

# Desmoplastic Small Round Cell Tumor with Ovarian Involvement

## - A Case Report -

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Desmoplastic small round cell tumor (DSRCT) is a rare, aggressive neoplasm that preferentially involves the abdominal and pelvic cavities in relatively young males. We present a rare case of DSRCT arising in the ovary of a 16-year-old girl. During surgery, a 15 cm-sized huge mass was noted in the right ovary and wide spreading of the tumor was identified in the left ovary, uterine wall, and omentum and bowel wall. Histological investigation showed nests of small round cells with round nuclei and scanty eosinophilic cytoplasm accompanied with dense desmoplastic stroma. The immunohistochemistry showed that the tumor coexpressed epithelial, mesenchymal, and neuronal markers. The tumor cells ultrastructurally showed poorly developed cell junctions and occasionally showed intracytoplasmic aggregates of intermediate filaments. Molecular analysis of the tumor revealed chromosomal translocation  $t(11:22)(p13;q12)$  associated with the EWS-WT1 fusion protein. DSRCT should be included in the differential diagnosis of ovarian neoplasms in young patients.

**Key Words :** Desmoplastic small round cell tumor; Ovary; EWS-WT1 fusion protein, Human

Desmoplastic small round cell tumor (DSRCT) is a rare aggressive neoplasm that is typically composed of clusters of small round cells within the desmoplastic stroma. Its histogenesis is uncertain, but this tumor has a well-defined clinicopathologic features with a specific genetic feature involving chromosomal translocation  $t(11:22)(p13;q12)$ . Clinically, it shows a distinct clinical presentation favoring young males and extremely aggressive clinical behavior. Even though the tumor has been seen to have spread widely throughout the intraabdominal and pelvic cavities at the time of diagnosis, ovarian involvement is very rare. We report a rare case in a 16-year-old girl with characteristic clinicopathologic, immunohistochemical, ultrastructural, and molecular features of ovarian DSRCT.

## CASE REPORT

A 16-year-old girl was admitted to our hospital for acute right lower quadrant pain whose past medical history was uneventful. Computed tomography (CT) scan of the abdomen revealed a huge

cystic mass with inhomogenously enhancing solid components with internal septations,  $17.0 \times 15.0 \times 7.0$  cm in size at the lower abdominal and pelvic cavities (Fig. 1). Many solid nodules were identified on the surface of the liver and spleen, and there were enlarged retrocaval lymph nodes. Laboratory tests revealed serum CA-125 was slightly elevated at 39.53 U/mL (normal range <35 U/mL) and all the other laboratory work-ups including a complete blood count, serum electrolytes, liver function tests, tumor markers, and urine analysis were normal.

Right salpingo-oophorectomy, left partial oophorectomy, and infracolic omentectomy were done. During surgery, spontaneous rupture of the right ovarian mass was noted. Gross examination revealed a  $15.0 \times 10.0 \times 10.0$  cm-sized multiseptated cystic mass with firm, whitish-gray, solid components in the right ovary. A small, gray, solid nodule was also identified in the left ovary measuring  $1.5 \times 1.3 \times 1.0$  cm in size (Fig. 2). Several biopsies were taken intraoperatively from the posterior wall of the uterus, uterosacral ligament, peritoneum, bowel wall, and omentum that were found to be involved with the tumor.

Microscopic examination of the tumor masses showed clusters

of small round blue cells surrounded by a prominent desmoplastic stroma. The individual tumor cells had round nuclei with granular chromatin and inconspicuous nucleoli and scant eosinophilic cytoplasm. The tumor nests revealed frequent central necrosis and mitosis was easily identified. From immunohistochemical studies, the tumor cells were stained with anti-cytokeratin 7 (Neomarker, Fremont, USA, 1:1,000), vimentin (Neomarker, Fremont, 1:6,000), desmin (DAKO, Glostrup, Denmark, 1:300), and neuron-specific enolase (Zymed, San Francisco, USA, 1:100) antisera (Fig. 3). Focal cytoplasmic staining was positive for calretinin (Zymed, San Francisco, 1:100) and CD99 (DAKO, Glostrup, 1:250). They did not show immunoreactivity to smooth muscle actin (Neomarker, Fremont, 1:2,000) and S-100 (Neomarker, Fremont, 1:1,000).

