Study on the ganglion cervicalis uteri of the aged rats

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I. Introduction

In the previous investigation Takahashi (1960) has reported on the cells in the ganglion cervicalis uteri of the rats and mice, with particular reference to the vacuoles which arise in the cells of that ganglion. In that report it has been described that the occurrence of the vacuoles in the cells is not recognizable in the young rats and young mice, but it is for the first time noticeable in the five and more months old rats, and then the vacuoles are gradually increased, especially at the pregnant period and after the water soluble follicle hormone injection. On the contrary, when the animals were castrated, the vacuoles in the cells decreased. Moreover such changes have been observed in the previous investigation as changes of the tissue into fibers, deposition of pigment and the degeneration and contraction of the cells of ganglion cerviclaais uteri.

However, in the previous investigation, the ganglion cervicalis uteri and the cells of that ganglion of the aged rats and mice were not ascertained. Similarly the reports on the ganglion cells of the aged rats and mice, especially on the vacuoles have not been published. Recently, with the progress of the clinical study for the aged mice, histological changes in the various organs of the aged mice, have been studied. Rathery et Turiaf (1938) have reported on abnormal swelling of the Langerhans' island of the aged mice. Andrew (1944) has described the degenerative atrophy of the cells and the adipose degeneration in the lobule of the pancreas of old mice. Moreover, Ogata (1954) has reported on

the senile degeneration, that occurs in advanced age, various endocrine impediments, especially the adipose degeneration in the main duct portion of the parotid gland and the degeneration atrophy in the striated tubules portion are found. Regarding abnormal swelling of Langerhans' island O g a t a (1956) has described that it is a modified phenomenon of aptyalism (senile degeneration). From the above mentioned reports, may be briefly summarized as follows, that the senile phenomena in animals are ascertainable in changes in the salivary gland and pancreas for the first time.

In the experiment by A n d r e w (1944), the rats of 700 to 1000 days were employed as material, but in Japan the average span of rat life is from 700 to 800 days, so that it is very difficult to breed for a much longer period than that.

The authors, employing healthy female rats which were reared for as long a period as possible, studied the senile phenomena, especially on the senile changes in the ganglion cervicalis uteri and in the cells of that ganglion.

II. Material and Methods

Eight healthy female rats of 730 to 760 days after birth, which were bred under the common condition were used. After the rats were operated on ventrotomy, the cervical portion of the uterus with enough parametrium were taken off and at the same time the pancreas and parotid glands were obtained. The parotid glands which are located at the portion above and forward the neck and near the skin, are red-bean-sized. These glands were surrounded with lymphatic glands. The materials were fixed with 96% alcohol solution and Bouin solution, embedded in paraffin and cut serially at 5 to 10 μ . Nissl staining, hematoxylin-eosin staining, azan staining and G o m o r i's chrome alum hematoxylin phloxine staining methods were employed.

III. Original Findings

The body weight of the rats of 730 to 760 days after birth which were bred under the same condition is 200 to 240 g. On the abductory findings the subcutaneous adipose tissue is well developed, but organs are generally contracted.

1) On the parotid glands.

The parotid glands macroscopically show a considerable contractive feature, and microscopically they show a contraction in the glandular cells and the vacuolization of the cytoplasm and besides, disappearance of the groups of the glandular cells and substitute adipose tissues are increased. At the striated portion the columnar epithelial cells are flattened and such changes as irregular arrangement of the nucleus in the cell, inspissation of the nucleus, enlargement of tubule and increasing or vitrification of the connective tissue around the tubule are noticeable (Figs. 1, 2).

2) On the pancreas.

In the glandular tissue in the pancreas, adipose degeneration is observable, namely, the fatty degeneration begins from the outer margin of the lobule and extends into the inner portion of the lobule. The nucleus of the glandular cell shows such degenerative changes as the contraction and heavy stainability. The excretory ducts in the lobule and blood vessels remain in the tissues which are degenerated in adiposis, but not any changes are found in the epithelial cells in the tubules. In Langerhans' island a figure which looks like on abnormal swelling is observed (Figs. 3, 4).

3) On the ganglion cervicalis uteri.

The uterus macroscopically shows a considerable contraction but not so heavy as that in the castrated female rats which were examined in the Takahashi's previous report (1960). The ganglion cervicalis uteri of the rats is microscopically contractive, especially the increasing of the connective tissue is intensive and the margin of the ganglion is depressed, besides the formation of a split which results from segmentation of the ganglion is recognized. The cells of the ganglion cervicalis uteri become low in their stainability and show a picture of contractive and degenerative destruction. Some of the nuclei are irregular in shape. By means of the Nissl staining method, the stainability of Nissl granules becomes low and distributes unequally (Figs. 5, 6). In the cells of the ganglion cervicalis uteri of rats, the number of the cells which contain the vacuoles is thought to be less than that in the rats which were injected with follicle hormone subcutaneously and those cells in the pregnant rats which were examined in the Takahashi's investigation, but somewhat more than the cells in the castrated rats. The portion where the vacuoles give rise to is mostly the head of the ganglion and the next lies at the

periphery of the ganglion.

The shape of the vacuoles is such various as drop-like, polyalveolar and monoalveolar. The vacuoles are stained clearly with Nissl staining, blue granular with azan stain and blue black fine granular with Gomori's method. Moreover, with Gomori's method, blue-black fine granules (Gomori positive granules) are observable, with high magnification of the microscopy (above 1000 $\times$), in the portions around the vacuoles and in the boundary between the polyalveolar shaped vacuoles.

