

Synovial Sarcoma Enzyme Histochemistry of a Typical Case

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Summary. A typical case of biphasic synovial sarcoma was studied using enzyme histochemistry. A marked difference between the staining characteristics of the spindle cells and the epithelial-like cells was demonstrated by reactions for various hydrolytic enzymes. The epithelial-like cells exhibited a strong reactivity for alkaline phosphatase, acid phosphatase, adenosine triphosphatase and nonspecific esterase, whereas spindle-cells were completely unreactive when tested for these enzymes.

This is, to our knowledge, the first report demonstrating differences in the enzymatic pattern of the two cell populations which compose synovial sarcoma.

Key words: Synovial sarcoma – Enzyme histochemistry

Introduction

Synovial sarcoma is considered to be a neoplasm of mesenchymal origin which can be morphologically subdivided into monophasic (spindle cell type or epithelial-like type) and biphasic types (Mackenzie 1966; Roth et al. 1975) although the histogenesis of these tumors is still controversial (Ichinose et al. 1979; Mickelson et al. 1980; Hajdu et al. 1977). The ultrastructure of the spindle and epithelial-like cells has been thoroughly characterized (Mickelson et al. 1980; Fernandez et al. 1976; Gabbiani et al. 1971; Katenkamp and Stiller 1980) but, to our knowledge, an enzyme histochemical study of these tumors has not been reported.

A case of typical biphasic synovial sarcoma, observed in our Department, was studied by means of enzyme histochemistry. The results are presented and discussed.

Material and Methods

Clinical History. A 16-year old caucasian boy was admitted to Orthopedic Department presenting with a mass in the right elbow that was intermittently painful and caused paresthesia;

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Table 1. Histochemical results

Histochemical reactions	Synovial sarcoma		Synovial membrane
	Spindle cells	Epithelia like cells	
ALP	—	+++	—
ALP + Levamisole	—	—	—
ATPase	—	+++	—
NSE	—	+++	+
NSE + NaF	—	—	—
ACP	—	+++	+
ACP + tartrate	—	—	—
GLUC	—	—	+
NADH-Diaphorase	+	++	+-
ORO	+	—	—

it was first noted 3–4 months before admission. The mass measured 2 × 3 cm in diameter. Physical examination did not show any involvement of the overlying skin. At surgery the mass was adjacent but distinct from the synovia of the elbow and involved the radial nerve. Following a diagnosis on frozen section of "malignant tumor of soft parts" an excision with wide surgical margins including the involved radial nerve was performed. Subsequent examination of multiple sections of paraffin embedded tissue led to the diagnosis of synovial sarcoma. Follow up study has been unremarkable; clinical and laboratory investigations did not suggest recurrence or metastasis after one year.

Histochemistry. Part of the surgical specimen was fixed in cold 10% calcium formalin (24 h), washed in water and embedded in a cold gum sucrose solution for 48 h as previously described (Chilosi et al. 1981). The sample was then snap-frozen in liquid nitrogen and sectioned in a cryostat at 6–8 µm thickness. The cryostat sections were stuck to albumin-coated glass slides and incubated in the proper media for the histochemical demonstration of alkaline phosphatase (ALP) with and without levamisole inhibition, nonspecific esterase (NSE) with and without fluoride inhibition, acid phosphatase (ACP) with and without L + tartrate inhibition, Mg²⁺ dependent adenosine triphosphatase (ATPase), β-glucuronidase and NADH-diaphorase as previously described (Chilosi et al. 1981a). Oil red O staining for the demonstration of lipids was performed on cryostat sections.

Other tissue specimens were conventionally dehydrated, embedded and stained with H.E., PAS, Alcian Blue (with and without hyaluronidase pretreatment) and silver reticulum stain for morphological examination.

In addition we studied with the same methods normal synovial tissues obtained at surgery for traumatic amputation.

