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Imprint Cytology of a Desmoplastic Small Round Cell Tumor

-A Case Report-

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Desmoplastic small round cell tumor (DSRCT) is a rare malignant mesenchymal neoplasm. It mainly involves the abdominal or pelvic peritoneum of male adolescents. We report here the imprint cytologic features of a case of DSRCT occurring in the intraabdominal cavity of a 21-year-old man. A microscopic examination showed moderate cellularity. The tumor cells were singly arranged and arranged in clusters. The cells had round to oval nuclei with finely granular chromatin, inconspicuous nucleoli and scanty cytoplasm. Some tumor cells showed nuclear molding, and some cells had an epitheloid appearance with a large amount of lightly eosinophilic cytoplasm. A rosette-like pattern was present. Spindle-shaped, fibroblastic stromal cells were occasionally found. The tumor cells were immunoreactive for the markers cytokeratin (AE1/AE3), epithelial membrane antigen (EMA), desmin, vimentin and neuron specific enolase (NSE).

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Key words : Desmoplastic small round cell tumor, Intraabdominal, Cytology, Imprint

INTRODUCTION

Desmoplastic small round cell tumor (DSRCT) is composed of small round tumor cells of uncertain histogenesis, and is associated with prominent stromal desmoplasia and polyphenotypic differentiation.[1] It was first described by Gerald and Rosai[2] in 1989 as a distinct tumor with specific histologic and immunohistochemical features. Its clinical and histopathological features have been well delineated and its cytologic features have been described in several reports.[3-11] To the best of our knowledge, cytologic findings of DSRCT have not been reported in the Korean literature. As DSRCT shows cytomorphologic features similar to other small round cell tumors, cytologic diagnosis of the disorder can be difficult. We describe here the imprint cytologic features of a case of DSRCT that arose in the intraabdominal cavity of a 21-year-old man.

CASE

A 21-year-old man presented with an abdominal mass and pain that had persisted for one month. The

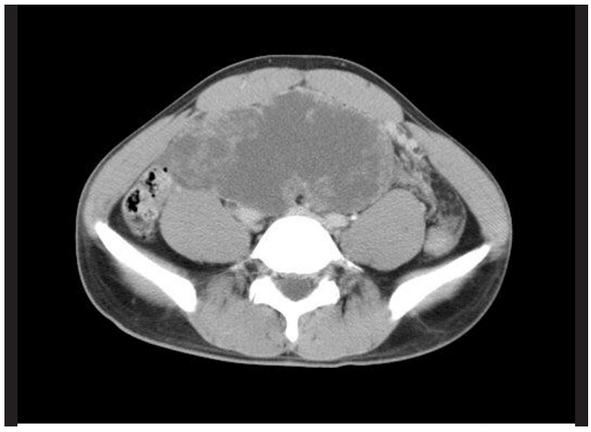

Fig. 1. The axial computed tomographic (CT) scan shows a large, well demarcated, lobulated, soft tissue mass filling up the pelvic cavity. The low density within the mass is noted.

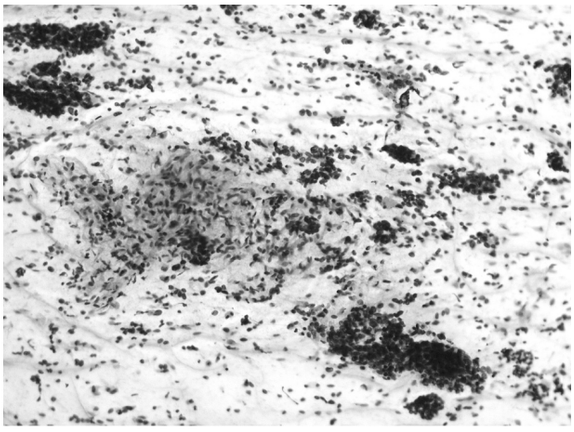

Fig. 2. Cytologic findings. The smear shows moderate cellularity. Tumor cells are seen in clusters and single cells (Papanicolaou).

