

# World Journal of *Clinical Cases*

*World J Clin Cases* 2020 October 6; 8(19): 4280-4687



**OPINION REVIEW**

- 4280 Role of monoclonal antibody drugs in the treatment of COVID-19  
*Ucciferri C, Vecchiet J, Falasca K*

**MINIREVIEWS**

- 4286 Review of simulation model for education of point-of-care ultrasound using easy-to-make tools  
*Shin KC, Ha YR, Lee SJ, Ahn JH*
- 4303 Liver injury in COVID-19: A minireview  
*Zhao JN, Fan Y, Wu SD*

**ORIGINAL ARTICLE****Case Control Study**

- 4311 Transanal minimally invasive surgery *vs* endoscopic mucosal resection for rectal benign tumors and rectal carcinoids: A retrospective analysis  
*Shen JM, Zhao JY, Ye T, Gong LF, Wang HP, Chen WJ, Cai YK*
- 4320 Impact of *mTOR* gene polymorphisms and gene-tea interaction on susceptibility to tuberculosis  
*Wang M, Ma SJ, Wu XY, Zhang X, Abesig J, Xiao ZH, Huang X, Yan HP, Wang J, Chen MS, Tan HZ*

**Retrospective Cohort Study**

- 4331 Establishment and validation of a nomogram to predict the risk of ovarian metastasis in gastric cancer: Based on a large cohort  
*Li SQ, Zhang KC, Li JY, Liang WQ, Gao YH, Qiao Z, Xi HQ, Chen L*

**Retrospective Study**

- 4342 Predictive factors for early clinical response in community-onset *Escherichia coli* urinary tract infection and effects of initial antibiotic treatment on early clinical response  
*Kim YJ, Lee JM, Lee JH*
- 4349 Managing acute appendicitis during the COVID-19 pandemic in Jiaying, China  
*Zhou Y, Cen LS*
- 4360 Clinical application of combined detection of SARS-CoV-2-specific antibody and nucleic acid  
*Meng QB, Peng JJ, Wei X, Yang JY, Li PC, Qu ZW, Xiong YF, Wu GJ, Hu ZM, Yu JC, Su W*
- 4370 Prolonged prothrombin time at admission predicts poor clinical outcome in COVID-19 patients  
*Wang L, He WB, Yu XM, Hu DL, Jiang H*

- 4380 Percutaneous radiofrequency ablation is superior to hepatic resection in patients with small hepatocellular carcinoma

*Zhang YH, Su B, Sun P, Li RM, Peng XC, Cai J*

- 4388 Clinical study on the surgical treatment of atypical Lisfranc joint complex injury

*Li X, Jia LS, Li A, Xie X, Cui J, Li GL*

- 4400 Application of medial column classification in treatment of intra-articular calcaneal fractures

*Zheng G, Xia F, Yang S, Cui J*

### Clinical Trials Study

- 4410 Optimal hang time of enteral formula at standard room temperature and high temperature

*Lakananurak N, Nalinthassanai N, Suansawang W, Panarat P*

### META-ANALYSIS

- 4416 Meta-analysis reveals an association between acute pancreatitis and the risk of pancreatic cancer

*Liu J, Wang Y, Yu Y*

### SCIENTOMETRICS

- 4431 Global analysis of daily new COVID-19 cases reveals many static-phase countries including the United States potentially with unstoppable epidemic

*Long C, Fu XM, Fu ZF*

### CASE REPORT

- 4443 Left atrial appendage aneurysm: A case report

*Belov DV, Moskalev VI, Garbuzenko DV, Arefyev NO*

- 4450 Twenty-year survival after iterative surgery for metastatic renal cell carcinoma: A case report and review of literature

*De Raffe E, Mirarchi M, Casadei R, Ricci C, Brunocilla E, Minni F*

- 4466 Primary rhabdomyosarcoma: An extremely rare and aggressive variant of male breast cancer

*Satală CB, Jung I, Bara TJ, Simu P, Simu I, Vlad M, Szodorai R, Gurzu S*

- 4475 Bladder stones in a closed diverticulum caused by *Schistosoma mansoni*: A case report

*Alkhamees MA*

- 4481 Cutaneous ciliated cyst on the anterior neck in young women: A case report

*Kim YH, Lee J*

- 4488 Extremely rare case of successful treatment of metastatic ovarian undifferentiated carcinoma with high-dose combination cytotoxic chemotherapy: A case report