Electron microscopic examination of the tumor cells revealed poorly developed cell junctions and irregular nuclear membranes

with occasional small nucleoli. Occasionally, the tumor cells showed intracytoplasmic aggregates of intermediate filaments (Fig. 4). Reverse transcriptase-polymerase chain reaction performed on the paraffin embedded tissue from the right ovarian tumor exhibited the *EWS-WT1* fusion chimeric transcript as a result of the  $t(11;22)(p13;q12)$  translocation (Fig. 5).

VACIE (vincristine, doxorubicin, cyclophosphamide, ifosfamide, etoposide) chemotherapy that is known to be highly effective against pediatric sarcomas was administered to the patient according to the protocols. Due to the toxicity of chemotherapy, the patient also received autologous peripheral blood stem cell transplantation. No radiation therapy was administered. The patient was still alive 28 months from diagnosis of DSRCT with clinical evidence of the disease reoccurring in the liver and lungs on the last follow up.

## DISCUSSION

In general, DSRCT predominantly affects young males<sup>1</sup> and mainly involves the abdominal cavity with multiple peritoneal implants. However, involvement of paratesticle,<sup>2</sup> bone,<sup>3</sup> paranasal sinus,<sup>4</sup> pleura,<sup>5</sup> lung,<sup>6</sup> ovary,<sup>7</sup> and kidney<sup>8</sup> have also been reported. It usually runs an aggressive course.<sup>9</sup>

Occasionally, the serum level of CA 125 is elevated in DSRCT patients as was the case in our patient.<sup>10</sup> However, the increased level of CA 125 was too small compared to the extent of tumor involvement of ovary. Imaging studies typically reveal multiple bulky peritoneal soft tissue masses without an apparent primary site. Clinically, the most important differential diagnosis is peritoneal carcinomatosis. Other malignancies that exhibit this type of spread include primary peritoneal tumors (mesothelioma and

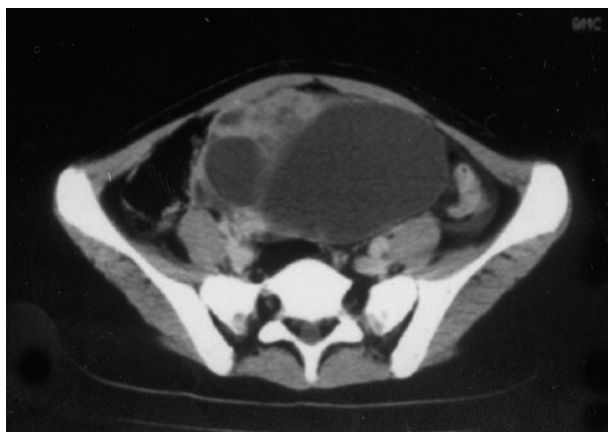


Fig. 1. Abdominal CT shows a multiseptated cystic mass in the pelvic cavity. It has strong enhancing solid nodules and suspicious adhesion to the bowel wall.

