

Length, Breadth and Thickness of the Pineal Gland

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Abstract:

Context: The pineal gland is capable of influencing or modifying the activity of the pituitary gland, islets of Langerhans, the parathyroid gland, adrenal gland and the gonads. The pineal gland through its hormone, melatonin influences many functions of the human, like circadian rhythm, mood, psychiatric disorder, sexual maturation, reproduction and aging. Melatonin, a potent antioxidant provides protection against damaging free radicals of oxygen. Various clinical problems occur due to abnormal melatonin secretion by the pineal gland. For the perfect and complete evaluation of various clinical conditions of the pineal gland, detailed morphological knowledge is essential.

Study Design: Cross sectional analytical type of study.

Place and period of study: Department of Anatomy, Dhaka Medical College, Dhaka from July 2009 to June 2010.

Materials: 60 postmortem human pineal glands were collected from unclaimed dead bodies that were under examination in the morgue of the Department of Forensic Medicine, Dhaka Medical College Dhaka.

Methods: The samples were divided into four different age groups i.e. Group-A (15-30 years), Group-B (31-40 years), Group-C (41-50 years) and Group-D (> 50 years).

Results: The mean±SD length of the pineal gland were found 8.11±0.83 mm in group A, 7.96±1.06 mm in group B, 7.51±0.55 mm in group C and 7.89±0.14 mm in group D. The mean±SD breadth of the pineal gland were found 4.39±0.34 mm in group A, 4.09±0.46 mm in group B, 4.12±0.58 mm in group C and 3.81±0.34 mm in group D. The mean±SD thickness of the pineal gland were found 2.52±0.64 mm in group A, 2.29±0.54 mm in group B, 2.14±0.32 mm in group C and 2.07±0.18 mm in group D.

Conclusion: breadth and thickness of the pineal gland were found to be decreased with advancing age.

Key words: Pineal gland, Length, Breadth, Thickness.

Introduction

The pineal gland (or the epiphysis cerebri) is a small, piriform, reddish grey organ, occupying a depression in between the superior colliculi¹. In human the pineal glands (also known as epiphysis cerebri or glandula pinealis) was the last endocrine gland to have its function discovered². The pineal gland is capable of

influencing or modifying the activity of the pituitary gland, islets of Langerhans, the parathyroid gland, adrenal gland and the gonads³. The pineal gland through its hormone, melatonin influences many functions of the human, like circadian rhythm, mood, psychiatric disorder, sexual maturation, reproduction and aging⁴. Melatonin, a potent antioxidant provides protection against damaging free radicals of oxygen⁵. The human pineal gland is characterized by the presence of the calcified concretions, called 'corpora aranacea' or brain sand. The concretions are recognizable in childhood and increase in number with age⁶. Various clinical problems occur due to abnormal melatonin secretion by the pineal glands. For the perfect and complete evaluation of various clinical conditions of the pineal gland, detailed histomorphological knowledge is essential.

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Materials and Methods:

The samples of human pineal gland were collected from the whole brains of unclaimed dead bodies that were under examination in the Department of Forensic Medicine, Dhaka Medical College, Dhaka from August 2009 to June 2010. After legal formalities and requisite permission from the department of Forensic Medicine, the whole brains were collected within 24-36 hours of death. During collection of the samples, appropriate age, sex and the cause of death were noted from the morgue's record book. The samples were brought to the Department of Anatomy, Dhaka Medical College, Dhaka. The samples were tagged immediately bearing code numbers for subsequent identification. Soon after collection, each sample was gently washed with tap water on a dissection tray. Blood and blood clots were removed as far as possible. The study was approved by the Ethical Review Committee of Dhaka Medical College.

Preservation of brains:

After collection of whole brain, 100ml of 40% formaldehyde solution was injected by using a 50cc syringe into the brain through the surfaces (superolateral and inferior surfaces). Then it was preserved in 40% formaldehyde solution (Origin Germany) for 15 days. After 15 days the pineal glands were collected from the preserved brains and the pineal gland fixed in 10% formol saline solution.

The collected samples were divided into four groups (according to Golan et al.³ 2002)

Table-I
Age distribution in different groups

Group	Age limit	Number of samples	
		Male	Female
A	15-30 years	09	09
B	31-40 years	17	08
C	41-50 years	08	03
D	>50 years	06	00

Measurement of the length, breadth and thickness of the pineal gland:

The length, breadth and thickness of the pineal gland were measured by using a digital slide calipers. As the pineal glands were of different size and shape, three readings were taken for each parameter and the average was calculated and recorded. The length of the pineal gland was measured at its maximum

antero-posterior distance. Then the breadth was measured by the distance between the highest point of the lateral edges of the gland and the thickness was measured at its maximum supero-inferior distance when the gland was placed in anatomical position. (Sumida, Barkovich and Newton 1996).⁷

Results:

The mean±SD length of the pineal gland were found 8.11±0.83 mm in group A, 7.96±1.06 mm in group B, 7.51±0.55 mm in group C and 7.89±0.14 mm in group D. The highest mean length was found in group A and the lowest in group C. The difference of mean length of the pineal gland in different age groups was not statistically significant. The mean±SD breadth of the pineal gland were found 4.39±0.34 mm in group A, 4.09±0.46 mm in group B, 4.12±0.58 mm in group C and 3.81±0.34 mm in group D. The highest mean breadth was found in group A and the lowest in group D. The difference of mean breadth of the pineal gland in between group A & D was statistically significant (p<0.05). The mean±SD thickness of the pineal gland



Fig.-1. Photograph of measurement of the length of the pineal gland by using a digital slide calipers.



