

# MORPHOLOGICAL CHANGES IN THE HUMAN PINEAL GLAND IN SUDDEN DEATH

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## ABSTRACT

In this study we have compared the structure of the pineal gland in sudden death cases and death cases in hospital. We have examined 110 pineal glands of autopsied cases in both Departments - 82 men and 28 women. In the 1<sup>st</sup> group we include 45 sudden death cases with average age  $53,51 \pm 1,3$  YEARS. IN THE 2<sup>nd</sup> group we include 65 death cases in hospital with average age  $53,28 \pm 0,9$  years. The measurements are made before fixation in 10% neutral formalin and included length, width, weight and density of the glandules. Paraffin sections are stained with Hematoxylin&Eosin and Van Gieson. The obtained results are processed with standart statistical methods. In group 1: Length -  $8,84 \pm 0,16$ mm; width -  $6,46 \pm 0,11$ mm; weight -  $135,18 \pm 5,73$ mg; density -  $3,47 \pm 0,23$ kg/m. In group 2: Length -  $8,11 \pm 0,1$ mm; width -  $6,08 \pm 0,08$ mm; weight -  $138,28 \pm 3,76$ mg; density -  $3,36 \pm 0,15$ kg/m. The difference in values between two groups are insignificant. There isn't a significant difference in the frequency of such indices as: the presence of unformed pseudoportions, gliosis, fibrosis of the capsulae, acervulus and cystes. The partial formed pseudoportions have a higher frequency in group 1 (33,33%) in comparison with group 2 (17,19%), but good formed pseudoportions are more frequent in group 2 (40,63%) than in group 1 (22,22%). The differences are insignificant. Therefore for the group of SD - cases a typical feature is lower morphological maturity of the structure of gl. pineale. In the light part of the twenty-four-hour period the deaths are more frequent in SD-group (58,06%) and the difference is statistical significant. The frequency in the dark part in two groups is similar and the difference is unreliable. **Conclusions:** In sudden death cases the macroscopical indices and a part of the structural elements of the pineal gland don't change. In sudden death cases the good formed pseudoportions are twice less, the partial formed - twice more in comparison with the deaths in hospital (features of morphological immaturity). In sudden death group the deaths are twice more in the day. The deaths in hospital are more frequent in the night. Probably in persons with sudden death there is a congenital or acquired morphological and functional insufficiency of the pineal gland and this probably is an element of the pathogenesis of sudden death.

**Keywords:** sudden death, pineal gland, anatomy, histology

## INTRODUCTION

The morphology of the human pineal gland (PG) isn't examined enough. It is known that circad disturbances and the pineal gland hypoplasia are related with the sudden death (SD). It isn't clarified if some typical features in pineal gland morphology are a precondition for the origine of sudden death.

Pineal gland also produces the main pineal hormone melatonin and his precursor serotonin.

By means of cascade of biochemical processes adrenergic receptors from the cell membrane to the nucleus (11) are stimulated and this is the way that the arylalkylamine

N-acetyltransferase (AA - NAT) gene has control over the levels of melatonin and the activity of serotonin -N - acetyltransferase in the frames (in the range) of twenty-four hour period. The expression of the gene is only in the night (4).

It could suppose that there is the relationship between pineal structure, secretion of melatonin and serotonin and the time of death in the usual light/dark (LD) cycle. By that reason we began the present investigation.

The aims of the study are:

1. An examination and a comparison of pineal gland structure in sudden death cases and death cases in hospital.
2. An investigation of the time of death according to LD cycle.
3. Search for typical features in the structure of pineal gland and in the time of death in sudden death cases

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(with short or lacking agony) and death cases in hospital (with marked agony).

To gain our purposes we formulate the following tasks/proposition/

1. Macroscopical study of the pineal gland
2. Histological analysis of the pineal gland
3. Investigation of the time of death according to LD cycle.

**MATERIAL AND METHODS:**

We have examined 110 pineal gland of autopsied cases in the department of General and Clinical Pathology and the Department of Forensic Medicine. 82 are men, 28 –women. We have divided pineal glands in two groups. In the 1<sup>st</sup> group we include 45 cases of SD . In the 2<sup>nd</sup> group we include 65 cases of death in hospital. Splanchnometrical measurings according Avtandilov (1973) include: length, width, weight and density of the glandules. The measures are made before fixation in 10% neutral formalin. Paraffin blocks have been cut into sections 8 mkm. thickness, which have been stained with Hematoxilin-eosin and Van Gieson. The obtained results have been worked with standart statistical methods.

**RESULTS AND DISCUSSION:**

The average age in 1<sup>st</sup> and 2<sup>nd</sup> droup is similar and the difference is unsignficant (tabl.1) This give us possibility to exclude the influence of the age chances by interpretation of the results.

