

ORIGINAL PAPER

A Study on the Size of Pineal Gland in Different Ages

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ABSTRACT

Introduction: At various times in the history of medicine the precise function of the small discrete pea-like structure we have in the centre of our brains, called the pineal gland (“corpus pineale”), was considered to be a memory valve, a valve controlling circulating vital fluids, the seat of the soul, and the site of a presumed pathology causing certain types of mental illness. In the mid nineteen fifties this confusion began to clear when the pineal gland’s true function was discovered. The gland is a neuroendocrine gland and consists of parenchymal cells, called pinealocytes and neuroglial cells. Melatonin, 5methoxy-N-acetyltryptamin, is a neurohormone of the brain produced by pineal gland. The modern systematic study of the pineal gland began in 1954. There are very few literatures where the size of the pineal gland has been described. **Material and Methods:** In the present study 50 numbers of MRI cases done for various purposes, where no pathology of brain was detected were taken in the Radiology department of Gauhati Medical College after obtaining due consent. The length (Antero-posterior diameter) and breadth (Cranio-caudal diameter) of the pineal gland was recorded. The data recorded was analysed statistically using Student’s T-test. P value < 0.05 is considered as statistically significant. **Result:** The maximum mean length of pineal gland was observed as 5.715 ± 0.651 mm in the age group of ‘20 to below 40’ years. **Discussion:** The findings of our study has the similar [ty with the observations made by other researchers of this field. **Conclusion:** Such a study may be useful in establishing a database which may be useful in correlating the size of the gland with various brain pathology.

Keywords: Neuroendocrine gland, Antero-posterior diameter, Cranio-caudal diameter

INTRODUCTION

The pineal gland or epiphysis cerebri is a small grey organ occupying a depression between the superior colliculi. It is inferior to the splenium of corpus callosum, from which it is

separated by the tela choroidea of third ventricle and contained cerebral vein.¹ The pineal gland is innervated by a nerve called nervus conarii which consists of postganglionic sympathetic fibers arising from superior cervical ganglion.² Melatonin, 5methoxy-N-acetyltryptamin, is a neurohormone of the brain produced by pineal gland. Within the pineal gland, serotonin is acetylated to yield melatonin.³ The main environmental control of the pineal melatonin synthesis is light intensity. Light perceived by the retina reaches the supra chiasmatic nucleus (SCN) through the retinohypothalamic tract. The SCN innervates the pineal gland via the dorsomedial hypothalamic nucleus, the upper thoracic intermediolateral cell columns of the spinal cord and the superior cervical ganglia, resulting in the rhythmic secretion of melatonin.⁴ In humans, as in animals, the plasma melatonin level rises in darkness and falls during the day.⁵ In humans, the pineal gland is 5 mm long, 1–4 mm thick and weighs about 100 mg, both in men and in women.⁶ The size of the pineal gland is significantly smaller in patients younger than 2 years old than in older patients. The size of the pineal gland increases until 2 years of age and remains stationary between the ages of 2 and 20 years. There is no difference in size between males and females.⁷ At present it is considered to be the most highly evolved gland of the body.⁸ A unique anatomical feature of pineal gland is that it is an unpaired midline organ in the brain which, alone of all equivalent organs, has resisted encroachment by the corpus callosum.^{9,10} Concretions of calcified material called brain sand progressively accumulate within the

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pineal gland with age.¹¹The calcium phosphates and carbonates are deposited in the gland with age in the form of multilaminar corpuscles called corpora arenacea or brain sand.¹²

OBJECTIVES

1. To measure the length (antero-posterior diameter) and breadth (cranio-caudal diameter) of the pineal gland in different ages with the help of MRI.
2. To correlate the size of the pineal gland with age.

MATERIALS AND METHODS

The study has been done at Gauhati Medical College & Hospital involving the Departments of Anatomy, and Radiology.

Selection of subjects: Two major groups, Group A (male) & Group B (female) were made for different age groups. In both the groups subjects were selected from the patients coming to the Radiology department of GMC and who did not have any major brain injury/pathology which could disturb the size of the pineal gland.

Time and place for MRI: From 10.00 am to 4.00 pm at Radiology department of Gauhati Medical College Hospital.