Results

Histology. The tumor was morphologically characterized by different histological patterns. It was generally formed by a nodular proliferation of epithelial-like cells arranged in nests and cords, often forming gland-like spaces (Fig. 1). Densely packed spindle cells separating the epithelial-like structures gave the typical biphasic appearance of synovial sarcoma (Fig. 2). PAS staining revealed the presence of diastase resistant material in the lumen of some glandular spaces as well as positive granules in the cytoplasm of a number of clustered epithelial-like cells. Alcian Blue stained only intercel-

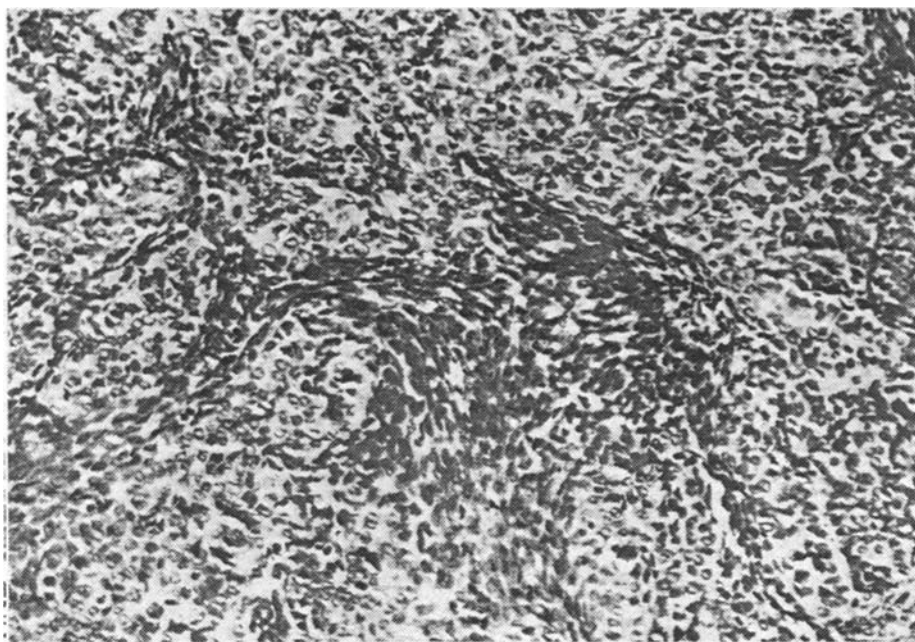


Fig. 1. Synovial sarcoma: the typical biphasic pattern is evident (H.E. $\times 180$)

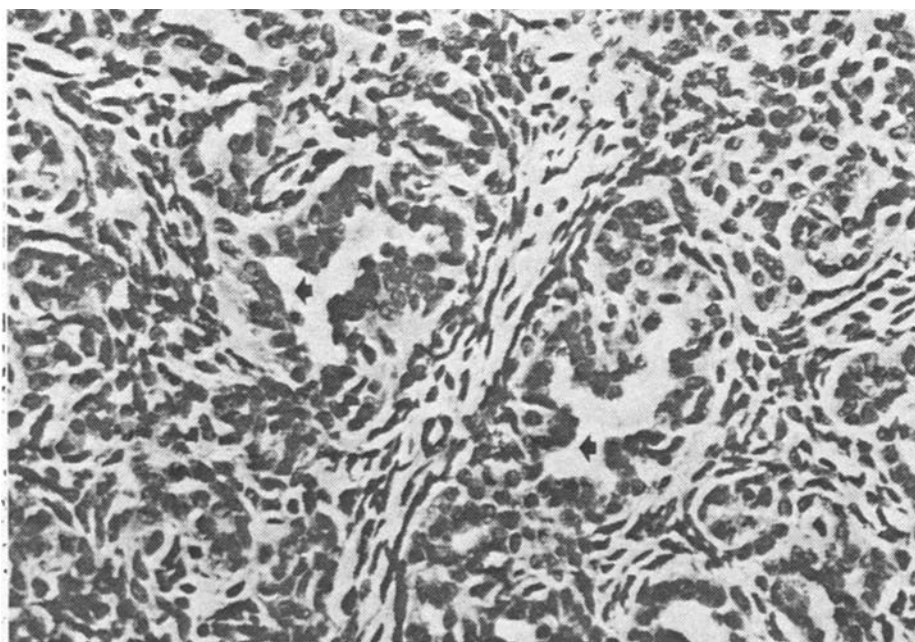


Fig. 2. Synovial sarcoma: glandular-like spaces (*arrow*) are intermingled with sarcomatous spindle cells. (H.E. $\times 400$)

