

Germ-cell tumors of the central nervous system in Peking Union Medical College Hospital: A 20-year clinicopathologic review

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To the Editor: Germ-cell tumors (GCTs) of the central nervous system (CNS), the morphologic, immunophenotypic, and (in some respects) genetic homologs of gonadal and other extraneuraxial germ-cell neoplasms, principally affect children and adolescents.^[1] The diagnosis of GCT of the CNS is not difficult, and the major GCT types are germinoma, teratoma, yolk sac tumor (YST), embryonal carcinoma, and choriocarcinoma. Neoplasms harboring multiple types are called mixed GCT (MGCT). Peak incidence of GCT of the CNS occurs in patients aged 10 to 14 years, and a clear majority of cases of all histologic types involve males. GCT of the CNS seems to be more prevalent in eastern Asia than in Europe and the United States.^[1-5] In Japan, 70% of patients with GCT of CNS aged 10 to 24 years and 73% were males,^[6] but there were limited Chinese patients' large-scale data, only two studies reported more than 100 cases.^[7,8] Were the types and clinical characteristics of GCTs in the CNS in Chinese patients consistent with Japan's? We reviewed all cases of GCTs in the CNS diagnosed by pathology in Peking Union Medical College Hospital from year 1999 to 2019. We retrospectively collected and analyzed all cases underwent optical microscopy and immunohistochemical staining examinations, aiming to summarize and analyze the clinicopathologic features of them.

There were 163 cases of GCT of the CNS in our cohort, and the male-to-female ratio was 74:89, the age ranged from 3 to 45 years (average age 16.4 years). One hundred and twenty-four cases (76.1%) were diagnosed as germinoma [Figure 1A]; Twenty-four cases (14.7%) were diagnosed as teratoma, including 21 cases of mature teratoma, two cases of immature teratoma [Figure 1B], and one case of teratoma with malignant transformation; thirteen cases (8.0%) were diagnosed as MGCT; one case (0.6%) was diagnosed as embryonal carcinoma

[Figure 1C]; one case (0.6%) was diagnosed as YST. There were no cases of pure choriocarcinoma originating in the CNS. Germinoma is the most common GCT of the CNS, and it can also occur as a component of an MGCT, in combination with other GCT. Germinoma is extremely sensitive to radiotherapy, and cure rates are high.^[9] There were 134 cases with germinoma components including 124 cases of pure germinoma in this report, and all were positive with CD117 [Figure 1D], octamer-binding transcription factor 3/4 [Figure 1E], and placental alkaline phosphatase. The ratio of male-to-female was 49:75 in 124 cases of pure germinoma, and aged 3 to 41 years (average age 15.7 years). Most of which occurred in the sellar region and suprasellar region (108 cases, 38 of which involved only the sellar region), and pineal gland (six cases), basal ganglia (five cases), periventricular (three cases), corpus callosum (one case), and lobe of brain (one case) were also involved in our cases. In the 70 cases involving the sellar region/suprasellar region, 23 cases also involved pineal body, 12 cases also involved the hypothalamus, ventricles were also involved in ten cases, basal ganglia in four cases, corpus callosum in two cases, and septum pellucidum in one case. There was one case containing syncytiotrophoblastic giant cells in this report. Twenty-four cases of teratoma in our series, aged 11 to 45 years (average age 24.5 years), and accounted for 0.3% of all teratoma cases in the same period. The locations of teratoma were intravertebral (14 cases), intrasellar region (four cases), pineal (three cases), suprasellar region (one case), left frontal base (one case), and middle cranial fossa (one case). Teratomas are sub-classified as mature, immature, or exhibiting malignant transformation. Two cases of which were immature teratoma with primitive neuroectodermal elements which were positive for CD99 and nestin, and one case was teratoma with malignant transformation, and the malignant components was carcinosarcoma.

