

A clinical evaluation of MRI of pituitary gland height, shape in correlation with the age, sex

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Abstract

Background: The pituitary gland was first described anatomically by a Belgian scientist Andreas Vesalius in 1543. Pituitary gland is the master endocrine gland of human body. Magnetic Resonance Imaging (MRI) is the most suitable modality for the evaluation of pituitary gland pathologies. Knowledge of the normal dimensions of the pituitary gland is needed to differentiate normal from abnormal cases. Size of the gland especially height varies according to age group and also gender. The reference values are helpful for evaluating pituitary gland especially in borderline cases in whom dynamic post contrast studies are needed for further evaluation. Hence we conducted a study to formulate the normal data for different age groups.

Aim of the study: Aim of the study is to evaluate the size and shape of pituitary gland according to different age groups on MRI.

Materials and Methods: This was a retrospective study conducted in the department of Radiology, Government Medical College, Baramulla, Jammu and Kashmir, India, a tertiary care teaching hospital. 203 patients who had undergone brain MRI, Patients with sellar or parasellar pathologies and endocrine disorders were excluded from the study. Mid sagittal T1 weighted images were analysed for size and shape of the gland.

Results: Our study included 203 patients, 112 males and 91 females. The patients were divided into different age groups from 0 to 10 years, 11-20 years, 21-30 years, 31-40 years, 41-50 years, 51-60 years and 61 years and above. Mean height of pituitary gland in our study was 5.42 mm. Maximum height was found in 11-20 years age group. After 11-20 years age group, gradual decline in the height was noted. Minimal increase in the elderly age group was also seen. Most common shape of the pituitary gland was flat in our study.

Conclusion: The reference value of normal size of pituitary gland in various genders and age groups has been standardized. Any variation in size will help the clinician to deduce any pathology and make early diagnosis and plan adequate this will be avoid unnecessary suffering to patients. Knowledge of pituitary gland height in different age groups is helpful in distinguishing normal from abnormal gland. Normal data of the study is useful for the same.

Keywords: Age, height, MRI, pituitary gland, shape, pituitary gland height, posterior pituitary gland, hyperintense, anterior pituitary gland, isointense

Introduction

The pituitary gland was first described anatomically by a Belgian scientist Andreas Vesalius in 1543^[1]. Pituitary gland is the master endocrine gland of human body. The pituitary is an organ of dual origin. The anterior lobe is derived from oral ectoderm and also known as adenohypophysis and is epithelial in origin, whereas the posterior lobe is known as neurohypophysis and is derived from the neural ectoderm. The pituitary gland lies within the sella turcica which is a cup shaped depression in the sphenoid bone^[2]. Pituitary gland is the major endocrine gland of the human body which is located in the sellaturcica of middle cranial fossa. Anatomically it is divided into larger anterior pituitary gland (adenohypophysis) and smaller posterior pituitary gland (neurohypophysis). MRI is the investigation of choice for the evaluation of the pituitary gland because it carries no radiation exposure and allows multiplanar scans of better contrast resolution than computed tomography (CT) without bony artifacts^[3]. The dimensions of pituitary gland varies according to each age group and gender. The signal intensity and shape of the gland on MRI changes at different stages of life^[4]. Posterior pituitary gland appears hyperintense on T1 weighted images while anterior pituitary gland appears isointense on T1 weighted images. Physiological hypertrophy of the gland is seen during puberty, pregnancy and lactation^[5]. Usually, subjectively we can differentiate normal from abnormal pituitary cases. However in patients with hormonal disorders, especially borderline cases, radiologists face dilemma in calling pituitary gland as normal, hypoplastic or hypertrophic. In such cases, patients are subjected to extra investigations for evaluation of the pituitary gland. To avoid this, we need to have a reference values of normal pituitary gland size for particular age and gender. The purpose of this study is to formulate the normal data for size, particularly the height of the normal pituitary gland in our region.

