Right Basal Ganglia Germinoma: Case Report and Literature Review

Pu Tian

Jilin University First Hospital

Hongbo Zhang

Jilin University First Hospital

Yaqian Liang

Jilin University First Hospital

Bingyang Bian

Jilin University First Hospital

Shujia Xu

Jilin University First Hospital

Dan Li (✉ li_d@jlu.edu.cn)

Jilin University First Hospital Department of Radiology <https://orcid.org/0000-0002-5567-6927>

Research Article

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Abstract

Background: Among intracranial germinomas, germinoma of basal ganglia has been rarely reported. We discuss a new case of basal ganglia germinoma(BGG) and perform the literature review over the last two decades, with the aim of emphasizing the diagnosis and treatment in early-stage BGG.

Case presentation: A seven years old Chinese boy presented with 4 months history of left limb movement disorder and oblique right mouth corner. The human chorionic gonadotropin(HCG) level in cerebrospinal fluid(CSF) was slightly increased. Magnetic resonance imaging(MRI) showed ipsilateral brain and brainstem atrophy. Susceptibility weighted imaging(SWI) revealed obvious hypointensity in right globus pallidus. Pathological diagnosis on biopsy was confirmed with germinoma. The patient had a favorable relief of symptoms after chemoradiotherapy.

Conclusion: Intracranial germinoma, a potentially curable tumor, the early diagnosis is essential for the prognosis. An elevated HCG level of CSF or serum can be used as a reference indicator. MRI, especially SWI, plays an important role in early diagnosis. Patients should be treated with standardized chemoradiotherapy early rather than surgery.

Background

Intracranial germinomas(IGs), originating from residual tissue of primordial germ cells, accounting for about 0.22-3% of all intracranial tumors in adolescents and children[1]. IGs occur most frequently in the midline locations, such as the pineal and suprasellar regions. Germinomas in the basal ganglia(BG) account for only 5–10% of all primary IGs[2]. Basal ganglia germinomas(BGGs) are slow growing and the clinical manifestations are diverse, including hemiparesis, abnormal sensation, and so on. So many patients are easily misdiagnosed or missed without timely and effective treatment.

We report the clinical features, imaging and treatment of a BGG. And review and summarize the Magnetic resonance imaging(MRI) characteristics of BGGs in combination with other literatures, with the aim of emphasizing the diagnosis and treatment in early-stage BGGs.

Case Presentation

A seven-year-old Chinese boy without significant past or family medical history presented with 4 months history of left limb movement disorder and oblique right mouth corner was admitted to our institute. Nervous system examination: left central-type facial palsy, left hemiplegic gait, left limb muscle strength grade 4/5, left knee tendon reflex slightly active. The remaining physical examinations were normal. Serum human chorionic gonadotropin(HCG) level is normal, but cerebrospinal fluid(CSF) HCG level was slightly increased to 6.08mIU/ml (normal range: 0.00–5.00).

Unenhanced computerized tomography (CT) of the head (4 months after the onset of the symptom) showed hyperdensity in right BG (Fig. 1a). MRI revealed that T1 hypointensity and T2 hyperintensity in right BG and no significant space occupying effect (Fig. 1b,c) and mild atrophy of right cerebral peduncle(Fig. 1f). Contrast-enhanced MRI demonstrated irregular rim enhancement(Fig. 1d). Susceptibility weighted imaging (SWI) revealed obvious hypointensity in right BG and the size was larger than that on conventional MRI(Fig. 1e).

Pathological diagnosis on stereotactic biopsy was confirmed with germinoma. The patient received four cycles of combination chemotherapy consisting of carboplatin, ifosfamide and etoposide, followed by radiotherapy to the whole neuraxis (30.6Gy/17fractions) and a boost to the main lesion (54Gy/30fractions). After chemoradiotherapy, the clinical symptoms improved significantly and malacia of the lesion can be found on MRI(Fig. 2a,b) and the enhancing degree of the lesion(Fig. 2c) was alleviated compared with before treatment.

