Int J Clin Exp Pathol 2018;11(5):2864-2868
www.ijcep.com /ISSN:1936-2625/IJCEP0071553

Case Report

Solid-pattern desmoplastic small round cell tumor of the orbit: a case report

Pei Wang[1], Yixiong Liu[2], Xiquan Liu[3], Qingguo Yan[2], Lu Wang[2]

[1]Department of Pathology, Weinan Central Hospital, Weinan, Shaanxi, P. R. China; [2]State Key Laboratory of Cancer Biology, Department of Pathology, Xijing Hospital and School of Basic Medicine, Fourth Military Medical University, Xi'an, Shaanxi, P. R. China; [3]Department of Neurosurgery, Weinan Central Hospital, Weinan, Shaanxi, P. R. China

Received December 26, 2017; Accepted February 24, 2018; Epub May 1, 2018; Published May 15, 2018

Abstract: Desmoplastic small round cell tumor (DSRCT) is a rare malignancy most commonly originating in the peritoneum. Only rare cases occur outside the abdomen. The present study describes a case of DSRCT in a young adolescent male who initially presented with an orbital mass. The diagnosis was confirmed by the presence of a polyphenotypic immunoprofile (positive for desmin and neural markers) and the characteristic EWS-WT1 gene fusion. Tumor histologically had an entirely solid pattern, lacking evidence of desmoplastic stroma. This purely solid variant shows that when occurring at an atypical location, DSRCT may be difficult to recognize. This reported case of DSRCT draws attention to the importance of including DSRCT in the differential diagnosis of orbital tumors.

Keywords: Orbital mass, desmoplastic small round cell tumor, molecular analysis, solid variant

Introduction

Desmoplastic small round cell tumor (DSRCT) was first described by Gerald and Rosai in 1989, who noticed a distinctive type of small cell tumor that predominantly involved the abdomen and affected young males [1]. Extraabdominal DSRCT is infrequent with cases reported in the brain, lung, pleura, salivary glands and soft tissue and bone [2]. Manifestations in the head are extremely uncommon. Desmoplastic small round cell tumor has been reported twice in the ethmoidal sinuses [3, 4] and once in the orbit [5]. Immunohistochemically, DSRCT shows multidirectional differentiation, with co-expression of epithelial, mesenchymal, and neural markers. DSRCT possesses a unique translocation, t (11; 22) (p13; q12) which may explain the multidirectional differentiation of DSRCT [6]. DSRCT is a rare, aggressive, malignant tumor. Due to the rarity of DSRCT and the absence of specific clinical manifestations of this tumor, clinicians may overlook the diagnosis of this disease, particularly for cases in which DSRCT arises in the orbit. In this report, we present a case of a young male who was diagnosed with solid pattern DSRCT of the orbit that produced a favorable outcome.

Case report

In March 2016, a 16-year-old male came from 3201 Hospital to our institution for consultation. He stated that he had a left eye mass for the last year, and the mass had growing rapidly for nearly 6 months. A computed tomography (CT) scan (**Figure 1**) revealed a homogeneous mass that was situated near the left eyeball without bony invasion. The tumor was resected in monobloc with negative margins for residual tumor. After surgery, the patient received no treatment, and he was still disease-free for 12 months after the diagnosis.

Histologically, the lesion had an entirely solid morphology, lacking evidence of desmoplastic stroma, and the tumor appeared to consist of a mixture of epithelioid and spindle cells. The shapes of tumor cells ranged from round to oval, with hyperchromatic nuclei, clumped ch-

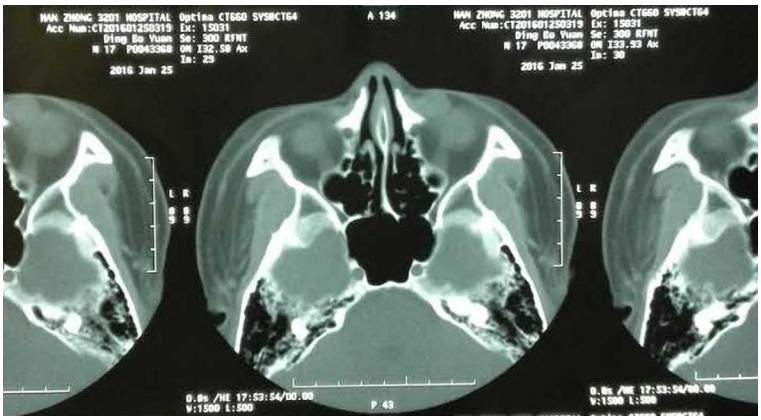

Figure 1. CT scan depicting a homogeneous mass situated near the left eyeball without bony invasion.

