Size and Shape of the Pituitary Gland with MR Imaging from Newborn to 30 Years: A Study at Siriraj Hospital

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Abstract— MRI can provide the best visualization of structures in cranio - spinal region, especially the anatomy of the pituitary gland. This study was a retrospective with the purpose to determine the size and shape of the pituitary gland in normal puberty groups of both genders at age 1-30 years at Siriraj Hospital. Two planar views of the MRI, sagittal and coronal views for measurement the height, width and the shape of pituitary gland. The sample size (299 cases, 149 male and 150 female) were included the patients in both in-patient and out-patient groups at Siriraj Hospital, during age 1-30 years old and divided into six groups. All cases have Medical Record and MRI brain scan, without pathology history related to the pituitary gland or hormonal disorders, surgery and treated by hormone therapy. The mean and standard deviation of the height of pituitary gland in group 1 (1-10 years) were 5.4 ± 1.2mm in male, n = 50, 5.1 ±1.3mm in female, n = 50, group 2 (11-20 years) were 6.8 ± 1.7mm in male, n = 50, 5.8 ±1.3mm in female, n = 50 and group 3 (21-30 years) were 5.4 ± 1.3mm in male, n = 50, 5.9 ±1.5mm in female, n = 50 and significantly different in female (p<0.001) but no significantly different in male (p = 0.181). The mean and standard deviation of the width of pituitary gland of group 1 (1-10 years) were 10.8 ± 1.9mm in male, n = 50, 10.2 ±2.2mm in female, n = 50, group 2(11-20 years) were 12.9 ± 2.0mm in male, n = 50, 13.5 ±1.5mm in female, n = 50 and group 3 (21-30 years) were 13.4 ± 1.7mm in male, n = 49 and 13.8 ± 1.7mm in female, n = 50 and significant different for both sexes (p<0.001). The most frequency grade shape of “flat” was shown in all groups except female groups 2(11-20 years) higher frequency of “convex” for both sagittal and coronal views. The study was analyzed by two experienced neuroradiologists. This aim to the demonstrated of database in Thai people with age range newborns to 30 years which an average size and shape of pituitary gland acquired from MR Imaging can apply to in clinical medicine.

Keywords— Pituitary gland, magnetic resonance imaging, age

I. INTRODUCTION

MRI could show the detail of brain structure [4] with morphology of a normal structure of the pituitary gland. Role of MRI can be the diagnosis and prognosis of the abnormalities of the pituitary gland such as tumor, inflammation, cyst or empty sellae etc. or include correlated with the endocrine evaluation [4]. MR allows multi-planar scan of better contrast resolution than CT without bony artifacts. The measurement of the pituitary gland for the evaluation of the size and shape were published [1-7], for newborns until Climacterium [5], one study measured in adolescence age range [2, 5, 6, 7]. However, those studies were retrospective, and no reported from Thai people, so we report this research with the purpose of twofold: (a) study the size and shape of normal pituitary gland in puberty groups of both genders with MR Imaging study; (b) to determine and evaluate mean normal size and shape of the pituitary gland related age and gender. The structure of the gland was paid high attention especially in puberty with pathology.

II. MATERIALS AND METHODS

The sample size was 229 patients (149 male and 150 female), at age 1-30 years old. All were Thai from in-patient and outside-patient departments of Siriraj Hospital. Brain scan with routine MR cranial was studied, showing normal anatomy, no pathology history related to the pituitary gland or hormonal disorders, surgery and treated by hormone therapy. In case of unclear, with pathology of the pituitary and abnormal anatomy, those were excluded. Medical Record was between January 2008 and June 2011. Divide the subject into six groups of three age ranges and both gender (1-10, 11-20, 21-30 years)

The measurement, two views of sagittal and coronal, the height from upper to lower, the width from the right to the left and the shape of pituitary gland were studied by grading score (fig.1, 2) which criterion of true midsine views, must see the stalk of the pituitary gland. Sylvia’s aqueduct and posterior gland bright spot in sagittal and coronal but this views, posterior gland bright spot could not be seen. Review the image using the electronic caliper of the display.

