

Original Article



Three-dimensional pituitary gland volume on MRI - A normative study

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Abstract

Background: Standard reference values for the pituitary gland volume of healthy Bangladeshi is necessary to facilitate assessment and diagnosis of pituitary pathology. **Objectives:** To obtain the dimensions of normal pituitary gland using T1-weighted magnetic resonance images (MRI) and to determine their relationship with age, sex. **Materials & Methods:** MRI of 100 individuals with clinically normal pituitary function (age range 14-82 years) was taken in order to obtain volumetric measurements of the pituitary gland. The data obtained were stratified based on age and sex for analysis. **Results:** The mean pituitary gland volumes were 332.1 ± 146.8 mm³ and 324.2 ± 130.2 mm³ while the mean pituitary heights were 6.22 ± 1.6 mm and 6.42 ± 1.57 mm in males and females, respectively. Although there was no statistically significant difference between pituitary height and pituitary volume in both sexes, they correlated negatively with increasing age ($r = -0.202$, $P = 0.04$ and $r = -0.410$, $P = 0.000$, respectively). The mean pituitary widths (9.03 ± 2.48 mm and 9.21 ± 1.84 mm) and depths (10.5 ± 1.6 mm and 10.42 ± 1.52 mm) in males and females, respectively, did not show remarkable changes with age and sex in the individuals studied. Statistical tests applied included Student's t-test and Pearson correlation. A minimum level of statistical significance was set at $P < 0.05$. **Conclusion:** With this study, we have provided reference values in Bangladeshi population for the dimensions of normal pituitary gland.

Keywords: MRI, Normal pituitary gland volume.

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Introduction

The pituitary gland was first described by a Belgian scientist Andreas Vesalius in 1543. The pituitary gland is the master endocrine gland of the human body. Its size varies with age. Magnetic Resonance Imaging (MRI) is the standard tool for the imaging of pituitary gland without using any harmful ionizing radiations. It is a small-sized gland with master functions; hence, its size and morphology have been a source of interest. Sometimes in imaging, one takes look at the contour of the superior surface of the pituitary gland as an indicator of enlargement of the gland. However, this would be misleading as the shape of the superior surface of the normal gland could either be flat, concave, or convex, depending on the hormonal status, age, sex, and even race of the individual.¹ Magnetic resonance imaging (MRI) presently supersedes computerized tomography (CT) and plain radiographs in the investigation of the sella, parasellar, and suprasellar regions.²⁻⁴ The coronal image is the best single view for imaging the pituitary gland, while the sagittal image best assesses the

relationship of the midline structures.⁵

Materials and Methods

One hundred subjects (58 males and 42 females) with no evidence of neuroendocrine disease, whose serum prolactin, follicle stimulating hormone (FSH), and luteinizing hormone (LH) were essentially normal, and who had normal pituitary gland on brain MRI scan were included into this study. Pregnant or breastfeeding women and those on exogenous hormone therapy were excluded from this study. The duration of this cross-sectional study from 1st June, 2014 to 31st May, 2016 was conducted in the radiology department of BIRDEM. Axial, sagittal, and coronal images were acquired using a 0.35 T open MR scanner (Neusoft). T1-weighted images were taken, as these sequences allow the visualization of the hyperintense posterior pituitary bright spot. 3 mm slice thickness T1-weighted sagittal image was acquired with time to repeat (TR) = 355-438 ms and time to echo (TE) = 10 ms.

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The pituitary height and depth were measured from the sagittal plane in midline image at a section where the cerebral aqueduct was visible and the pituitary gland width was measured from the coronal plane, at a section where the pituitary stalk was visible, using the in-built electronic calipers. The pituitary volume (mm³) was obtained by multiplying the height (H) by depth (D) by width (W) by 0.52.⁶ (Figure-1).

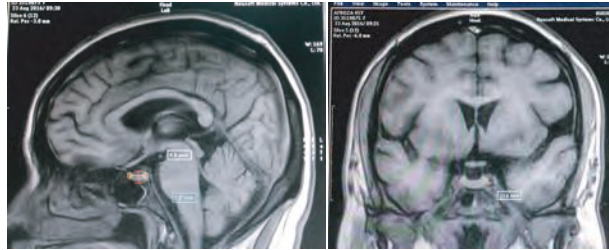


Figure 1 : Sagittal & coronal T1-weighted MRI in 45year old female shows height, depth & width of pituitary gland.