*Kim HB, Lee HJ, Hong R, Park SG*

- 4494** Acute amnesia during pregnancy due to bilateral fornix infarction: A case report  
*Cho MJ, Shin DI, Han MK, Yum KS*
- 4499** Ascaris-mimicking common bile duct stone: A case report  
*Choi SY, Jo HE, Lee YN, Lee JE, Lee MH, Lim S, Yi BH*
- 4505** Eight-year follow-up of locally advanced lymphoepithelioma-like carcinoma at upper urinary tract: A case report  
*Yang CH, Weng WC, Lin YS, Huang LH, Lu CH, Hsu CY, Ou YC, Tung MC*
- 4512** Spontaneous resolution of idiopathic intestinal obstruction after pneumonia: A case report  
*Zhang BQ, Dai XY, Ye QY, Chang L, Wang ZW, Li XQ, Li YN*
- 4521** Successful pregnancy after protective hemodialysis for chronic kidney disease: A case report  
*Wang ML, He YD, Yang HX, Chen Q*
- 4527** Rapid remission of refractory synovitis, acne, pustulosis, hyperostosis, and osteitis syndrome in response to the Janus kinase inhibitor tofacitinib: A case report  
*Li B, Li GW, Xue L, Chen YY*
- 4535** Percutaneous fixation of neonatal humeral physal fracture: A case report and review of the literature  
*Tan W, Wang FH, Yao JH, Wu WP, Li YB, Ji YL, Qian YP*
- 4544** Severe fundus lesions induced by ocular jellyfish stings: A case report  
*Zheng XY, Cheng DJ, Lian LH, Zhang RT, Yu XY*
- 4550** Application of ozonated water for treatment of gastro-thoracic fistula after comprehensive esophageal squamous cell carcinoma therapy: A case report  
*Wu DD, Hao KN, Chen XJ, Li XM, He XF*
- 4558** Germinomas of the basal ganglia and thalamus: Four case reports  
*Huang ZC, Dong Q, Song EP, Chen ZJ, Zhang JH, Hou B, Lu ZQ, Qin F*
- 4565** Gastrointestinal bleeding caused by jejunal angiosarcoma: A case report  
*Hui YY, Zhu LP, Yang B, Zhang ZY, Zhang YJ, Chen X, Wang BM*
- 4572** High expression of squamous cell carcinoma antigen in poorly differentiated adenocarcinoma of the stomach: A case report  
*Wang L, Huang L, Xi L, Zhang SC, Zhang JX*
- 4579** Therapy-related acute promyelocytic leukemia with FMS-like tyrosine kinase 3-internal tandem duplication mutation in solitary bone plasmacytoma: A case report  
*Hong LL, Sheng XF, Zhuang HF*
- 4588** Metastasis of esophageal squamous cell carcinoma to the thyroid gland with widespread nodal involvement: A case report  
*Zhang X, Gu X, Li JG, Hu XJ*

- 4595** Severe hyperlipemia-induced pseudoerythrocytosis - Implication for misdiagnosis and blood transfusion: A case report and literature review  
*Zhao XC, Ju B, Wei N, Ding J, Meng FJ, Zhao HG*
- 4603** Novel brachytherapy drainage tube loaded with double 125I strands for hilar cholangiocarcinoma: A case report  
*Lei QY, Jiao DC, Han XW*
- 4609** Resorption of upwardly displaced lumbar disk herniation after nonsurgical treatment: A case report  
*Wang Y, Liao SC, Dai GG, Jiang L*
- 4615** Primary hepatic myelolipoma: A case report and review of the literature  
*Li KY, Wei AL, Li A*
- 4624** Endoscopic palliative resection of a giant 26-cm esophageal tumor: A case report  
*Li Y, Guo LJ, Ma YC, Ye LS, Hu B*
- 4633** Solitary hepatic lymphangioma mimicking liver malignancy: A case report and literature review  
*Long X, Zhang L, Cheng Q, Chen Q, Chen XP*
- 4644** Intraosseous venous malformation of the maxilla after enucleation of a hemophilic pseudotumor: A case report  
*Cai X, Yu JJ, Tian H, Shan ZF, Liu XY, Jia J*
- 4652** Intravesically instilled gemcitabine-induced lung injury in a patient with invasive urothelial carcinoma: A case report  
*Zhou XM, Wu C, Gu X*
- 4660** Bochdalek hernia masquerading as severe acute pancreatitis during the third trimester of pregnancy: A case report  
*Zou YZ, Yang JP, Zhou XJ, Li K, Li XM, Song CH*
- 4667** Localized primary gastric amyloidosis: Three case reports  
*Liu XM, Di LJ, Zhu JX, Wu XL, Li HP, Wu HC, Tuo BG*
- 4676** Displacement of peritoneal end of a shunt tube to pleural cavity: A case report  
*Liu J, Guo M*
- 4681** Parathyroid adenoma combined with a rib tumor as the primary disease: A case report  
*Han L, Zhu XF*

**ABOUT COVER**

Peer-reviewer of *World Journal of Clinical Cases*, Professor Adrián Ángel Inchauspe, obtained his MD in 1986 from La Plata National University (Argentina), where he remained as Professor of Surgery. Study abroad, at the Aachen and Tübingen Universities in Germany in 1991, led to his certification in laparoscopic surgery, and at the Louis Pasteur University in Strasbourg France, led to his being awarded the Argentine National Invention Award in 1998 for his graduate work in tele-surgery. He currently serves as teacher in the Argentine Acupuncture Society, as Invited Foreigner Professor at the China National Academy of Sciences and Hainan Medical University, and as editorial member and reviewer for many internationally renowned journals. (L-Editor: Filipodia)

**AIMS AND SCOPE**

The primary aim of *World Journal of Clinical Cases* (*WJCC*, *World J Clin Cases*) is to provide scholars and readers from various fields of clinical medicine with a platform to publish high-quality clinical research articles and communicate their research findings online.

*WJCC* mainly publishes articles reporting research results and findings obtained in the field of clinical medicine and covering a wide range of topics, including case control studies, retrospective cohort studies, retrospective studies, clinical trials studies, observational studies, prospective studies, randomized controlled trials, randomized clinical trials, systematic reviews, meta-analysis, and case reports.

**INDEXING/ABSTRACTING**

The *WJCC* is now indexed in Science Citation Index Expanded (also known as SciSearch®), Journal Citation Reports/Science Edition, PubMed, and PubMed Central. The 2020 Edition of Journal Citation Reports® cites the 2019 impact factor (IF) for *WJCC* as 1.013; IF without journal self cites: 0.991; Ranking: 120 among 165 journals in medicine, general and internal; and Quartile category: Q3.

