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Morphometric Study of The Human Pituitary Gland

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Abstract:

Context: *The pituitary gland produces several hormones which regulate growth, metabolism and reproduction. Deviations from the normal morphometry and functions of the gland certainly derange the harmony of life.*

Objective: *The study was carried out to identify morphological variation of pituitary gland in relation to age.*

Materials & Methods: *A cross-sectional, descriptive type of study was carried out in the Department of Anatomy, Dhaka Medical College, Dhaka, from July 2009 to June 2010 on 60 post mortem human pituitary glands (40 male and 20 female). The samples were divided into four groups and length, width & height of the pituitary gland were recorded in mm by using a digital slide calipers.*

Results: *The length was noted as 6.35±0.48, 5.93±1.08, 5.35±0.48 and 5.11±0.27 mm in group A, B, C and D respectively. The width of the pituitary gland was 11.37±0.96, 10.43±0.74, 10.12±1.32 and 9.07±0.38 mm in group A, B, C and D respectively. The height of the pituitary gland was found 6.35±0.48, 5.69±0.86, 5.34±0.92 and 4.62±0.38 mm in group A, B, C and D respectively.*

Conclusion: *The length, width & height of the pituitary gland showed gradual decreasing values with advancing age.*

Key Words: *Morphometry, Pituitary Gland.*

Introduction

The pituitary gland (hypophysis cerebri) is a reddish grey, ovoid body lies within the hypophyseal fossa of the sphenoid bone, covered superiorly by diaphragma sellae, which is pierced centrally by an aperture for the infundibulum[1]. It is attached to the hypothalamic region of the brain by a narrow stalk and has both neural and vascular connections with the brain[2]. Structurally the gland is divided into a larger anterior region (adenohypophysis) and a smaller posterior region (neurohypophysis).They differ in development, types, arrangement of cells, in their vascular and neural innervations. The gland measures about 12 mm in transverse and 8 mm in antero-posterior diameter and weighs about 500 mg[2]. Dynamic changes occur in the size, shape and signal intensity of the pituitary gland during life[3]. These changes reflect the complex hormonal environment of the gland and are most pronounced at times of hormonal flux, such as menarche and pregnancy[3]. Previous observers have noted transient changes which occur in the shape or signal intensity of the pituitary gland at different stages of life, which also reflect concurrent changing of hormonal levels. A radiological study on pituitary gland revealed that, there was a gradual but definite increase in both width and antero-posterior diameter of the pituitary gland with age and a decrease in height with age[3]. Pituitary adenomas are indolent tumors, which accounts for 10-15% of all diagnosed intracranial neoplasms[4].A prospective cross sectional study in the Northern part of Bangladesh reveals that, the prevalence of hyperprolactinemia accounts for about 43% and 21% of primary and secondary infertility respectively[5]. Prolactinomas are accounting for about 60% of primary pituitary tumors[6].The second most common type is somatotrophic adenoma - which is characterized by elevated level of Growth hormone- results in gigantism and acromegaly before and after closure of epiphysis respectively[7]. About 25% of patients have diabetes insipidus[8].

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To study the pituitary growth and for diagnosing and treating diseases affecting pituitary gland, normal morphometrical knowledge regarding pituitary gland is essential.

Materials & Methods

***Materials*:**

The present study was performed on 60 post mortem human pituitary glands of different age groups, of which 40 were male and 20 were females. Among them, the lowest age was 22 years in both sexes and the highest was 55 years in male and 45 years in female.

The samples were collected from the whole brains of the unclaimed dead bodies that were under examination in the Department of Forensic Medicine of Dhaka Medical College, Dhaka. After accomplishing all legal formalities the samples were collected within 24 – 36 hours of death. The samples were brought to the Department of Anatomy, Dhaka Medical College, Dhaka. 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. Then the samples were fixed in 10% formol saline solution.

Methods:

Place and duration of study:

This study was carried out in the Department of Anatomy, Dhaka Medical College, Dhaka, Bangladesh, from July 2009 to June 2010.