Fig.-2: Photograph of measurement of the breadth of the pineal gland by using a digital slide calipers.

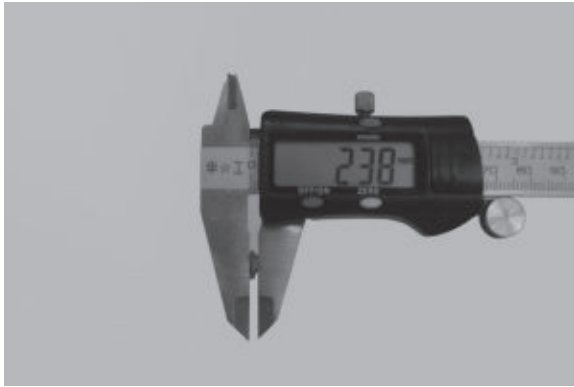


Fig.-3. Photograph of measurement of the thickness of pineal gland by using a digital slide calipers.

were found 2.52±0.64 mm in group A, 2.29±0.54 mm in group B, 2.14±0.32 mm in group C and 2.07±0.18 mm in group D. The highest mean thickness was found in group A and the lowest in group D. The difference of mean thickness of the pineal gland in between different age groups was not statistically significant (>0.50).

Table-II

Length of the pineal gland in different age groups

Age groups	Length (mm) Mean±SD
A (n=18)	8.11±0.83 (6.18 - 9.75)
B (n=25)	7.96±1.06 (6.25 - 11.12)
C (n=11)	7.51±0.55 (6.24 - 8.18)
D (n=6)	7.89±0.14 (7.76 - 8.02)
	<i>P value</i>
A vs B	>0.50 ^{ns}
A vs C	>0.10 ^{ns}
A vs D	>0.50 ^{ns}
B vs C	>0.50 ^{ns}
B vs D	>0.50 ^{ns}
C vs D	>0.50 ^{ns}

Figures in parentheses indicate range. Comparison between group done by One way ANOVA (PostHoc), ns = not significant

- Group A : 15 30 years
- Group B : 31 40 years
- Group C : 41 50 years
- Group D : 51 60 years

Table-III

Breadth of the pineal gland in different age groups

Age groups	Breadth (mm) Mean±SD
A (n=18)	4.39±0.34 (3.94 - 4.94)
B (n=25)	4.09±0.46 (3.12 - 5.51)
C (n=11)	4.12±0.58 (3.14 - 4.98)
D (n=6)	3.81±0.34 (3.17 - 4.02)
	<i>P value</i>
A vs B	>0.10 ^{ns}
A vs C	>0.50 ^{ns}
A vs D	<0.05 [*]
B vs C	>0.50 ^{ns}
B vs D	>0.50 ^{ns}
C vs D	>0.50 ^{ns}

Figures in parentheses indicate range. Comparison between group done by One way ANOVA (PostHoc), ns = not significant, * = significant

- Group A : 15 30 years
- Group B : 31 40 years
- Group C : 41 50 years
- Group D : 51 60 years

Table-IV

Thickness of the pineal gland in different age groups

Age groups	Thickness (mm) Mean±SD
A (n=18)	2.52±0.64 (1.25 - 3.69)
B (n=25)	2.29±0.54 (1.22 - 3.33)
C (n=11)	2.14±0.32 (1.89 - 3.02)
D (n=6)	2.07±0.18 (1.76 - 2.22)
	<i>P value</i>
A vs B	>0.50 ^{ns}
A vs C	>0.10 ^{ns}
A vs D	>0.10 ^{ns}
B vs C	>0.50 ^{ns}
B vs D	>0.50 ^{ns}
C vs D	>0.50 ^{ns}

Figures in parentheses indicate range. Comparison between group done by One way ANOVA (PostHoc), ns = not significant

- Group A : 15 30 years
- Group B : 31 40 years
- Group C : 41 50 years
- Group D : 51 60 years

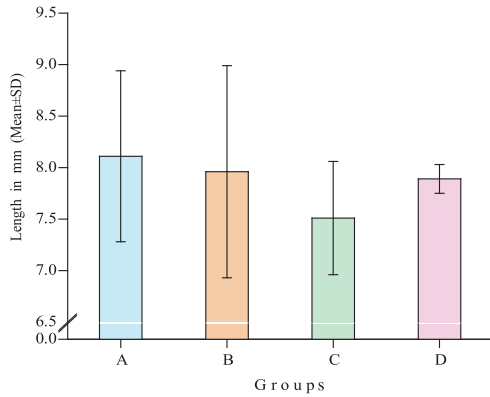


Fig. 4. Length of pineal gland in different age groups
 Group A : 15 30 years
 Group B : 31 40 years
 Group C : 41 50 years
 Group D : 51 60 years

