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Peripheral primitive neuroectodermal tumor of the posterior mediastinum: A case report

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Abstract Peripheral primitive neuroectodermal tumor (pPNET) is an extremely rare disease entity of malignant tumors belonging to the Ewing sarcoma family that usually occurs in children and adolescents. We describe a 41-year-old female who presented with right upper abdominal pain. Surgical resection and biopsy revealed small round-cell tumor. Combined with immunohistochemical analysis, pPNET was diagnosed. No evidence of recurrence was noted at 18 months postoperatively. Even thought pPNET is a highly malignant tumor, Wide tumor-free resection and multi-agent chemotherapy can also obtain good clinical outcomes.

Key words peripheral primitive neuroectodermal tumor (pPNET); neurogenic mediastinal tumor; posterior mediastinum tumor; immunohistochemistry

Primary mediastinal malignant tumors are rare and represent only about 3% of all tumors within the chest. Among these uncommon malignancies peripheral primitive neuroectodermal tumor (pPNET) is even more infrequent [1]. pPNET is a small-round-cell-tumor of the soft tissue which belongs to the Ewing sarcoma family. This extremely rare malignancy occurs preferably in children and adolescents [2]. PNET is a highly malignant neoplasm and it is composed of small, round, uniform cells [3]. This tumor has been identified as peripheral primitive neuroectodermal malignancies by Askin in 1979 who reported about a rare small cell tumor arising from the soft tissue of the chest wall [2]. The posterior mediastinum within the chest is the second most localization of pediatric pPNET [1], and diagnosis of the tumor is confirmed by using various immunohistochemical studies and detecting the presence of a translocation, t(11;22) through fluorescent *in situ* hybridization (FISH) [4–5]. We report a pPNET arising in the posterior mediastinum. Radical surgical resection and chemotherapy had been done.

Case presentation

A 41-year-old female was admitted to our hospital (Subei People's Hospital, Yangzhou, China) because of right upper abdominal pain repeatedly which started 2 years ago and exacerbated 5 hours. While the patient's physical examination was unremarkable. Computed tomography (CT) of the chest demonstrated a nearly round soft tissue density shadow, with clear boundary, and approximately 83 mm × 60 mm in diameter in the right posterior mediastinum which uneven enhancement. No mediastinal lymph node enlargement and pleural thickening, but there was a small amount of pleural effusion in the right chest (Fig. 1). We therefore diagnosed a posterior mediastinal neurogenic tumors, and surgical resection was recommended both to clarify the diagnosis and accomplish definitive treatment.

The patient underwent a right posterolateral thoracotomy, during operation we could see the neoplasm located in the posterior mediastinum near spine and extended into the chest wall intercostals muscles, so we completed removal of the tumor including intercostals muscles and pleural tissues. Intraoperative frozen section of the 7 cm × 7 cm solid-cystic, capsule and fish-meat like appearance mediastinal mass revealed a malignant small round-cell neoplasm. Subsequent histopathologic examination of the resection specimen demonstrated a diffuse proliferation of small round uniform cells, and the cells contained small, round to oval nuclei, with scanty cytoplasm which are arranged in a prominent nesting pattern (Fig. 2). We also could see the cell interstitial rich in blood vessels and necrosis tissue in focal area. Immunohistochemical analysis demonstrated strong immunoreactivity of the neoplastic cells for CD99 (+)(Fig. 3) and Vimentin (+++). The neoplastic cells were positive for S-100 protein (+++)(Fig.

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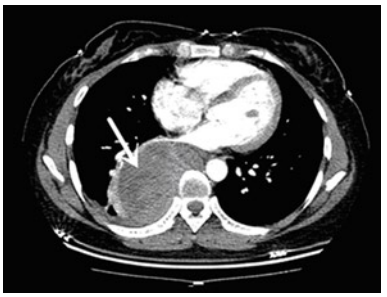

Fig. 1 Initial axial CT image showing a tumor in the posterior mediastinum (arrow)

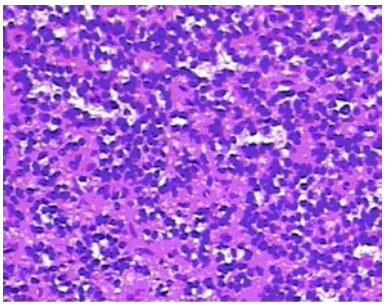

Fig. 2 Histologic specimen of the tumor stained with hematoxylin and eosin showing round and oval cells (magnification 20 ×)

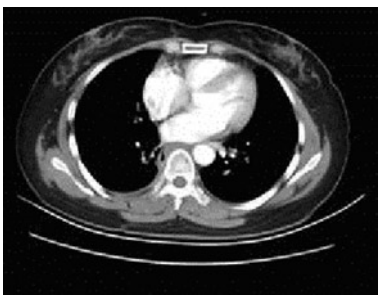

Fig. 5 After 4 times of chemotherapy, there was no relapse of tumor shown by CT evaluation

Fig. 3 Immunohistochemical staining showing consistent membranous expression of CD99 (magnification 200 ×)

