Ultrastructural Study of Glomus Tumor

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Abstract

The fine structure of five cases of glomus tumor was described. All of the cases showed a solid type, and the glomus cells were shown to be typical or modified smooth muscle cells. The authors' conclusion is that the glomus cells were not derived from pericytes, but from smooth muscle cells of vascular part of the glomus, and are thought to be a specialized smooth muscle cell tumor.

Key word : Glomus Tumor, Ultrastructural Study

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J Med Assoc Thai 2001; 84: 1619-1623

Glomus tumor (glomangioma), a benign neoplasm that derives from the neuromyoarterial glomus, are present in many parts of the body. Clinically, they can be classified into solitary and multiple glomus tumors, with the latter being subdivided into regional and disseminated types. The disseminated type is frequently familial. It occurs most commonly on the fingertips, but also occurs in many other locations[1]. The aim of this paper was to describe the histologic and ultrastructural features of the glomus tumor cells.

MATERIAL AND METHOD

Five cases of glomus tumor in patients, from 36 to 65 years of age, were used in this study. All of these were painful tumors of the nail (5 mm in diameter), thigh (4 mm), big toe (8 mm), right leg (1 cm) and forearm (3 mm, 2 mm). The tumor

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sample for light microscopy was fixed in 10 per cent buffered formalin, embedded in paraffin, sectioned and stained with hematoxylin and eosin (H.E.), Mallory's stain for collagen, Weigert's stain for elastin and Watanabe's stain for reticulin. For electron microscopy, small pieces were further fixed in 5 per cent glutaraldehyde buffered with cacodylate and postfixed in 2 per cent osmium tetroxide. They were embedded in Epon. Ultrathin sections were cut by an LKB-ultrotome and stained with uranyl acetate followed by lead citrate. The specimens were photographed with an electron microscope (JEM-100 S).

RESULTS

Light microscopy

The tumor was composed of polygonal cells with large round or ovoid nuclei and relatively clear cytoplasm. The cells were separated by thin stroma. The thin-walled vascular channels were lined by a single layer of endothelial cells and were surrounded by glomus cells. All of the cases showed a solid type (Fig. 1).

Electron microscopy

The five cases studied by electron microscope showed similar findings. The glomus cells were always outside of the basement membrane of the endothelial lining and were, in general, polygonal with round or ovoid nuclei and moderate amounts of cytoplasm with interdigitating cell processes (Fig. 2). Many cells had deep convolutions of the nuclear membranes. The tumor cells were found to be enveloped by basement membranes. Cells with clear and dark cytoplasm were found in the tumor. The former displayed scant filaments measuring 5 to 7 um in diameter, some of which were arranged in scattered thin bundles and were irregularly dispersed (Fig. 3). Mitochondria were, in general, present in the ectoplasm, but Golgi apparatus as well as ribosomes and endoplasmic

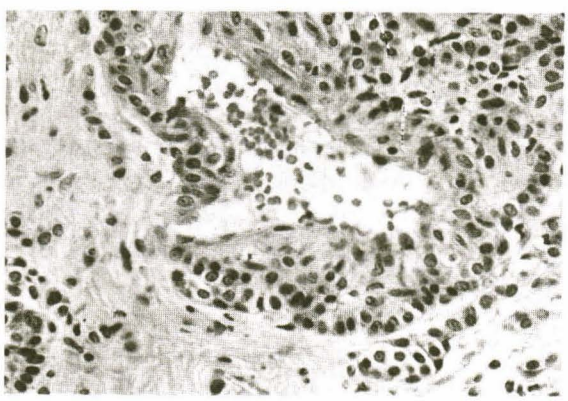

Fig. 1. Light micrograph of a glomus tumor shows closely packed glomus cells surrounding small vascular channels. (H.E. x 66)

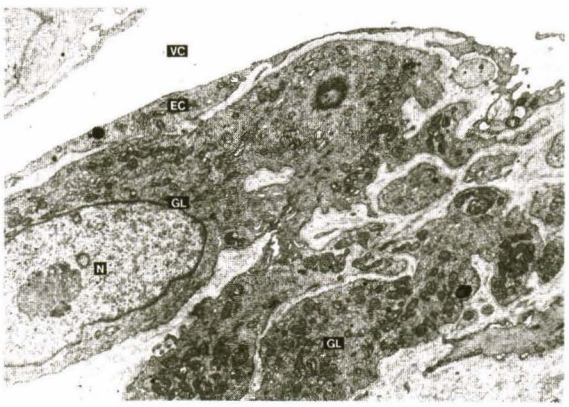

Fig. 2. Glomus tumor cell (GL) with oval-shaped nuclei (N) and cytoplasmic microfilament. Note the interdigitation cell processes along the glomus cells, VC = vascular channel, EC = Endothelial cell. (x 10,000)