Materials and Methods

This was a retrospective study done in the, department of Radiology, Government Medical College, Baramulla, Jammu and Kashmir, India, a tertiary care teaching hospital. Study consisted of total of 203 patients who had undergone Magnetic Resonance Imaging (MRI). Patients with hormonal disorders or sellar or parasellar pathologies were excluded from the study. Empty sella patients with height of pituitary gland measuring less than 2 mm were also excluded from the study. MRI was performed using GE signa excite 1.5 T scanner. All the patients underwent plain MRI of the brain using head coil. Sagittal T1 weighted images were analyzed for the dimensions of pituitary gland. The parameters for sagittal MRI were TE value of 9.7ms, TR of 1474ms, matrix of 320 x 192, FOV of 25 x 25, slice thickness of 6 mm with interslice gap of 2 mm. Mid sagittal T1 weighted images were reviewed to look for height of pituitary gland. Height was measured from the superior aspect to inferior aspect of gland on midsagittal T1 weighted images Figure 1. We also evaluated the shape of the gland and categorized into flat Figure 2, convex [Figure 3] and concave shape. All the patients were divided into different age groups from 0-10, 11- 20, 21-30, 31-40, 41-50, 51-60, and 61 years and above. The variations in the pituitary height according to the age groups were obtained. Measurements were noted in mean \pm SD in the scale of mm. Data analysis was done by SPSS. To test the relation between the mean heights with different age groups, ANOVA test was used. A P value of less than 0.05 was considered significant.

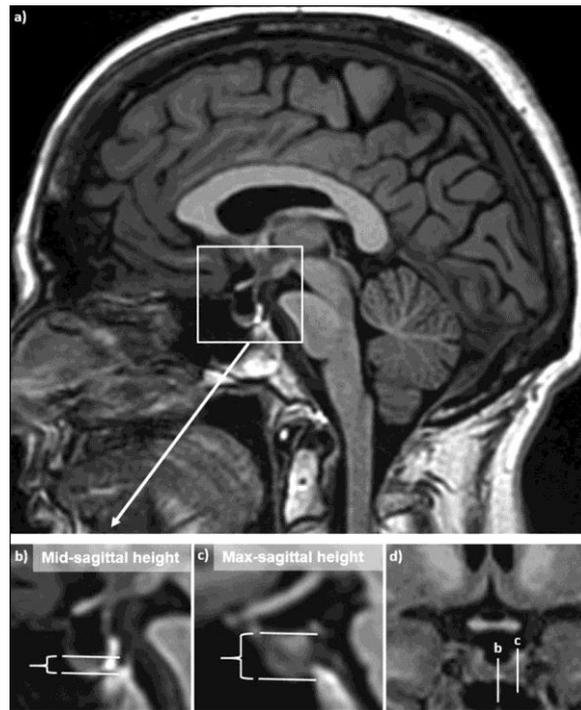


Fig 1: Mid sagittal T1 weighted image showing the measurement of height of pituitary gland.

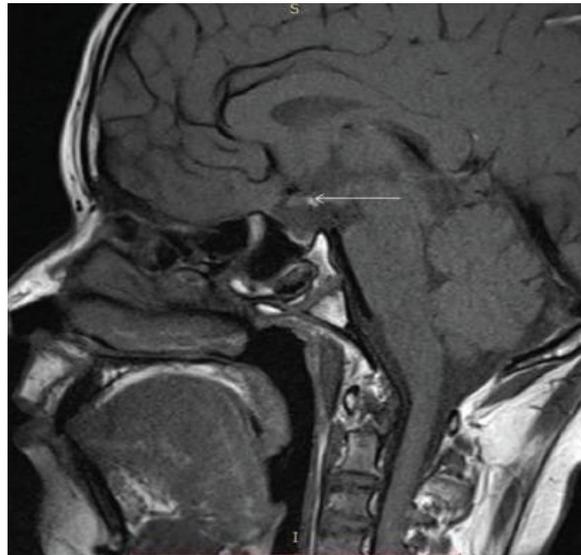


Fig 2: Mid sagittal T1 weighted image showing the flat shape of pituitary gland. Also notice the bright signal of posterior pituitary gland.