Number of cases: In both male and female, we have studied the length & breadth of the pineal gland, seen in sagittal section of M.R.I. for 50 (fifty) number of cases. In M.R.I. the pineal gland is best visualized in sagittal section. In some of the cases the pineal gland is not seen in M.R.I. For those cases we have put the value '0' (Zero).

Statistical analysis: The data recorded were analysed statistically using Student's T-test. P value ≤ 0.05 is considered as statistically significant.

OBSERVATION & RESULTS

The results and observations of the present study is tabulated and graphed as follows:

Table 1 Total number of male and female cases for different age groups

| Age of subject | Number of cases | |
|------------------|-----------------|-----------|
| | Male | Female |
| 0 to 19 years | 4 | 8 |
| 20 to 39 years | 8 | 5 |
| 40 to 59 years | 8 | 6 |
| 60 years & above | 7 | 4 |
| Total | 27 | 23 |

In '0 to 19' years group length and breadth of 12 numbers of male and female subjects were seen. The length ranges from 0 to 7.3 mm with a mean value of 3.45, Standard Deviation ± 2.434 and Standard Error of Mean ± 0.702 . The breadth ranges from 0 to 3.2 mm with a mean value of 1.80, Standard Deviation ± 1.217 and Standard Error of Mean ± 0.351 .

In '20 to 39' years group length and breadth of 13 numbers of male and female subjects were seen. The length ranges from 0 to 8.3 mm with a mean value of 5.715, Standard Deviation ± 2.350 and Standard Error of Mean ± 0.651 . The breadth ranges from 0 to

7.4 mm with a mean value of 3.185, Standard Deviation ± 1.742 and Standard Error of Mean ± 0.483 .

In '40 to 59' years group length and breadth of 14 numbers of male and female subjects were seen. The length ranges from 0 to 6.9 mm with a mean value of 4.507, Standard Deviation ± 1.818 and Standard Error of Mean ± 0.485 . The breadth ranges from 0 to 6.6 mm with a mean value of 3.321, Standard Deviation ± 1.520 and Standard Error of Mean ± 0.887 .

In '60 years and above' group length and breadth of 11 numbers of male and female subjects were seen. The length ranges from 0 to 8.2 mm with a mean value of 4.682, Standard Deviation ± 2.448 and Standard Error of Mean ± 0.738 . The breadth ranges from 0 to 3.3 mm with a mean value of 2.382, Standard Deviation ± 0.963 and Standard Error of Mean ± 0.290 .

The mean values of length and breadth of these four groups are represented in **Figure 1**.

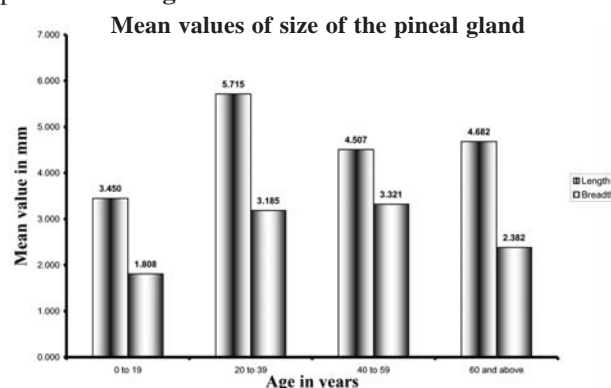


Figure 1 Mean values of length and breadth of pineal gland in different ages

Table 2 Level of significance of differences of mean value

| Serial number | Comparison of mean between | "t" | P |
|---------------|---|-------|-------|
| 1 | Length of pineal gland in male and female | 0.194 | >0.05 |
| 2 | Breadth of pineal gland in male and female | 0.115 | >0.05 |
| 3 | Length of pineal gland in 20 to 39 years and 0 to 19 years | 2.347 | <0.05 |
| 4 | Length of pineal gland in 20 to 39 years and 40 to 59 years | 1.489 | >0.05 |
| 5 | Length of pineal gland in 20 to 39 years and 60 years & above | 1.050 | >0.05 |

Table 3 Relative frequency of length & breadth of pineal gland

| Relative frequency (fr) | | |
|-------------------------|----------|----------|
| Class interval in mm | Length | Breadth |
| 0 to 2 | 0 | 0.059 |
| 2 to 4 | 0.128 | 0.702 |
| 4 to 6 | 0.436 | 0.136 |
| 6 to 8 | 0.326 | 0.103 |
| 8 to 10 | 0.11 | 0 |
| Sum | 1 | 1 |

Table 3 shows that the highest length of pineal gland is seen in the class interval of 4 to 6 mm with relative frequency of occurrence of 0.436 as evident in **figure 2**. Whereas the highest breadth of pineal gland is seen in the class interval of 2 to 4 mm with relative frequency of occurrence of 0.702 as evident in **figure 2**.

