



## EVALUATION OF PINEAL GLAND'S LENGTH AND VOLUME IN DIFFERENT AGE GROUPS OF FEMALES - A RADIOLOGICAL STUDY

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**ABSTRACT** **INTRODUCTION:** The human pineal gland, a part of the diencephalon, is a small neuroendocrine organ that has a function in the circadian rhythm by the secretion of melatonin neurohormone. It is a circumventricular organ because of its deep location in the subarachnoid cistern surrounding the surface of the third ventricle. From ancient times many scientists (e.g. 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. The gland through its hormone (melatonin) influences many functions of the human body, like circadian rhythm, mood, psychiatric disorders, sexual maturation, reproduction and ageing. **MATERIAL AND METHOD:** The study group consisted of 27 female patients, age range from 21–79 years who had undergone cranial 3D CT scan studies at R.D. Gardi Medical College & Ujjain Charitable Hospital & Research Center Ujjain, Department of Radiology over a period of One and half years. All images were obtained with a 3D CT Scan Machine 128 slice of Wipro G Company. **RESULTS:** In our study significant difference was found in the length between <30 and >50 age groups ( $p < 0.05$ ). Significant difference was found in the length between 31–40 and >50 age groups ( $p < 0.05$ ). Significant difference was found in the length between 41–50 and >50 age groups ( $p < 0.01$ ). No significant difference was found in the parameters volume between 31–40 and >50 age groups ( $p > 0.05$ ). No significant difference was found in the parameters volume between 41–50 and >50 age groups ( $p > 0.05$ ).

**KEYWORDS :** Pineal Gland, 3D CT Scan, Pineal Gland Morphometry.

### INTRODUCTION

The human pineal gland, a part of the diencephalon, is a small neuroendocrine organ that has a function in the circadian rhythm by the secretion of melatonin neurohormone.<sup>1</sup> It is a circumventricular organ because of its deep location in the subarachnoid cistern surrounding the surface of the third ventricle.<sup>2,3</sup> 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.<sup>4</sup> Descartes in his studies located the human soul in this structure.<sup>5</sup> Nowadays, the number of papers concerning the pineal gland is increasing.<sup>6</sup> The gland through its hormone (melatonin) influences many functions of the human body, like circadian rhythm, mood, psychiatric disorders, sexual maturation, reproduction and ageing.<sup>7</sup> 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.<sup>8</sup>

It has been stated that the pineal gland grows in size from birth until two years of age and then remains constant between 2 to 20 years of age.<sup>9</sup> Formerly, it was believed that the pineal gland played an important functional role in the onset of puberty.<sup>10,11</sup> Some autopsy studies have reported that the average size of the pineal gland is 7.4mm in length, 6.9mm in width, and 2.5mm in height.<sup>12</sup> Interestingly, Tapp and Huxle reported a gradual increase in the size of the pineal gland from puberty to old age in humans.<sup>13</sup>

### MATERIAL AND METHOD

**Approval of institutional Ethical committee:** The research protocol was approved by institutional ethics committee version no 224 date 16.06.2012

**Patient Population:** This is a retrospective study, was carried out at Chandrikaben Rashmikant Gardi hospital and Ruxmaniben Deepchand Gardi Medical College Ujjain; Madhya Pradesh (India). It is 600 bedded private tertiary care teaching hospitals. The study group consisted of 27 female patients, age range from 21–79 years who had undergone cranial 3D CT scan studies at R.D. Gardi Medical College Ujjain.

### Inclusion Criteria:

patient who give consent and age range: 21–79 years.

### Exclusion Criteria:

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 endocrinological disorder or malignant tumor as well as those who were undergoing radiation therapy or chemotherapy or if the required images were missing or destroyed.

**Image Acquisition:** data collection done by picture archiving and communication system (PACS) computer records of all patients who undergo cranial 3D CT scan. All images were obtained with a 3D CT Scan Machine 128 slice of Wipro G Company. 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.