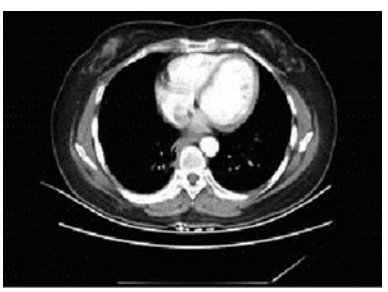

Fig. 6 No evidence of recurrence was noted at 18 months postoperatively

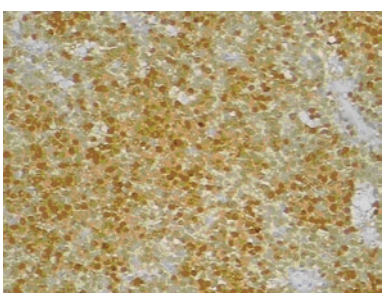

Fig. 4 Immunohistochemical staining showing positive expression of S-100 (magnification 200 ×)

4) and Ki67 (+), but negative for CD20, CD3, CD56, CgA, Ckpan, LCA, NSE, Pax-5 and Syn. The pathologic diagnosis was small round cell tumor. Based on the histologic and immunohistochemical findings, the tumor was diagnosed as a primitive neuroectodermal tumor of the posterior mediastinum.

Considering the particularity of tumor, the chemotherapy of choice consisted of combinations of ifosfamide, mesna, cisplatin, and epiruicin. After 4 times of chemotherapy, there was no relapse of tumor shown by CT evaluation (Fig. 5). Thereafter, no evidence of recurrence was noted at 18 months postoperatively (Fig. 6).

Discussion

Primitive neuroectodermal tumors (PNETs) are rarities and most frequently arise from the soft tissues and the bones [6], in the thoracic region, these tumors are more commonly seen originating from the chest wall, while our case was originated from the soft tissues in the posterior mediastinum, as we know, peripheral primitive neuroectodermal tumor (pPNET) is an extremely rare disease entity of malignant tumors belonging to the Ewing sarcoma family that usually occurs in children and adolescents with a predilection for the truncal and axial soft tissue. Thoraco-pulmonary manifestation in child mostly involves the chest and the posterior mediastinum [1]. In adults pPNET is even more uncommon and has therefore only anecdotally been reported in the posterior mediastinum [7–8], and it is also remarkable that our patient was a 41-year-old and beyond the average age of 30 years [9].

The classic histological pattern of more differentiated ES/PNET like pPNET, Homer-Wright rosettes could be

identified (Fig. 2), but it is difficult to distinguish from histologically similar small round-cell tumors including rhabdomyosarcoma, poorly differentiated synovial sarcoma, mesenchymal, chondrosarcoma, neuroblastoma, malignant lymphoma and small cell carcinoma. Among these tumors, to identify the malignant lymphoma and small cell carcinoma was so important that are relevant to us. Immunohistochemical studies are performed to confirm the diagnosis. The outcome of the immunohistochemical staining in this case matches very well with the results of other reports. CD99 (Fig. 3), a cell surface glycoprotein involved in cell adhesion, as well as vimentin have been positive in all reported adult and pediatric pPNETs [7, 10–11]. CD99 positivity is considered to confirm the diagnosis of pPNET [11]. On protein S-100 outcome of immunohistochemistry is heterogeneous (Fig. 4), in our case, as well as in other reports, the neoplastic cells were positive whereas in some pPNETs protein S-100 had not been detected. So did Synaptophysin (Syn). Considering the protein S-100 is sensitive to damage of the central nervous system and specific biochemical marker, it may be associate with the neural differentiation degree of tumor cells. Malignant lymphoma is distinguished from pPNETs, which do not stain for LCA. Small cell carcinoma is distinguished with the consistent positive immunoreactivity to cytokeratins (CKpan) [4], on account of this, we could exclude these tumors.

PNET is a highly malignant tumor with a very poor prognosis. The treatment of choice for these tumors was various combinations of radical surgical resection, neoadjuvant and adjuvant chemotherapy, and irradiation [12]. Some studies indicate that the 2-year survival rates who were treated with neoadjuvant chemotherapy and resection with or without adjuvant chemotherapy are higher than other treatments, reached to 66% [13]. The present case was treated with radical resection and adjuvant chemotherapy because the tumor was well-defined and had smooth edge. The patient had symptoms like abdominal pain and pleural effusion, in our experience, for patients who without obvious metastases were suitable for the early surgical treatment. Video-assisted thoracoscopic surgery (VATS) has advantages of less trauma, suffering light, quick recovery and small postoperative complications [14], but the tumor is so big that it would increase operative difficulty. If we found that the surrounding tissue have tumor invasion, tumor and surrounding tissue must be completely removed. Adjuvant chemotherapy after surgery is necessary because PNET is more chemosensitive tumor [4].

In conclusion, this illustrates that pPNET belongs to the differential diagnosis of neurogenic mediastinal malignancy, and ancillary laboratory techniques, including immunhistochemistry are invaluable to establish diagnoses. Early detection and resection of the tumor are essential for the treatment of the disease. Wide tumor-free resection and multi-agent chemotherapy are both necessary for good clinical outcomes.

Conflicts of interest

The authors indicated no potential conflicts of interest.

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