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Morphological & functional study in human pineal gland with the help of CT – Scan & its age related changes in female

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Introduction:

Pineal gland is a midline cone-shaped reddish grey structure occupying the vertical groove between the two superior colliculi below the splenium of corpus callosum. From ancient times many scientists (eg. Galen, Avicenna) have examined the pineal gland. Descartes in his studies located the human soul in this structure." Nowadays, the number of papers concerning the pineal gland is increasing.[1] The gland through its hormone (melatonin) influences many functions of the human body, like circadian rhythm, mood, psychiatric disorders, sexual maturation, reproduction and ageing. Scientific reports prove that there is significant relationship between the gland function and many systemic disorders. Obesity, hypertension and sudden infant death syndrome are examples of this. Structures like the adrenal cortex are also functionally connected with the pineal gland. Only few works concerning the relationship between the gland's morphological change with age and development index in humans could be found. Although pineal gland weight and volume vary greatly in respect of time, age, and physiological condition, the mean weight of the adult human pineal gland is generally 50 to 150 milligrams.[2]

Pineal research has proceeded with ever increasing speed and investigators have had the advantage of being able to draw upon a substantial body of information, Researchers representing a variety of different disciplines have become involved in pineal studies, and this field has developed into an acknowledged area of the neurosciences. Although the existence of the mammalian pineal gland has been recognized for many centuries it was only thirty years ago that it was considered to be more than a "vestigial organ of little functional importance".[3,4]

The expansion of neuroscientific research has witnessed the pineal gland attain the status of one of the most important participants in the regulation of various physiological and behavioral processes. The mammalian pineal gland enjoys a large measure of protection by virtue of its location and yet it is directly exposed to the vascular system, providing an ideal

environment in which to monitor homeostasis. The pineal also exhibits other unique features

such as (a) receiving both peripheral and central innervations, (b) being part of the brain, yet existing outside the blood brain barrier, and (e) especially exhibiting an astonishing and often bewildering species-directed variation in their innervations and biochemical properties.[5,6]
The pineal gland is considered to lie outside the blood brain barrier, with its own arterial blood supply of up 10 four branches of the posterior cerebral artery and posterior choroidal artery. Drainage consists of some sixteen veins into the great cerebral vein which leads to the systematic circolation via the confluence sinuum. The pineal is thus sensitive to stimuli from the periphery, including hormones and those drugs not entering the brain. 2412 Profuse blood supply reaches the pineal gland at a rate of 4ml/min/g surpassed only by the kidney. This blood supply is greater at night than during the day
The biosynthesis of melatonin commences with the uptake of circulating tryptophan by the parenchymal cells of the pineal gland. A major portion of this is converted to 5-hydroxy tryptophan. This conversion is catalyzed by tryptophan hydroxylase which may differ from the one in the brain. The next step involves the acetylation of serotonin to form Nacetylserotonin by the enzyme NAT, acetyl CoA being the donor of the acetyl group. Serotonin is also oxidized to 5-hydroxyindole acetaldehyde by monoamine Oxidase." Some of this is then converted to 5- hydroxyin-doleacetic acid by aldehyde dehydrogenase can also be methoxylated by HIOMT to form 5- Methoxytryptamine. Serotonin Melatonin is produced in the retina, harderian gland and the extra- orbital lacrimal glands 125,126,127 Clearly, the consequences of the pineal and melatonin are extremely widespread, perhaps influencing every organ system in the body. [7,8,9]

Aims and objectives

To study the morphometric parameters of pineal gland by CT Scan and their variations in the parameters and volume with different age groups in 100 patients who visited in the out-patient and/or admitted in the wards of Index Medical College Hospital and Research Centre Indore, MP and undergone for CT Scan head and having no pathology in the pineal gland. This study will be very informative to know the morphometric variations in pineal gland with different age groups.

1. The objective of the study is to compare the length, width, thickness and volume of the pineal gland in different age groups in females.
2. To establish facts about the age related changes in the Morphometry of the pineal gland in females.

MATERIAL & METHODS

Patient Population The study group consisted of 200 patients (age range: 21-79 years, average 39.69 SD 13.84 years) Who had undergone cranial CT scan studies at Index Medical College Hospital and Research Centre Indore, MP, Department of Radiology over a period of One and half years. The radiology reports and electronic medical records of each patient were reviewed to determine the indication for and to record any history of surgery to the epiphyseal area, or symptoms referable to the pineal gland. For the purposes of this study, patients were excluded if there was a history of pineal tumor, cyst, or dysfunction, if there

was any brain abnormality adjacent to the pineal gland, patients with any known endocrinologic disorder or malignant tumor as well as those who were undergoing radiation therapy or chemotherapy or if the required images were missing or destroyed.