MR Imaging was acquired on a 3.0-T, Philips scanner, (Achieva Release 2.6 3.5 12-10-2009 software). The coronal and sagittal views were displayed using midline plane of both T1-weighted sagittal spin-echo and T2-weighted coronal spin-echo image. The technique parameters were 10/4.72-msec (repetition time/echo
time/one average), 512x256 matrix, 23-cm field of view and 3-5-mm thickness slice.

The measurements were mean ± SD in the scale of mm. Data analysis by SPSS, test the relation between mean size height/width with age groups by One way ANOVA test and found frequency grade shape evaluated to percentage, test Chi-square test, considered the P-value was less than 0.05 refer to a significance.

**Figure 1. Scheme grade score for the shape evaluated in sagittal views.**

**Figure 2. Scheme grade score for the shape evaluated in coronal views.**

Grade 1 (G1) call “Concave”, Grade 2 (G2) call “Concave” (different than G1, less than center of gland 2 mm.), Grade 3 (G3) call “Flat”, Grade 4 (G4) up more Grade 3 (but less than 2 mm.) call “Convex”, Grade 5 (G5) call “Convex” (rather round shape).

### III. RESULTS

The mean and standard deviation of the height of pituitary gland in group 1 (1-10 years) were 5.4 ± 1.2mm in male, n = 50, 5.1 ±1.3 in female, n = 50, group 2 (11-20 years) were 6.8 ± 1.7mm in male, n = 50, 5.8 ±1.3mm in female, n = 50 and group 3 (21-30 years) were 5.4 ± 1.3mm in male, n = 50, 5.9 ±1.5mm in female, n = 50 and significantly different in female (p<0.001) but no significantly different in male (p = 0.181). The mean and standard deviation of the width of pituitary gland of group 1 (1-10 years) were 10.8 ± 1.9mm in male, n = 50, 10.2 ±2.2mm in female, n = 50, group 2(11-20 years) were 12.9 ± 2.0mm in male, n = 50, 13.5 ±1.5mm in female, n = 50 and group 3 (21-30 years) were 13.4 ± 1.7mm in male, n = 49 and 13.8 ± 1.7mm in female, n = 50 and significant different for both sexes (p<0.001). [Table1, Fig.3] Height of pituitary gland was greatest in female, especially in age range 11-20 years, but width at 21-30 years. Percentage of value for the shape shows in table 2, 3. The most of frequency grade of shape, in sagittal views were type of “flat” in male all groups (1-3) 58%, 62% and 65% but no significant (p = 0.724) and 48%, 58% in female groups except in female groups 2(11-20 years) higher frequency type of “convex” equal to 54% include statistic significant (p=0.001). In coronal views most of frequency grade of shape type of “flat” was shown in 64% 64% and 67% in male and no significant (p = 0.746), 44% 38% and 60% in female but in groups 2(11-20 years) tend type to “convex” include this groups was statistic significant (p = 0.016) (Value of score shape show in Table 2.3 and to see compare with both sex show in the bar graph of individual shape type 1-5 [Fig.4])

<table>
<thead>
<tr>
<th>Patient Age Range (years)</th>
<th>Mean measurement ; mm± SD</th>
<th>Height</th>
<th>Width</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Female</td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>1-10</td>
<td>5.1±1.3</td>
<td>5.4±1.1</td>
<td>10.2±2.2</td>
</tr>
<tr>
<td>n=100</td>
<td>n = 50</td>
<td>n = 50</td>
<td>n = 50</td>
</tr>
<tr>
<td>11-20</td>
<td>6.8±1.7</td>
<td>5.8±1.3</td>
<td>13.5±1.9</td>
</tr>
<tr>
<td>n=100</td>
<td>n = 50</td>
<td>n = 50</td>
<td>n = 50</td>
</tr>
<tr>
<td>21-30</td>
<td>5.9±1.5</td>
<td>5.4±1.3</td>
<td>13.8±1.7</td>
</tr>
<tr>
<td>n= 99</td>
<td>n = 50</td>
<td>n = 49</td>
<td>n = 50</td>
</tr>
</tbody>
</table>

*p-Value*ANOVA <0.001 0.181 <0.001 <0.001

*Comparison of size and shape in different age groups within gender
**Comparison of shape in two genders within age groups.**

Table 2 The grade scores of pituitary gland for both gender in sagittal views.