**RESPONSIBLE EDITORS FOR THIS ISSUE**

Production Editor: Yan-Xia Xing; Production Department Director: Yun-Xiaojuan Wu; Editorial Office Director: Jin-Lai Wang.

**NAME OF JOURNAL**

*World Journal of Clinical Cases*

**ISSN**

ISSN 2307-8960 (online)

**LAUNCH DATE**

April 16, 2013

**FREQUENCY**

Semimonthly

**EDITORS-IN-CHIEF**

Dennis A Bloomfield, Sandro Vento, Bao-Gan Peng

**EDITORIAL BOARD MEMBERS**

<https://www.wjnet.com/2307-8960/editorialboard.htm>

**PUBLICATION DATE**

October 6, 2020

**COPYRIGHT**

© 2020 Baishideng Publishing Group Inc

**INSTRUCTIONS TO AUTHORS**

<https://www.wjnet.com/bpg/gerinfo/204>

**GUIDELINES FOR ETHICS DOCUMENTS**

<https://www.wjnet.com/bpg/GerInfo/287>

**GUIDELINES FOR NON-NATIVE SPEAKERS OF ENGLISH**

<https://www.wjnet.com/bpg/gerinfo/240>

**PUBLICATION ETHICS**

<https://www.wjnet.com/bpg/GerInfo/288>

**PUBLICATION MISCONDUCT**

<https://www.wjnet.com/bpg/gerinfo/208>

**ARTICLE PROCESSING CHARGE**

<https://www.wjnet.com/bpg/gerinfo/242>

**STEPS FOR SUBMITTING MANUSCRIPTS**

<https://www.wjnet.com/bpg/GerInfo/239>

**ONLINE SUBMISSION**

<https://www.f6publishing.com>

## Germinomas of the basal ganglia and thalamus: Four case reports

Zhen-Chao Huang, Qing Dong, En-Peng Song, Zhi-Jie Chen, Jin-Hua Zhang, Bo Hou, Zheng-Qi Lu, Feng Qin

**ORCID number:** Zhen-Chao Huang 0000-0002-2411-4921; Qing Dong 0000-0002-2400-5477; En-Peng Song 0000-0002-9967-6013; Zhi-Jie Chen 0000-0002-6262-288X; Jin-Hua Zhang 0000-0002-2131-3781; Bo Hou 0000-0003-0520-3969; Zheng-Qi Lu 0000-0002-2118-0368; Feng Qin 0000-0001-8468-2018.

**Author contributions:** Huang ZC and Qin F were the patients' neurosurgeons; Dong Q prepared the manuscript; Song EP, Chen ZJ, Zhang JH and Hou B reviewed the literature and contributed to manuscript drafting; Lu ZQ and Qin F were responsible for revision of the manuscript for important intellectual content.

**Supported by** The Third Affiliated Hospital of Sun Yat-Sen University, Clinical Research Program, No. YHJH201907.

**Informed consent statement:** Written informed consent was obtained from the patient for publication of this report and any accompanying images.

**Conflict-of-interest statement:** The authors declare that they have no conflict of interest.

**CARE Checklist (2016) statement:** The authors have read the CARE Checklist (2016), and the manuscript was prepared and revised according to the CARE Checklist (2016).

**Zhen-Chao Huang, En-Peng Song, Zhi-Jie Chen, Jin-Hua Zhang, Bo Hou, Feng Qin,** Department of Neurosurgery, The Third Affiliated Hospital of Sun Yat-Sen University, Guangzhou 510630, Guangdong Province, China

**Qing Dong, Zheng-Qi Lu,** Department of Neurology, The Third Affiliated Hospital of Sun Yat-Sen University, Guangzhou 510630, Guangdong Province, China

**Corresponding author:** Feng Qin, MD, Chief Doctor, Neurosurgeon, Department of Neurosurgery, The Third Affiliated Hospital of Sun Yat-Sen University, No. 600 Tianhe Road, Guangzhou 510630, Guangdong Province, China. [qinfeng2@mail.sysu.edu.cn](mailto:qinfeng2@mail.sysu.edu.cn)

### Abstract

#### BACKGROUND

The early diagnosis of basal ganglia and thalamus germinomas is often difficult due to the absence of elevated tumor markers, and atypical clinical symptoms and neuroimaging features.

#### CASE SUMMARY

Four male children aged 8 to 15 years were diagnosed with germinomas in the basal ganglia and thalamus by stereotactic biopsy from 2017 to 2019. All patients developed hemiplegia except patient 4 who also had cognitive decline, speech disturbance, nocturnal enuresis, polydipsia, polyuria, precocious puberty and abnormalities of thermoregulation. All four cases were alpha-fetoprotein and beta-human chorionic gonadotrophin ( $\beta$ -HCG) negative except patient 3 who had slightly elevated  $\beta$ -HCG in cerebrospinal fluid (CSF). No malignant cells were detected in the patients' CSF. Brain magnetic resonance imaging findings were diverse in these patients with the exception of the unique and common characteristics of ipsilateral hemisphere atrophy, especially in the cerebral peduncle. All patients were diagnosed with germinomas of the basal ganglia and thalamus by stereotactic brain biopsy.

#### CONCLUSION

Stereotactic brain biopsy is necessary to confirm the diagnosis of ectopic germinomas. Serial neuroimaging studies can not only differentiate disease but also determine the biopsy site.

