Ultrastructure of Telangiectatic Osteosarcoma

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Summary. Recent investigations have shown that telangiectatic osteosarcoma has a poorer prognosis than other osteosarcomas. To elucidate the histogenesis of TOS two cases were investigated on the electron microscopic level. The results show that besides anaplastic, osteoblast-like, and fibroblast-like tumor cells angiosarcomatous components can be observed in this malignant bone tumor, which are characterized by endothelial cells with pinocytotic vesicles, tight intercellular junctions, fine fibrils, and so-called Weibel-Palade bodies in their cytoplasm. From these results, it is concluded that telangiectatic osteosarcoma is derived from multipotent mesenchymal cells with potential differentiation into various directions, such as osteoblast-like cells, endothelial cells, and fibroblast-like cells.

Key words: Telangiectatic osteosarcoma – Histogenesis – Electron microscopy

Telangiectatic osteosarcoma (TOS) is usually considered a histologic variant of osteosarcoma without particular clinical significance (Farr et al., 1974). In recent investigations, Matsuno et al. (1976) found a significantly poorer prognosis in TOS compared to other osteosarcomas (Dahlin, 1978).

Histologically, TOS is characterized by a typical osteosarcoma pattern with blood-filled spaces sometimes segmented by thin septa. On the light microscopic level these spaces are free of endothelial cells.

Regarding the histogenesis of TOS, Ewing (1939) called it a cavernous angiosarcoma with osteoid formation as a secondary phenomenon in contrast to the nowadays most convenient opinion that TOS is only a variant of osteogenic sarcoma with degenerative changes (Jaffe, 1958). Describing the different cell types of TOS on the ultrastructural level we shall find some arguments for an angiosarcomatous component in this malignant bone tumor.
Materials and Methods

Case 1

A 15-year-old boy was admitted with a painful, progressively growing swelling of 6 weeks duration in the proximal part of the left fibula. Physical examination revealed a firm, slightly tender mass situated in the soft tissues over the fibula. The mass was fixed to the underlying tissues but not to the skin. Radiographs showed an osteolytic type of osteosarcoma involving a large portion of the proximal metaphysis and the mid-shaft with an ill-defined permeative area of bone destruction, with a fine, delicate, lamellated periosteal new bone response leaving a cortex only segmentally destroyed. A very large tumor mass with a faint cloudy increase in density invaded the surrounding soft tissues.

Angiograms revealed a highly vascularized intrasosseous and extrasosseous tumor with early opacification of large draining veins.

Frozen section biopsy was followed by resection of the tumor with a wide portion of surrounding soft tissue. Recent X-rays 1.5 years after resection showed no recurrence of the tumor.

Case 2

A 17-year-old boy was admitted to the hospital with a 2-month history of a rapidly growing swelling of his left lower leg. He had pains which persisted even during the night. On physical examination there was a hard mass with tenderness on pressure at the proximal fibular level.

Radiographs showed an expansile destructive area with a very wide zone of transition of the proximal metaphyseal fibula. The tumor had aggressively destroyed the cortex leaving some cortical sequestrations. Distally, there was a triangular detachment of periosteum adjacent to reactive bone sclerosis of the mid-shaft. An area of soft tissue new bone formation revealed thin, filiform spicules to give the “sunburst” pattern. The angiogram showed hypervascularity of the tumor mass with large abnormal arteries and veins, arteriovenous shunts and cavity-like vessels associated with a considerably large well-defined soft tissue component. After frozen section diagnosis, a local resection of the tumor was performed because consent to amputation was declined. Subsequent chemotherapy was initiated with Adriblastine, Vincristine, Endoxan, and Methotrexat.

In both cases immediately after removal small tissue samples from various parts of the tumors were minced into 1 mm pieces, fixed in 2.25% glutaraldehyde (0.05 m phosphate buffer, ph 7.4) for 2 at 4 °C, then rinsed in the buffer for 24 h. Postfixation was carried out in 1.33% osmic acid with 0.05 m phosphate buffer, ph 7.4 for 2 h. The tissues were dehydrated in graded ethanols and embedded in Epon 812. Sections were cut with a Porter Blum ultramicrotome, mounted on 3 mm copper grids and poststained for 15 min with 5% uranyl acetate and for 3 min with lead citrate. The specimens were studied with a Philips EM 400 electron microscope at 80 kv using the double condenser system. Semithin sections from Epon-embedded tissue were stained with toluidine blue for light microscopy. Formalin-fixed, Paraffin-embedded material was stained with hematoxilin and eosin, van Gieson, Ladewig, or Azan.

Results

Light Microscopy

Paraffin Sections. In both cases most areas of the tumor were composed of cystic spaces filled with clotted blood and segmented by thin septa without endothelial cells (Fig. 1a). These septa contained tumor cells often with irregularly structured nuclei and prominent nucleoli. Sometimes small amounts of osteoid, produced by these mesenchymal tumor cells, could be observed. Besides these cystic areas, the tumors sometimes showed more solid regions where the osteoid production of the mesenchymal tumor cells was considerably more pronounced. The cells were densely packed showing cytologic signs of malignancy with nuclei of irregular shape and a wide variation of sizes. Nuclei were often hyperchromic containing prominent nucleoli (Fig. 1b). It was remarkable that some capillary slits with an endothelial cell lining could be observed in these regions.