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Pituitary gland volume and stalk measurements in normal Indian paediatric population on MRI

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***Abstract*---**Background: The present study was conducted for assessing pituitary gland volume and stalk measurements in normal Indian paediatric population on MRI. Materials & methods: A total of 100 subjects within the age range upto 17 years were enrolled. Complete demographic details of all the subjects were obtained. Only those subjects were enrolled in the present study who underwent MRI. Pituitary gland assessment was done based on MRI analysis. Results: While assessing MRI findings, it was seen that mean Pituitary gland volume was 157.2 mm^3 while mean stalk height was 5.7 mm. while evaluating the pituitary gland volume and stalk measurements in normal Indian paediatric population on MRI, it was seen that mean stalk height and mean volume increased significantly with age. Conclusion: The authors conclude that Pituitary size can be accurately determined by using MRI and should be correlated with the subject's age for further correlation.

***Keywords*---**pituitary, stalk, MRI, paediatric population.

Introduction

The normal development of the pituitary gland is dependent on fluctuating neuroendocrine changes throughout life, thus the pituitary height and volume naturally varies with age and sex across the lifespan. The majority of Magnetic Resonance Imaging (MRI) studies conducted on the normal physiological development of adolescence and adult pituitary size agrees that the pituitary size reaches its peak sometime during the 2nd or 3rd decade of life, and later declines in both men and women.[1- 3] Magnetic resonance imaging (MRI) is the gold standard for imaging the pituitary gland. Rapid advances in MRI technology have improved its diagnostic accuracy in a growing number of oncological, neurological and endocrine pathologies over the last two decades. The size and shape of the pituitary gland are known to be associated with a variety of pathologies or disorders including endocrinopathies, idiopathic intracranial hypertension, schizophrenia, poor growth in children and many others.[4, 5]

The PG forms in the sixth to seventh embryonic weeks and is situated in a protective sella turcica. The anterior PG arises from an invagination of the oral ectoderm and forms Rathke's pouch, whereas the posterior PG originates from neuroectoderm. The sizes of PG vary with age and physiologic status and it becomes its largest size during hormonally active conditions (such as puberty or pregnancy).[6, 7] Hence; the present study was conducted for assessing pituitary gland volume and stalk measurements in normal Indian paediatric population on MRI.

Materials & Methods

The present study was conducted for assessing pituitary gland volume and stalk measurements in normal Indian paediatric population on MRI. A total of 100 subjects within the age range upto 17 years were enrolled. Complete demographic details of all the subjects were obtained. Only those subjects were enrolled in the present study who underwent MRI. Pituitary gland assessment was done based on MRI analysis. All the results were recorded and analysed using SPSS software.

Results

A total of 100 paediatric subjects were enrolled. Mean age of the subjects was 13.9 years. Out of 100 subjects, 59 subjects belonged to age range of 10 years to 17 years while 41 subjects belonged to the age range of less than 10 years. While assessing MRI findings, it was seen that mean Pituitary gland volume was 157.2 mm^3 while mean stalk height was 5.7 mm. While evaluating the pituitary gland volume and stalk measurements in normal Indian paediatric population on MRI, it was seen that mean stalk height and mean volume increased significantly with age.

Table 1: Pituitary gland volume and stalk measurements

Age group (years)	Mean height in mm	Mean volume in mm^3
Less than 10 years	5.2	202.3
10- 17 years	5.9	289.8

Overall	5.7	157.2
p- value	0.000*	0.001*

*: Significant

Discussion

A systematic approach of the pituitary region is very important because sometimes findings are very subtle. For complete assessment of pituitary gland, we should be aware of its normal anatomy with the physiological variations in its size and shape in different age groups in both males and females. Changes are seen in size, shape and signal intensity of pituitary gland which reflects the changes in complex hormonal physiology of the gland. Frequently there are borderline pituitary abnormalities encountered such as physiological hypertrophy of gland, subtle microadenoma, increased lobulated margins, inflammatory diseases and empty sella. Measurements of the normal pituitary gland for various age ranges are helpful to diagnose such cases.[6- 8]

There are variations among normative data described by different authors. Though, there are numerous studies on pituitary morphometry, they all have inherent limitations like including subjects of only narrow age range and subjects with intracranial pathologies which could have potentially affected pituitary gland size.[9- 11] Hence; the present study was conducted for assessing pituitary gland volume and stalk measurements in normal Indian paediatric population on MRI.