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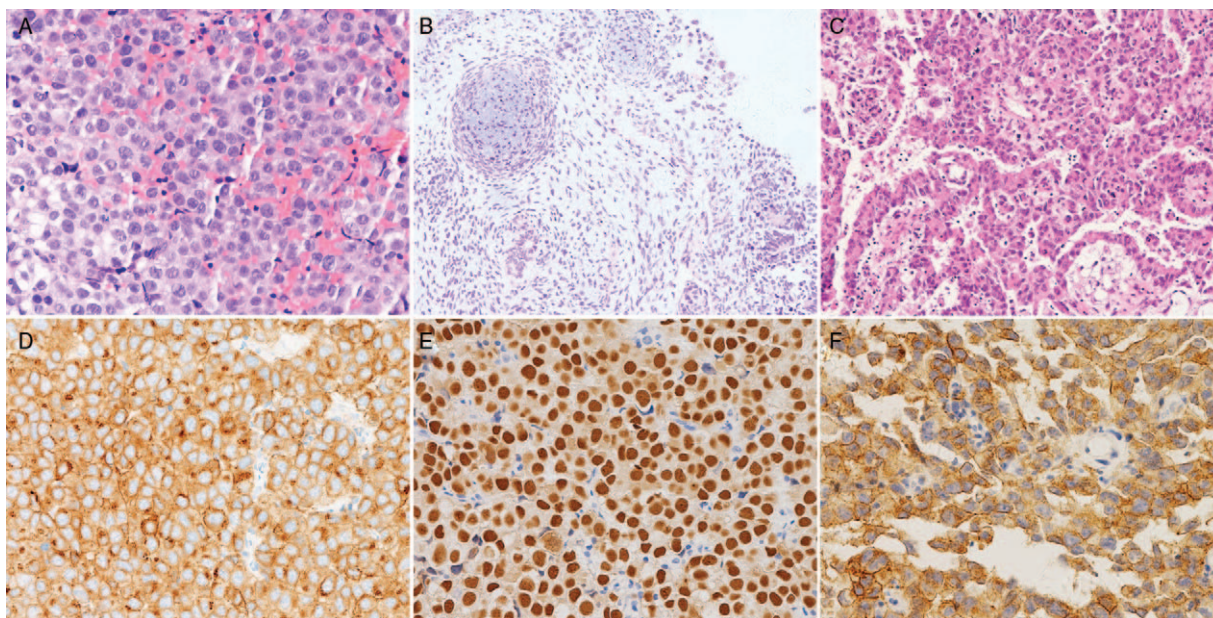


Figure 1: Histomorphology and immunohistochemical expression of different types of germ-cell tumors. (A) Germinoma contained large, undifferentiated cells with round vesicular nuclei, prominent nucleoli, and clear cytoplasm in sheet arrangement (HE staining, original magnification, $\times 200$). (B) Immature teratoma consisted of incompletely differentiated elements resembling fetal tissues (HE staining, original magnification, $\times 40$). (C) Embryonal carcinoma composed of large epithelial cells with macronuclei, and forming abortive papillae or line gland-like spaces (HE staining, original magnification, $\times 100$). (D) Immunoreactivity for CD117 in germinoma (Envision immunohistochemical staining, original magnification, $\times 200$). (E) Immunoreactivity for OCT3/4 in germinoma (Envision immunohistochemical staining, original magnification, $\times 200$). (F) Immunoreactivity for CD30 in embryonal carcinoma (Envision immunohistochemical staining, original magnification, $\times 200$). OCT3/4: Octamer-binding transcription factor 3/4; HE: Hematoxylin and eosin.

There were 13 cases of MGCT in our series (nine males and four females), aged 5 to 28 years (average age 10 years), which accounted for 13% of all MGCT in the same period. The sites of occurrence were sellar region (six cases), pineal region (four cases), spinal canal (two cases), and posterior third ventricle (one case), in which the components in turn were germinoma, mature teratoma, YST, choriocarcinoma (human chorionic gonadotrophin positive), immature teratoma, malignant transformation of teratoma, and embryonic carcinoma. One case of embryonal carcinoma was AE/AE3 and CD30 positive [Figure 1F, male, 13 years old], which was located in both sellar region and suprasellar region, accounting for 1.5% of the total embryonal carcinoma cases in the same period. One case of YST was alpha-1-fetoprotein and spalt-like transcription factor 4 positive (male, 13 years old), which was located in the sellar region, accounting for 1% of the total YST in the same period.

Our data suggested that GCT of the CNS were predominant in adolescents, which is consistent with other large-scale studies. However, there were slightly more women in our report, which is different from other large-scale studies showing that male patients were more common. Germinoma was the most common type of GCT of the CNS by pathologically confirmation, followed by teratoma and MGCT. Sellar region is the most common region of germ-cell tumors in the CNS in our hospital, followed by pineal region, which may be related to the patient's choices, and intraspinal canal is the most common site of teratoma.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patients have given their consent for their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Conflicts of interest

None.

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