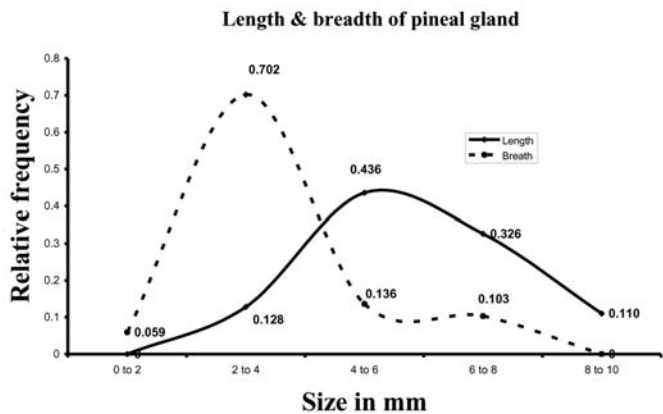


Figure 2 Distribution of ‘Relative frequency’ for length and breadth of pineal glands

Table 4 Relative frequency of length & breadth of male pineal glands

| Male | | |
|----------------------|--------------------|--------------------|
| Class interval in mm | Length | Breadth |
| | Relative frequency | Relative frequency |
| 0 to 2 | 0 | 0.048 |
| 2 to 4 | 0.115 | 0.74 |
| 4 to 6 | 0.415 | 0.123 |
| 6 to 8 | 0.269 | 0.089 |
| 8 to 10 | 0.201 | 0 |
| Sum | 1 | 1 |

Table 4 shows that the highest length of pineal gland in case of male is seen in the class interval of 4 to 6 mm with relative frequency of occurrence of 0.415 as evident in **Figure 3**. Whereas the highest breadth of pineal gland in case of male is seen in the class interval of 2 to 4 mm with relative frequency of occurrence of 0.74 as evident in **Figure 3**.

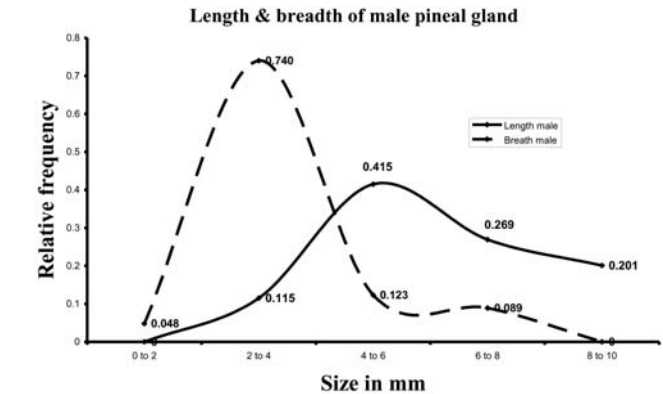


Figure 3 ‘Relative frequency’ for length and breadth of male pineal glands

Table 5 Relative frequency of length & breadth of female pineal glands

| Female | | |
|----------------------|--------------------|--------------------|
| Class interval in mm | Length | Breadth |
| | Relative frequency | Relative frequency |
| 0 to 2 | 0 | 0.075 |
| 2 to 4 | 0.144 | 0.656 |
| 4 to 6 | 0.457 | 0.15 |
| 6 to 8 | 0.399 | 0.119 |
| 8 to 10 | 0 | 0 |
| Sum | 1 | 1 |

Table 5 shows that the highest length of pineal gland in case of female is seen in the class interval of 4 to 6 mm with relative frequency of occurrence of 0.457 as evident in **figure 4**. Whereas the highest breadth of pineal gland in case of female is seen in the class interval of 2 to 4 mm with relative frequency of occurrence of 0.656 as evident in **figure 4**.