Result

Out of the 100 subjects (58 males, 42 females), the youngest was 14 year old and the oldest was 82 year old (mean age ± SD = 40.32 ± 13.32 years) (Table I).

Table I: Age and sex distribution of patients

Age in group(years)	No of Male	No of female	Total
11-20	4	7	11
21-30	13	8	21
31-40	10	6	16
41-50	12	11	23
51-60	14	7	21
61-70	3	2	5
71-80	1	1	2
81-90	1	0	1

The mean pituitary height was 6.22 ± 1.6 mm and 6.42 ± 1.57 mm in males and females, respectively. Maximum values were seen in the 11-20 years age group (7.42 ± 1.4 mm³ and 7.44 ± 1.60 mm³ for males and females, respectively) and the values were higher in females than in males (Table II).

Table II: Pituitary dimensions (mean±SD mm) by age group and sex of subjects.

Age in group (years)	Pituitary height (mm)		Pituitary volume (mm ³)	
	Males	Females	Males	Females
11-20	7.42±1.4	7.44±1.6	368.5±84.3	318.4±191.4
21-30	7.1±1.5	6.8±1.3	354.2±136.4	358.3±92.4
31-40	6.7±1.7	5.8±1.4	347.6±145.7	345.3±158.7
41-50	5.8±1.3	5.9±1.2	346.3±128.0	330.7±132.5
51-60	6.3±1.4	6.3±1.7	335.6±169.9	299.1±49.5
61-70	5.1±2.9	5.0±0.4	217.4±200.4	293.3±123.5
71-80	3.9	4.11	142.9	176.5
81-90	5.0	0.00	158.5	0.00

The pituitary volume was larger in males (mean volume

332.1±146.8mm³) than in females (mean volume 324.1±130.2mm³), although not significant statistically. Both the pituitary volume and height correlated negatively and significantly with age (P < 0.05). In this study the measured the largest pituitary volume value (368.5±84.3 mm³) in the age group 11-20 years and it was found in males. In females, however, the largest volume (358.3±92.4 mm³) was found in the age group 21-30 years (Table III).

Table III: Pituitary dimensions by sex and test of statistical significance

Pituitary dimentionions	Males	Females	P value
Volume (mm ³)	332.1±14 6.8	324.1±130.2	0.84
Height (mm)	6.22 ±1.6	6.42±1.57	0.92
Width (mm)	9.03±2.48	9.21±1.84	0.79
Depth (mm)	10.5±1.6	10.42±1.52	0.76

Discussion

In the present study, the mean pituitary height was 6.42 mm and the volume was 331.52 mm³. This is very much comparable to the earlier studies.^{6,7} Our peak values for pituitary height (7.42±1.4 mm and 7.44±1.6 mm in males and females, respectively) were, higher than the findings of Ikram et al⁸ (6.3 ± 1.4 mm and 5.9 ± 1 mm, respectively), lower than the findings of Denk et al⁹ (7.7 ± 1.2 mm and 7.9 ± 1.3 mm, respectively). These variations can be explained as due to the differences in the populations studied. After birth, serum levels of growth hormone and prolactin decrease, which leads to a decrease in gland height in the immediate postnatal period. After the second month of life, the pituitary gland gradually increases in height to reach its maximum at puberty. This can be explained by the rapid hormonal changes at puberty. Similar to previous studies,⁸⁻¹⁰ we found that the pituitary height peaked at the second decade of life in both sexes and higher values found in females. We further analyzed the differences in mean height with respect to the various age groups in both sexes, the sex differences were not statistically significant, unlike seen in other reports.¹¹⁻¹⁴ These study findings on pituitary volume, however, differed slightly with respect to age and sex. The peak age was in the third decade, while the peak value was higher in males. However, both pituitary height and volume declined steadily thereafter, and the lowest levels were recorded after the seventh decade of life.

Conclusion

By this study, we have provided reference values for the normal pituitary gland in Bangladeshi population, which will facilitate assessment and diagnosis in patients with abnormalities in pituitary function.

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