Grouping of the samples:

The samples were divided into four age groups. The age groups were group A (20-29 years), group B (30- 39 years), group C (40-49 years) and group D (50-59 years). Detailed grouping and distribution of samples for morphological study were shown in Table –I (after Tsunoda A, Okuda O)[9].

Table- I

Grouping of the samples

Group	Age limit in years	Number of samples	
		Male	Female
A	20-29	09	09
B	30-39	17	08
C	40-49	09	03
D	50-59	05	00

Measurement of length:

Immediately after collection, the length of the pituitary gland was measured by using a digital slide calipers in mm. The length of the gland was measured from antero-posterior distance of the gland[10]. Three readings were taken and the average result was noted.

Measurement of width:

The width of the gland was measured from the distance between the highest points of the lateral edges[11] . Three readings were taken and the average result was noted.

Measurement of height:

Height of the gland was measured from the centre of the concavity that usually forms the superior surface of the gland (where no concavity, the greatest supero - inferior dimension)[11]. Three readings were taken and the average result was noted.

Fig-1: *Showing the antero-posterior distance (A=length) from the inferior view and the transverse distance (B=width) and the supero-inferior distance (C=height) of the pituitary gland from the anterior view.*

Results

Results are shown in the Table –II, Figure- 2,3, & 4.

Table – II

Results of the length, width and height of the pituitary gland

Group (Age) in years	Number (n)	Length (mm) Mean ± SD	Width (mm) Mean ± SD	Height (mm) Mean ± SD
A 20-29	18	6.35 ± 0.48 (5.35- 7.30)	11.37 ± 0.96 (9.97 -12.79)	6.35 ± 0.48 (3.77-6.83)
B 30-39	25	5.93 ± 1.08 (4.19-7.7)	10.43 ± 0.74 (8.32 -12.53)	5.69 ± 0.86 (3.68 - 7.03)
C 40-49	12	5.35 ± 0.48 (4.38 -6.28)	10.12 ± 1.32 (8.31-12.87)	5.34 ± 0.92 (4.16 – 6.80)
D 50-59	5	5.11 ± 0.27 (4.75- 5.5)	9.07 ± 0.38 (8.50-9.50)	4.62 ± 0.38 (4.14 -5.38)

P < 0.01 **; Length between group A & C, A & D.

P >0.01 ns; Length between group A & B, B & C, B & D, C & D.

P < 0.01 **; Width between group A & B, A & C, A & D, B & D.

P >0.01 ns; Width between group B & C and C & D.

P >0.01 ns; Height between group A & B, A & C, A & D, B & C, B & D, C & D.

n = Number of samples, SD = Standard deviation,

ns = not significant,**= significant.

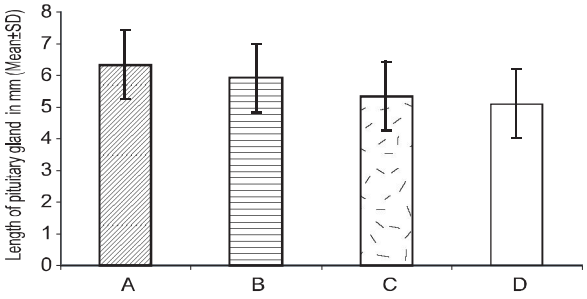

Fig- 2: *Bar diagram showing the length of the pituitary gland in mm in different age groups.*

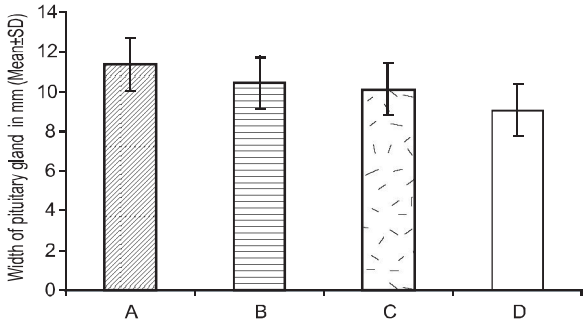

Fig.-3: *Bar diagram showing the width of the pituitary gland in mm in different age groups.*