Discussion

Germinoma is the most common type (2/3) of the intracranial germ cells tumors[3] and 90% of cases are diagnosed before 20 years of age[4]. BG is a rare location for IGs, preceded by the pineal and suprasellar regions. BGGs are more common in Asian populations, with males predominating[5]. In Table 1, we reviewed the clinical, laboratory and imaging data of the 35 patients with biopsy-proven BGG from 2000 to 2020.(32 males and 3 females, mean age 12.98 years, range 7 to 21 years).

Table 1
Cases of germinoma in the basal ganglia reported in literature

References	Age (y), Sex	Weakness of Limbs	Diabetes Insipidus	Increased ICP	sHCG, cHCG	CT	T1	T2	Contrast Enhancement	Ipsilateral brain and brainstem atrophy	SWI
ya Takeda et al,2004 ¹⁴	11,M	Y	N	N	-,0	Hyper	Hyper	Hyper	N	Y	N/A
Noriko Oyama et al,2005 ¹⁵	10,M	Y	N	N	-,0	N/A	Hyper	Hyper/Hypo	Y	N/A	N/A
Rodrigo V. Ozelame et al,2006 ¹⁶	14,M	Y	N	N	-,0	Hyper	Hypo	Hyper	N/A	N/A	N/A
	13,M	Y	Y	N	0*	Hyper	Hypo	Hyper	Y	Y	N/A
	9,M	Y	N	N	0*	Hyper	N/A	Hetero	Y	Y	N/A
	13,M	Y	Y	N	N/A	N/A	Hypo	Hyper	Y	Y	N/A
Joong-Seok Kim et al,2007 ¹⁷	9,M	Y	N	N	N/A	N/A	N/A	Hyper	N		N/A
O. Klein et al,2007 ¹⁸	8,F	Y	Y	Y	-,0	Hypo	N/A	Hyper	Y		N/A
Anita Villani et al,2008 ¹⁹	13,M	Y	N	N	-,0	Hyper	Hypo	Hyper	Y	Y	N/A
Andrea Rossi,et al,2008 ²⁰	14,M	Y	Y	N	-,0	Hyper/Hypo	N/A	Hyper N/A	Y	Y	N/A
Shuyu Hao,et al, 2009 ²¹	13,F	Y	N	N	-,0	Hypo	Hypo	Hyper	N/A	Y	N/A
Sui-To Wong,et al, 2009 ²²	7,M	Y	N	N	0,0	Hyper		Hyper	Y	Y	N/A
	10,M	Y	N	N	0,0	Hetero	Hypo	Hyper	Y	Y	N/A
En Xu,et al, 2010 ²³	9,M	Y	N	N	0,0	N/A	Hyper	Hyper	Y	Y	N/A
D D Rasalkar, et al, 2010 ²⁴	11,M	Y	N	Y	-,N/A	Hyper		Hyper	N	N/A	N/A
	15,M	Y	N	Y	0,N/A	Hyper	Hetero	Hetero	Y	N/A	N/A
	11,M	Y	N	N	-,0	Hyper/Hypo	Hypo	Hyper	Y	N/A	N/A
	13,F	Y	N	N	-,0	Hyper/Hypo	Hypo	Hyper	Y	Y	N/A
Soumik Goswami,et al, 2013 ²⁵	9.5,M	N	N	N	0,0	N/A	Hyper	Hyper	Y	N/A	N/A
Takafumi Watayai,et al, 2015 ²⁶	15,M	Y	N	N	0,-	Hyper	Iso	Hyper	Y	N/A	N/A
C.J. Maurer,et al, 2016 ²⁷	15,M	Y	N	N	N/A	Hyper	Hypo	Hyper	Y	Y	N/A
Yasushi Ogasawara,et al, 2016 ⁸	12,M	Y	N	N	-,N/A	N/A	Hetero	Hetero	Y	Y	N/A
Clement Vialatte de Pemille,et al, 2016 ⁴	21,M	Y	N	N	-,0	N/A	Hypo	Hyper	Y	N/A	N/A