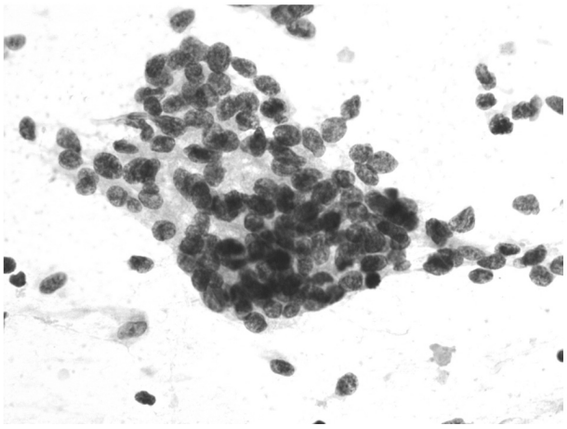

Fig. 3. Cytologic findings. Tumor cells have round to oval nuclei with finely dispersed chromatin and scanty cytoplasm. A Rosette–like pattern is seen (Papanicolaou).

past medical history was noncontributory. A physical examination showed a palpable mass in the abdomen. A computed tomographic (CT) scan showed a large, well demarcated, lobulated soft tissue mass in the intraabdominal cavity (Fig. 1). The gastrointestinal and urinary tracts were unremarkable. On positron emission tomography combined with computed tomography (PET/CT), a large, hypermetabolic mass was present in the abdominopelvic cavity. There was no evidence of distant metastasis to other organs. A wide excision of the mass with complete omentectomy and pelvic peritonectomy was performed. The excised specimen was sent to our department for an intraoperative consultation. Imprint smears as well as frozen section were obtained for the case.

Cytologic Findings

Alcohol-fixed smears were stained by the hematoxylin-eosin and Papanicolaou method. The smears were moderately cellular (Fig. 2). The tumor cells were arranged in clusters, sheets, or single cells. The nuclei were round to oval, with finely granular chromatin and inconspicuous nucleoli. The cytoplasm was scanty. The tumor cells were approximately three to six times the size of a lymphocyte and revealed high nuclear/cytoplasmic ratios. A rosette-like pattern was seen (Fig. 3). Nuclear molding was occasionally found and nuclear grooves were also present. Some of the tumor cells showed vesicular nuclei with small nucleoli (Fig. 4), and infolding and lobulation of the nuclear membrane were seen. Some tumor cells had eccentric nuclei with a large amount of lightly eosinophilic cytoplasm, resulting in an epithelioid appearance (Fig. 5). Single necrotic cells were seen on the background. Stromal fragments composed of spindle-shaped, fibroblastic cells were occasionally found (Fig. 6). Some tumor cells were seen in the peripheral portion of the stroma or within the stroma. The nuclei of fibroblastic cells were larger than

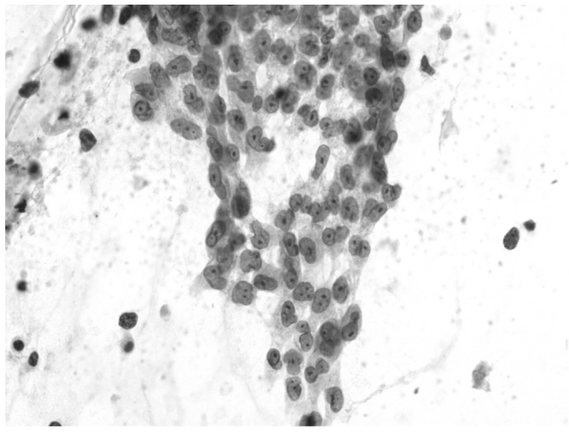

Fig. 4. Cytologic findings. Tumor cells show vesicular nuclei with small nucleoli. The infolding and lobulation of the nuclear membrane are noted (Papanicolaou).

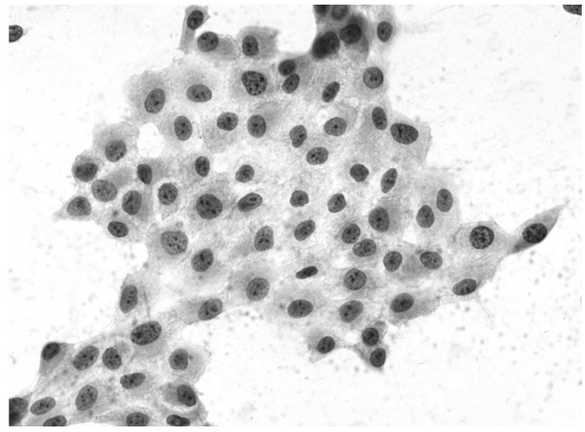

Fig. 5. Cytologic findings. The tumor cells have eccentric nuclei with a large amount of lightly eosinophilic cytoplasm (H&E).