**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.<sup>14</sup>

The volume (V) was calculated according to the formula:

$$V = 1/2 \times H \times L \times W^{15}$$

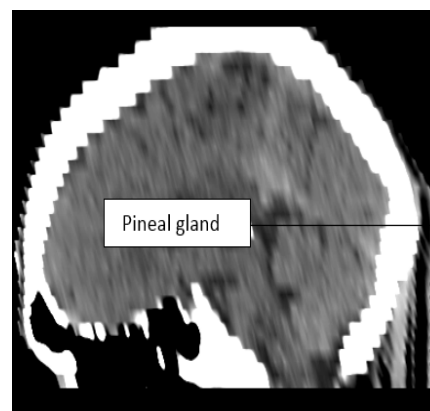
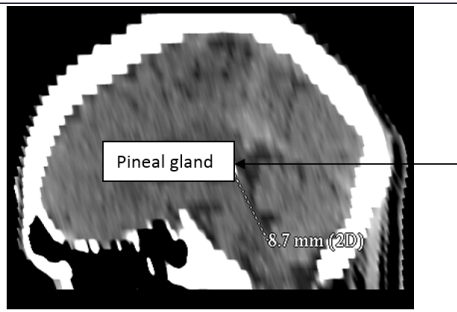


Image no. 01: CT scan head-sagittal section.



**Image no. 02:** CT scan head (Sagittal section) showing length of pineal gland.

**Observation and results:** statistical analysis was done by using appropriate software. 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. 01:** Mean and significant values of Pineal gland length and volume in age groups (<30 & 31-40) in females.

Variable	Age	n	Mean	Std. Deviation	p Value
Length	<30	9	6.9922	0.16574	0.712
	31-40	6	7.0933	0.21942	
Volume	<30	9	195.37	18.31615	0.293
	31-40	6	191.71	13.93190	

In above mentioned table, no significant difference was found in the parameters length and volume between <30 and 31-40 age groups (p>0.05).

**Table No. 02:** Mean and significant values of Pineal gland length and volume in age groups (<30 & >50) in females.

Variable	Age	n	Mean	Std. Deviation	p Value
Length	<30	9	6.9922	0.16574	0.000*
	>50	4	7.7500	0.24739	
Volume	<30	9	195.37	18.31615	0.370
	>50	4	206.22	21.75759	

In above mentioned table, significant difference was found in the length between <30 and >50 age groups (p<0.05). No significant difference was found in the parameters volume between <30 and >50 age groups (p>0.05).

**Table No. 03:** Mean and significant values of Pineal gland length and volume in age groups (31-40 & 41-50) in females.

Variable	age	n	Mean	Std. Deviation	p Value
Length	31-40	6	7.0933	0.21942	0.744
	41-50	8	7.0400	0.33945	
Volume	31-40	6	191.71	13.93190	0.508
	41-50	8	184.49	22.82197	

In above mentioned table, no significant difference was found in the parameters length and volume between 31-40 and 41-50 age groups (p>0.05).

**Table No. 04:** Mean and significant values of Pineal gland length and volume in age groups (31-40 & >50) in females.

Variable	Age	N	Mean	Std. Deviation	p Value
Length	31-40	6	7.0933	0.21942	0.002*
	>50	4	7.7500	0.24739	
Volume	31-40	6	191.71	13.93190	0.230
	>50	4	206.22	21.75759	

In above mentioned table, significant difference was found in the length between 31-40 and >50 age groups (p<0.05). No significant difference was found in the parameters volume between 31-40 and >50 age groups (p>0.05).

**Table No. 05:** Mean and significant values of Pineal gland length and volume in age groups (41-50 & >50) in females

Variable	Age	n	Mean	Std. Deviation	p Value
Length	41-50	8	7.0400	0.33945	0.004*
	>50	4	7.7500	0.24739	
Volume	41-50	8	184.49	22.82197	0.146
	>50	4	206.22	21.75759	

In above mentioned table, significant difference was found in the length between 41-50 and >50 age groups (p<0.01). No significant difference was found in the parameters volume between 41-50 and >50 age groups (p>0.05).