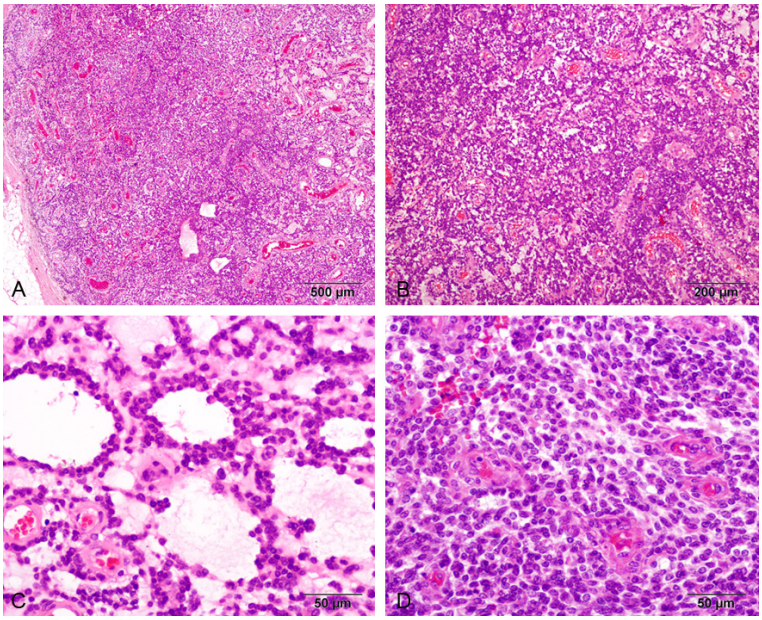

Figure 2. A, B. Biopsy reveals a cellular tumor having an entirely solid morphology, lacking evidence of desmoplastic stroma. C. Local areas of epithelioid cell morphology forming glandular or cribriform structures. D. Low mitotic figures.

romatin, unapparent nucleoli, and scanty cytoplasm. There were occasional scattered mitotic figures, and the tumor cells were arranged in sheets. The tumors displayed local areas of epithelioid cell morphology, forming glandular or cribriform structure (**Figure 2**). The small cells had occasionally scattered mitotic figures.

Immunohistochemical staining was performed using an automatic staining workstation (Leica Cytomation) with the Envision system with diaminobenzidine chromogen used as the substrate. The antibodies utilized are listed in **Table 1**. The small round cells showed strong immunoreactivity for desmin and CD99, were focally weak positive for SMA, Pgp9.5, NSE, Syn (**Figure 3A**), and Nestin, but negative for the other markers (**Table 1**). A distinctive dot-like perinuclear pattern was observed with staining for desmin (**Figure 3B**). The tumor cells were non-uniform positive for CD99 (**Figure 3C**). Ki-67 showed an active region of proliferation in the range of 10-15% (**Figure 3D**).

Fluorescence in situ hybridization (FISH) was performed on paraffin sections using the EWSR1 break-apart probe (Abbott-Vysis), where the splitting of normally fused red and green signals into separate red and green signals indicated the presence of EWSR1 gene translocation. In FISH analysis, each tumor cell nucleus showed one combined red-green signal and one green and one separate red signal, indicating the presence of a translocation involving EWSR1 gene (**Figure 4**).