Fig. 6. Cytology findings. Stromal fragments of composed of spindle-shaped fibroblastic cells were seen (Papanicolaou).

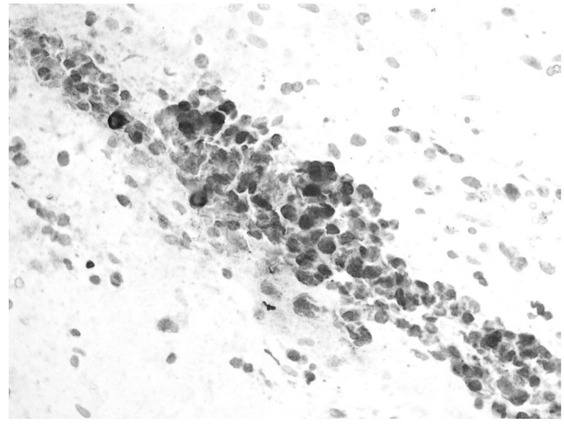

Fig. 7. Cytologic findings. Tumor cells reveal cytoplasmic staining for EMA (Immuohistochemical stain).

the nuclei of the vascular endothelial cells.

Immunohistochemical staining was performed for the cytological samples. The tumor cells were positive for cytokeratin (AE1/AE3), epithelial membrane antigen (EMA) (Fig. 7), desmin, vimentin and neuron specific enolase (NSE).

Gross and Histologic Findings

The tumor measured 15.0 × 12.5 × 8.5 cm in size (Fig. 8). The external surface was grayish white, smooth, and glistening. The cut surface of the tumor was grayish white, with hemorrhagic, cystic, and myxoid areas. A histological examination showed nests of small neoplastic cells surrounded by the cellular desmoplastic stroma (Fig. 9). The tumor cells had round to ovoid nuclei, and nuclear molding and grooves were occasionally found. Some tumor cells had large amounts of eosinophilic cytoplasm. The nuclear and cytoplasmic features resembled those seen in the cytologic smears. Mitotic figures were 7 per 10 high-power fields (×400). Glomeruloid vascular proliferation was noted as was tumor necrosis. There was tumor metastasis to the pelvic peritoneum, but the regional

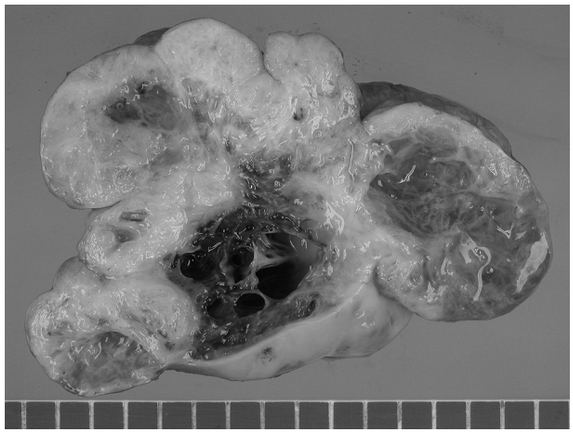

Fig. 8. A gross photograph shows a 15.0 × 12.5 × 8.5 cm, circumscribed, lobulated tumor. The cut surface is grayish white with hemorrhagic, cystic, and myxoid areas.

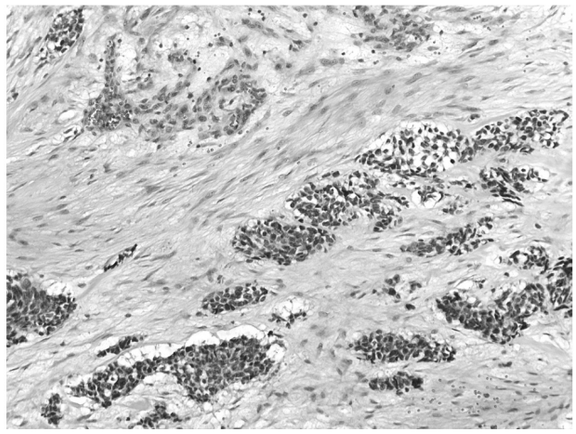

Fig. 9. Histologic findings. Tumor cell nests are separated by desmoplastic stroma. Glomeruloid vascular proliferation is noted (H&E).

lymph nodes revealed no tumor metastasis. On the immunohistochemical staining of the tissue sections, tumor cells were positive for cytokeratin (AE1/AE3), EMA, desmin, vimentin, NSE, and negative for leukocyte common antigen (LCA) and myogenin. An electron microscopic examination was performed and tumor cells showed intermediate filaments and intercellular junctions. A intraoperative diagnosis of desmoplastic small round cell tumor (DSCRT) was made. The patient is currently undergoing chemotherapy and is still alive 4 months after surgery.