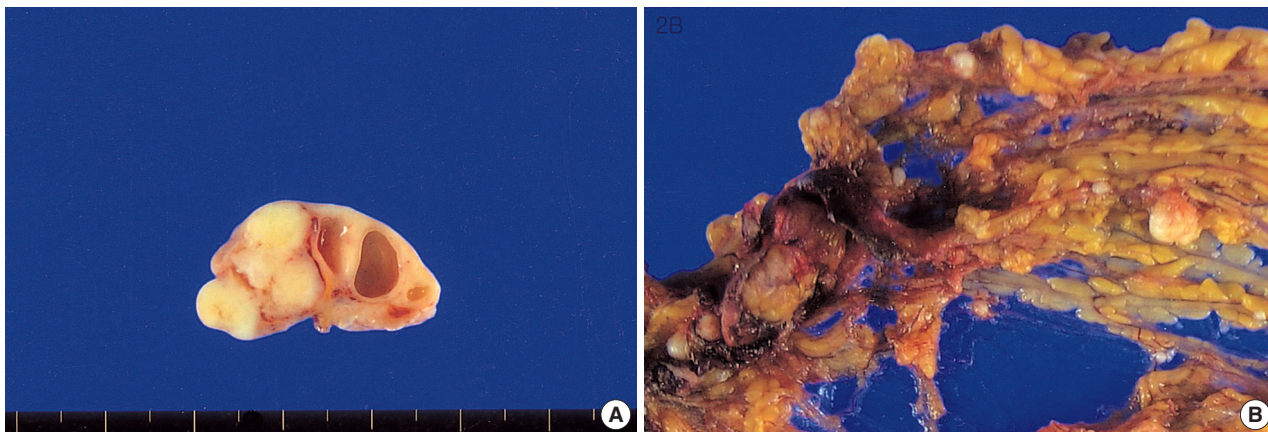


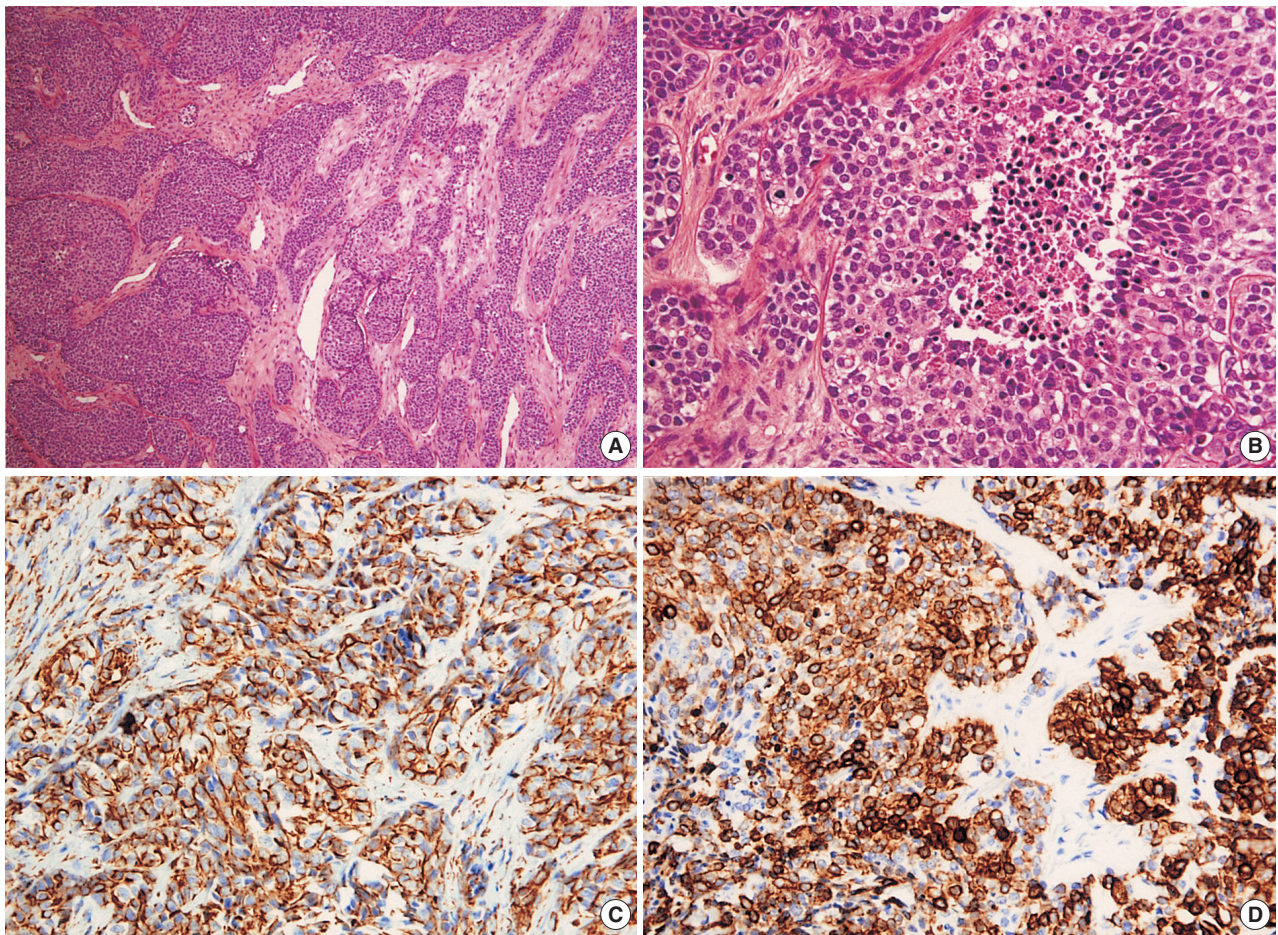
Fig. 2. Left ovary reveals gray to yellow solid mass (A). Omentum reveals multiple masses (B).



