

STRUCTURAL CHANGES IN THE HUMAN PINEAL GLAND IN CASES OF FIBROSING CAPSULE

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ABSTRACT

The capsule and its trabeculae are an active element of the human pineal gland's structure. During the examination of section material we observed that in part of the pineal glands the capsule was thickened and with fibrosis (TFC). The literature review as well as our observations made us to undertake the current study with the aim to find out what is the role of the thick and fibrotic capsule on the macroscopic characteristics and the main histologic structures of the human pineal gland. We studied 134 pineal glands taken from bodies of people who died from both non-violent and violent cause of death. 95 of the pineal glands were taken from men and 39 from women, with mean age 52,57 years. Slices 5 μ thick were stained with hematoxylin and eosin and Van Gieson. The material was examined on light microscope and results analyzed with standard statistical methods. Cases with TFC represent 43,08% of all studied pineal glands. There is no statistically significant difference in the percentage of cases with TFC between the groups of those who died at 20-39 years of age and 40 and above. There is no statistically significant difference in the percentage of cases with TFC among men and women. The length width and weight of pineal glands with fibrose capsulae are bigger. Density is not changed. The percentage with gliosis is higher in the group of pineal glands with gentle capsulae. The rest of the variables are without changes.

Key words: pineal gland, structure, capsule, histology

The capsule of the human pineal glands consists of flat cells without well-defined shape (8). A lot of connective tissue septi including blood vessels and nerves come off it (1,3) enclosing the gland parenchyma in the form of well or partially defined pseudolobes. The capsule and the septi are richly innervated. A peptidergic innervation is proved. CGRP (calcitonin gene-related peptide), SP (substance P), or VIP (vasoactive intestinal polypeptide)-immune reactive fibres pass through the capsule and the septi and end in the gland parenchyma (10,11). An opioidergic innervation is also described (12) as well as plenty of NPY (neuropeptide Y)-positive sympathetic nerve fibres (13). Well-expressed NADPH-diaphorase activity is found around nerve fibres and the endothelial cells of the capsule vessels (9). The capsule and the trabeculae coming off it are an active element in the pineal gland structure.

In our section material we find out that in some pineal glands the capsule is thicker and with fibrosis, i.e., a thick and fibrotic capsule (TFC). The above presented literature review and our observations made us to undertake the present study with the aim to find out the role of the thicker capsule with fibrotic changes for the macroscopic characteris-

tics and the main histological structures of human pineal gland. In order to achieve this objective we defined the percentage of cases with and without TFC by gender, by macroscopic criteria (length, width, weight, density), and by main histological structures (availability of acervulus, gliosis, non-tumour cysts, and way of forming of pseudolobes from the trabecular elements).

MATERIAL AND METHODS

We studied 134 pineal glands of deceased people that underwent an autopsy in the Department of General and Clinical Pathology or in the Department of Forensic Medicine and Deontology at Prof. Paraskev Stoyanov Medical University of Varna during the period from September 2002 till March 2003. Of them, 95 were men and 39 women at a mean age of 52,57 (20-95) years. Macroscopic observations were made before fixation of the material. After fixation in 10% solution of neutral formaldehyde slices of 5 μ were cut from paraffin blocks and stained with hematoxylin and eosin and Van Gieson. Routine statistical methods were used for the analysis.

RESULTS AND DISCUSSION

We observed a thick and fibrotic capsulae in 53

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histologically studied pineal glands (in 43,08% of the glands).

(Table 1). There was no significant difference in the percentage of cases in both groups.

Table 1 Frequency of fibrotic changes in the capsule of human pineal glands in relation to age

Age groups	20-39 years		> 40 years			
	n	P	n	P	t	P
Capsule fibrosis	19	36,84	101	45,54	0,71	n.s

The pineal glands with TFC we separated in two groups.

Table 2. Frequency of fibromatous changes in the capsule of human pineal glands in relation to sex

Type of capsule	Men		Women			
	n	P	n	P	t	P
Gentle	75	58,33	28	57,14	0,1	n.s
Thick	75	41,66	28	42,85	0,1	n.s

Table 3. Structure of the pineal gland in relation to the state of the capsule

Structural characteristics	Gentle		Thick			
	n	P	n	P	t	P
1. Acervulus	69	66,66	53	81,13	1,85	n.s.
2. Pseudolobs						
Not defined	69	43,17	53	41,50	0,22	n.s.
Partially defined	69	23,18	53	28,30	0,64	n.s.
Well defined	69	33,33	53	30,18	0,37	n.s.
3. Gliosis	69	57,97	53	33,96	2,73	<0,05
4. Cysts	69	18,84	53	22,64	0,51	n.s.