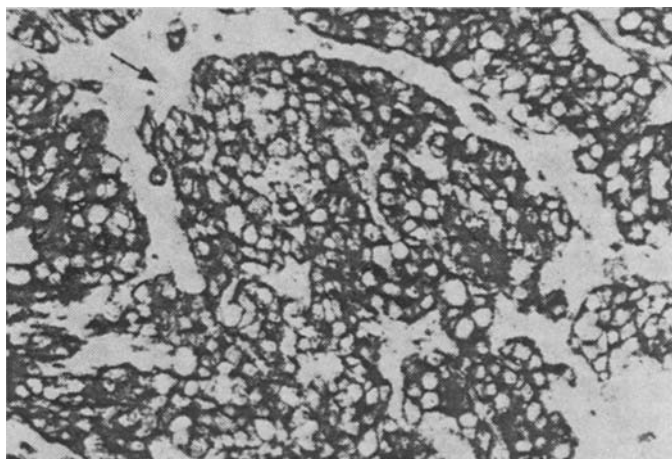


Fig. 3. Epithelial-like cells show intense membrane reactivity for ATPase, whereas spindle cells (*arrow*) are negative. (ATPase $\times 400$)

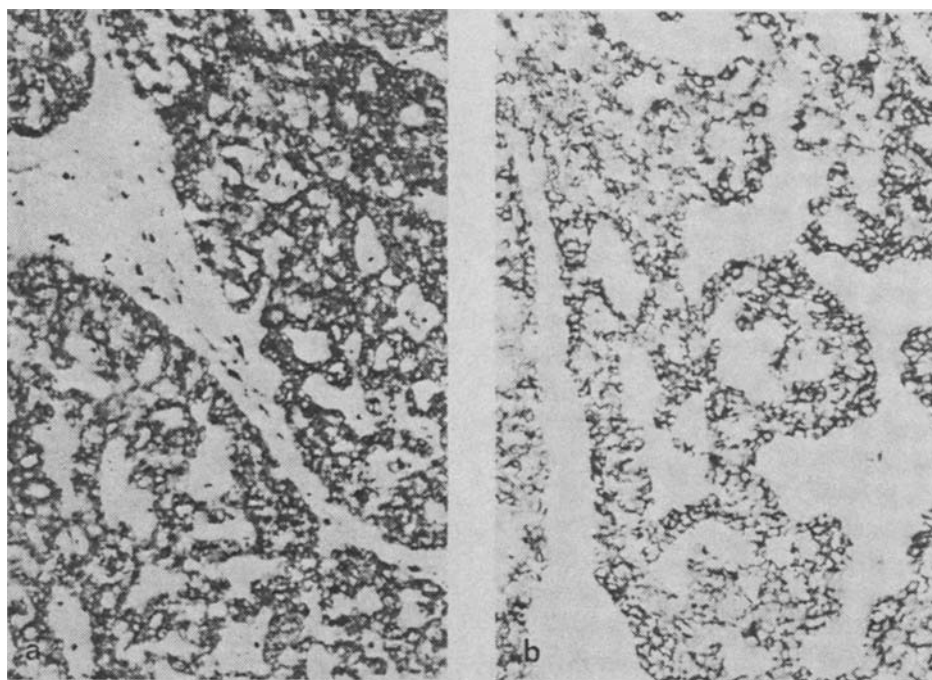


Fig. 4a, b. Epithelial-like cells exhibit a strong reactivity for nonspecific esterase (a) and alkaline phosphatase (b). In sarcomatous areas, negative for both enzymes, few scattered NSE + ve macrophages (a) and ALP + ve capillaries (b) are present