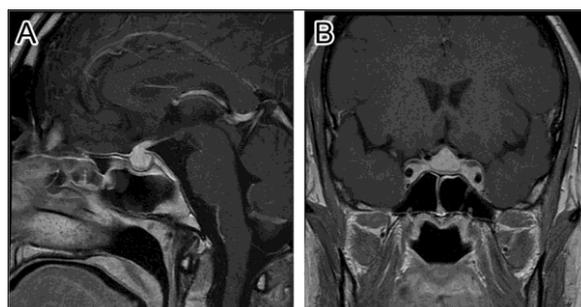


Fig 3: Convex shape of the pituitary gland is demonstrated on this mid sagittal T1 weighted image, A) Sagittal MRI view at second presentation, B) Coronal MRI view at second presentation.

Results

Out of the 203 patients included in the study, 112 were males (55.17%) and 91 (44.83%) were females. In 112 male cases majority were in 0 to 10 years age group i.e. 45 (40.1%) followed by 11-20 years age group (13.4%) whereas among females, majority were from 0 to 10 years age group i.e. 28 (30.8%) followed by 31-40 years age group (18.7%). The variables are shown in Table number 1 and Figure 4.

Table 1: Distribution of patients according to age and gender

Age group in years	Male		Female	
	Cases	%	Cases	%
0-10	45	40.1	28	30.8
11-20	15	13.4	15	16.5
21-30	10	9	10	11
31-40	14	12.5	17	18.7
41-50	7	6.3	9	10
51-60	8	7.1	8	8.8
>60	13	11.6	4	4.4
Total	112	100	91	100

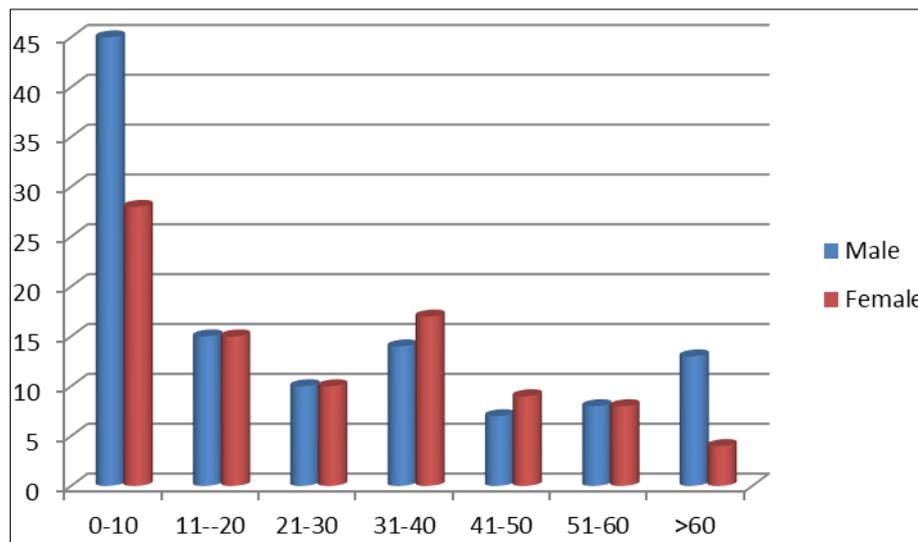


Fig 4: Distribution of patients according to age and gender

In the present study the mean height of pituitary gland in 11-20 years age group among males was 5.40 ± 1.20 mm while in females it was 6.45 ± 1.55 mm. This difference in mean height was statistically significant with a P value of less than 0.05. This difference in male and female cases in other age groups was not significant. This is shown in Table number 2 and Figure 5.

Table 2: Showing mean pituitary heights comparison in different age groups and in both the sex.