IV. Discussion

It was already described that eight healthy female rats which were bred under the same condition were 730 to 760 days after birth and weighing above 200 g each; when autopsy was carried out on these rats, the subcutaneous adipose tissue was well developed, while the organs generally showed a contractive figure.

1. In the parotid glands of these rats, all of the glandular cells show a contraction (degeneration into the vacuoles) and disappearance of the glandular cell group, substitute phenomenon of the adipose tissue, degeneration of the epithelial cells at the striated portion and enlargement of the glandular duct are observed. These findings are consistent with the findings on a phenomenon of senility by Ogata (1954) and by Takizawa (1952).

In the pancreas of the rats, adipose degeneration of the glandular tissue, degeneration of the glandular cells and abnormal swelling of the Langerhans' island are observed. These findings agree with the results obtained by Rathery and Turiaf (1938), Andrew (1944), Carlson (1952), Ogata (1956), Yokoo (1956) and others. Namely, Rathery and Turiaf have reported on an abnormal swelling of Langerhans' island as a phenomenon of senility.

Andrew, studying on the phenomenon of senility in the rats of 700 to 1000 days after birth, has described on the adipose degeneration in the lobule of the pancreas. Ogata and Yokoo also have insisted that in phenomenon of senility or in asialia the adipose degeneration in the lobule of the pancreas and abnormal swelling of Langerhans' island are recognizable.

From these data mentioned above, it may be thought that in the rats which are used in the authors' observation, several figures

showing superannuation are in progress.

2. In the ganglion cerviclis uteri of the rats, generally contraction is observable, especially the disintegration and fiberformation of the ganglion and the formation of the splits are noticeable. These findings are similar to the pathological findings on the ganglion above the cervix which was reported by Herzog (1926), and are the same as the findings that were obtained from the Takahashi's previous castrated rats, while deposition of pigment which was observed in the portion between the ganglion cerviclis uteri of the castrated rats is not recognizable in this experiment.

The cells of the ganglion cerviclis uteri become low in their stainability and with Nissl staining the extent of the stainability is low and extremely uneven. A few reports on the senile phenomenon in the nerve cells have been published, and reports on the cells of the ganglion have rarely been encountered. J.L. O'Leary (1952), as a senile phenomenon in the central nervous system, has reported the desquamation of the nerve cells and the lowering of the stainability of Nissl granules. Similarly, in the authors' findings the stainability of Nissl granules is unequal and becomes low.

As regards the deciduation of the nerve cells, in the authors' observation the number of the cells is generally decreased and the formation of the spaces is recognized, but the decided conclusion that it is a deciduous phenomenon was not possible to be found. In the ganglion cerviclis uteri, the number of the cells, which contain the vacuoles is but small, the shapes of the vacuoles are various. The contents of the vacuoles are stainable with azan stain or with Gomori's staining method, but not with Nissl staining. With Gomori's staining method, Gomori positive granules are observable around the vacuoles and between the cells. From the results mentioned above, it is thought, that the vacuoles have rather to do with the neurosecretion than that they are accompanied by the senile phenomenon in the cells. If the vacuoles occurring in the nerve cells should spell the degeneration or contraction of the nerve cells as insisted on by Storz and his coworker, the occurrence of numerous vacuoles should be observable in the cells of the ganglion in which the senile phenomenon started. However even in the cells of the ganglion cerviclis uteri of the castrated rats which were examined in the Takahashi's previous report, very few vacuoles occurred. From these points it is thought that

the vacuoles which arise in the ganglion cells, does not mean the degeneration or contraction of the nerve cells.

The senile phenomena of the ganglion cervicalis uteri of the female rats are, as mentioned before, increasing of the connective fibers in the ganglion, disintegration of the ganglion, formation of splits, lowering in the stainability of the cells, and modification of the nuclear membrane. These findings generally are believed to be the senile phenomena of the organs, similarly in the ganglion and in the ganglion cells as well as the organs it is thought that the same phenomena are recognizable.

It is though that there is the advancement of the cell function related with neurosecretion, when numerous cells which contain the vacuoles are observable. Not any pathological changes in the ganglion or the desposition of pigment which is observed in the castrated rats, are observable in this experiment. But it is uncertain that these facts explain the incomplete phenomenon of senility or have not to do with the phenomenon of senility.

V. Conclusion

1. Employing the healthy female rats of 720 to 760 days after birth which were bred under the common condition, the author observed the senile phenomena in the parotid gland, pancreas, and ganglion cervicalis uteri.

2. On ganglion cervicalis uteri of rats, increasing of fibers, segmentation of the ganglion, formation of splits, lowering in the stainability of the ganglion cells and deformation of the nucleus were observed. These findings are thought to be a kind of the phenomena of senility.

3. The vacuoles which occurred in the cells of the ganglion cervicalis uteri are not those which show a process of degeneration or contraction in the ganglion cells, but they are those which have to do with the cell function connected with neurosecretion.

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Explanation of figures

- Fig. 1. Disappearance of the glandular cells at the striated portion of the parotid glands.
- Fig. 2. Flatly transformed epithelial cells at the striated portion of the parotid glands and the enlargement of space.
- Fig. 3. Adipose degeneration in the lobule of the pancreas and the lobular duct and blood vessels remaining in the degenerated tissue.
- Fig. 4. Abnormal swelling of Langerhans' island of the pancreas.
- Fig. 5. Segmentation, depression and contraction of the ganglion cervicalis uteri.
- Fig. 6. Contraction and space formation in the cells of the ganglion cervicalis uteri.