S-100 protein distribution in liposarcoma
An immunoperoxidase study with special reference to the distinction of liposarcoma from myxoid malignant fibrous histiocytoma

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Abstract. The presence and distribution of S-100 protein were studied in 63 cases of liposarcoma and 20 cases of myxoid malignant fibrous histiocytoma (MFH), using the immunoperoxidase technique. Normal adipose tissue and benign lipomatous tumours were also studied by the same technique, for purposes of comparison. In all liposarcomas, most of the adipocytes and vacuolated lipoblasts were positive for S-100 protein, although the tumour cells in non-lipogenic areas of dedifferentiated liposarcoma and the non-vacuolated giant cells with a deeply eosinophilic cytoplasm in the pleomorphic liposarcomas were devoid of S-100 protein immunoreaction products. One third of the myxoid type liposarcomas contained numerous immunoreactive, immature-appearing spindle or oval cells, reminiscent of the primitive fat organs of white adipose tissue. Conversely, none of the myxoid MFHs contained S-100 protein in the tumour cells, including the irregularly vacuolated ones. These results suggest that the immunohistochemical demonstration of S-100 protein is a useful diagnostic tool, particularly for the assessment of vacuolated tumour cells and for the diagnosis of myxoid tumours.

Key words: Liposarcoma – Malignant fibrous histiocytoma – Soft tissue neoplasms – S-100 protein – Immunohistochemistry

Introduction

S-100 protein was first isolated as a soluble nervous tissue-specific protein by Moore in 1965. In the nervous system, this protein is located mainly in astrocytes, oligodendrocytes, Schwann cells, satellite cells in sympathetic ganglia and some neurons (Bradshaw and Schneider 1980). Recently, S-100 protein has been identified in adipocytes (Nakajima et al. 1982b; Suzuki et al. 1982; Hidaka et al. 1983; Kato et al. 1983; Michetti et al. 1983), as
well as in various cells outside the nervous system; melanocytes and Langerhans cells in the skin (Cocchia et al. 1981; Nakajima et al. 1982a), interdigitating reticulum cells in the lymph nodes (Takahashi et al. 1981), T lymphocytes (Kanamori et al. 1982), folliculo-stellate cells in the pituitary gland (Nakajima et al. 1980), chondrocytes (Stefansson et al. 1982), myeloid cells (Nakajima et al. 1982b; Hara et al. 1983). Moreover, Cocchia et al. (1983) and Weiss et al. (1983) confirmed the presence of S-100 protein positive tumour cells in liposarcoma, using an immunoperoxidase method.

We used immunohistochemical approaches to study S-100 protein in a larger number of liposarcomas and myxoid malignant fibrous histiocytomas and compared our findings with observations made in normal adipose tissue and benign lipomatous tumours.

Materials and methods

From files in the Second Department of Pathology, Kyushu University Faculty of Medicine, from 1956 to 1982, we selected for immunohistochemical study 63 cases of liposarcoma (31 myxoid, 16 well-differentiated, 6 dedifferentiated (Evans 1979), 4 pleomorphic, 3 round cell, 3 mixed) and 20 cases of myxoid malignant fibrous histiocytoma. The diagnostic criterion of liposarcoma was the finding of convincing histological evidence of lipogenic differentiation in the tumour cells on conventional sections stained with haematoxylin and eosin (Hashimoto and Enjoji 1982; Enzinger and Weiss 1983).

In addition, white adipose tissue in the subcutis from two aborted human fetuses of 18 weeks' and 20 weeks' of gestation, human brown adipose tissue from the mediastinum and the perirenal region from a full-term baby with anencephaly and adjacent to a haemangioma in the neck of a 15-year-old girl, and various benign lipomatous tumours (6 lipomas, 8 spindle cell lipomas, 2 pleomorphic lipomas, 2 benign lipoblastomatoses, and 1 hibernoma) were used as control material.

Six-micron-thick sections of 10% formalin-fixed, paraffin embedded materials were prepared for the immunohistochemical study. After the tissue sections were deparaffinized and endogenous peroxidase activity was blocked by employing a short 10-min oxidation in 0.01 M aqueous periodic acid followed by treatment with a freshly prepared 0.02% aqueous sodium borohydrate for 30 min, a peroxidase-antiperoxidase (PAP) method (Sternberger 1979) was used to determine the localization of S-100 protein. Dilution and time in 0.01 M phosphate buffer saline, pH 7.4 were as follows: normal swine serum (DAKO-immunoglobulin Co. Ltd., Denmark) (1:10) for 30 min; anti-bovine S-100 protein rabbit IgG (kindly provided by Dr. Takashi Nakajima, National Cancer Center Research Institute, Tokyo. The details of the method for preparation of the anti-S-100 protein antibody were as reported elsewhere) (Nakajima et al. 1982b), diluted 1:300, overnight at 4°C; anti-rabbit IgG swine serum (DAKO-immunoglobulin Co. Ltd., Denmark) (1:30) for 1 h at room temperature; PAP complex (DAKO-immunoglobulin Co. Ltd., Denmark) (1:50) for 1 h at room temperature. The location of antigen was visualized by incubating slides for 5 min with 0.01% hydrogen peroxidase and 0.05% diaminobenzidine in 0.05 M tris buffer, pH 7.6. These sections were counterstained with methyl green. Normal rabbit serum was used instead of the first antibody for the controls, and cells positive for S-100 protein were never observed in any of the controls.

Results

Normal adipose tissues

In the primitive organs of white adipose tissue in the subcutis of the two aborted fetuses, brown benzidine products in the immunoperoxidase reaction for S-100 protein were observed in the cytoplasmic rim and the nuclei