Age group in years	Sex	Mean height(mm)	SD	P	Inference
0-10	Male	4.51	1.00	0.18	Not significant
	Female	4.22	0.64		
11-20	Male	5.40	1.20	0.043	Significant
	Female	6.45	1.55		
21-30	Male	5.71	1.12	0.75	Not significant
	Female	5.86	1.04		

31-40	Male	5.70	1.36	0.28	Not significant
	Female	6.22	1.11		
41-50	Male	5.89	0.85	0.54	Not significant
	Female	5.64	0.86		
51-60	Male	5.95	0.79	0.3	Not significant
	Female	5.35	1.17		
>60	Male	5.71	0.83	0.81	Not significant
	Female	5.63	0.31		

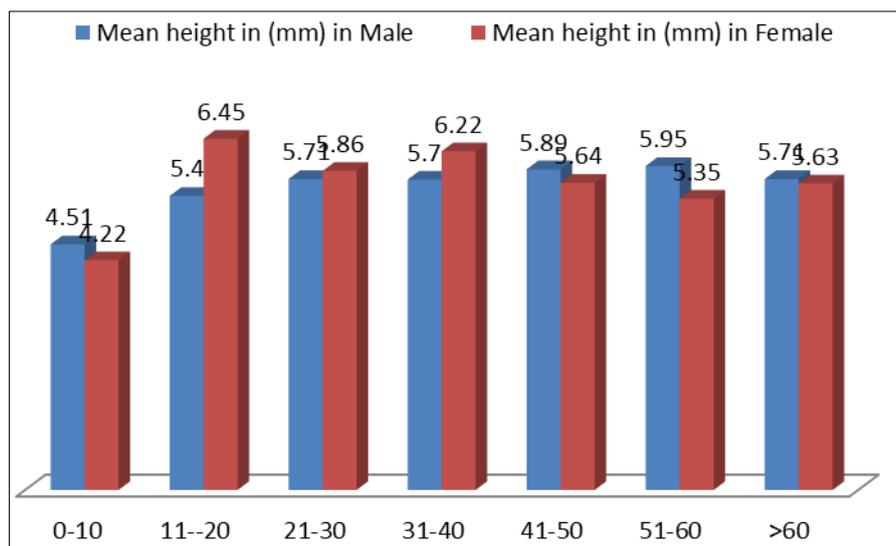


Fig 5: Mean Height in (mm) male and female.

The mean the height of pituitary gland was more in 31- 40 years age group (5.99 ± 1.23) followed by 11-20 (5.96 ± 1.48) and 41-50 years age group (5.77 ± 0.84). When the mean pituitary height of all age groups was compared together by applying one way ANOVA test, there was significant difference at each age group as shown in Table number 3 and Figure 6.

Table 3: Showing the mean values of pituitary height in different age groups

Age group in years	Cases	Mean	SD	F	P	Inference
0-10	67	4.38	0.88			
11-20	33	5.96	1.48			
21-30	20	5.78	1.06			
31-40	27	5.99	1.23	14.07	0.0001 (<0.001)	Highly Significant
41-50	19	5.77	0.84			
51-60	14	5.61	1.04			
>60	23	5.69	0.71			
Total	203	5.36	1.25			

Flat shaped pituitary gland was the most common type seen in 95 patients (46.8%). Next most common shape was convex seen in 63 patients (31.03%). Concave shape was seen in 42 patients (20.7%).