The study has undertaken only after ethical review and approval from ethical committee. The relevant information was collected from the patient's case file and by any means patient has not been interviewed. The name of the patient has not included in the recording format to maintain the patient confidentiality so the patient consent was not necessary. Image Acquisition All images were obtained with a 3D CT Scan Machine 128 slice of Wipro G Company. Size=1mm x 1mm × 1 mm; slice thickness -1mm without gap. In this study, the pineal boundary was exactly identified on the sagittal sections taken in addition to coronal and axial views. Antero-posterior dimension was measured in the sagittal view and vertical and transverse dimensions were measured in coronal and axial views. Material & Methods Page 23 Volume Estimation It is done by using planimetry, which involves manually tracing the boundaries of objects of interest on images of sections is the most commonly used technique for estimation of volume. The volume (V) was calculated according to the formula: V= 1/2 x H x L x W Statistical Analysis Statistical analysis was performed using SPSS 16.0 (SPSS Inc. Chicago, IL). We use statistical tools like mean, SD, test, diagrams, one way analysis of variance for comparing different parameters of pineal gland with respect to sex and age groups.

Observation & Results

Statistical analysis was performed using SPSS 16.0 (SPSS Inc., Chicago, IL). We use statistical tools like mean, SD, t-test, diagrams, one way analysis of variance for comparing different parameters of pineal gland with respect to sex and age groups.

Table No.1

Variable	Source	Sum of Square	DF	Means Squares	F	Sig.
Length	B/W Groups	1.778	3	0.593	9.396	0.000
	With in groups	1.451	23	0.063		
	Total	**3.229**	**26**			
width	B/W Groups	0307	3	0.102	1.387	0.272
	With in groups	1.696	23	0.074		
	Total	**2.003**	**26**			
Thickness	B/W Groups	0.249	3	0.083	1.219	0.325
	With in groups	1.563	23	0.068		
	Total	**1.812**	**26**			
Volume	B/W Groups	1338.533	3	446.178	1.177	0.340
	With in groups	8720.413	23	379.148		
	Total	**10058.946**	**26**			

For comparing all age groups parameters in females we apply one way ANOVA technique. In the ANOVA table significant difference was found for the parameter length with respect to age groups ($p<0.01$). No significant difference was found in width, thickness and volume with respect to age groups ($p>0.05$).

Table No. 02: Mean and significant values of pineal gland length, width, thickness and volume in age groups (<30 & 31-40) in females.

Variables	age	N	Means	Std. Deviation	P-Value
Length	<30	18	6.9922	0.16574	0.327
	31-40	12	7.0933	0.21942	
Width	<30	18	6.8044	0.33065	0.866
	31-40	12	6.8317	0.24078	
Thickness	<30	18	4.1000	0.18561	0.134
	31-40	12	3.9533	0.15462	
Volume	<30	18	195.37	18.31615	0.686
	31-40	12	191.71	13.93190	

Table No. 03: Mean and significant values of pineal gland length, width, thickness and volume in age groups (<30 & >50) in females.

Variables	age	N	Means	Std. Deviation	P-Value
Length	<30	18	6.9922	0.16574	0.000
	>50	8	7.7500	0.24739	
Width	<30	18	6.8044	0.33065	0.141
	>50	8	6.5050	0.26665	
Thickness	<30	18	4.1000	0.18561	0.146
	>50	8	4.0800	0.18565	
Volume	<30	18	195.37	18.31615	0.370
	>50	8	206.22	21.75759	

Table No. 04: Mean and significant values of pineal gland length, width, thickness and volume in age groups (31-40 & 41-50) in females.

Variables	age	N	Means	Std. Deviation	P-Value
Length	31-40	12	7.0933	0.21942	0.744
	41-50	16	7.0400	0.33945	
Width	31-40	12	6.8317	0.24078	0.515
	41-50	16	6.7500	0.21334	
Thickness	31-40	12	3.9533	0.15462	0.663
	41-50	16	3.8775	0.39005	
Volume	31-40	12	191.71	13.93190	0.508
	41-50	16	184.49	22.82197	

Table No. 05 : Mean and significant values of pineal gland length, width, thickness and volume in age groups (31-40 & >50) in females.

Variables	age	N	Means	Std. Deviation	P-Value
Length	31-40	12	7.0933	0.21942	0.002*
	>50	8	7.7500	0.24739	
Width	31-40	12	6.8317	0.24078	0.078
	>50	8	6.5050	0.26665	
Thickness	31-40	12	3.9533	0.15462	0.274
	>50	8	4.0800	0.18565	
Volume	31-40	12	191.71	13.93190	0.230
	>50	8	206.22	21.75759	

Table No. 06: Mean and significant values of pineal gland length, width, thickness and volume in age groups (41-50 & >50) in females.

Variables	age	N	Means	Std. Deviation	P-Value
Length	41-50	16	7.0400	0.33945	0.004
	>50	8	7.7500	0.24739	

Width	41-50	16	6.7500	0.21334	0.113
	>50	8	6.5050	0.26665	
Thickness	41-50	16	3.8775	0.39005	0.356
	>50	8	4.0800	0.18565	
Volume	41-50	16	184.49	22.82197	0.146
	>50	8	206.22	21.75759	

Table No 07 : One way ANOVA for different parameters of female with respect to age groups.