*Tabl. 1 The average age of the deceased in the examined groups*

GROUPS	I		II		t	Pt
	n	X ±Δ	n	X ±Δ		
Mean age	45	53,51 ±1,3	65	53,28 ±0,9	0,06	n.s

*Tabl. 2 Macroscopical indices of the examined pineal glands*

GROUPS	I		II		t	Pt
	n	X ±Δ	n	X ±Δ		
Length (mm)	45	8,84 ±0,16	65	8,11±0,11	1,48	n.s
Width (mm)	45	6,46 ±0,11	65	6,08±0,08	1,6	n.s
Weight (mg)	40	135,18±5,73	61	138,28±3,76	0,19	n.s
Density (kg/m <sup>3</sup> )	40	3,47±0,23	61	3,36±0,15	0,16	n.s

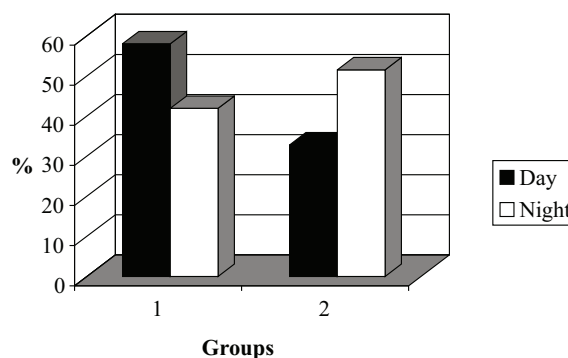
Splanchnometrical analysis in the examined 2 groups doesn't, find out statistical significant differences in macroscopical characteristics of the pineal glands (tabl.2)

The histological examination doesn't establish significant differences in the frequency of such indices as: the presence of unformed pseudoportions, gliosis, fibrosis of the capsulae, acervulus and cysts. The partial formed pseudoportions have higher frequency in group 1 (33,33%) in comparison with group 2 (17,19%), but good formed pseudoportions are more frequent in group 2 (40,63%), than in group 1 (22,22%). The differences are statistical significant. Therefore for the group of SD –cases a typical feature is lower morphological maturity of the structure of the pineal gland.

*Tabl.3 – Histological structure of the pineal glands*

GROUPS	I		II		t	Pt
	n	P	n	P		
1. Pseudolobs						
a. Not defined.	45	44,44	64	40,63	0,39	n.s
b. Partially defined.	45	33,33	64	17,19	1,91	<0,05
c. Well defined.	45	22,22	64	40,63	2,11	<0,05
2. Gliosis	45	66,66	64	53,13	1,44	n.s
3. Thick capsule	45	42,22	64	31,25	1,17	n.s
4. Acervulus	45	68,88	64	79,69	1,27	n.s
5. Cysts	45	22,22	64	28,13	0,71	n.s

In the light part of the twenty-hour period the deaths are more frequent in SD-groups (58,06%) and the difference is unsignficant (Fig.1).



*Fig. 1 The distribution of the deceased in the groups according LD period*

The distribution of the deceased in the groups according to LD period

It is known the role of the main pineal gland hormone – melatonin, as a protective factor in cardiovascular diseases (10), his antioxidant properties (9), his reducing ability on LDL-holesterol in the blood (8). It is established the strong cycle in the secretion of melatonin and the high levels are registered in the dark part (3), but synthesis and secretion of

his precursor – serotonin, is observed in the light part of the twenty four hour period (6).

According Volkova and Pekarski (1976), the good formed pseudoportions by persons above 40 years is observed in about 30% of cases. Their development is related with the reduction of the part of the parenchyma. The frequency of the pseudoportions in the investigated pineal glands in sudden death cases is considerably lower(22,22%), but in death cases in hospital – higher(40,63%). Considering the fact that the partial forming of the pseudoportions in sudden death cases (33,33%) is considerably higher than in the hospital death cases (17,19%), we could suppose the morphological immaturity of the pineal parenchyma in sudden death.

We have compared the frequency of the hospital deceased and sudden death deceased in two parts of the twenty-four hour period and we have proved that in the light part of this period (when the synthesis of melatonin is blocked and the synthesis of serotonin is increased), the deaths in sudden death cases are more frequent. In both examined groups in the nights (when the synthesis and secretion of melatonin is high), the frequency of deaths is equal.

It could supposed the relationship between the enhanced daily secretion of serotonin, structural immaturity of the pineal gland and sudden death.

### CONCLUSION

1. In sudden death cases the good formed pseudoportion are twice less, the partial formed – twice more in comparison with the deceased in hospital (features of morphological immaturity).
2. In sudden death group the deaths are twice more frequent in the day. The deaths in hospital are more frequent in the night.
3. There is probably a congenital or acquired morphological and functional insufficiency of pineal glands in sudden death persons. Maybe this is an element of the pathogenesis of sudden death.
4. The macroscopical indices and a part of the structural elements in pineal gland don't change in sudden death cases.

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