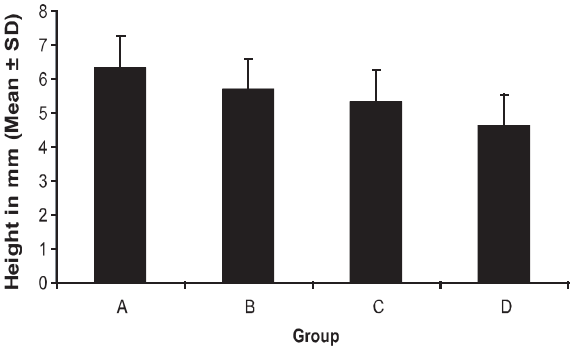

Fig.-4: *Bar diagram showing the height of the pituitary gland in mm in different age groups.*

Discussion:

In the present study the mean ± SD of length of the pituitary gland was found to be 6.35± 0.48, 5.69 ± 0.86, 5.34 ± 0.92 and 4.62 ± 0.38 mm in group A, B, C and D respectively, which was smaller to all the values that were found in texts or literatures. The gland is about 10 mm in length as stated by Fawcett[12], Gartner and Hiatt[13], Aron, Findling and Tyrrell[6], Mescher[14]. Maitra[8] found the length 9 mm which was much higher than the values of the

present study. The reason of this difference may be due to racial variation of the study population. The study also revealed that mean ± SD of length declines with age which was statistically significant and dissimilar to that Dietrich et al. in 1995 [3]. Dietrich et al[3] conducted an MRI study on 100 children (0-2 years of age) and revealed increased antero-posterior diameter of the gland with age, e.g. the mean length was 6.79 mm and 8.16 mm in 0.1-1.5 weeks and 56-97 weeks aged children respectively[3].

In the present study the mean ± SD of width of the pituitary gland was 11.37 ± 0.96 mm in group A, which was close to the result of Oon, Lavender and Joplin[15] conducted a radiological study on 33 adult autopsy subjects and revealed the range of width to be 11.5 to 16.1 mm. Again in group B, C and D, the mean ± SD of width was 10.43 ± 0.7, 10.12 ±1.32 and 9.07 ± 0.38 mm respectively, which can be included within the range (10-15 mm) of width described by Kelly, Wood and Enders[16], Fawcett[12] , Gartner and Hiatt[13]. The study also revealed that mean ± SD of width declines with age which was statistically significant ($P < 0.01$) and was dissimilar to the study findings of Dietrich et al[3]. Dietrich et al.[3] in 1995 conducted an MRI study on 100 children (0-2 years of age) and revealed increased width of the gland with age, e.g. the mean width was 8.41 mm and 10.08 mm in 0.1-1.5 week and 56-97 week aged children respectively.

In the present study the range of height was 3.77 to 6.83 and 3.68 to 7.03 mm in group A and B respectively, which can be included within the range of height mentioned by Argyropoulou et al (3-7mm)[17], Tien et al (2-7mm)[18], Aron, Findling and Tyrrell[6], Maitra[8] (6mm). The mean ± SD of height was 5.34 ± 0.92 mm in group C, which was near to that of Wolpert et al[19] (mean 5.7 mm), Fawcett[12], Gartner and Hiatt[13] (5mm), Tsunoda, Okuda and Sato (5.1 ± 1.1mm)[9]. The mean ± SD of height was 4.62 ± 0.38mm in group D, which was close to Elster et al.(4.8mm)[20]. The present study recorded that-pituitary height peaked in the 20-29 age group and declined between 20-29 and 50-59 years (particularly in males) was similar to the study of Tsunoda, Okuda and Sato[9], but the differences were not statistically significant ($P>0.01$). The present study also revealed that mean ± SD of height declines with age which was statistically not significant but was similar to the study findings of Dietrich et al[3].

Conclusion:

The observation and results of the present study are expected to standardize the morphology of the pituitary gland in Bangladeshi people. The length, width & height of the pituitary gland showed gradual decreasing values with advancing age. Further studies to find out the cause of decreasing morphological parameters are recommended.

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