Note: Y,yes; N,no; ICP, intracranial pressure; sHCG, serum human chorionic gonadotropin; cHCG,cerebrospinal fluid human chorionic gonadotropin; N/A, not av Hetero, heterogeneous; Hyper, hyperintense; Hypo, hypointense; Iso, isointense; Nor,normal; CT, computerized tomography; SWI, susceptibility-weighted imaging T2WI,T2-weighted imaging; S,surgery; SB, stereotactic biopsy; WB, whole-brain irradiation; WS, whole-spine irradiation; LF, local field irradiation; CMT, chemotherapy sample source

References	Age (y), Sex	Weakness of Limbs	Diabetes Insipidus	Increased ICP	sHCG, cHCG	CT	T1	T2	Contrast Enhancement	Ipsilateral brain and brainstem atrophy	SWI
A.N.Konovalov,et al, 2016 ²⁸	15,M	Y	Y	Y	-, $\emptyset$	N/A	Hypo	Hyper	Y	N/A	N/A
	13,M	Y	Y	N	-,N/A	N/A	Hypo	Hyper	Y	N/A	N/A
	14,M	Y	N	N	$\emptyset$, $\emptyset$	N/A	Hypo	Hyper	Y	N/A	N/A
	16,M	Y	N	N	N/A	N/A	Hypo	Hyper	Y	N/A	N/A
Peter Yat Ming Woo,et al, 2017 ²⁹	21,M	Y	N	N	-,N/A	N/A	Iso	Hyper		Y	N/A
Seishiro Nodomi et al,2017 ³⁰	14,M	Y	N	N	$\emptyset$, $\emptyset$	N/A	N/A	Hyper	Y	N/A	N/A
Jihong Yan,et al, 2019 ³¹	13,M	Y	N	N	$\emptyset$,N/A	Hyper	Hyper	Hyper	N	N/A	N/A
Eike Steidl,et al, 2019 ³²	21,M	Y	N	N	N/A	N/A		Hyper	N	Y	N/A
Zhen-Chao Huang,et al, 2020 ³³	12,M	Y	N	N	-, $\emptyset$	N/A	Hypo	Hyper	Y	Y	Hypo
	10,M	Y	N	N	-, $\emptyset$	N/A	Hypo	Iso	Y	Y	N/A
	16,M	Y	N	N	-, $\emptyset$	N/A	Hypo	Hyper	Y	Y	N/A
	10,M	Y	Y	N	-, $\emptyset$	N/A	Iso	Hyper	N	Y	Nor
Note: Y,yes; N,no; ICP, intracranial pressure; sHCG, serum human chorionic gonadotropin; cHCG,cerebrospinal fluid human chorionic gonadotropin; N/A, not av Hetero, heterogeneous; Hyper, hyperintense; Hypo, hypointense; Iso, isointense; Nor,normal; CT, computerized tomography; SWI, susceptibility-weighted imaging; T2WI,T2-weighted imaging; S,surgery; SB, stereotactic biopsy; WB, whole-brain irradiation; WS, whole-spine irradiation; LF, local field irradiation; CMT, chemotherapy sample source											

The most common first symptom of BGGs was hemiplegia, which progressed slowly with an average age of 9.7 years[6]. In the last 20 years, 27/35 patients reviewed came to medical attention because of symptoms of hemiplegia. The symptoms of our case were left limb movement disorder and oblique right mouth corner too.

HCG levels are useful for the diagnosis of germinoma. In Table 1, HCG levels of CSF or serum were measured in 30 patients. Among these patients who had measured, 18 patients were negative and 12 patients were positive. An elevated HCG level of CSF or serum is not present in all patients with germinomas, so it only can be used as a reference indicator. When elevated, a diagnosis of germinomas is more strongly suggested. But a negative test does not exclude the diagnosis. Our patient had a normal serum HCG and slightly elevated CSF HCG, thus supporting the diagnosis of germinoma.

