A postmortem study on the volume of the human adrenal glands

Siddiqua D¹, Nurunnabi ASM², Ara S³, Zohora F⁴, Hena H⁵, Pervin D⁶

Abstract

Objective: A Cross-sectional descriptive type of study was done in the Department of Anatomy, Dhaka Medical College, Dhaka, from July 2008 to June 2009, to see the variation in the volume of the adrenal glands with age in Bangladeshi people. Materials & Methods: The study was performed on 140 post mortem human adrenal glands collected from 70 unclaimed dead bodies which were in the morgue under examination in the Department of Forensic Medicine, Dhaka Medical College, Dhaka. The samples were divided into four age-groups including group A (11-20 years), group B (21-30 years), group C (31-40 years) & group D (41-60 years). The length, breadth and thickness of each adrenal gland were measured by using a slide calipers. Then the volume of each adrenal gland was determined by the product of its length, breadth and thickness multiplied by 0.52, according to the prolate ellipsoid formula. Results: The mean volume of the right adrenal glands were found 6.36±0.85 cm³ in group A (11-20 years), 6.49±0.76 cm³ in group B (21-30 years), 6.50±0.80 cm³ in group C (31-40 years), 6.76±0.79 cm³ in group D (41-60 years). The mean volume of the left adrenal glands were found 6.97±1.02 cm³ in group A (11-20 years), 6.93±0.83 cm³ in group B (21-30 years), 6.65±0.79 cm³ in group C (31-40 years), 7.09±0.81 cm³ in group D (41-60 years). The differences between the right and left adrenal glands and the difference between age groups were not statistically significant.

Key words: Human adrenal gland, volume of adrenal gland.

Introduction:
The adrenal gland is a life-saving endocrine gland of the human body¹. Adrenal pathology can manifest in various ways either hypofunctional (Addison’s disease) caused by primary atrophy, tuberculous destruction, adrenal cancer etc. or hyperfunctional (Cushing’s syndrome) caused by hyperplasia, adrenal tumour etc.². Volume of different adrenal cortical layers are indicators of functional state of the gland and influenced by aging, alcohol consumption, stress and systemic disease³. Moreover, there are interobserver variations in different techniques of determining the volume of adrenal glands both in normal and diseased people⁴. Besides, it has been observed by various researchers that the dimensions of different organs in Bangladeshi population have got variations from those of the western population⁵. However, we have only a few studies on human organs especially in their gross anatomy e.g. studies on morphological variations of the adrenal gland in different age groups in Bangladeshi people. Moreover, the estimation of the size of the adrenal gland is important for the evaluation and management of the adrenal disorders and facilitatory to the radiologists, endocrinologists, pathologists and surgeons⁶. In the present study, the adrenal glands were collected from cadavers through a meticulous dissection. Then their surfaces were dried by a

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Materials and Methods:

Materials of the study:
A cross-sectional descriptive type of study was designed and done in the Department of Anatomy, Dhaka Medical College, Dhaka, from July 2008 to June 2009, based on collection of 140 human adrenal glands from 70 unclaimed dead bodies that were under examination in the Department of Forensic Medicine, Dhaka Medical College, Dhaka, from November 2008 to April 2009. All the samples were collected within 24-36 hours of death without any sign of putrefaction and taken from medicolegal cases excluding poisoning, any cutting or crushing injury to the adrenal glands, and adrenal glands found in one side and diseased. After isolation, the samples were divided into four age-groups i.e. group A (11-20 years), group B (21-30 years), group C (31-40 years) and group D (41-60 years) (Table-I), according to Kangarloo et al. (1986) 9.

Methods:

Estimation of the volume of the adrenal glands:
At first, the length of the adrenal gland was measured from its upper pole to the lower pole, then its breadth was measured transversely at its maximum and the thickness was measured at the region of its maximum antero-posterior diameter (according to Ahmed et al. 2007) 10. Then volume of each ovary was calculated by applying the ellipsoid formula which requires the measurement of these three dimensions. The prolate ellipsoid formula 11 is as follows:

\[
\text{Volume} = \text{Length} \times \text{Breadth} \times \text{Thickness} \times 0.52
\]

Statistical processing of data:
The comparison between right and left side was done by unpaired Student’s ‘t’ test and the comparison between different groups was done by One-way ANOVA. All the statistical analyses were done by using the SPSS 11.0 version.