**Key Words:** Intracranial germinoma; Stereotactic brain biopsy; Basal ganglia; Thalamus; Tumor marker; Case report

©The Author(s) 2020. Published by Baishideng Publishing Group Inc. All rights reserved.

**Open-Access:** This article is an open-access article that was selected by an in-house editor and fully peer-reviewed by external reviewers. It is distributed in accordance with the Creative Commons Attribution NonCommercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited and the use is non-commercial. See: <http://creativecommons.org/licenses/by-nc/4.0/>

**Manuscript source:** Unsolicited manuscript

**Received:** June 1, 2020

**Peer-review started:** June 1, 2020

**First decision:** July 25, 2020

**Revised:** July 29, 2020

**Accepted:** August 29, 2020

**Article in press:** August 29, 2020

**Published online:** October 6, 2020

**P-Reviewer:** Zavras N

**S-Editor:** Huang P

**L-Editor:** MedE-Ma JY

**P-Editor:** Xing YX



**Core Tip:** Basal ganglia and thalamus germinomas are rare and early diagnosis of these tumors is usually difficult due to insidious onset, absence of elevated tumor markers, and subtle and atypical neuroimaging features. The definite diagnosis of these ectopic germinomas depends on histopathological examination. In this report, we describe four intractable cases whose histopathological diagnoses were germinomas in the basal ganglia and thalamus. Ipsilateral hemiatrophy, which was a common characteristic on neuroimaging of germinomas in the basal ganglia and thalamus, may be an important feature in differentiating these lesions from other intracranial tumors.

**Citation:** 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(19): 4558-4564

**URL:** <https://www.wjgnet.com/2307-8960/full/v8/i19/4558.htm>

**DOI:** <https://dx.doi.org/10.12998/wjcc.v8.i19.4558>

## INTRODUCTION

Intracranial germinomas account for approximately 50% of all central nervous system germ cell tumors and constitute 0.3%-3.4% of all brain cancers<sup>[1,2]</sup>. They are usually located at the midline structures including the pineal and suprasellar regions. The off-midline germinomas also called ectopic germinomas are rare including those in the basal ganglia and thalamus. Germinomas in the basal ganglia and thalamus are more frequently seen in the Asian population. Intracranial germinomas have a male predominance, especially those that originate in the basal ganglia and thalamus<sup>[3]</sup>. Pure intracranial germinomas are negative for alpha-fetoprotein (AFP) and beta-human chorionic gonadotropin ( $\beta$ -HCG) in both body fluid and histological staining<sup>[3-6]</sup>. Slightly elevated  $\beta$ -HCG levels in the body fluid predict syncytiotrophoblastic giant cells in germinomas<sup>[7,8]</sup>. Early clinical diagnosis of a basal ganglia germinoma is more difficult than in the midline region due to unusual localization, slow clinical course and subtle or atypical neuroimaging findings. Definite diagnosis of germinoma depends on histopathological findings. The prognosis of an intracranial germinoma is usually favorable following chemotherapy and radiotherapy. However, treatment outcome of ectopic germinoma is worse if diagnosis is delayed. Here, we describe four atypical and intractable cases which were ultimately diagnosed as germinomas by stereotactic brain biopsy and histological staining.

## CASE PRESENTATION

### Chief complaints

All four patients were male and the age of onset ranged from 8-15 years. Patient 1 suffered from three episodes of transient numbness of his right extremities. Patient 2 and patient 3 developed slow progressive weakness of their hemilateral legs and arms. Patient 4 gradually developed walking and writing disorders, cognition decline, speech disturbance, nocturnal enuresis, polydipsia, polyuria, precocious puberty and abnormalities of thermoregulation.

### History of past illness

All four patients had no particular medical history or family history.

### Physical examination

Patients 1, 2 and 3 had mild to moderate spastic paresis of unilateral limbs, brisk deep reflexes and the Babinski sign. Cranial nerve palsy was not observed. Sensory examinations were almost bilaterally symmetric. Patient 4 presented with mild cognitive impairment, involuntary movement of his right arm, increased muscle tone of bilateral extremities without muscle weakness and precocious puberty signs including enlarged testicles and penis, and the appearance of pubic and underarm hair.

### Laboratory examinations

All four cases were AFP and  $\beta$ -HCG negative except patient 3 who had a slightly elevated  $\beta$ -HCG in cerebrospinal fluid (CSF, 22.9 mIU/mL, reference value 0-5 mIU/mL) (Table 1). Serum carcinoembryonic antigen and other tumor marker levels were also within the reference range. No malignant cells were detected in CSF. No other significant abnormalities in laboratory examinations were observed.

### Imaging examinations

Magnetic resonance imaging (MRI) of the brain revealed local lesions in unilateral basal ganglia region in patients 1, 2, and 3. Brain MRI revealed subtle and ill-defined lesions in bilateral basal ganglia and thalamus in patient 4. The characteristics of these brain lesions are shown in Table 2 and Figure 1. In addition, patient 3 and 4 underwent both 18F-fluorodeoxyglucose-positron emission tomography (18F-FDG-PET) and 18F-fluorodopa-positron emission tomography (18F-DOPA-PET). In patient 3, 18F-FDG-PET revealed diffuse low metabolism in the left cerebral cortex, basal ganglia and thalamus (Figure 2A). 18F-DOPA-PET showed slightly low metabolism in the left basal ganglia (Figure 2B). In patient 4, 18F-FDG-PET demonstrated low metabolism in the left hemisphere and left cerebral peduncle (Figure 2C). 18F-DOPA-PET showed normal metabolism (Figure 2D).