The diagnosis of early-stage BGG is essential for the prognosis of patients. Whereas patients' clinical symptoms and serum or CSF HCG were not highly specific. Besides, the lesion is deep-seated, access to pathology by puncture is challenging, and carries a risk of bleeding. Imaging plays an important role in early IGs diagnosis. In the early stage of the disease, abnormalities can be found on imaging. In Table 1, BGGs appear predominantly hyperdense on CT, with the cystic component being hypodense. Although conventional MRI is able to sensitively detect signal changes in the BG, such as cystic formation, calcification, and/or intratumoral hemorrhage, etc, early BGGs merely show T2WI hyperintensity with slight or no space occupying effect and mild or no enhancement, which are less specific. If patients were misdiagnosed or untreated, the MRI findings will show large, space-occupying, multicystic, and gadolinium-enhancing tumors at the site of initial lesion and/or other distant locations[7]. Ipsilateral brain and brainstem atrophy was another character of BGGs, which can be found in up to 33% of cases[8]. 19/35 patients in the Table 1 also presented with ipsilateral brain atrophy. Just as our case, MRI revealed slightly atrophy of right cerebral peduncle. Therefore, ipsilateral brain and brainstem atrophy can be considered as an early sign for the diagnosis. Approximately 50–70% of BGGs involve intratumoral hemorrhages[9]. Pathology has indicated that even at the early stage, hemorrhage and iron deposition may occur in germinoma[10]. SWI is more sensitive in detecting hemorrhage due to it can detect blood products and biologic metal accumulation. In our case, at the first MR examination, SWI revealed obvious hypointensity in right globus pallidus and the size was larger than that on conventional MRI. Previous studies have reported that SWI is more sensitive in detecting early-stage BGG[10]. But only 2/35 cases in the literature used the SWI technique. It is clear that the SWI technique is underutilized. We cannot ignore the role of SWI and should combine SWI with conventional MRI for an early diagnosis of BGG.

Because neurological function may be severely compromised, surgical resection should be avoided. Germinomas are highly sensitive to radiotherapy and chemotherapy, especially radiotherapy, and have the potential to be curative[11]. Radiotherapy is the mainstay of treatment for IGs. Chemoradiotherapy can reduce the dose of radiotherapy, with the aim of decreasing the complications of radiotherapy, especially in children and adolescents. The therapeutic effect of chemotherapy followed by reduced-dose radiotherapy can be similar to those of radiotherapy alone[12]. The patients with germinoma who are treated by

standardized chemotherapy and radiation therapy have long-term progression-free survival rates that exceed 90%[13]. In Table 1, 29 patients completed the treatment, 22 were treated with chemoradiotherapy, 3 with chemotherapy alone, 4 with radiotherapy alone. Clinical follow-up data were available for 17 cases with average time of 29.9 months ranging from 6 to 120 months. None of the patients presented recurrence of tumor. However, Wong et al.[6] and Kanamor et al.[14] had demonstrated that chemotherapy without radiotherapy is unable to cure intracranial germinomas. Our patient was treated with chemotherapy followed by reduced-dose radiotherapy and his clinical symptoms improved significantly.

Brain disease occurs infrequently in the BG. There are many diseases with high T2 hyperintensity in the bilateral BG, such as infarction, hypoglycemia, Leigh disease, encephalitis, MELAS, and the others[15]. The diagnosis of patients should be considered comprehensively based on age, gender, clinical symptoms, laboratory tests, imaging examinations, etc. If organic diseases cannot be completely excluded, early MRI scans and measurement of serum tumor markers and blood hormones are recommended for these patients. Although in many cases, the diagnostic sensitivity of serum tumor markers is not high, it is still considered to be valuable because of its non-invasive property and convenience. Stereotactic biopsy can determine the type of tissue and thus confirm the diagnosis. Although there is a high risk of bleeding during the procedure, stereotactic biopsy is recommended for lesions in the diagnosis of early-stage BGGs when necessary. Our case was also confirmed by stereotactic biopsy and had no complications such as bleeding. If a germinoma is suspected but a biopsy is refused or when biopsy does not reveal tumor cells, SWI is strongly recommended. Hypointense lesion in SWI, combined with patient gender, age and serum or CSF HCG level, other MR signs such as ipsilateral brain and brainstem atrophy, diagnostic treatment, such as radiotherapy or chemoradiotherapy may be performed.