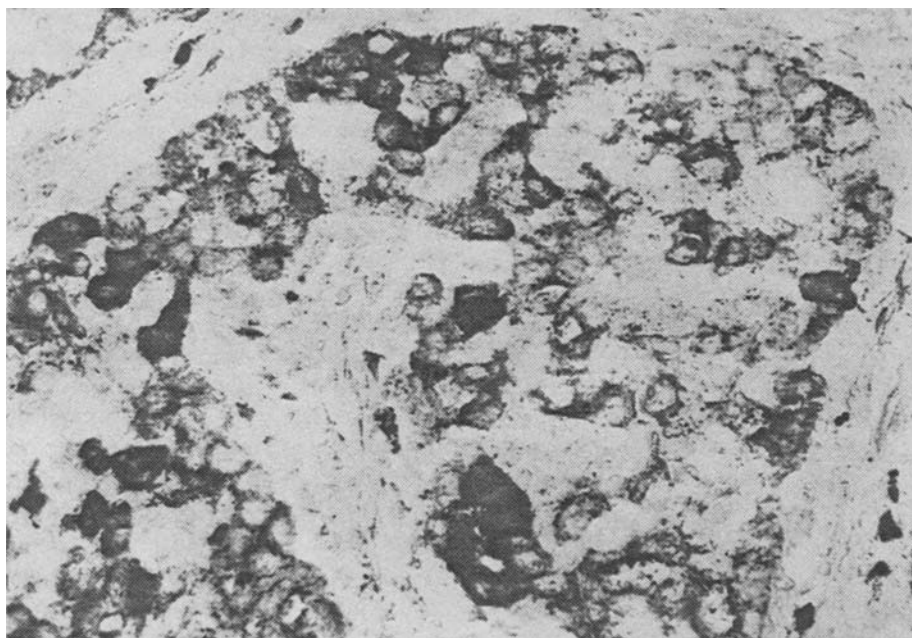


Fig. 5. Nonspecific esterase reactivity appears as a granular product in the cytoplasm of epithelial-like cells with stronger positivity in the cells lining the glandular spaces (NSE $\times 600$)

lular background in the sarcomatous areas; this material was negative after treatment of the sections with hyaluronidase.

Histochemistry. The results, as shown in Table 1 and in the figures, displayed a varying enzymatic activity according to the cell type. The epithelial-like component of the tumor appeared strikingly reactive for all tested enzymes. ATPase and ALP were demonstrated as strongly staining rims, probably corresponding to membranes; NSE and ACP gave mainly cytoplasmic granular reaction products with a stronger reactivity in the cells lining glandular lumens. The latter two reactions were inhibited by fluoride and L + tartrate respectively. Unlike the other enzymes which were present in all epithelial-like cells β -glucuronidase activity could only be detected within the cytoplasm of those cells that line glandular-like spaces.

The spindle cells, on the other hand, were completely devoid of reaction product when tested histochemically for hydrolytic enzymes. There was no intermediate pattern of positivity, for any of the enzymes tested, between fibrosarcomatous and epithelial-like cells (Figs. 3, 4 and 5).

NADH-diaphorase was the only enzyme present throughout the lesion, since it stains mitochondria.

Table 1 summarizes the enzymatic activities of the two cell types analyzed in this case of synovial sarcoma and compares them with the histochemical pattern observed in normal synovial membrane. The epithelial-like

cells of synovial sarcoma appear to share few similarities with the enzymatic pattern of normal synovial cells.

Discussion

Histochemical analysis of this case of typical biphasic synovial sarcoma shows that marked differences between spindle and epithelial-like cells exist. The spindle cells contain no hydrolytic enzymes, at least when analyzed with histochemical techniques on fixed material, and only some NADH-diaphorase that can also be demonstrated in epithelial-like cells. This is presumably related to basic cellular functions. In contrast, the epithelial-like cells are rich of enzymes involved in more specialized cell functions; ALP and ATPase are membrane-bound enzymes mainly detected in tissues where active transport processes take place. NSE and ACP are related to active endoplasmic reticulum and lysosomes. Synovial sarcoma contains cells involved in synthetic and secretory functions, as stated by Buonassisi and Ozzello (1973). The enzymatic content of epithelial-like cells probably reflects these functions. Enzyme histochemical analysis can contribute to the characterization of this neoplasm and to the understanding of its relationships with those other tumors which show common features and, probably, common histogenesis. Examples are epithelioid and chordoid sarcomas (Hajdu et al. 1977; Cooney et al. 1982). It is interesting that few enzyme histochemical similarities between synovial sarcoma and normal synovium can be observed (Table 1).

The recent demonstration of an epithelial antigen on the epithelial-like cells in two cases of synovial sarcoma (Sloane et al. 1981) together with the ultrastructural and histochemical characteristics of this neoplasm leave the problem of its histogenesis still open.

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