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Evaluation of pituitary gland dimensions by age and gender in healthy individuals in the Turkish population

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ABSTRACT

Aim: Evaluating pituitary gland dimensions in varying age ranges and genders is essential for determining average values in MRI examinations. Therefore, the main objective of our study is to create normative data for pituitary gland size in the Turkish population.

Material and Method: Anteroposterior (AP), transverse (TR), and craniocaudal (CC) dimensions of the pituitary glands of 200 patients over 18 years of age, who underwent Brain MRI examination in our centre between November 2022 and March 2023, did not have any known endocrine disease, did not use hormonal therapy, were not pregnant or breastfeeding, had no history of radiotherapy or chemotherapy were measured from their sagittal and axial MRI sequences. The Kolmogorov-Smirnov test was used for normality analyses. The Mann-Whitney U test was used to compare the non-normally distributed numerical variables between the two groups. Spearman correlation was applied to determine the relationship between age and pituitary gland measurement values.

Results: Anteroposterior and craniocaudal measurements of the pituitary gland of female patients included in the study were significantly higher than males ($p=0.011$ and $p<0.01$, respectively). When the patients under 50 years of age and those aged 50 and over are grouped, anteroposterior, transverse, and craniocaudal measurements were found to be significantly higher in the group under 50 years old ($p<0.001$). When the patient groups between 18-29 and 30-49 were compared, anteroposterior, transverse, and craniocaudal measurements were higher in the group between 18-29 ($p<0.01$, $p<0.001$, and $p=0.026$, respectively).

Conclusion: This work gives normative data that may simplify the examination of the pituitary gland in neuroendocrine diseases. It also reveals that gender-specific changes in pituitary size and shape accompany aging. Changes related to race, age, and gender should be kept in mind.

Keywords: Magnetic resonance imaging, normal pituitary gland, sella turcica

INTRODUCTION

Since the proper growth of the pituitary gland is based on neuroendocrine changes that vary throughout life, pituitary gland height and volume naturally vary by age and gender (1,2). Most Magnetic Resonance Imaging (MRI) studies on the normal physiological development of the adolescent and adult pituitary gland size agree that the size peaks somewhere in the second or third decade of life and then decreases in both men and women (2-5).

However, there are inconsistent findings regarding those over 50 years of age. Many studies have shown that women's pituitary glands are more prominent in the 6th and 7th decades than that men's (1,2,4,6). Some studies even suggest that pituitary gland size increases in women over 50. It has been recommended that this is due to the increase in gonadotropic hormone levels due to the absence of negative feedback from gonadal steroids in the postmenopausal period (2-6). In contrast, many studies show that men in this age range have larger pituitary glands than women, and even one study shows an increase in pituitary size in men (5,7).

These studies show that changes in the endocrine environment can cause changes in pituitary gland morphology, such as an increase in pituitary gland height during adolescence (1,8) followed by an age-related decrease in size (9).

Therefore, evaluating pituitary gland dimensions in varying age ranges and genders is essential for determining average values in MRI examinations. Therefore, the main objective of our study is to create normative data for pituitary gland size in the Turkish population.

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MATERIAL AND METHOD

Patient Selection and Evaluation

The study was carried out with the permission of Dr. Abdurrahman Yurtaslan Ankara Oncology Training and Research Hospital Non-invasive Clinical Researches Ethics Committee (Date: 09.03.2023, Decision No: 2023-03/27). All procedures were carried out under the ethical rules and the principles of the Declaration of Helsinki. Furthermore, consent was obtained from all patients in the study before the MRI examination.

The images and clinical histories of the patients who underwent brain MRI examinations in our centre between November 2022 and March 2023 were evaluated retrospectively. Patients under 18 with a history of endocrine disease, patients using hormonal therapy, patients during pregnancy or breastfeeding, and patients with a history of chemotherapy or cranial radiotherapy were excluded from the study. As a result, pituitary gland anteroposterior (AP), transverse (TR), and craniocaudal (CC) dimensions were measured from the sagittal and axial post-contrast T1 MRI sequences of 200 patients. The sample measurement is presented in **Figure 1**.

