting recurrence may not be needed after 5 years [17, 18, 24, 32]. CNS germinoma, as well as gonadal germinoma, is sensitive to both radiotherapy and platinum-based chemotherapy, and patients have a good prognosis with overall survival of approximately 90% at 5 years [2, 10, 15, 16, 19, 21, 25, 26]. Therefore, late recurrence of germinoma may be an exceptional event similar to that of gonadal germinoma.

CNS germinoma is a rare malignancy in childhood accounting for only 1–2% of primary CNS tumors. Although the overall survival rates of patients with germinoma treated with various therapeutic methods have been reported in the literature, reports focusing on its recurrence rate and time-course of recurrence are scarce due to its rarity and the short follow-up periods of the previous studies [1–4, 9–12, 15, 16, 19, 21, 25, 26, 28, 31].

In particular, late recurrence of germinoma beyond 5 years is unknown. Elucidation of the time-course of recurrence may provide insight on the necessary duration of observation in outpatient clinics. We assessed 25 patients with recurrent germinoma after a complete remission induced by various initial therapies. In addition, to determine the optimal therapy for recurrent CNS

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