DISCUSSION

DSRCT is a rare and aggressive malignant tumor. It has most commonly been reported in children and young adults, with a male-to-female ratio of 4:1. The vast majority of tumors develops in the abdominal cavity, and are frequently located in the retroperitoneum, pelvis, omentum, and mesentery.[1]

DSRCT usually reveals a large tumor mass with extensive peritoneal involvement. Grossly, the tumor is gray-white, and firm with foci of hemorrhage and necrosis.[1] Histologically, DSRCT is characterized by nests of small neoplastic cells surrounded by a prominent desmoplastic stroma. Tumor cells are typically uniform, with small hyperchromatic nuclei and scanty cytoplasm.

The cytomorphologic features of DSRCT appear to be similar to the histologic features.[3-11] The tumor cells have round to oval nuclei with fine chromatin and inconspicuous nucleoli. The cytoplasm is scanty. Nuclear molding is present and a rosette-like feature is seen. Nuclear membranes are smooth or irregular with nuclear grooves, infoldings and lobulations. Fibroblast-like cells are occasionally present. All of these morphologic features were seen in this case. In addition, the epithelioid-appearing tumor cells and the infolding and lobulation of the nuclear membrane were also recognized in the present case.

DSRCT simultaneously expresses epithelial, muscular and neural markers.[12,13] These findings suggest that this tumor has a capacity for epithelial, muscular, and neural differentiation. In the present case, tumor cells were positive for the markers cytokeratin (AE1/AE3), EMA, vimentin, desmin, and NSE.

The histogenesis of DSRCT is still uncertain. Its predilection for serosal involvement suggests that is may have a mesothelial origin.[14] The demonstration of some neuroectodermal features may indicate a neuroectodermal origin. A characteristic cytogenetic abnormality of

DSRCT is the EWS/WT1 gene fusion resulting from the chromosomal translocation t(11;22) (p13:q12).[15,16]

DSRCT must be differentiated from other small round cell tumors such as Ewing's sarcoma/PNET, rhabdomyosarcoma, neuroendocrine carcinoma, malignant mesothelioma, neuroblastoma, and malignant lymphoma.[17,18] In Ewing's sarcoma/PNET, a uniform population of cells with well defined cell borders and round nuclei is typically seen. In addition, Ewing's sarcoma/PNET is negative for the markers cytokeratin and desmin. Rhabdomyosarcoma appears less cohesive and has more cellular pleomorphism than DSRCT. Neuroendocrine carcinoma demonstrates many cytologic similarities to DSRCT.[16,19] However, it is typically associated with older age and usually originates in the lung and less commonly the pancreas. Immunohistochemically, neuroendocrine carcinoma is negative for the marker desmin. In the present case, the presence of nuclear grooves and infoldings is not typical for a neuroendocrine carcinoma. Morphologically DSRCT may resemble the small cell variant of malignant mesothelioma.[20] The immunohistochemical patterns seen in DSRCT (BerEp4, B72.3 and Leu M1 positivity) differ from those of malignant mesothelioma (cytokeratin 5/6 and calretinin positivity). Neuroblastoma shows a fibrillary background, cytoplasmic process, and Homer Wright rosettes. Malignant lymphoma can be excluded by virtues of its nuclear molding and the clustering of tumor cells seen in the tumor. The diagnosis of DSRCT can be suggested when one observes a small round cell tumor with distinctive fibrous stroma in an intraabdominal neoplasm. The finely granular nuclear chromatin and nuclear molding may be additional clues to the diagnosis. Ancillary techniques such as immunohistochemical staining and the use of electron microscopy are particularly helpful for the differential diagnosis.

DSRCT is a highly aggressive neoplasm with a poor prognosis and a high recurrence rate.[21] Treatment consists of a combination of surgery, chemotherapy and radiotherapy. In our case, the patient is undergoing chemotherapy and is still alive 4 months after surgery.

In conclusion, DSRCT appears to have distinctive cytologic features. The use of a combination of characteristic cytomorphological, clinical and radiologic information, and the results of a panel of immunohistochemical markers is useful in the correct diagnosis of DSRCT in cytologic specimens.

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