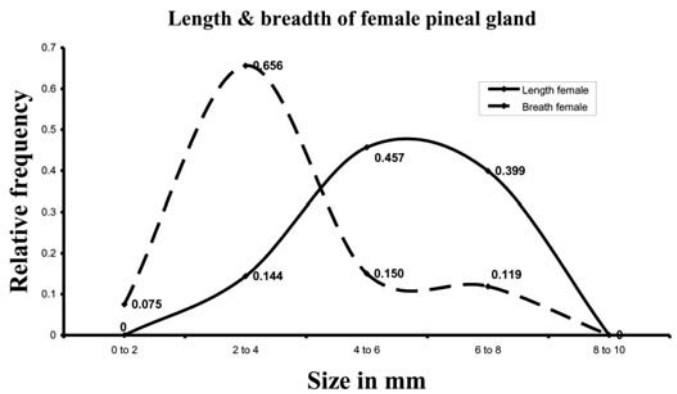


Figure 4 ‘Relative frequency’ for length and breadth of female pineal glands

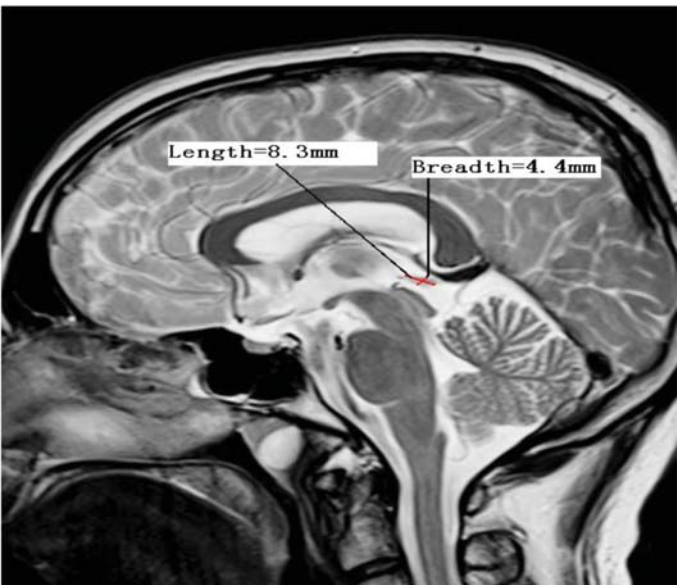


Figure 5 M.R.I. showing pineal gland of a 38 years male in sagittal section

DISCUSSION

Most of the studies have shown that the size of the pineal gland increases upto a specific period of life and there is no difference in size between males and females.^{5,6,7} Our study is similar with the observation made by those researchers. The range of length of the pineal gland is from 2.1 to 9 mm and range of breadth is 1.4 mm to 7.4 mm. The distribution pattern of the pineal gland length is skewed to the right indicating presence of a group of subjects with longer pineal glands of more than 6.00 mm having a relative frequency of 0.436 covering the ranges from 6 mm to 10 mm depicting that about 50% of the subjects under study have pineal gland more than 6 mm in its longitudinal axis. But the distribution pattern of pineal gland breadth is normal without any apparent skewness suggesting that the distribution of pineal gland breadth is more consistent than its length.

In the present study the mean length of the pineal gland for the male subjects is found to be 4.725 ± 0.463 mm and in the female subjects the mean length is 4.465 ± 0.476 mm. The mean breadth of pineal gland for male and female subjects is found to be 2.740 ± 0.272 mm and 2.686 ± 0.341 mm respectively. No significant difference ($P > 0.05$) is observed in both the dimensions of pineal gland between male and female subjects signifying absence of any appreciable differences in the size of the pineal gland between male and female. The presented trend of relationship between age and pineal gland length in different age groups under the current investigation clearly depicts that the size of the pineal gland (length) increases proportionately upto the age of 20 (twenty) years followed by a period of constancy in length independent of increase in age.

CONCLUSION

The maximum mean length of pineal gland is observed to be 5.715 ± 0.651 mm in the age group of '20 to below 40' years. There is correlation between age and length of pineal gland in the age group of '20 to below 40' years followed by absence of correlation above the age of 40 years.

Finally, it may be concluded that there is no difference in size of pineal glands in male and female and the size of the pineal gland, specially the length is increased upto 40 years of age following which there is no age related dependency of pineal size studied under the limitations of the presented setup.

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Conflicts of interest: No conflict of interest is associated with this work.

Contribution of Authors: We declare that this work was done by the authors named in this article and all liabilities pertaining to claims relating to the content of this article will be borne by the authors.

Ethical clearance: Taken from Institutional Ethical Committee.

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