Intracranial Hemangiopericytoma
Ultrastructural Evidence of its Leiomyoblastic Differentiation
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Abstract. Two intracranial hemangiopericytomas revealed subcellular features of the neoplastic elements comparable to those observed in normal and neoplastic smooth muscle. These included intracytoplasmic and submembranous fusiform dense bodies associated with bundles of filaments, tapered configuration of cells with grouping of cytoplasmic organelles at nuclear poles and deposition of intercellular basement lamina-like material. These observations are consistent with the pericytic origin but opposed to the oftentimes postulated meningothelial derivation of the neoplasm.

Key words: Hemangiopericytoma — Leiomyoblastic differentiation — Ultrastructure.

The histogenesis of intracranial hemangiopericytoma remains controversial. A school of thought maintains that this tumor is an angioblastic meningioma, (Rubinstein; Russell and Rubinstein) a view supported by tissue culture studies (Muller and Mealey). Other investigators, however, have expressed the opinion that the tumor is of pericytic origin (Begg and Garret; Fisher et al.; Popoff et al.). Still others have withheld judgment (Kernohan and Uihlein; Kruse). This paper provides ultrastructural evidence for the occurrence of leiomyoblastic differentiation in two intracranial hemangiopericytomas studied, a finding in favor of the pericytic origin of the neoplasm.

Materials and Methods
The tumors were removed surgically from their attachments to the dura mater and brain, from a 63 year old man and a 62 year old woman, both of whom presented with hemiparesis of several months' duration. Specimens were examined by light microscopy in the usual manner. For electron microscopy, small pieces were fixed in phosphate-buffered glutaraldehyde or formaldehyde and postfixed in osmium tetroxide. One micron sections were stained with toluidine blue. Ultrathin sections were stained with uranyl acetate and lead citrate and examined with a JEOL JEM 100B electron microscope.

Observations
By light microscopy (Fig.1) both tumors were composed of ovoid cells arranged in sheets interspersed with numerous vascular spaces whose endothelium was separated from tumor cells by a thin layer of reticulin fibers. There were frequent mitotic figures and a rich pericellular reticulin component. Ultrastructurally, neoplastic cells had tapered cytoplasm, elongated ovoid nuclei and or-
ganelles grouped towards the nuclear poles in a manner reminiscent of smooth muscle cells (Fig. 2). Other tumor cells were irregular and had frequent cytoplasmic pseudopodal extensions and ovoid or indented nuclei (Fig. 3). Characteristically, neoplastic elements contained large numbers of intracytoplasmic filaments, 6—8 nm thick, arranged in bundles or whorls (Fig. 4). In some places the filaments coalesced into fusiform dense bodies measuring on the average 650 by 180 nm (range 350—2200 nm in length by 100—270 nm in width) (Fig. 3 and 5). Most frequently the filaments could be traced for some distance into the dense bodies, which had a finely granular matrix. In addition to those seen free within the cytoplasm, dense bodies of similar size and appearance were associated with the inner surface of the plasma membrane (Fig. 6). These were frequently located in areas abutting intercellular deposits of basal lamina-like material and resembled large hemidesmosomes. Another conspicuous cytoplasmic element was the abundant glycogen content of the neoplastic cells (Fig. 4). Rough endoplasmic reticulum Golgi complex and mitochondria showed various degrees of development. Centrioles and cilia were common. Nuclei contained a finely dispersed chromatin and inconspicuous nucleoli. Intercellular attachments measuring 80—100 nm in length and formed by condensations of apposing plasma membranes were observed between adjacent neoplastic cells. Inasmuch as intercellular dense laminae or tonofilament insertions were absent, these attachment structures appeared to constitute short zonulae adherentes rather than desmosomes (Fig. 3 and 7). The interstitial space contained collagen bundles and frequent pericellular strands of filamentous basal lamina-like material of medium electron density. Frequently, cytoplasmic extensions of tumor cells were wrapped around pools of this substance in a characteristic pinwheel fashion (Fig. 8). Blood vessels were lined by a single row of fenestrated endothelial cells surrounded by a thin basal lamina that often times split into two layers to encompass either thin elongated or round prominent pericytic cells. These cells contained a moderate number of cytoplasmic organelles including filaments and occasional intracytoplasmic fusiform dense bodies.