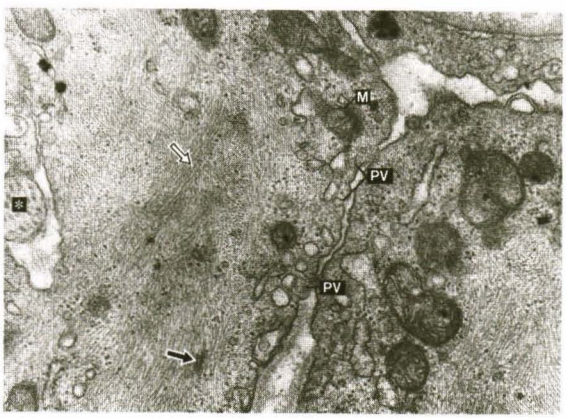

Fig. 3. Tumor cell with clear cytoplasm contains a disarray of 6 nm filament bundles (⇨). Fusiform densities are present in the bundles (→). Micropinocytotic vesicles (PV) are seen along the cell membrane. M = Mitochondria; * = nerve fiber. (x 38,000)

reticulum were sparse. Micropinocytotic vesicles were found along the cell membrane or under the cell membrane (Fig. 3). These cells resembled modified smooth muscle cells. Glomus cells were surrounded by a broad, fine fibrillar network and the unmyelinated nerve could be found in association with these glomus cells (Fig. 4). Small dense bodies (lysosomes) were seen occasionally in the tumor cell cytoplasm. The latter had numerous filaments and micropinocytotic vesicles, and scant cell organelles (Fig. 5). The basement membrane was present around the cells, which resembled typical smooth muscle cells.

The intercellular spaces were not uniform. In fact, in places they disappeared completely when adjacent cells touched them. There were desmosome-like structures between the tumor cells (Fig. 6). Microfibrils and ground substances were also present in these spaces. In capillaries, endothelial cells were arranged in a single layer, and they were non-fenestrated. The basement membrane of the endothelial cells was continuous and of an almost uniform thickness (300-500 Å).

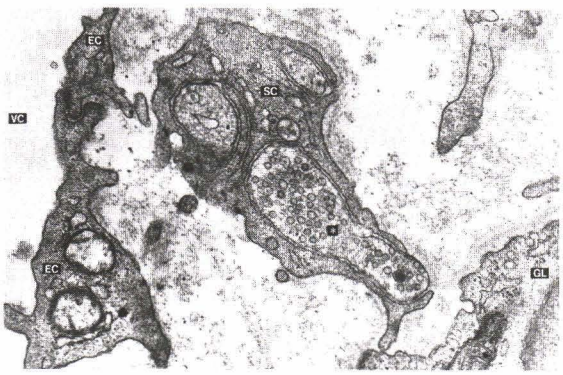

Fig. 4. Unmyelinated nerves (*) could be found in association with glomus cells (GL), VC = vascular channel, EC = endothelial cell, SC = schwann cell. (x 54,000)

DISCUSSION

Masson (1924)[2] first described pathological changes in cutaneous arteriovenous anastomoses and named the small, well defined lesions "glomic tumors". Glomus tumours are relatively uncommon neoplasms that arise from modified smooth muscle cells that are normally found in specialized arteriovenous shunts present in acral sites, especially the fingertips. This distribution reflects their function, as the arteriovenous anastomoses of these areas, also known as the Sucquet-Hoyer canals, are involved in temperature regulation. Sucquet-Hoyer canals are lined with endothelial cells, contain several layers of glomus cells in their walls, and connect afferent arterioles to efferent venules. Murray and Stout (1942)[3] sug-

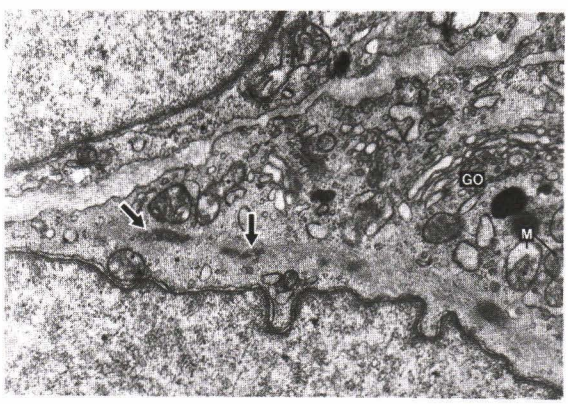

Fig. 5. Tumor cell with dark cytoplasm contains 6 nm filaments with scattered fusiform densities(→). Micropinocytotic vesicles are seen along the cell membrane. M = well - developed mitochondria, G0 = well - developed golgi apparatus. (x 16,000)

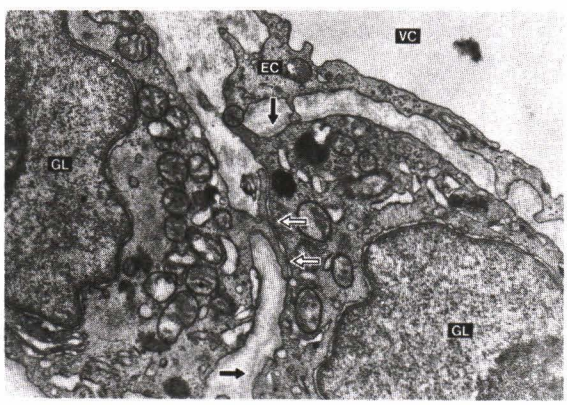

Fig. 6. A tumor cell (GL) has well – developed mitochondria near which are present filaments. Arrows (⇨) indicate desmosome-like structures in neighboring cells. → Basement membrane. VC = vascular channel, EC = Endothelial cell. (x 10,000)

gested that epithelioid cells of the glomus tumor were derived from vascular pericytes in their tissue culture, and that hemangiopericytoma was a related tumor. However, because of ultrastructural observations,[4-9] glomus cells have been thought to be smooth muscle cells[5,10-13]. Osamura et al (1977) [14] demonstrated the presence of smooth muscle cells and pericytes in a gastric glomus tumor. The authors observed that tumor cells had cytoplasmic filaments, micropinocytotic vesicles, and basement membranes. Some tumor cells contained whole cytoplasm with filaments and others contained a few filaments. The former resembled typical smooth muscle cells, and the latter resembled modified smooth muscle cells or pericyte-like cells. Both of these cells also contained fusiform densities in the filament bundles. Fusiform densities have been thought to be a most distinctive feature of the smooth muscle cells[11]. It is said that similarity of smooth muscle cells to pericytes has been reported[11]. However, fusiform densities are rarely seen in pericytes, so the cells with a few cytoplasmic filaments and micropinocytotic vesicles are considered not to be pericytes, but to be modified smooth muscle cells. Miettinen et al (1983)[6] concluded in their histochemical analysis that glomus tumor cells resembled some vascular smooth muscle cells. On histochemical examination, glomus tumor cells express vimentin, myosin and desmin which analogue to smooth muscle cells.

In conclusion, the tumor cells showing cytoplasmic filaments with fusiform densities in varying degrees, micropinocytotic vesicles, and basement membranes are considered to be typical of modified smooth muscle cells. As for the histogenesis, many theories are concerned[12,15,16]. In the present study, the glomus cells are not derived from pericytes, but from smooth muscle cells of vascular part of the glomus, and are thought to be a specialized smooth muscle cell tumor.

(Received for publication on November 30, 2000)

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การศึกษาทางจุลทรรศน์อีเล็คตรอนของเนื้องอกชนิดโกลมัส

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ได้ทำการศึกษาจุลทรรศน์อีเล็คตรอนของเนื้องอก glomus ชนิด solid 5 ราย พบลักษณะซึ่งสามารถสรุปได้ว่า เนื้องอกประเภทนี้ไม่ได้มีต้นกำเนิดมาจากเซลล์เพอริไซต์รอบหลอดเลือด แต่น่าจะมาจากกล้ามเนื้อเรียบชนิดพิเศษ ซึ่งเกิดขึ้นบริเวณรอบหลอดเลือด

คำสำคัญ : เนื้องอกชนิดโกลมัส, การศึกษาจุลทรรศน์อีเล็คตรอน

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