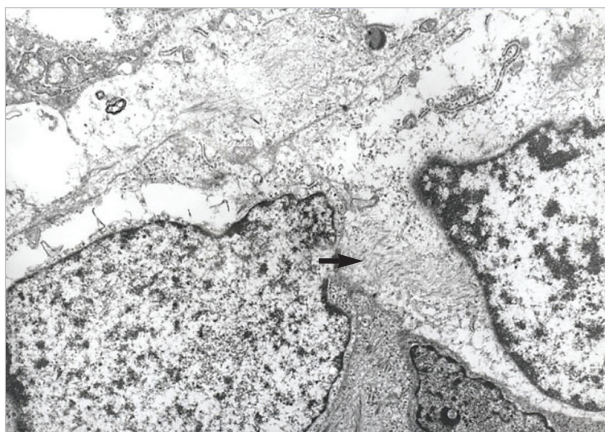
papillary serous tumor of the surface epithelial origin), ovarian tumors (germ cell tumors, borderline and malignant epithelial

tumors), and lymphomas.

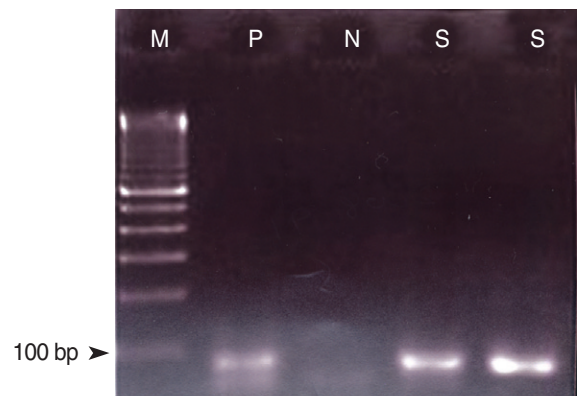
Histologically, the tumor consisted of nests of small, round



**Fig. 3.** Low power magnification reveals nests of small round cells within desmoplastic stroma (H&E) (A). High power magnification reveals tumor cells with hyperchromatic nuclei with inconspicuous nucleoli and foci of necrosis (H&E) (B). Positive immunostaining for cytokeratin 7 (C), and neuron specific enolase (D).



**Fig. 4.** Ultrastructurally, the tumor cells show small aggregates of intracytoplasmic intermediate filaments (arrow), glycogen particles and a few rough endoplasmic reticuli.