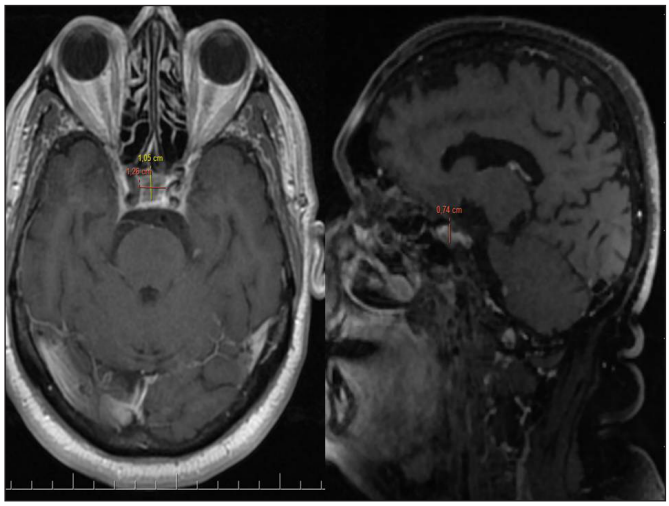

Figure 1. Pituitary gland size measurement in a sample case.

Gland size range and median values were determined and presented by age groups (18-29, 30-49, and above 50 years). Age groups were determined by taking the groupings made in previous studies as an example(10).

Statistical Analysis

All analyses were performed with SPSS 25.0 (IBM®, USA). The findings of the study are presented as frequency and percentages. The Kolmogorov-Smirnov test was used for normality analyses. Numerical variables that do not show normal distribution are presented as the median and interquartile range (IQR:25-75 percentile). The Mann-Whitney U test was used to compare the non-normally distributed numerical variables between the two groups. Spearman correlation was applied to determine the relationship between age and pituitary gland measurement values. For statistical significance, $p < 0.05$ was accepted as significant.

RESULTS

Age, gender, and pituitary gland anteroposterior, transverse, and craniocaudal measurement values of the patients participating in the study are shown in **Table 1**.

Table 1. Age, gender and pituitary gland anteroposterior, transverse, and craniocaudal measurement values of the patients

Age (Median, IQR:25-75 p)	55.0 (42.0-64.8)
Gender (n/%)	
Female	129 (64.5)
Male	71 (35.5)
Pituitary gland measurements (Median, IQR:25-75 p)	
Anteroposterior	8.5(7.4-9.5)
Transverse	13.1 (11.6-14.6)
Craniocaudal	5.7 (4.9-6.7)

IQR: Interquartile range

Anteroposterior and craniocaudal measurements of the pituitary gland of female patients included in the study were significantly higher than males (p=0.011 and p<0.01, respectively). However, there was no significant difference between pituitary gland transverse measurements by gender (p=0.123) (**Table 2**).

Table 2. Age and pituitary gland anteroposterior, transverse, and craniocaudal measurement values by gender

	Female (n=129)	Male (n=71)	p
Age (Median, IQR:25-75 p)	51.0 (41.5-62.0)	62.0 (41.0-71.0)	
Pituitary gland measurements (Median, IQR:25-75 p)			
Anteroposterior	8.7 (7.5-9.7)	8.0 (7.1-9.0)	0.011
Transverse	13.1 (11.8-14.6)	12.3 (10.8-14.6)	0.123
Craniocaudal	5.9 (5.3-6.7)	5.3 (4.6-6.4)	<0.01

IQR: Interquartile range

A negative correlation was detected between age and pituitary gland are anteroposterior (Rho=-0.765, p<0.001), transverse (Rho=-0.709, p<0.001), and craniocaudal (Rho=-0.777 p<0.001) measurements. When the patients under 50 years of age and those aged 50 and over are grouped, anteroposterior, transverse, and craniocaudal measures were found to be significantly higher in the group under 50 years old (for all measurement values p<0.001). When the patient groups between 18-29 and 30-49 were compared, anteroposterior, transverse, and craniocaudal measurements were higher in the group between 18-29 (p<0.01, p<0.001, and p=0.026, respectively). Pituitary gland measurement values by age group are shown in **Table 3**.