Conclusion

When adolescent Oriental males develop progressive hemiplegia with slow onset, abnormal MR signal in BG with ipsilateral brain atrophy, SWI should be performed. Germinoma should be considered if the patient presents with above symptoms and abnormal imaging findings with hypointensity in SWI as well as an elevated serum or/and CSF HCG level. When necessary, a biopsy can confirm the diagnosis and patients should be treated with standardized chemoradiotherapy early rather than surgery.

Abbreviations

BG

basal ganglia; BGG:basal ganglia germinoma; CSF:cerebrospinal fluid; CT:computerized tomography; HCG:human chorionic gonadotropin; IG:Intracranial germinomas; MRI:magnetic resonance imaging; SWI:susceptibility weighted imaging.

Declarations

Ethics approval and consent to participate

The study was approved by the Research Ethics Board of the First Hospital of Jilin University. Written informed consent and any image information were obtained from the patient for publication of this case report.

Consent for publication

Written informed consent and any accompanying images were obtained from the patient for publication of this case report.

Availability of data and materials

The authors declare that all data and materials of the article are available to all readers of our article.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

PT and HZ performed the case analysis and drafted the manuscript. YL reviewed the literature. Radiology image reporting was performed by DL; BB and SX revised the manuscript. DL contributed to the process of review. All authors read and approved the final manuscript.

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References

1. Ostrom QT, Gittleman H, Xu J, Kromer C, Wolinsky Y, Kruchko C, Barnholtz-Sloan JS: **CBTRUS Statistical Report: Primary Brain and Other Central Nervous System Tumors Diagnosed in the United States in 2009-2013.** *Neuro Oncol* 2016, **18**:v1-v75.