---

## FINAL DIAGNOSIS

All patients were diagnosed with germinomas of the basal ganglia and thalamus by stereotactic brain biopsy. Histopathological diagnoses were further confirmed by another hospital.

---

## TREATMENT

All four patients received whole brain radiotherapy and chemotherapy at another hospital.

---

## OUTCOME AND FOLLOW-UP

The brain lesions on MRI were reduced or disappeared and their symptoms remained stable without aggravation.

---

## DISCUSSION

Germinomas in the basal ganglia and thalamus show a male predominance<sup>[5,5,6,9-11]</sup>. The reason for this is unclear. They usually occur in young adolescents aged from 10 to 19 years. This may be correlated to gonad development in this age group<sup>[3]</sup>. Basal ganglia germinomas usually have an insidious onset and slow progression. The clinical presentation of these tumors depends on their localization. The most common symptoms are progressive hemiparesis, mental status change and cognitive decline. In this report, patient 1 developed paroxysmal paresthesia which is very rare. The other 3 patients had hemiplegia. Patient 4 developed cognitive decline, diabetes insipidus, precocious puberty in addition to hemiplegia. Although patients 3 and 4 had longer duration than patients 1 and 2, the brain lesions shown by MRI were much smaller and more ill-defined. Hence, the size of the lesion did not correspond to the duration and severity of the clinical presentation. Symptoms and signs are valuable for localization and contribute to the identification of subtle lesions on brain MRI.

Tumor markers of pure germinomas including AFP and  $\beta$ -HCG were negative in these patients<sup>[3-6]</sup>.  $\beta$ -HCG levels were slightly elevated in the body fluid of some patients which indicated syncytiotrophoblastic giant cells in the germinoma. Germinomas with elevated  $\beta$ -HCG in serum but not in CSF, might be associated with a poor outcome<sup>[7,8]</sup>. It was reported that intracranial germinomas with serum  $\beta$ -HCG levels higher than 15 mIU/mL had a high recurrence rate<sup>[7]</sup>. However, all the cases in that study were midline germinomas including those in the pineal region and suprasellar region or both sites. Further studies are needed to evaluate the prognosis

Table 1 Patients' characteristics

| Case | Onset age (yr) | Sex | Duration(mo) | AFP (S/C) | HCG (S/C) | Histological diagnosis |
|------|----------------|-----|--------------|-----------|-----------|------------------------|
| 1    | 12             | M   | 2            | -/-       | -/-       | Germinoma              |
| 2    | 10             | M   | 3            | -/-       | -/-       | Germinoma              |
| 3    | 15             | M   | 18           | -/-       | -/+       | Germinoma              |
| 4    | 8              | M   | 24           | -/-       | -/-       | Germinoma              |

AFP: Alpha-fetoprotein; HCG: Human chorionic gonadotrophin; S/C: Serum/cerebrospinal fluid. M: male