Table 3. Pituitary gland measurement values by age groups

	18-29 years (n=24)	30-49 years (n=54)	≥50 years (n=122)
Pituitary gland measurements (median; IQR:25-75p)			
Anteroposterior	10.3 (9.8-11.0)	9.2 (8.7-10.0)	7.7 (6.7-8.5)
Transverse	15.8 (14.9-16.6)	14.4 (13.1-15.0)	11.8 (10.5-13.1)
Craniocaudal	7.0 (6.7-7.6)	6.7 (5.9-7.3)	5.2 (4.5-5.7)

IQR: Interquartile range

DISCUSSION

The pituitary gland was first described anatomically in 1543 by Belgian scientist Andreas Vesalius (11). Despite its small size, slight changes in the pituitary gland can cause significant effects on other neuroendocrine organs. Although pituitary gland contour or sella turcica width is rapidly evaluated in radiological evaluation, this evaluation may be misleading due to changes in pituitary gland size and shape depending on age, gender, and race. In addition, sella size is not a sensitive parameter in evaluating pituitary gland abnormalities (since conditions such as empty sella can also cause sella turcica enlargement) (12-14).

In addition to providing information about pituitary gland functional status, gland dimensions are critical in evaluating, diagnosing, and prognosis of intracellular masses and pituitary gland tumours (15). For example, Suzuki et al. (16) have shown that height measurements above 9 mm in females and 8 mm in males reflected abnormal pituitary gland findings.

Studies have reported that pituitary gland sizes vary in age groups, races, and gender (17). Age-related size changes have been associated with changes in the hormonal cycle at different ages. In addition, some studies have revealed significant differences in gland sizes between genders and that gland sizes are significantly higher in females (9).

Due to this complex hormonal cycle and age, gender, and race-related changes, it is clinically and radiologically essential to know the standard pituitary gland sizes. Unfortunately, although normative data studies are conducted on different races in the literature (11,18), few studies are shown on the Turkish population (18-20).

In our study with the Turkish population, pituitary gland measurements in females were statistically significantly higher than in males, especially more prominent in the AP and CC axis. In addition, pituitary gland dimensions were found to be considerably higher in people under the age of 50 compared to those over the age of 50. When the patient group under 50 was examined in 18-29 and 30-49, a significant height was found in all measurements (AP-TR-CC) in the 18-29 age group. In addition, gland size range and median values were determined and presented by age groups (18-29, 30-49, and above 50 years).

Our study is one of the few studies conducted with the Turkish population, and diameter measurements that can be made by each radiologist in each centre can help the radiological and clinical evaluation of the gland. In addition, knowing the average range measurements determined by age groups can give an idea about the functional status of the gland. The limitation of our study is the small number of samples and the retrospective nature of the study. Another area for improvement was the stage of the menstrual cycle information is not available in our study. Studies with more extensive series to be prospectively conducted in the future should be conducted.

CONCLUSION

This work gives normative data that may simplify the examination of the pituitary gland in neuroendocrine diseases. It also reveals that gender-specific changes in pituitary size and shape accompany aging. Changes related to race, age, and gender should be kept in mind.

ETHICAL DECLARATIONS

Ethics Committee Approval: The study was carried out with the permission of Dr. Abdurrahman Yurtaslan Ankara Oncology Training and Research Hospital Non-invasive Clinical Ethics Committee (Date: 09.03.2023, Decision No: 2023-03/27).

Informed Consent: Because the study was designed retrospectively, no written informed consent form was obtained from patients.

Referee Evaluation Process: Externally peer reviewed.

Conflict of Interest Statement: The authors have no conflicts of interest to declare.

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Author Contributions: All the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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