Variable	Source	Sum of Squares	Df	Mean Square	F	Sig.
Length	Between Groups	1.778	3	0.593	9.396	0.000
	Within Groups	1.451	23	0.063		
	Total	**3.229**	**26**			
Width	Between Groups	0307	3	0.102	1.387	0.272
	Within Groups	1.696	23	0.074		
	Total	**2.003**	**26**			
Thickness	Between Groups	0.249	3	0.083	1.219	0.325
	Within Groups	1.563	23	0.068		
	Total	**1.812**	**26**			
Volume	Between Groups	1338.533	3	446.178	1.177	0.340
	Within Groups	8720.413	23	379.148		
	Total	**10058.946**	**26**			

Table No 08 : One way ANOVA for different parameters with respect to age groups.

Variable	Source	Sum of Squares	Df	Mean Square	F	Sig.
Length	Between Groups	1.081	3	0.360	4.911	0.003*
	Within Groups	7.044	96	0.073		
	Total	**8.125**	**99**			
Width	Between Groups	0.281	3	0.094	0.853	0.468
	Within Groups	10.547	96	0.110		

	Total	**10.828**	**99**			
Thickness	Between Groups	1.089	3	0.363	3.951	0.011*
	Within Groups	8.819	96	0.092		
	Total	**9.908**	**99**			
Volume	Between Groups	2892.561	3	964.187	3.256	0.025*
	Within Groups	28424.073	96	296.084		
	Total	**31316.634**	**99**			

Table No 09 : Pineal gland length, width, thickness and volume mean values in age related groups.

Age group (in years)	**n**	**LENGTH**		**WIDTH**		**THICKNESS**		**VOLUME**	
		Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
<30	56	7.0325	0.1456	6.738	0.2772	4.1083	0.1942	194.49	13.98
31-40	52	7.10584	0.2492	6.740	0.4745	4.1873	0.4330	199.813	19.25
41-50	52	7.10884	0.2853	6.732	0.2415	3.9153	0.2897	187.484	17.85
>50	40	7.3285	0.3895	6.869	0.2696	4.001	0.2309	201.45	17.62

Conclusiuon –

In the present study, we evaluate the morphometric parameters of pineal gland by 3 DCT scan in a tertiary care institute in Ujjain.

The conclusions of present study are-

1. Pineal gland mean length gradually increased with age.
2. The width of the gland is increased up to the 40 years then it slightly decreased with age.
3. There is no particular pattern of the thickness, as it first increased with age and then decreased.
4. The volume of gland slightly increased up to the age of 40 years with age and then there is fall in 41-50 years age groups, then again increase in volume was noted.
5. There was significant difference in length ($p<0.01$), thickness and volume ($p<0.05$) between different age groups but no significant difference was found in width.

6. In females significant difference was found for the parameter length with respect to age groups ($p<0.01$). NO significant difference was found in width, thickness and volume with respect to age groups.

In the pineal region, where a variety of tumors occur, including germ cell tumors and pinealoma, knowledge of the normal size of the developing gland can help to distinguish healthy tissue from tumor. In addition, the lack of a blood-brain barrier in the normal pineal gland results in an inability to separate a normal gland from a neoplasm on the basis of enhancement characteristics.

Bibliography

1. McKinley MJ, McAllen RM, Mendelssohn FAO, Allen AM, Chai SY, and Oldfield BJ. "Circumventricular organs: neuroendocrine inter- faces between the brain and the hemal milieu". Frontiers in Neuroendocrinologic. 1990;11:91-127.
2. Duvernoy HM and Risold PY. "The circumventricular organs: an atlas of comparative anatomy and vascularization". Brain Research. Reviews, 2007;56:119-47.
3. Sumida M, James Barkovich A and Hans Newton T. "Development of the pineal gland: measurement with MR". American Journal of Neuroradiology. 1996;17:233-36. Bibliography Page 56
4. Kitay JI. "Pineal lesions and precocious puberty: a review". Journal of Clinical Endocrinology and Metabolism, 1954;14:622-25,
5. Wurtman RJ and Moskowitz MA. "The pineal organ". The New England Journal of Medicine. 1977;296:1329-33.
6. Yamamoto I and Kageyama N. "Microsurgical anatomy of the pineal region". Journal of Neurosurgery, 1980:53:205-21
7. Tapp E and Huxley M. "The weight and degree of calcification of the pineal gland". Journal of Pathology. 1971;105:31-39.
8. Tapp E and Huxley M. "The histological appearance of the human pineal gland from puberty to old age". Journal of Pathology. 1972;108:137-44.
9. Korf HW and Moller M. Pineal Res. 1984;2:41-86.