Table-I: Grouping of the sample of the present study (n = 140)

<table>
<thead>
<tr>
<th>Group</th>
<th>Age limit in years</th>
<th>Number of samples</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Right</td>
</tr>
<tr>
<td>A</td>
<td>11-20</td>
<td>10</td>
</tr>
<tr>
<td>B</td>
<td>21-30</td>
<td>15</td>
</tr>
<tr>
<td>C</td>
<td>31-40</td>
<td>25</td>
</tr>
<tr>
<td>D</td>
<td>41-60</td>
<td>20</td>
</tr>
</tbody>
</table>

Results:

Right adrenal gland:
In the present study, the mean volume of the right adrenal gland were found 6.36±0.85 cm$^3$ in group A (11-20 years), 6.49±0.76 cm$^3$ in group B (21-30 years), 6.50±0.80 cm$^3$ in group C (31-40 years), 6.70±0.79 cm$^3$ in group D (41-60 years). The highest mean volume was found in group D and the lowest mean volume was in group A. The difference between the groups was not statistically significant (Table-II).

Table-II. Volume of right and left adrenal gland in different age group

<table>
<thead>
<tr>
<th>Group</th>
<th>Volume (cm$^3$)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Right</td>
<td>Left</td>
</tr>
<tr>
<td></td>
<td>Mean±SD</td>
<td>Mean±SD</td>
</tr>
<tr>
<td>A</td>
<td>6.36±0.85</td>
<td>6.97±1.02</td>
</tr>
<tr>
<td></td>
<td>(5.27-7.54)</td>
<td>(5.55-8.70)</td>
</tr>
<tr>
<td>B</td>
<td>6.49±0.76</td>
<td>6.93±0.83</td>
</tr>
<tr>
<td></td>
<td>(5.27-7.64)</td>
<td>(5.55-8.29)</td>
</tr>
<tr>
<td>C</td>
<td>6.50±0.80</td>
<td>6.65±0.79</td>
</tr>
<tr>
<td></td>
<td>(5.06-7.80)</td>
<td>(5.11-7.96)</td>
</tr>
<tr>
<td>D</td>
<td>6.76±0.79</td>
<td>7.09±0.81</td>
</tr>
<tr>
<td></td>
<td>(5.27-8.12)</td>
<td>(5.47-8.58)</td>
</tr>
</tbody>
</table>

P value P value
A vs B >0.50ns >0.50ns
A vs C >0.50ns >0.10ns
A vs D >0.10ns >0.50ns
B vs C >0.50ns >0.10ns
B vs D >0.10ns >0.50ns
C vs D >0.10ns >0.05ns

Figures in parentheses indicate range. Comparison between the right & the left side done by unpaired Student’s ‘t’ test and in between different age group were done by One-way ANOVA (PostHoc) ns = not significant.

Left adrenal gland:
In the present study, the mean volume of the left
adrenal gland were found 6.97±1.02 cm$^3$ in group A (11-20 years), 6.93±0.83 cm$^3$ in group B (21-30 years), 6.65±0.79 cm$^3$ in group C (31-40 years), 7.09±0.81 cm$^3$ in group D (41-60 years). The highest mean volume was found in group D and the lowest mean volume was in group C. The difference between the groups was not statistically significant (Table-II).

Moreover, no difference was found between the volume of the right and left adrenal glands in any age group (Table-II).

Discussion:
According to Arey (1966), Fawcett (1994), Glass and Mundy (2005) and Ross and Pawlina (2006), the volume of the adrenal gland is about 7.5-8.5 cm$^3$ (12-15). In the present study, the mean highest volume of the adrenal gland was found 6.70±0.79 cm$^3$ at right and 7.09±0.81 cm$^3$ at left side. This value is slightly lower than that of the findings described by Arey, Fawcett, Glass and Mundy, Ross and Pawlina (12-15). This dissimilarity may be due to the racial variation and method of measurement. The study results have similarity with some other studies on weight and volume of different organs in Bangladesh (15-16).

To the best of our knowledge, this is the first ever study to determine volume of the adrenal gland in Bangladeshi people. The results of the present study can be used as a standard volume reference for the adrenal glands of Bangladeshi people. However, further studies with larger sample and high technical backup are recommended.

Ethical Clearance:
This study was approved by the Ethical Review Committee of Dhaka Medical College, Dhaka.

Acknowledgement:
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References:


