

ELECTRON MICROSCOPIC INVESTIGATIONS IN XANTHOMATOUS MENINGIOMA

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Electron microscopic investigations on meningiomas were started with the article written by S. A. Luse in 1960 (7). More recently the papers of J. Kepes (5), S. H. Nyström (8), A. J. Raymond, S. Mullans and J. P. Evans (11), W. Gusek (3), M. Besen and N. Gonatas (2) were also published. All listed works deal with the problem of electron microscopic structure of the meningotheial, fibrous and psammous meningioma. Scarcely with the work by R. Koynov, A. Boyadjieva-Mihaylova and A. I. Hadjiolov (1964) the question was posed for electron-microscopic investigation of the xanthomatous meningioma.

The present work, based on the electron microscopic, light beam microscopic and clinical study of two xanthomatous meningiomas greatly contributed for the extension of our knowledge in this particular field.

Clinical observations

Case Report — Tzvetana N. K., aged 41, admitted for treatment at the Higher Army Medical Institute — Department of Neurosurgery — Sofia on January 20, 1964. History of illness № 647/54 — 20. I. 1964. The pains in the sinciput and occiput date back 5—6 years ago and since one year they are intensified. Sight was weakened and recently numbness of the right limbs occurred.

Objective state: rightside spastic hemiparesis, bradypsychia, bradykinesia, blindness of the right eye and concentric narrowing of the left optic field and papillary stasis — 3 d.

In January 24, 1964 she underwent operation — a tumour was found in the leftside frontal area.

The light-beam microscopic investigation of the tumour revealed xanthomatous meningioma (T. Genchev).

Case report — Blagovesta N. B., aged 22, admitted for treatment at the Nerve Clinic — Higher Medical Institute — Varna on July 1, 1964 (history of illness № 7756/59). Complaints of headache in the temporal area with nausea and vomiting date back in November 1963.

Objective state: rightside spastic hemiparesis, papillary stasis — 2 d.

Operation carried out on July 10, 1964 — a parasagittal meningioma with leftside shifting was established.

The light microscopic investigation demonstrates richly vascularized meningioma with areas of xanthomatous cells.

Material and Methods

The material for electron microscopy investigation was obtained during operation of the patients and thereupon immersed in a fixative of 1% buffered with veronal — acetate osmic tetroxide. In the solution itself the piece of tumour was cut into small particles, each measuring 1 mm³ and fixation was continued for two hours at 4°C. After dehydration, carried out in serial gradually increasing concentrations of ethyl alcohol, the material was embedded in a mixture of butyl-methyl methacrylate in a proportion 4 : 1 and 1% benzoyl peroxide added. Polymerization was carried out at temperature 56° for 48 hours. Ultra-thin sections measuring in thickness 200 Å were cut on LKB ultramicrotome and after contrast staining with uranyl acetate, they were examined and photographed on JEM 6 C electron microscope. Ultra-microscopy was carried out at the Electron Laboratory, under the guidance of A. S. Shubin, of the Oncological Institute — Medical Science Academy — Moscow, Soviet Union, director academician N. N. Blohin, to all of whom we express our deep gratitude.

Results

The cells are more or less elliptical, measuring up to 10—12 μ . Their nuclei present elliptical form with long dimension 6—8 μ and short dimension 4—5 μ . The chromatin is with rather peripheric disposition, with isolated patches being observed also in the middle portions of the cell nucleus. It consists of grains with the size of ribonucleoprotein Palade granules, and of fibers. Three — to four-fold bigger grains are likewise encountered. The surface of the nuclei is smooth or slightly waved. A double nuclear membrane is clearly outlined. Pores are distinguished along the internal layer of the membrane and ribonucleoprotein granules — along the external layer. The perinuclear reservoir displays inflations and dilatations measuring 50—60 μ . Within some of the cell nuclei, nucleoles are discerned with dimensions about 1 μ the short and 2 μ the long diameter. The cytoplasm is more substantially modified. The endoplasmic reticulum is reduced; in certain areas however, it exhibits substantial expansions taking the form of cisterns or lakes. The ribonucleic granules appear to be considerably reduced in number, equally the membranes of the endoplasmic reticulum and those lying freely in the matrix of the cytoplasm.

The mitochondria display highly variable size — from 200—300 μ up to 1500—16000 μ in length. Moreover, the greater part of them appear to be inflated and turgid. Some of them are with electron proved dense content, others are with reduced septae, displaying two or even one external membrane.

In the cytoplasm rather more often electron proved empty formations are found of elliptical form and with longitudinal dimension from 0.5—0.6 to 2—3 μ . These formations account for the foamy appearance of the cells. The impression is had that they greatly resemble the turgid and degenerated mitochondria.

Figures are also detected, similar to myelin, with thickness of the dark layers about 70Å, and of the bright — about 140Å.

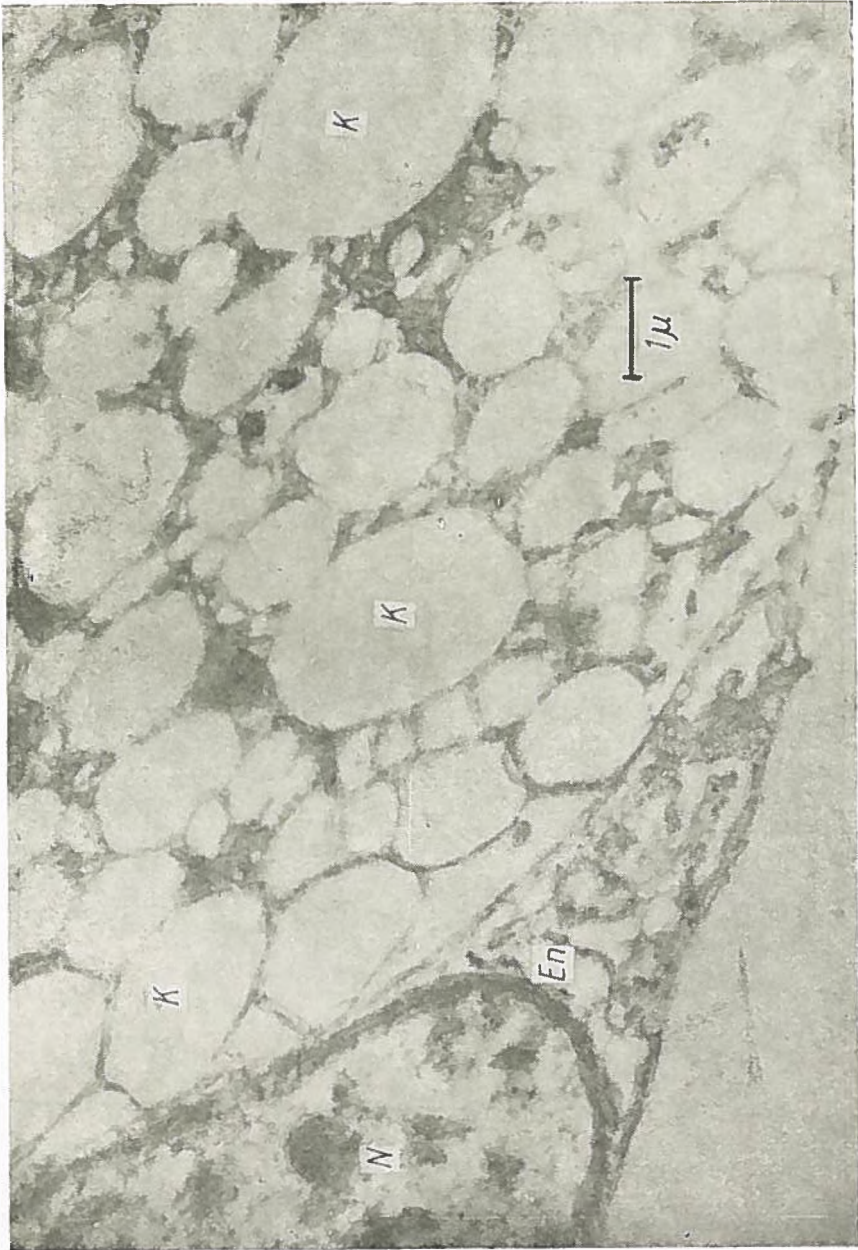


Fig. 1

N — nucleus; *En* — endoplasmic reticulum. *K* — little cells of extracted iats.
Magnif. 13700 x.



Fig 2

M — mitochondriae in various stages of degeneration. Magnif. 117000 x

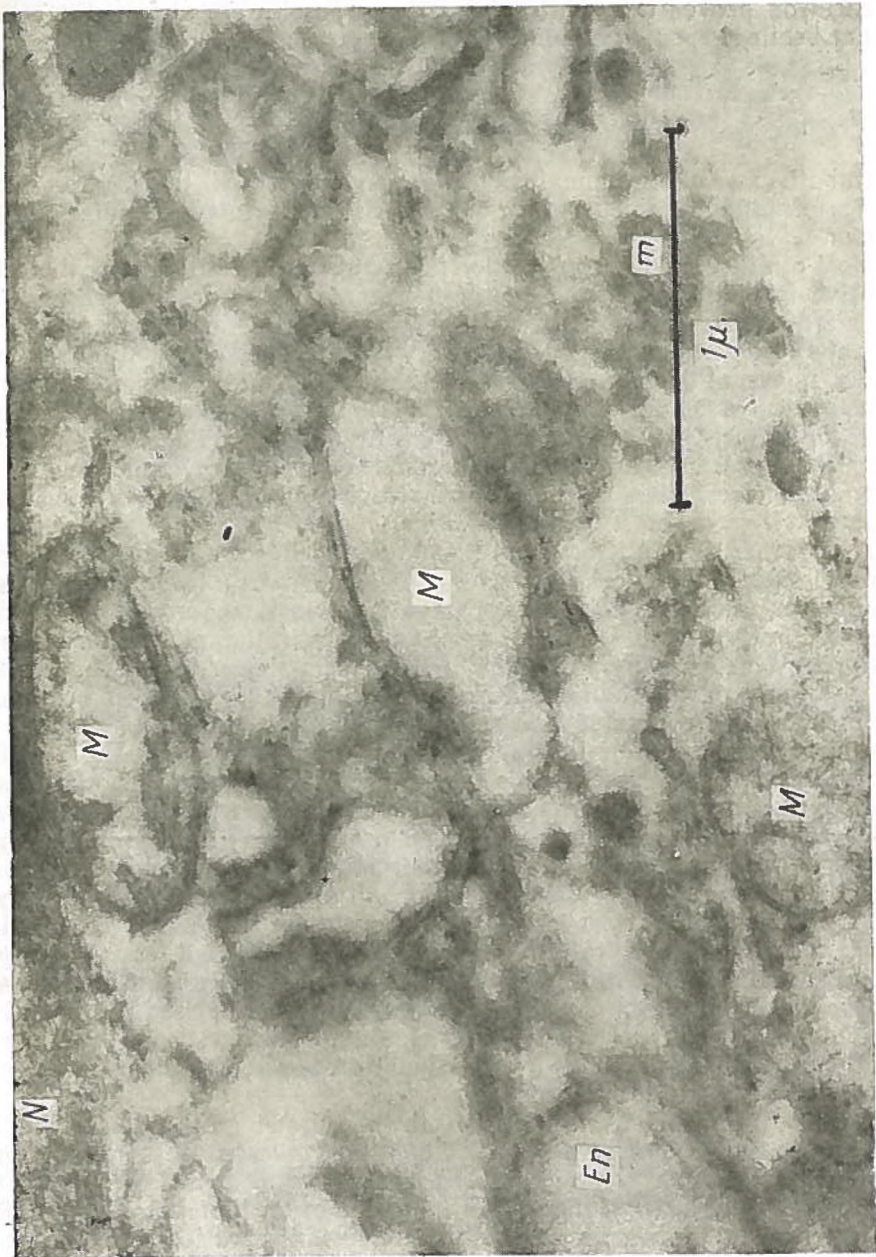


Fig. 3

N — nucleus; *M* — mitochondria; *En* — endoplasmic reticulum; *m* — promitochondria.
Magnif. 57500

Electron proved dense intraplasmatic corpuscles are also distinguished, oval or beetle shaped, sized up to 100—200 $m\mu$.

Discussion

In both cases of xanthomatous meningioma presented, the electron microscopical finding revealed rather characteristic for this particular type of tumour features.

Most of all, the characteristic for the majority of cases elliptical electro-negative formations, located in the cellular cytoplasm, are striking. The latter are readily visible with light-beam microscope also and produce the characteristic of the so-called foam cells picture. These formations, as well known, represent deposits of cholesterol esthers. In the electronogram, owing to the process of dehydration with serial alcohols, the content is extracted and their appearance assumes the form of electron negative fields. For the time being, the causes accounting for this odd cholesterol accumulation are unknown, but nevertheless the importance of disturbed metabolism of substances has been stressed (L. I. Smirnova).

It is rather difficult for us to postulate a definite opinion on this particular issue, but we feel that its discussion is warranted on the basis of the electron microscopical findings established in the course of our investigations. Firstly, the disclosure of severe changes in the mitochondria should be emphasized. At many points the mitochondria appear to be rounded, turgid, with large part of their cristae missing, with one or even both membranes non existant and converted into small bags. The alterations listed are very similar to the process of turbid turgescence of mitochondria (H. Oberling and V. Bernard). Along with this type of changes in the mitochondria, also small dense mitochondria are observed, known as regenerating mitochondria, by way of which the cell attempts the restoration of dying organellae. Thus, it is very likely that the process of degeneration in the mitochondria should also be considered in discussing the problem of fatty degeneration of these cells. Analogous alterations in the mitochondria are ascribed by H. Oberling and V. Bernard to respiratory disorders due to defficient vascularization. Such a casual relationship in our experience is hardly admissible, bearing in mind that in one of the cases it concerns a richly vascularized xanthomatous meningioma. By all probability, the rich vascularization constitutes merely an attempt for improvement of oxidational processes, as well as of the production of young mitochondria.

On the other hand, we feel it is worthwhile drawing attention to the fact that these peculiar compartments, in which the cholesterol has been accumulated, resemble rather strongly the turguscent mitochondria insofar shape is concerned; the latter fact justifies the assumption that this accumulation is effected in the mitochondria. If so, the question is raised as to the possibility of fatty degeneration of mitochondria — a problem hitherto not sufficiently clarified.

In addition to the data presented, it is also necessary to lay emphasis on the fact that the cytoplasm of this particular tumour proves to be relatively poor in ribonucleinic granules, bound to the endoplasmatic reticulum membranes and freely lying in the martix of the cytoplasm alike. The latter fact

justifies the assumption that the production of protein in these tumours is substantially lowered. Lastly, it is necessary to give due consideration to the form, size and surface of the nuclei, displaying a relative tranquility in the comparatively protracted clinical course of the morbid process. Nevertheless, it should be pointed out that the perinuclear reservoir, at some points exhibits dilatations, uncommon for normal cells.

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ЭЛЕКТРОННО-МИКРОСКОПИЧЕСКОЕ ИЗУЧЕНИЕ ПРИ КСАНТОМАТОЗНОЙ МЕНИНГЕОМЕ

Р. Койнов

РЕЗЮМЕ

Автор описывает клиническую картину, гистологическую и электронно-микроскопическую находку в двух случаях ксантоматозных менингеом. Электронномикроскопическое исследование указывает на тяжелые дегенеративные изменения в митохондриях, которые, по мнению автора, являются причиной нарушения оксидационных процессов в цитоплазме и накопления холестерина, будь то в других местах, будь то в митохондриях. Наряду с этим, устанавливается уменьшение количества рибонуклеопротеиновых гранул, что указывает на пониженную продукцию протеина.