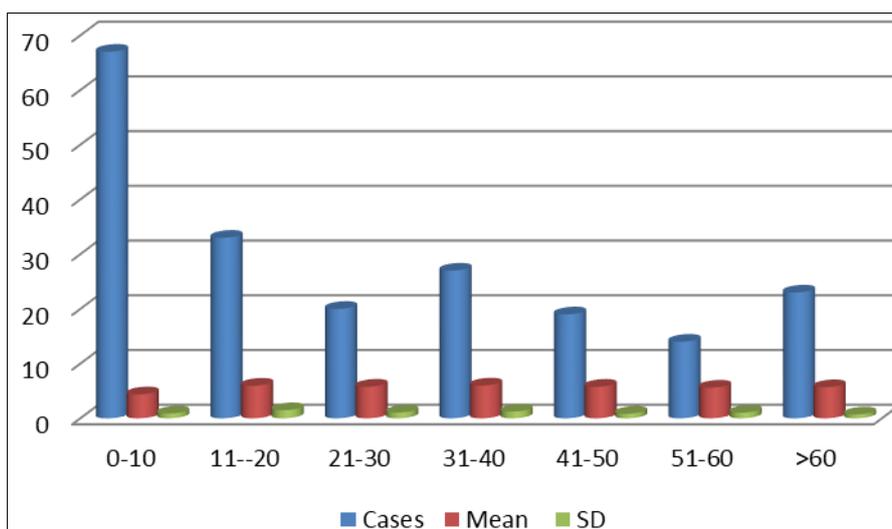


Fig 6: Showing the mean values of pituitary height in different age groups

Discussion

In our study maximum height of pituitary gland was seen in teenage group, i.e. 11 to 20 year's age group. After that as the age increases, there was gradual reduction in the height. The mean pituitary height was more in females than in the males in majority of the age groups. This is similar to the study done by Yadav *et al.* [6]. According to the study done by Argyropoulou *et al.* [7] there is increase in the height of the pituitary gland with age except during the first year of life. Increase in the height of pituitary gland during puberty is a normal physiological change [8,9]. In our study mean height of pituitary gland in 0 to 10 year age group was 4.47mm. This is in accordance with the study done by Argyropoulou *et al.* and Denk *et al.* [8,10]. With increasing age, there is diminution in the height of pituitary gland [9,11,12]. In our study also, we found that the mean heights of pituitary gland decreased as the age advances. The variations in the height of pituitary gland may be due to change in the hormonal levels in the body which in turn varies according to age. The increase in pituitary gland height during puberty may be related to augmented production of Luteinizing hormone levels during this time of growth. The height of pituitary gland reduces with age because of the senile atrophy of the gland and change in the hormonal levels. However there might be increased height of pituitary gland in elderly patients because of the absence of negative feedback from the target organs [13]. In our study maximum height of 6.24 mm was seen in 11 to 20 years age group which is in accordance with the study done by Suzuki *et al.* [14]. The most common shape of pituitary gland was flat in our study which is similar to that found in Yadav *et al.* convex shape was seen more in the younger age group and concave shape was seen in elderly patients. Limitations of the study were retrospective design of the study and relatively less sample size. The results of this study are comparable to study in Indian population by Naik D *et al.* [15] (5.5±1.6mm and 6.0±1.5mm for males and females), and also in studies by Burghio S *et al.*, [16] (5.6±0.74mm and 5.8±0.67 mm for males and females), Sinclair J *et al.* [17] (5.52±0.72 for males and 5.66±0.96 for females), Cemdenk C *et al.*, [18] (5.7±0.2 for males and 6.1±0.1 for females), Tsunoda A *et al.* [19] (4.93 ±1.0 for males and 5.35±1.3 for females) and Ikram MF *et al.*, [20] (5.9±1.0 for males and 6.3±1.4 for females), respectively.

Conclusion

The reference value of normal size of pituitary gland in various genders and age groups has been standardized. Any variation in size will help the clinician to deduce any pathology and make early diagnosis and plan adequate this will be avoid unnecessary suffering to patients. Dimensions of the pituitary gland, predominantly height changes with age. There are less age

related effects on the pituitary width or length. Hence knowledge of pituitary gland height in different age groups is helpful in distinguishing normal from abnormal gland. In our study we tried to formulate the data according to different age groups in our region. This data is definitely helpful to physicians whenever they encounter patients with physiologic hyperplasia of pituitary gland whose symptoms mimic that of pituitary tumor.

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Conflict of interest: None

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