2. Zhang S, Liang G, Ju Y, You C: **Clinical and Radiologic Features of Pediatric Basal Ganglia Germ Cell Tumors.** *World Neurosurg* 2016, **95**:516-524 e511.
3. Mueller W, Schneider GH, Hoffmann KT, Zschenderlein R, von Deimling A: **Granulomatous tissue response in germinoma, a diagnostic pitfall in endoscopic biopsy.** *Neuropathology* 2007, **27**:127-132.
4. Vialatte de Pemille C, Bielle F, Mokhtari K, Kerboua E, Alapetite C, Idbaih A: **Basal Ganglia Germinoma in an Adult.** *World Neurosurg* 2016, **92**:584 e511-584 e514.
5. Wang M, Zhou P, Zhang S, Liu X, Lv L, Wang Z, Ye F, Ju Y, Jiang S: **Clinical features, radiologic findings, and treatment of pediatric germ cell tumors involving the basal ganglia and thalamus: a retrospective series of 15 cases at a single center.** *Childs Nerv Syst* 2018, **34**:423-430.
6. Wong TT, Chen YW, Guo WY, Chang KP, Ho DM, Yen SH: **Germinoma involving the basal ganglia in children.** *Childs Nerv Syst* 2008, **24**:71-78.
7. Lou X, Tian C, Ma L: **Evolution of Unilateral Basal Ganglia Lesion Over 16 Months.** *JAMA Neurol* 2018, **75**:376-377.
8. Liu E, Robertson RL, du Plessis A, Pomeroy SL: **Basal ganglia germinoma with progressive cerebral hemiatrophy.** *Pediatr Neurol* 1999, **20**:312-314.
9. Ogasawara Y, Beppu T, Murakami T, Sasaki M, Ogasawara K: **Basal ganglia germinoma presenting as a growing intratumoral hematoma in a 12-year-old boy.** *Childs Nerv Syst* 2016, **32**:589-590.
10. Lou X, Ma L, Wang FL, Tang ZP, Huang H, Cai YQ, Wong EH: **Susceptibility-weighted imaging in the diagnosis of early basal ganglia germinoma.** *AJNR Am J Neuroradiol* 2009, **30**:1694-1699.
11. Huh SJ, Shin KH, Kim IH, Ahn YC, Ha SW, Park CI: **Radiotherapy of intracranial germinomas.** *Radiother Oncol* 1996, **38**:19-23.
12. Lian X, Hou X, Yan J, Sun S, Miao Z, Liu Z, Wang W, Shen J, Shen J, Hu K, Zhang F: **Treatment outcomes of intracranial germinoma: a retrospective analysis of 170 patients from a single institution.** *J Cancer Res Clin Oncol* 2019, **145**:709-715.
13. Millard NE, Dunkel IJ: **Advances in the management of central nervous system germ cell tumors.** *Curr Oncol Rep* 2014, **16**:393.
14. Kanamori M, Kumabe T, Saito R, Yamashita Y, Sonoda Y, Ariga H, Takai Y, Tominaga T: **Optimal treatment strategy for intracranial germ cell tumors: a single institution analysis.** *J Neurosurg Pediatr* 2009, **4**:506-514.
15. Wataya T, Ishizaki R, Kitagawa M, Tashiro Y: **Germinoma in the bilateral basal ganglia presented with cognitive deterioration.** *Childs Nerv Syst* 2015, **31**:953-958.
16. Takeda N, Fujita K, Katayama S, Uchihashi Y, Okamura Y, Nigami H, Hashimoto K, Kohmura E: **Germinoma of the basal ganglia. An 8-year asymptomatic history after detection of abnormality on CT.** *Pediatr Neurosurg* 2004, **40**:306-311.
17. Oyama N, Terae S, Saitoh S, Sudoh A, Sawamura Y, Miyasaka K: **Bilateral germinoma involving the basal ganglia and cerebral white matter.** *AJNR Am J Neuroradiol* 2005, **26**:1166-1169.
18. Ozelame RV, Shroff M, Wood B, Bouffet E, Bartels U, Drake JM, Hawkins C, Blaser S: **Basal ganglia germinoma in children with associated ipsilateral cerebral and brain stem hemiatrophy.** *Pediatr Radiol* 2006, **36**:325-330.
19. Kim JS, Han SJ, Kim W, Kim BS, Kim YI, Lee KS: **Focal hand dystonia secondary to Basal Ganglia germinoma.** *J Clin Neurol* 2007, **3**:150-153.
20. Klein O, Voirin J, Civit T, Auque J, Marchal JC: **Germinoma located in the basal ganglia in an 8-year-old girl.** *Childs Nerv Syst* 2007, **23**:105-108.
21. Villani A, Bouffet E, Blaser S, Millar BA, Hawkins C, Bartels U: **Inherent diagnostic and treatment challenges in germinoma of the basal ganglia: a case report and review of the literature.** *J Neurooncol* 2008, **88**:309-314.
22. Rossi A, Garre ML, Ravegnani M, Nozza P, Abbruzzese A, Giangaspero F, Tortori-Donati P: **Bilateral germinoma of the basal ganglia.** *Pediatr Blood Cancer* 2008, **50**:177-179.
23. Hao S, Liu B, Tang J, Jia G, Zhang Y, Ma Z, Wang Z: **Germinoma of basal ganglia in female: case report and review of the literature.** *Childs Nerv Syst* 2009, **25**:613-617.
24. Wong ST, Yuen SC, Fong D: **Pathophysiological mechanism of ipsilateral cerebral and brainstem hemiatrophy in basal ganglia germ cell tumors: case report.** *Childs Nerv Syst* 2009, **25**:693-699.
25. Xu E, Wang X, Hao Z, Chen Z, Lu X: **Germinoma in the basal ganglia with an abnormal karyotype: case report and review of the literature.** *Childs Nerv Syst* 2010, **26**:707-712.
26. Rasalkar DD, Chu WC, Cheng FW, Paunipagar BK, Shing MK, Li CK: **Atypical location of germinoma in basal ganglia in adolescents: radiological features and treatment outcomes.** *Br J Radiol* 2010, **83**:261-267.