Discussion

This is the second reported case of DSRCT arising in the orbit region [5]. However, it is different from previous cases. Histologically, the lesion had an entirely solid morphology, lacking evidence of desmoplastic stroma. Solid-pattern DSRCT that presented as a large intra-abdominal mass was reported by Ali [7]. Diagnosis typically requires a tissue biopsy with identification of the histopathologic features along with immunohistochemistry and molecular testing. To the best of our knowledge, each of the previously reported cases of this entity has been located in or near a serosal membrane (peritoneum, tunica vaginalis testis, or pleura), a feature that led to the suggestion

Table 1. List of immunohistochemical antibodies used in diagnosis

Antibody	Clone	Source	Results
Cytokeratin (CK8/CK18)	5D3	Maixin Biotech, China	-
Epithelial membrane antigen (EMA)	E29	Maixin Biotech, China	-
MyoD1	S8A	Maixin Biotech, China	-
Fli-1	G146-222	Maixin Biotech, China	-
ERG	EP111	Zhongshan Biotech, China	-
GFAP	GA-5	Maixin Biotech, China	-
CD117	YR145	Maixin Biotech, China	-
p63	4A4	Maixin Biotech, China	-
CK7	OV-TL12/30	Maixin Biotech, China	-
Nestin	10C2	Maixin Biotech, China	Focal +
Neuron-specific enolase (NSE)	E27	Maixin Biotech, China	Focal +
Synaptophysin	SP11	Maixin Biotech, China	Focal +
WT1	WT49	Maixin Biotech, China	-
S-100	4C4.9	Maixin Biotech, China	-
Desmin	D33	Maixin Biotech, China	+
CD99	013	Maixin Biotech, China	+
Pgp9.5	Rabbit polyclonal antibody	Maixin Biotech, China	-
Smooth muscle actin	IA4	Maixin Biotech, China	Focal +
Myogenin	F5D	Maixin Biotech, China	-
Ki-67	MIB-1	Maixin Biotech, China	10-15%

that this tumor arises from a mesothelial-related cell, possibly representing a "mesothelioblastoma" [8]. The current case demonstrates that DSRCT can also occur independently of serosal surfaces, more specifically, in an intracranial location, and enlarges the topographic spectrum of this tumor, although its morphologic spectrum has already been considerably expanded in several recent series [8-10]. CT showed a mass which was not a distinct organ of origin: solid, dominant, heterogeneous pelvic masses in the orbital regions. of the DSRCT we describe lacked immunohistochemical evidence of epithelial differentiation but had histologic and other immunohistochemical features which suggested this diagnosis. The ability to confirm the diagnosis of this rare tumor using molecular genetic techniques is particularly useful in those cases with unusual histologic or immunophenotypic features. Cases of DSRCT typically harbor the unique t (11; 22) (p13; q12) translocation [11], which may be confirmed by FISH and/or PCR studies. DSRCT is an uncommon tumor which shares similarities with other small round cell tumors and, therefore, its diagnosis remains a challenge.

The differential diagnosis of DSRCT is usually with Ewing's sarcoma/primitive neuroectodermal tumor (ES/PNET), embryonal and alveolar rhabdomyosarcomas, and neuroblastoma, but when the lesion does not present typical features, a variety of other neoplastic conditions, such as metastatic adenocarcinoma, and sarcomatoid carcinoma could enter into the differential diagnosis. All these tumors have similar features. Therefore, to make a correct diagnosis, a combination of immunohistochemical staining and cytogenetic analysis can be useful and important. In this case, rhabdomyosarcoma was suspected at first, as the patient was a young man. However, no expression of the rhabdomyosarcoma markers myogenin and MyoD1 was detected. Next, a possible diagnosis of a small round blue cell tumor was suggested, and the corresponding panel of markers was applied. The tumor cells did not express CK7, EMA, p63, CD117, Cam 5.2, GFAP, ERG, Fli-1 and S-100, and thus we did not consider carcinoma or neuroblastoma. Then, it was necessary to differentiate the tumor from Ewing's sarcoma/primitive neuroectodermal tumor. The tumor cells were non-uniform positive for CD99 rather than strong or diffuse. Above all, the desmin immunopositivity was of a classic dot-like perinuclear pattern, so all the findings fulfilled the criteria for a DSRCT.