Table 2 Neuroimaging findings before stereotactic brain biopsy

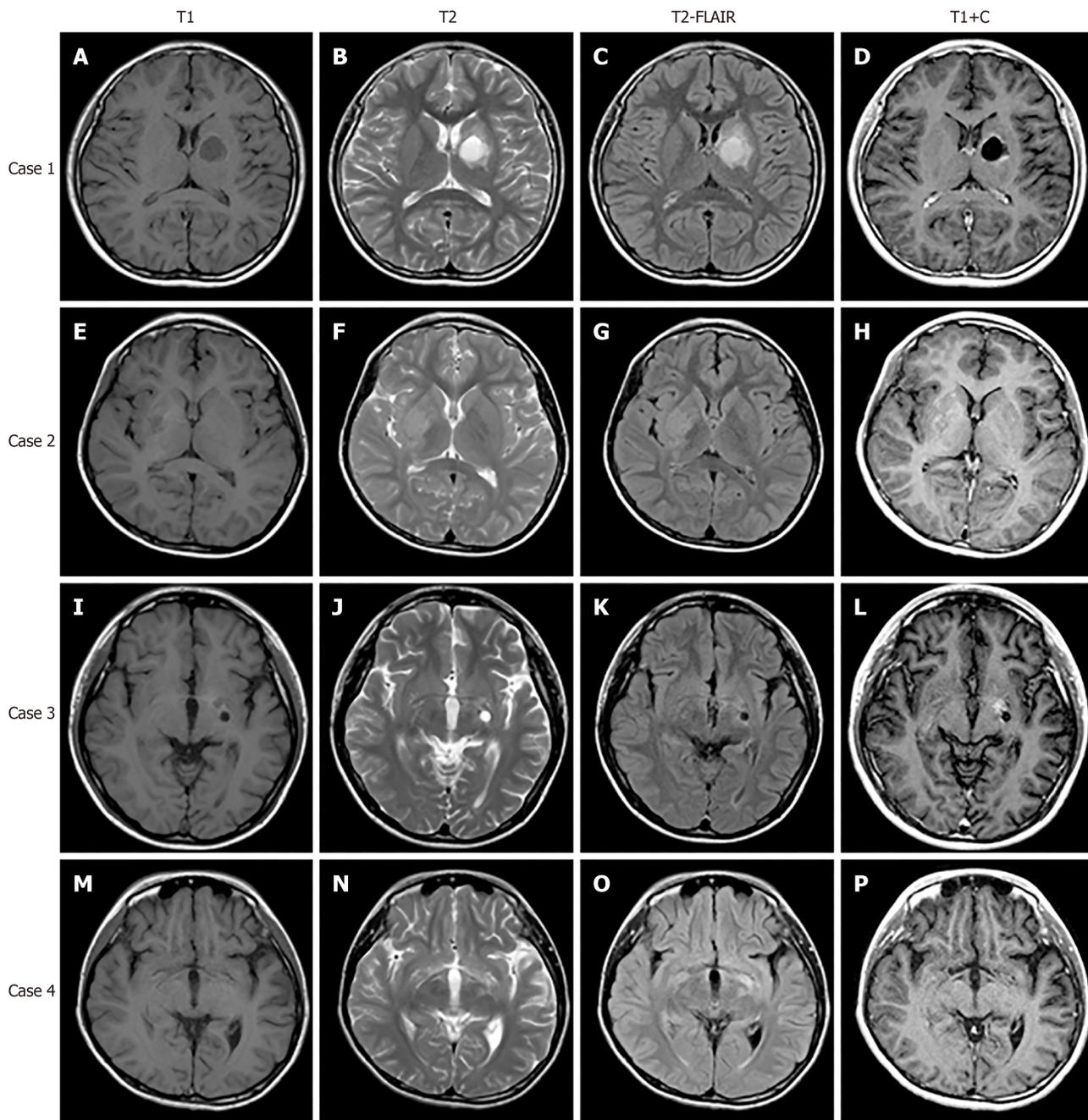
| Case | MRI findings         |             |            |               |                |                         |      |         |             | 18F-FDG-PET | 18F-DOPA-PET |
|------|----------------------|-------------|------------|---------------|----------------|-------------------------|------|---------|-------------|-------------|--------------|
|      | Contrast enhancement | Mass effect | Hemorrhage | Calcification | Cyst formation | Ipsilateral hemiatrophy | SWI  | MRS     | DTI         |             |              |
| 1    | Y                    | Y           | N          | Y             | Y              | Y                       | Hypo | Low NAA | Nor         | Low         | Low          |
| 2    | Y                    | N           | N          | N             | N              | Y                       | N/A  | N/A     | N/A         | N/A         | N/A          |
| 3    | Y                    | N           | N          | N             | Y              | Y                       | N/A  | N/A     | Interrupted | N/A         | N/A          |
| 4    | N                    | N           | N          | N             | N              | Y (Bi)                  | Nor  | Nor     | N/A         | Low         | Nor          |

MRI: Magnetic resonance imaging; SWI: Susceptibility weighted imaging; MRS: Magnetic resonance spectroscopy; DTI: Diffusion tensor imaging; 18F-FDG-PET: 18F-fluorodeoxyglucose-positron emission tomography; 18F-DOPA-PET: 18F-fluorodopa-positron emission tomography; Hypo: Hypointense; NAA: N-acetylaspartate peak; Nor: Normal; N/A: Not applicable; Bi: Bilateral.

of basal ganglia germinomas with elevated  $\beta$ -HCG. All our cases were AFP and  $\beta$ -HCG negative except patient 3 who had a slightly elevated level of  $\beta$ -HCG in CSF. Although these tumor markers are usually negative in germinomas, they serve to differentiate germinomas from other germ cell tumors.

According to the literature, typical brain MRI signs of basal ganglia germinomas are usually cystic formation, amorphous calcification, focal hemorrhage, peritumoral edema, contrast enhancement and ipsilateral cerebral and brain stem hemiatrophy<sup>[12-14]</sup>. None of our four cases presented all of the above typical neuroimaging characteristics. One patient had calcification, two patients exhibited cystic formation, and three patients had contrast enhancement. All these patients developed ipsilateral hemisphere atrophy especially in the cerebral peduncle. None had intratumoral hemorrhage. Although the MR images of case 1 shared overlapping features with craniopharyngioma, the location of the tumor was useful in differentiating it from craniopharyngioma. In cases 2-4, it was easy to miss the lesions on brain MRI. The most atypical case was patient 4 who showed bilateral involvement and did not present with the above signs except bilateral hemisphere atrophy. As shown in the literature, ipsilateral hemiatrophy is the predominant feature of basal ganglia germinoma<sup>[3,15]</sup>. Wallerian degeneration of the conduction tract is hypothesized to be the etiology of hemiatrophy<sup>[15]</sup>. In our report, patients 1 and 3 underwent diffusion tensor imaging examination which further supported this hypothesis. Why only germinomas rather than other brain tumors lead to ipsilateral hemiatrophy requires further investigation. Previous reports revealed that susceptibility weighted imaging (SWI) might be more sensitive in detecting early basal ganglia germinoma than conventional MRI, and MR spectroscopy (MRS) was helpful for monitoring the effects of treatment<sup>[6,16]</sup>. Patient 1 had similar SWI and MRS findings to those in the literature. A preoperative computed tomography scan was helpful in evaluating hemorrhage and calcification. Patients 3 and 4 underwent both 18F-FDG-PET and 18F-DOPA-PET. It seems that both these techniques had limited use for germinoma. Further studies are needed to confirm the value of PET examination in the diagnosis of germinoma. The reason why patient 4 had the longest clinical course before definite diagnosis was the limited findings on radiological examination.