A total of 100 paediatric subjects were enrolled. Mean age of the subjects was 13.9 years. Out of 100 subjects, 59 subjects belonged to age range of 10 years to 17 years while 41 subjects belonged to the age range of less than 10 years. While assessing MRI findings, it was seen that mean Pituitary gland volume was 157.2 mm^3 while mean stalk height was 5.7 mm. John S et al produced accurate data for the dimensions of the normal pituitary gland in 101 patients and is first study using 3D FLAIR sequence. Their results show a mean pituitary gland height for males of 5.52±0.73mm and 5.66±0.96 for females which is consistent with previous similar studies performed internationally. Their data also postulated the relationship between the different dimensions of the pituitary gland in relation to the age of the patient with regards to the height, width and depth of the gland. They have also highlighted the need for a standard for accurate measurement of the pituitary gland size and further studies into the volumetric changes in relation to age.[10]

While evaluating the pituitary gland volume and stalk measurements in normal Indian paediatric population on MRI, it was seen that mean stalk height and mean volume increased significantly with age. Singh AK et al established normative measurements of pituitary gland in Indian population. They measured dimensions of pituitary gland in 482 (213 females and 269 males) Indian subjects with apparently normal pituitary gland function. Mid-sagittal T1-weighted image (T1-WI) on magnetic resonance imaging (MRI) was used to measure height and length of pituitary gland. Mean height, length and calculated volume of pituitary gland was significantly higher in females compared to males ($p = <0.001$, $P = 0.03$ and $P = <0.001$, respectively) when all age groups were combined but pituitary gland width was not statistically different in male and female subjects. When

subjects were divided into different age groups, except for 10–14 years age group where pituitary height was significantly higher in females as compared to male, no significant difference was observed between male and female in any of the parameters (height, length, width and volume). The mean pituitary gland height was 5.80 ± 1.32 mm and 5.37 ± 1.25 mm in female and male subjects, respectively. Females achieved peak pituitary gland height in 10 to 14-year age group, while males achieved their peak pituitary gland height in 15 to 19-year age group. Their study provides age and sex wise normative data for pituitary measurements derived from Indian population.[11]

Sari S et al provided normative data about pituitary diameters in a pediatric population. Among 14,854 cranial/pituitary gland magnetic resonance imaging scans performed from 2011 to 2013, 2755 images of Turkish children aged between 0 and 18 were acquired. After exclusions, 517 images were left. Four radiologists were educated by an experienced pediatric radiologist for the measurement and assessment of the pituitary gland and pituitary stalk. Twenty cases were measured by all radiologists for a pilot study and there was no interobserver variability. There were 10-22 children in each age group. The maximum median height of the pituitary gland was 8.48±1.08 and 6.19±0.88 mm for girls and boys, respectively. Volumes were also correlated with gender similar to height. Minimum median height was 3.91±0.75 mm for girls and 3.81±0.68 mm for boys. The maximum and minimum pituitary stalk basilar artery ratios for girls were 0.73±0.12 and 0.59±0.10 mm. The ratios for boys were 0.70±0.12 and 0.56±0.11 mm. Their study demonstrated the pituitary gland and stalk size data of children in various age groups from newborn to adolescent.[12]

Conclusion

From the above results, the authors conclude that Pituitary size can be accurately determined by using MRI and should be correlated with the subject's age for further correlation.

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