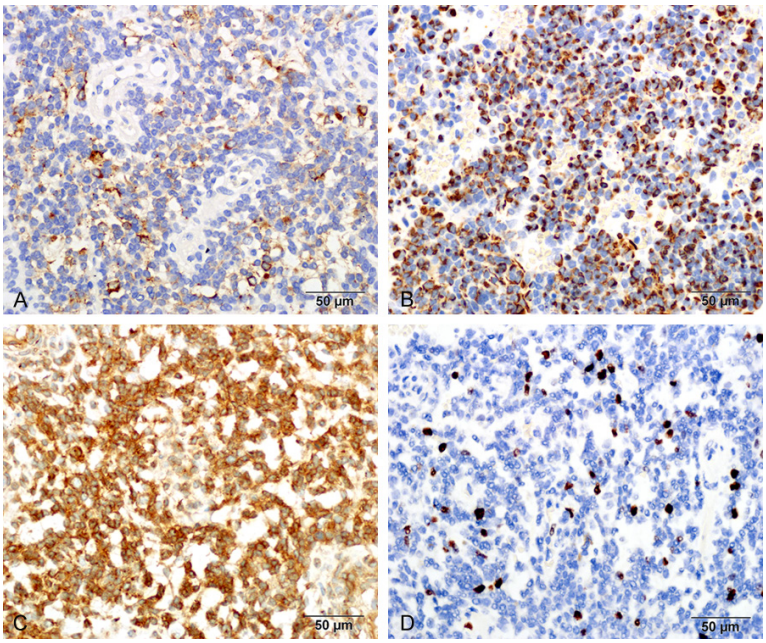

Figure 3. A. Synaptophysin is focally weak positive. B. Desmin staining with a prominent globoid "dot-like" pattern. C. CD99 is non-uniform positive in the cell membrane. D. Ki-67 show low proliferation index.

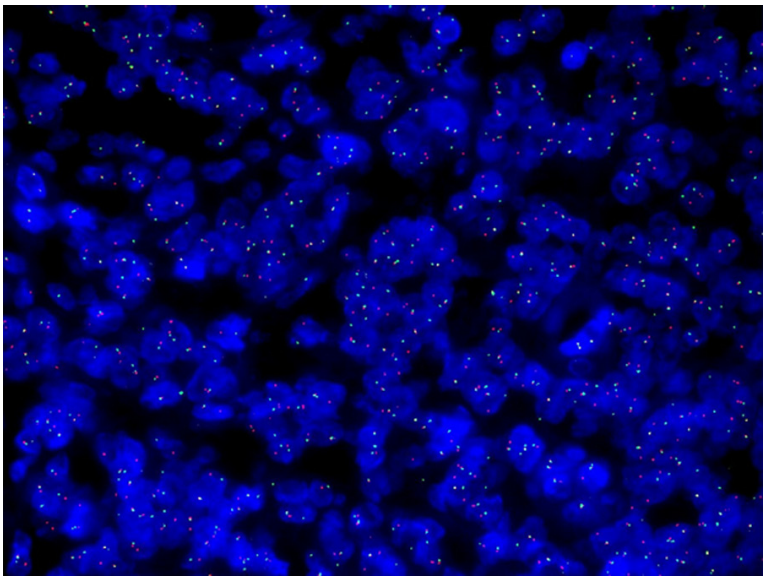

Figure 4. Fluorescent in situ hybridization assay was positive for Ewing sarcoma breakpoint region 1 (EWSR1) gene break-apart.

The overall prognosis of intra-abdominal DSRCT is poor and with a high recurrence rate. Curative drug therapies are not available, and the best treatments seem to be complete surgical resections, when possible [12]. For limited stage disease, complete surgical resection is the treatment of choice. The reported results have been variable with some studies showing survival benefit when complete resection has been used instead of traditional systemic chemotherapy [13, 14]. Our patient underwent surgery and is alive and disease-free 12 months later without other treatment. This fact may support the notion that extra-abdominal DSRCT have a more benign behavior. Lo'pez et al [4] reported a case of sinonasal DSRCT which had a better prognosis.