According to the above findings, germinomas originating from atypical regions are not easy to diagnosis, especially in patients with small and ill-defined brain lesions.

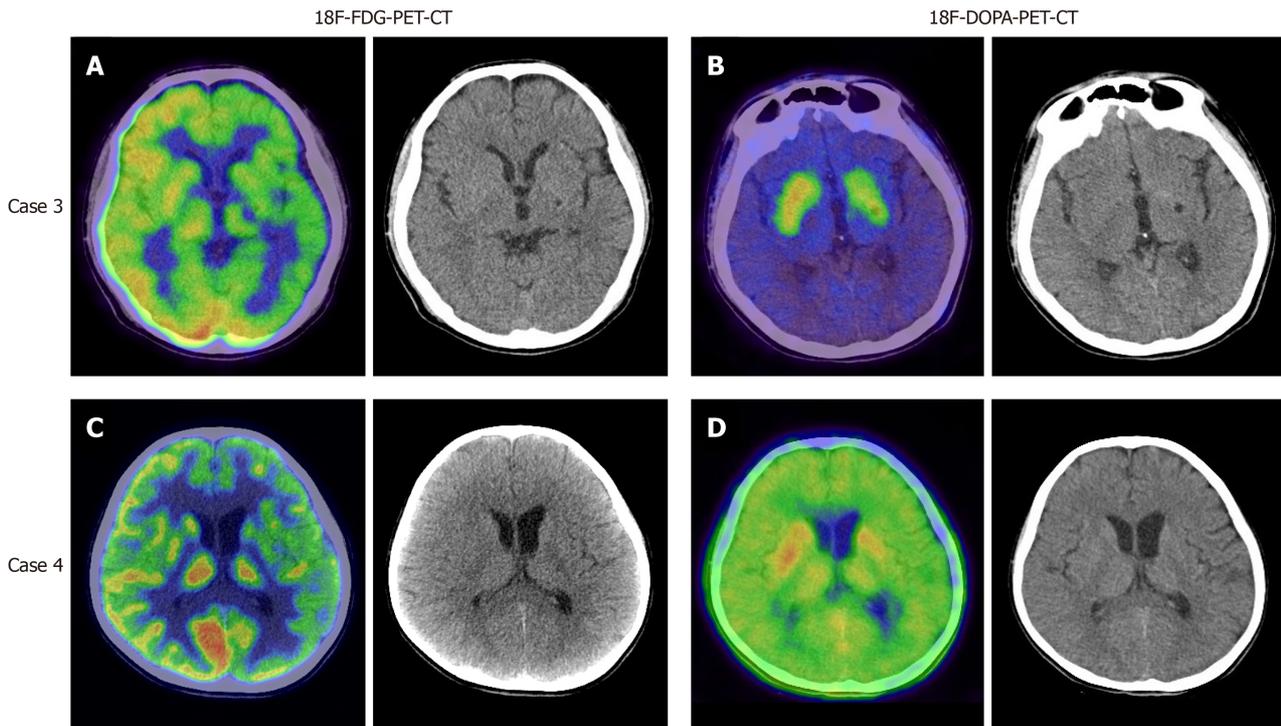


**Figure 1 Appearance of germinomas on conventional magnetic resonance images.** A-D: Case 1. A round space occupying lesion in the left basal ganglia and thalamus was hypointense on T1 and hyperintense on T2/T2-fluid-attenuated inversion recovery (FLAIR) with annular enhancement around the cystic component. Mild ipsilateral hemiatrophy appeared; E-H: Case 2. An irregular lesion in the right basal ganglia was slightly hypointense on T1 and isointense to hyperintense on T2/T2-FLAIR with mild heterogeneous enhancement and ipsilateral hemiatrophy; I-L: Case 3. An ill-defined lesion was hypointense on T1 and hyperintense on T2/T2-FLAIR in the left basal ganglia beside malacia foci. The left hemisphere showed mild atrophy. Heterogeneous enhancement was shown after gadolinium administration; M-P: Case 4. The subtle lesions were isointense on both T1 and T2/T2-FLAIR around bilateral internal capsule and thalamus. Bilateral cerebral atrophy was revealed which was predominant on the left side. No enhancement was found. T1+C: Contrast-enhanced T1-weighted imaging; FLAIR: Fluid-attenuated inversion recovery.

Stereotactic biopsy was valuable for early diagnosis. Serial neuroimaging studies are needed not only for disease differentiation but also for determining the biopsy site.

## CONCLUSION

The diagnosis of germinomas in the basal ganglia and thalamus is often delayed due to the absence of elevated tumor markers, and atypical clinical symptoms and neuroimaging features. The association of a focal lesion in the basal ganglia or



**Figure 2 Appearance of germinomas on positron emission tomography-computed tomography.** A: 18F-fluorodeoxyglucose-positron emission tomography-computed tomography (18F-FDG-PET-CT) detected diffuse low FDG uptake in the left hemisphere in case 3; B: 18F-fluorodopa-positron emission tomography-computed tomography (18F-DOPA-PET-CT) detected low uptake of DOPA in the left basal ganglia in case 3; C: 18F-FDG-PET demonstrated low uptake in the left hemisphere in case 4; D: 18F-DOPA-PET-CT showed normal metabolism in case 4. 18F-FDG-PET-CT: 18F-fluorodeoxyglucose-positron emission tomography-computed tomography; 18F-DOPA-PET-CT: 18F-fluorodopa-positron emission tomography-computed tomography.

thalamus of children with progressive hemiparesis, neuroendocrine and neuropsychiatric symptoms and ipsilateral hemiatrophy could prompt the diagnosis of ectopic germinoma. Histological examinations are necessary to confirm the diagnosis of an atypical lesion. Serial neuroimaging studies not only differentiate diseases but also determine the biopsy site.