**Fig. 5.** Chimeric transcription of EWS and WT1 RT-PCR revealed EWS-WT1 gene fusion transcript of 79 base size. Positive control (P), Negative control using dextrose water (N), Duplicated tumor sample (S).



to ovoid cells within desmoplastic stroma. Immunohistochemically, the tumor cells were characterized by coexpression of epithelial, mesenchymal, myogenic, and neural markers. Our case was positive for cytokeratin 7, vimentin, desmin, and neuron specific enolase. Lae *et al.*<sup>11</sup> reported desmin, keratin, and NSE positivity for 81%, 87%, and 84% of the patients respectively. The origin of this tumor cell is still uncertain, however, Gerald *et al.*<sup>12</sup> suggested that DSRCT could be of mesothelial origin on the basis of their growth on the peritoneal surfaces and involvement of WT1. *EWS-WT1* gene fusion is very specific and has been described only in DSRCT. Lae *et al.*<sup>11</sup> reported *EWS-WT1* gene fusion for 93% of the patients by RT-PCR and 97% by Southern blot hybridization.

DSRCT must be distinguished histologically from other small round cell tumors: Ewing sarcoma/PNET, small cell carcinoma, lymphoma, neuroblastoma, Wilm tumor, and rhabdomyosarcoma. The young age of the patient, the absence of primary visceral lesions by CT scan, and distinctive microscopic and immunohistochemical features are helpful to make a confirmative diagnosis. Molecular studies could be used to elucidate the diagnosis. Even though the ovarian involvement is extremely rare, the gynecological oncologist should be aware of this disease as a part of the differential diagnosis for an ovarian neoplasm.

## REFERENCES

1. Chang F. Desmoplastic small round cell tumors: cytologic, histologic, and immunohistochemical features. *Arch Pathol Lab Med* 2006; 130: 728-32.
2. Roganovich J, Bisogno G, Cecchetto G, D'Amore ES, Carli M. Paratesticular desmoplastic small round cell tumor: case report and review of the literature. *J Surg Oncol* 1999; 71: 269-72.
3. Murphy A, Stallings RL, Howard J, *et al.* Primary desmoplastic small round cell tumor of bone: report of a case with cytogenetic confirmation. *Cancer Genet Cytogenet* 2005; 156: 167-71.
4. Finke NM, Lae ME, Lloyd RV, Gehani SK, Nascimento AG. Sinonasal desmoplastic small round cell tumor: a case report. *Am J Surg Pathol* 2002; 26: 799-803.
5. Karavatakis EM, Moschovi M, Stefanaki K, *et al.* Desmoplastic small round cell tumor of the pleura. *Pediatr Blood Cancer* 2007; 49: 335-8.
6. Syed S, Haque AK, Hawkins HK, Sorensen PH, Cowan DF. Desmoplastic small round cell tumor of the lung. *Arch Pathol Lab Med* 2002; 126: 1226-8.
7. Slomovitz BM, Girotra M, Aledo A, *et al.* Desmoplastic small round cell tumor with primary ovarian involvement: case report and review. *Gynecol Oncol* 2000; 79: 124-8.
8. Su MC, Jeng YM, Chu YC. Desmoplastic small round cell tumor of the kidney. *Am J Surg Pathol* 2004; 28: 1379-83.
9. Saab R, Khoury JD, Krasin M, Davidoff AM, Navid F. Desmoplastic small round cell tumor in childhood: the ST. Jude children's research hospital experience. *Pediatr Blood Cancer* 2007; 49: 274-9.
10. Ordóñez NG, Sahin AA. CA 125 production in desmoplastic small round cell tumor: report of a case with elevated serum levels and prominent signet ring morphology. *Hum Pathol* 1998; 29: 294-9.
11. Lae ME, Roche PC, Jin L, Lloyd RV, Nascimento AG. Desmoplastic small round cell tumor: a clinicopathologic, immunohistochemical, and molecular study of 32 tumors. *Am J Surg Pathol* 2002; 26: 823-35.
12. Gerald WL, Miller HK, Battifora H, Miettinen M, Silva EG, 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.