The first group included glands taken from people who died within the age range of 20-39 years and in the second group those taken from people who died at 40 years and above

Table 4. Macroscopic characteristics of the pineal gland in relation to the state of the capsule

Macroscopic characteristics	Gentle		Thick		t	P
	n	$X \pm \Delta$	n	$X \pm \Delta$		
Length mm	77	$8,26 \pm 0,83$	57	$9,4 \pm 0,96$	2,53	<0,05
Width mm	77	$6,05 \pm 0,58$	57	$6,77 \pm 0,67$	2,32	<0,05
Weight mg	69	$129,35 \pm 27,24$	55	$162,15 \pm 31,36$	2,21	<0,05
Density (kg/m^3)	69	$3,49 \pm 1,12$	55	$2,78 \pm 1,25$	1,18	n.s.

The status of the capsulae was studied in relation to gender (Table 2). There was no difference in the percentage of cases with TFC among men and women.

In the histological study of the pineal gland in relation to the four variables of interest in three of the four characteristics there was no statistically significant difference. Gliosis of the pineal glands was more seldom observed in the group with TFC as compared to the group without changes in their capsulae. This difference was statistically significant (Table 3).

Considerable differences were registered during the macroscopic observations and measurements. The length, width and weight of the pineal glands with TFC were significantly higher as compared with the glands without changes in their capsulae. There was no difference between both groups in relation to density only (Table 4).

In experimental animals an increased production of collagen is registered with age and it is related with deposition of acervulus in the pineal glands' capsulae (2,6,7).

The observations of ours and of foreign authors (4,5) on pineal glands do not establish any differences in relation to sex and age. This can be a result of species specificity or some other reasons not studied up to that moment.

CONCLUSIONS

1. Cases with TFC represent 43,08% of all pineal glands.
2. There is no statistically significant difference in the percentage of cases with TFC between the groups of younger and older persons at age of death. TFC is not related to aging.
3. There is no statistically significant difference in the percentage of cases with TFC among men and women. TFC is not related to sex.

4. The length, width and weight of pineal glands with fibrotic capsulae are bigger. Density is not changed. The percentage of capsulae with gliosis is higher in the group of pineal glands with gentle capsulae. The rest of the variables are without changes.

REFERENCES

- Bhaskar, K. S., S. R. Katti, A. G. Sathyanesan. The pineal gland of the Indian palm squirrel, *Funambulus pennanti* (Wroughton).- *Arch. Anat. Microsc. Morphol. Exp.*, **75**, 1986-1987, No 2, 117-125.
- Boya, J., J. Calvo. Structure and ultrastructure of the aging rat pineal gland.- *J. Pineal Res.*, **1**, 1984, No 1, 83-89.
- Dominguez, S., R. S. Piezzi, L. Scardapane, J. A. Guzman. A light and electron microscopic study of the pineal gland of the viscacha (*Lagostomus maximus maximus*).- *J. Pineal Res.*, **4**, 1987, No 2, 211-219.
- Gusek, W. Histology of the pineal gland in the elderly human.- *Aktuelle Gerontol.*, **13**, 1983, No 3, 111-114.
- Hasegawa, A., K. Ohtsubo, W. Mori. Pineal gland in old age: quantitative and qualitative morphological study of 167 human autopsy cases.- *Brain Res.*, **409**, 1987, 343-349.
- Humbert, W., F. Cuisinier, J. C. Voegel, P. Pevet. A possible role of collagen fibrils in the process of calcification observed in the capsule of the pineal gland in aging rats.- *Cell Tissue Res.*, **288**, 1997, No 3, 435-439.
- Johnson, J. E., Jr. Fine structural alterations in the aging rat pineal gland.- *Exp. Aging Res.*, **6**, 1980, No 2, 189-211.
- Krstic, R. V. Scanning electron microscopic study of the freeze-fractured pineal body of the rat.- *Cell Tissue Res.*, **201**, 1979, No 1, 129-135.
- Lewczuk, B., J. Wojtkiewicz, M. Majewski, B. Przybylska-Gornowicz. Localization of NADPH-diaphorase activity in the pineal gland of the domestic pig.- *Folia Histochem. Cytobiol.*, **39**, 2001, No 2, 181-182.
- Matsushima, S., Y. Sakai, Y. Hira. Peptidergic peripheral nervous systems in the mammalian pineal gland.- *Microsc. Res. Techn.*, **46**, 1999, No 4-5, 265-280.
- Moller, M., J. Fahrenkrug, J. Hannibal. Innervation of the rat pineal gland by pituitary adenylate cyclase-activating polypeptide (PACAP)-immunoreactive nerve fibres.- *Cell Tissue Res.*, **296**, 1999, No 2, 247-257.
- Phansuwan-Pujito, P., W. Jitjaijampang, M. Ebadi, P. Govitrapong, M. Moller. Opioidergic innervation of the tree shrew pineal gland: an immunohistochemical study.- *J. Pineal Res.*, **24**, 1998, No 4, 209-214.
- Przybylska-Gornowicz, B., B. Lewczuk, M. Moller. Demonstration of nerve fibers containing the C-terminal flanking peptide of neuropeptide Y (CPON) in the pig pineal gland (*Sus domesticus*): an immunocytochemical study by light and electron microscopy.- *Anat. Rec.*, **248**, 1997, No 4, 576-582.