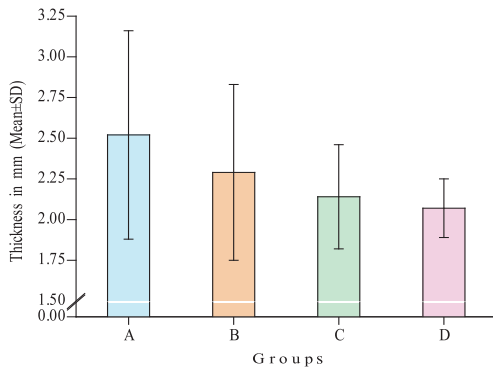


Fig-6: Thickness of pineal gland in different age groups
 Group A : 15 30 years
 Group B : 31 40 years
 Group C : 41 50 years
 Group D : 51 60 years

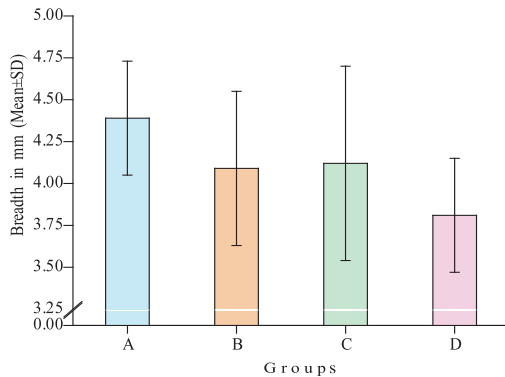


Fig-5. Breadth of pineal gland in different age groups
 Group A : 15 30 years
 Group B : 31 40 years
 Group C : 41 50 years
 Group D : 51 60 years

Discussion:

In the present study, the length of the pineal gland was found to be 8.11±0.83 mm, 7.96±1.06 mm, 7.51±0.55 mm and 7.89±0.14 mm in group A, B, C, D respectively. Zimmermann and Bilaniuk (1982) stated that the length of the pineal gland was 5-9 mm.⁸ According to Kelly, Wood and Enders⁹ (1984), the length was 8-12 mm. Sumida, Barcovich and Newton (1996) noted that the average length of the gland was 7.4 mm⁷. Reiter (2001) found that the length to be <1 cm. Thibodeau and Patton (2003) stated that the length of each pineal gland was 1 cm or 1/4 of an inch.¹⁰ Fawcett¹¹ (1994), Gartner and Hiatt¹² (2001), Ross and Pawlina (2006), Mescher¹³ (2010) stated that the length of the pineal gland was 5-8 mm. Crossman (2005) stated that its length was 0.8 cm. Docherty (2007) found the length to be about 1 cm.¹⁴ The present findings is near to findings of Gartner and Hiatt (2001), Thibodeau and Patton (2003), Crossman (2005), Ross and Pawlina (2006), Docherty (2007), and Mescher (2010). The present findings are slightly lower than that of Kelly, Wood and Enders (1984). In the present study, the breadth of the pineal gland was found to be 4.39±0.34 mm, 4.09±0.46 mm, 4.12±0.58 mm, 3.81±0.34 mm in group A, B, C, D respectively. Sumida, Barcovich and Newton (1996) noted that the average breadth of the gland was 6.9 mm. Fawcett (1994), Gartner and Hiatt (2001), Ross and Pawlina (2006), Mescher (2010) stated that the breadth of the pineal gland was 3-5 mm. Golan et al. (2002) reported that the breadth of the pineal gland in group A (<30 years) 7.12±1.47 mm, in group B (31-40years) 6.37±0.84mm, in group C (41-50 years) 7.05±0.93mm and in group D (>50years) 6.78±0.05mm. Zimmermann and Bilaniuk (1982) stated that the breadth of the pineal gland was 3-6 mm. The present findings are similar to the findings of Fawcett (2004), Gartner and Hiatt (2001), Ross and Pawlina (2006) and Mescher (2010). The present findings were lower than that of Zimmermann and Bilaniuk (1982), Sumida, Barcovich and Newton (1996) and Golan et al. (2002). In the present study, the thickness of the pineal gland was found to be ranging from 2.52±0.64 mm to 2.07±0.18 mm. Golan et al¹⁴. in 2002 found that the thickness of the pineal gland in group A (<30 years) 4.39±0.92 mm, in group

B (31-40years) 5.61 ± 1.39 mm, in group C (41-50 years) 4.01 ± 0.83 mm and in group D (>50years) 4.26 ± 0.98 mm. Zimmarman and Bilaniuk (1982) stated that the thickness of the pineal gland was 3-5 mm. Sumida, Barcovich and Newton (1996) noted that the average thickness of the gland was 2.5 mm. The present findings were very close to the findings of Zimmarman and Bilaniuk (1982), and similar to the findings of Sumida, Barcovich and Newton (1996). The present findings are slightly lower than that of Golan et al. (2002).

Conclusion:

In the present study, it was observed that the breadth and thickness of the pineal gland was found to decrease with advancing age.

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