<table>
<thead>
<tr>
<th>Sagittal view: Grade</th>
<th>P-Value <strong>Chi-square test</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>Age Groups (years)</td>
</tr>
<tr>
<td>Male</td>
<td>(n=149)</td>
</tr>
<tr>
<td>Female</td>
<td>(n=150)</td>
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</tbody>
</table>

**Comparison of shape in two genders within age groups.**

Figure 3. (a, b) the mean value of measurement, [a.] show the bar graph of mean data in sagittal and coronal views and [b.] compare different both gender in linear graph.

Table 2 The grade scores of pituitary gland for both gender in sagittal views.

<table>
<thead>
<tr>
<th>Coronal view: Grade</th>
<th>p-Value <strong>Chi-square test</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>Age Groups (years)</td>
</tr>
<tr>
<td>Male</td>
<td>(n=149)</td>
</tr>
<tr>
<td>Female</td>
<td>(n=150)</td>
</tr>
</tbody>
</table>

**Comparison of shape in two genders within age groups.**

Figure 4. 1) Shape type score 1-5 of pituitary gland for compare between the male (m) and female (f) groups evaluated in sagittal views.

Figure 4. 2) Shape type score 1-5 of pituitary gland for compare between the male (m) and female (f) groups evaluated in coronal views.

IV. DISCUSSION

Previous study related brain structure described the growth patterns of brain midline in MR Imaging with the measurement of four brain midline structure, one of that was a pituitary gland [1]. The average height of pituitary gland was 4.8±1.0mm for male and 6.0±0.8mm for female in age range 21-40 years old, these subject in adult groups was different from our study that determined aging groups since newborn to
adult with various data. Aging of pituitary gland affected the growth pattern such as height increase or decrease [4]. The pituitary gland height greater in pubertal patients [2,4,5,6,7] than in pre-pubertal (1-10 years) and post-pubertal (21-30 years). The growth spurt several definite in the pituitary gland in teenage girls was 7-10 mm but not larger than 10 mm and the boys no larger than 7mm, this is in agreement with values provided by Elster et al.[2].

In some age groups, the statistically significant conclusion as the subject was less number. Muhammad Faisal Ikram et al.[7], recent study, determined all subject 220 cases and range age was the same as this study less than the different and significantly mean pituitary height in female. Kato K. et al. reported a significantly higher gland size in ≤ 10 years old [6]. The shape measured with evaluation by grading was at very few publications. This study designs a type of grade shape for addition details of scoring.

This study is a new research, at update from the previous research, using MR instrument regarded as modern tool of better and help in the measurement with easiness and comfortable, because using the electronic caliper on monitor display with less error than direct manual. The data was average of three times on the measurement on the sagittal and coronal planes by two experienced neuroradiologists and eventually consensus of those measurement data. Our information can provide the benefit effectively for the clinicians in evaluation of pituitary disease in age group of our study.

The suggestion from this study is to find the database using actually test within the patients and then using a specificity and sensitivity for the diagnosis to the patients for supporting the reliability of the results.

V. CONCLUSIONS

This study demonstrated the database of Thai people in age groups from children to puberty to young adults which its average size and shape of pituitary gland from each data groups, acquired from MR Imaging, can apply to clinical practices particularly when clinical symptomatology of patients in pubertal period and young adults which physiologic pituitary hyperplasia can mimic pituitary tumor.

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REFERENCES


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