In summary, in addition to its typical histologic appearance, DSRCT may present a wide range of other histologic patterns that can cause diagnostic difficulty. In this case, a careful search for areas of more typical morphology, together with the use of other techniques, such as immunohistochemistry, and cytogenetic features, would allow the diagnosis to be established.

Acknowledgements

This study was supported by a research grant from the National Natural Science Foundation of China (No. 81570-176).

Disclosure of conflict of interest

None.

Address correspondence to: Dr. Lu Wang, State Key Laboratory of Cancer Biology, Department of Pathology, Xijing Hospital and School of Basic Medicine, Fourth Military Medical University, Xi'an 710032, Shaanxi, P. R. China. E-mail: wanglu@fmmu.edu.cn

References

[1] Gerald WL and Rosai J. Case 2. Desmoplastic small cell tumor with divergent differentiation. Pediatr Pathol 1989; 9: 177-183.

[2] Hayes-Jordan A, Anderson PM. The diagnosis and management of desmoplastic small round cell tumor: a review. Curr Opin Oncol 2011; 23: 385-389.
[3] Finke NM, Lae ME, Lloyd RV, Gehani SK and Nascimento AG. Sinonasal desmoplastic small round cell tumor: a case report. Am J Surg Pathol 2002; 26: 799-803.
[4] Lo'pez F, Costales M, Vivanco B, Fresno MF, Suarez C and Llorente JL. Sinonasal desmoplastic small round cell tumor. Auris Nasus Larynx 2013; 40: 573-576.
[5] Yoon M, Desai K, Fulton R, Bucci K, Russin M, Conway RM and O'Brien JM. Desmoplastic small round cell tumor: potentially lethal neoplasm manifesting in the orbit with associated visual symptoms. Arch Ophthalmol 2005; 123: 565-567.
[6] Lae ME, Roche PC, Jin L, Lloyd RV and Nascimento AG. Desmoplastic small round cell tumor: a clinicopathologic, immunohistochemical, and molecular study of 32 tumors. Am J Surg Pathol 2002; 26: 823-835.
[7] Ali A, Mohamed M, Chisholm J and Thway K. Solid-pattern desmoplastic small round cell tumor. Int J Surg Pathol 2017; 25: 158-161.
[8] Gerald WL, Miller HK, Battifora H, Miettinen M, Silva EG and Rosai J. Intra-abdominal desmoplastic small round-cell tumor: report of 19 cases of a distinctive type of high-grade polyphenotypic malignancy affecting young individuals. Am J Surg Pathol 1991; 15: 499-513.
[9] Layfield LJ and Lenarsky C. Desmoplastic small cell tumors of the peritoneum coexpressing mesenchymal and epithelial markers. Am J Clin Pathol 1991; 96: 536-543.
[10] Norton J, Monaghan P and Carter RL. Intra-abdominal desmoplastic small cell tumor with divergent differentiation. Histopathology 1991; 19: 560-562.
[11] Sawyer JR, Tryka AF and Lewis JM. A novel reciprocal chromosome translocation t(11;22)(p13;q12) in an intraabdominal desmoplastic small round cell tumor. Am J Surg Pathol 1992; 16: 411-416.
[12] Hassan I, Shyyan R, Donohue JH, Edmonson JH, Gunderson LL, Moir CR, Arndt CA, Nascimento AG and Que FG. Intraabdominal desmoplastic small round cell tumors: a diagnostic and therapeutic challenge. Cancer 2005; 104: 1264-1270.
[13] Hayes-Jordan A, Green H, Fitzgerald N, Xiao L and Anderson P. Novel treatment for desmoplastic small round cell tumor: hyperthermic intraperitoneal perfusion. J Pediatric Surg 2010; 45: 1000-1006.
[14] Msika S, Gruden E, Sarnacki S, Orbach D, Philippe-Chomette P, Castel B, Sabate JM, Flamant Y and Klanmanesh R. Cytoreductive surgery associated to hyperthermic intraperitoneal chemoperfusion for desmoplastic round small cell tumor with peritoneal carcinomatosis in young patients. J Pediatric Surg 2010; 45: 1617-1621.