27. Goswami S, Chakraborty PP, Bhattacharjee R, Roy A, Thukral A, Selvan C, Ghosh S, Mukhopadhyay S, Chowdhury S: **Precocious puberty: A blessing in disguise!** *Indian J Endocrinol Metab* 2013, **17**:S111-113.
28. Maurer CJ, Trippel M, Korinthenberg R, Urbach H: **Teaching Neuroimages: Basal Ganglia Germinoma with Hemiatrophy.** *Clin Neuroradiol* 2016, **26**:97-98.
29. Konovalov AN, Kadyrov SU, Tarasova EM, Mazerkina NA, Gorelyshev SK, Khukhlaeva EA, Kobayakov GL, Trunin YY, Sanakoeva AV, Kholodov BV, et al: **[Basal ganglia germinomas in children. Four clinical cases and a literature review].** *Zh Vopr Neurokhir Im N N Burdenko* 2016, **80**:71-82.
30. Woo PYM, Chu ACH, Chan KY, Kwok JCK: **Progressive hemiparesis in a young man: Hemicerebral atrophy as the initial manifestation of basal ganglia germinoma.** *Asian J Neurosurg* 2017, **12**:65-68.
31. Nodomi S, Umeda K, Ueno H, Saida S, Hiramatsu H, Funaki T, Arakawa Y, Mizowaki T, Adachi S, Heike T: **Efficacy of Ifosfamide-Cisplatin-Etoposide (ICE) Chemotherapy for a CNS Germinoma in a Child With Down Syndrome.** *J Pediatr Hematol Oncol* 2017, **39**:e39-e42.
32. Yan J, Zhang Y, Yang Y, Yuan X, Xiao H, Niu J, Gu Y: **Basal Ganglionic Germinoma With Syncytiotrophoblastic Giant Cells Mimicking a Growing Hematoma.** *J Craniofac Surg* 2019, **30**:e306-e308.
33. Steidl E, Zschemack V, Traber F, Schafer N: **Early diagnosis in a case of atypically located germinoma: (1)H-MR-spectroscopy as a decision tool.** *Oxf Med Case Reports* 2019, **2019**:omz001.
34. Huang ZC, Dong Q, Song EP, Chen ZJ, Zhang JH, Hou B, Lu ZQ, Qin F: **Germinomas of the basal ganglia and thalamus: Four case reports.** *World J Clin Cases* 2020, **8**:4558-4564.

Figures

Figure 1

Radiographic findings of 4 months after the onset of the symptom. (a) Unenhanced axial head computerized tomography (CT) demonstrates hyperdensity nodules in the right basal ganglia (BG) (arrow). MRI revealed that T1 hypointense (Fig. 1b) and T2 hyperintense signal (Fig. 1c) in right BG and no significant space occupying effect and mild atrophy of right cerebral peduncle (Fig. 1f). (d) Contrast-enhanced MR image demonstrated irregular rim enhancement of the lesion (arrow). (e) Susceptibility weighted imaging (SWI) revealed obvious hypointensity in right globus pallidus (arrow) and the size of the focus was larger than that on conventional T1WI and T2WI.

Figure 2

Radiographic findings after two cycles of chemoradiotherapy. Malacia of the lesion (arrow) can be found on T1WI (a) and T2WI (b). (c) Contrast-enhanced MR image showed the enhancing degree of the lesion (arrow) were alleviated compared with before treatment.