## REFERENCES

- 1 Cuccia V, Galarza M. Pure pineal germinomas: analysis of gender incidence. *Acta Neurochir (Wien)* 2006; **148**: 865-871; discussion 871 [PMID: 16791430 DOI: 10.1007/s00701-006-0846-x]
- 2 Finlay J, da Silva NS, Lavey R, Bouffet E, Kellie SJ, Shaw E, Saran F, Matsutani M. The management of patients with primary central nervous system (CNS) germinoma: current controversies requiring resolution. *Pediatr Blood Cancer* 2008; **51**: 313-316 [PMID: 18421722 DOI: 10.1002/pbc.21555]
- 3 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 [PMID: 19082612 DOI: 10.1007/s00381-008-0769-3]
- 4 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 [PMID: 19752170 DOI: 10.1259/bjr/25001856]
- 5 Konovalov AN, Kadyrov SU, Tarasova EM, Mazerkina NA, Gorelyshev SK, Khukhlaeva EA, Kobayakov GL, Trunin YY, Sanakoeva AV, Kholodov BV, Shishkina LV, Panina TN, Ryzhova MV. [Basal ganglia germinomas in children. Four clinical cases and a literature review]. *Zh Vopr Neurokhir Im N N Burdenko* 2016; **80**: 71-82 [PMID: 27029333 DOI: 10.17116/neiro201680171-82]
- 6 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 [PMID: 19581340 DOI: 10.3174/ajnr.A1696]
- 7 Utsuki S, Kawano N, Oka H, Tanaka T, Suwa T, Fujii K. Cerebral germinoma with syncytiotrophoblastic giant cells: feasibility of predicting prognosis using the serum hCG level. *Acta Neurochir (Wien)* 1999; **141**: 975-977; discussion 977-978 [PMID: 10526079 DOI: 10.1007/s007010050404]
- 8 Utsuki S, Oka H, Tanaka S, Tanizaki Y, Fujii K. Long-term outcome of intracranial germinoma with hCG elevation in cerebrospinal fluid but not in serum. *Acta Neurochir (Wien)* 2002; **144**: 1151-1154; discussion 1154-1155 [PMID: 12434171 DOI: 10.1007/s00701-002-1008-4]
- 9 Yasue M, Tanaka H, Nakajima M, Kamio M, Nakamura N, Numoto T, Tanaka J. Germ cell tumors of the

- basal ganglia and thalamus. *Pediatr Neurosurg* 1993; **19**: 121-126 [PMID: 8499324 DOI: 10.1159/000120716]
- 10 **Tang J**, Ma Z, Luo S, Zhang Y, Jia G, Zhang J. The germinomas arising from the basal ganglia and thalamus. *Childs Nerv Syst* 2008; **24**: 303-306 [PMID: 17882439 DOI: 10.1007/s00381-007-0460-0]
  - 11 **Wang Y**, Zou L, Gao B. Intracranial germinoma: clinical and MRI findings in 56 patients. *Childs Nerv Syst* 2010; **26**: 1773-1777 [PMID: 20665036 DOI: 10.1007/s00381-010-1247-2]
  - 12 **Moon WK**, Chang KH, Kim IO, Han MH, Choi CG, Suh DC, Yoo SJ, Han MC. Germinomas of the basal ganglia and thalamus: MR findings and a comparison between MR and CT. *AJR Am J Roentgenol* 1994; **162**: 1413-1417 [PMID: 8192009 DOI: 10.2214/ajr.162.6.8192009]
  - 13 **Okamoto K**, Ito J, Ishikawa K, Morii K, Yamada M, Takahashi N, Tokiguchi S, Furusawa T, Sakai K. Atrophy of the basal ganglia as the initial diagnostic sign of germinoma in the basal ganglia. *Neuroradiology* 2002; **44**: 389-394 [PMID: 12012122 DOI: 10.1007/s00234-001-0735-1]
  - 14 **Kim DI**, Yoon PH, Ryu YH, Jeon P, Hwang GJ. MRI of germinomas arising from the basal ganglia and thalamus. *Neuroradiology* 1998; **40**: 507-511 [PMID: 9763338 DOI: 10.1007/s002340050634]
  - 15 **Nagata K**, Nikaido Y, Yuasa T, Fujimoto K, Kim YJ, Inoue M. Germinoma causing wallerian degeneration. Case report and review of the literature. *J Neurosurg* 1998; **88**: 126-128 [PMID: 9420084 DOI: 10.3171/jns.1998.88.1.0126]
  - 16 **Li J**, Zhang XY, Wang B, Geng JZ. MRI and MR spectroscopy findings of the evolution of an intracranial germinoma: A case report. *Oncol Lett* 2015; **10**: 1194-1196 [PMID: 26622651 DOI: 10.3892/ol.2015.3351]



Published by **Baishideng Publishing Group Inc**  
7041 Koll Center Parkway, Suite 160, Pleasanton, CA 94566, USA

**Telephone:** +1-925-3991568

**E-mail:** [bpgoffice@wjgnet.com](mailto:bpgoffice@wjgnet.com)

**Help Desk:** <https://www.f6publishing.com/helpdesk>

<https://www.wjgnet.com>