**Table No. 06:** 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			
Volume	Between Groups	1338.533	3	446.178	1.177	0.340
	Within 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 (p value-0.000) with respect to age groups (p<0.01). No significant difference was found in volume (p value-0.340) with respect to age groups (p>0.05).

**DISCUSSION**

To the best of my knowledge only single study (Golan et al. 2002) have been done previously on morphometric parameters of pineal gland and this was a cadaveric study.<sup>16</sup> Pineal gland remained the organ of interest for the different researchers since the historical time but still we don't have a common consensus about its parameters with age in human being. Golan et al<sup>10</sup> observed that the lowest average length of pineal gland was in the group of 41-50 years. The highest was found in the group of 31-40 years. Maximal mean value appeared in the group of 31-40 years. In the group of 31-40 years the average volume of the pineal gland was the lowest. The highest mean volume was observed in the 31-50 years group.

In our study, we observed The lowest mean length (6.99mm) of pineal gland was found in the age group of <30 years in females. The highest mean length (7.75mm) was found in the age group of >50 years in females. In the age group of 41-50 years the average volume (184.49mm<sup>3</sup>) of the pineal gland was the lowest in females. The highest mean volume (206.22mm<sup>3</sup>) was observed in the >50 years age group in females.

**SUMMARY & CONCLUSION**

The conclusions of present study are that Pineal gland mean length gradually increased with age. 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. There was significant difference in length (p<0.01) and volume (p<0.05) between different age groups. In females significant difference was found for the parameter length with respect to age groups (p<0.01).

**REFERENCES**

1. Turgut M and Kumar R. Pineal Gland and Melatonin: Recent Advances in Development, Imaging, Disease and Treatment. Eds. Nova Science, New York, USA, 2011.
2. McKinley MJ, McAllen RM, Mendelssohn FAO, Allen AM, Chai SY, and Oldfield BJ. "Circumventricular organs: neuroendocrine interfaces between the brain and the hemalmilieu". Frontiers in Neuroendocrinology. 1990;11:91-127.
3. Duvernoy HM and Risold PY. "The circumventricular organs: an atlas of comparative anatomy and vascularization". Brain Research Reviews. 2007;56:119-47.
4. Vishram Singh, epithalamus: textbook of clinical neuroanatomy, second edition. 2010;132-33.
5. Lopez-Munoz F, Boya J. The role of the pineal gland in Cartesian psychophysiological doctrine. Acta Physiol Pharmacol Ther Latinoam. 42:205-16.
6. Lopez-Munoz F, Boya J, Marin F, Calvo JL. Scientific research on the pineal gland and melatonin: a bibliometric study for the period 1966-1994. J Pineal Res. 20:115-24.
7. Shedpure M, Pati AK. The pineal gland: structural and functional diversity. Indian J Exp Biol. 33:625-40.
8. Keller SS and Roberts N. "Measurement of brain volume using MRI: software, techniques, choices and prerequisites". Journal of Anthropological Sciences. 2009;87:127-51.
9. 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.
10. Kitay JI. "Pineal lesions and precocious puberty: a review". Journal of Clinical Endocrinology and Metabolism. 1954;14:622-25.
11. Wurtman RJ and Moskowitz MA. "The pineal organ". The New England Journal of Medicine. 1977;296:1329-33.
12. Yamamoto I and Kageyama N. "Microsurgical anatomy of the pineal region". Journal of Neurosurgery. 1980;53:205-21.
13. Tapp E and Huxley M. "The weight and degree of calcification of the pineal gland". Journal of Pathology. 1971;105:31-39.
14. Tien RD, Barkovich AJ, Edwards MSB. MR imaging of pineal tumors. AJNR Am J Neuroradiol. 1990;11:557-65.
15. Elster AD, Chen MYM, Williams DW. Pituitary gland: MR imaging of physiological hypertrophy in adolescence. Radiology. 1990;174:681-85.
16. Langman J. Medical Embryology. 3rd ed. Baltimore: Williams & Wilkins, 1975;175-78.