

Original article

A postmortem study on the weight of the human adrenal glands

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Abstract

Objective: A cross-sectional descriptive type of study was designed to find out the difference in weight of the right and left adrenal glands of Bangladeshi people in relation to age and to compare with the previous studies. **Materials & Methods:** The study was done in the Department of Anatomy, Dhaka Medical College, Dhaka from July 2008 to June 2009 and 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) and the weight of the adrenal glands were measured and recorded. **Results:** There was no difference found in weight in between the right and the left adrenal glands in any age group. For the right adrenal gland, the differences in weight between group A & group B and group A & group D were statistically significant ($p < 0.05$). For the left adrenal gland, the differences in weight between group A & group D and group C & group D were statistically significant ($p < 0.05$).

Key words: Adrenal gland, weight of adrenal gland.

Introduction

The adrenal gland is a life-saving endocrine gland of the human body. In 1855, Thomas Addison showed that adrenal glands were necessary for life, by identifying them as the site of damage in previously mysterious and ultimately fatal illness which became known as 'Addison's disease'¹. Any deviation from the normal functions of the adrenal glands certainly causes derangement of the harmony of life. Adrenal pathology can manifest in various ways either hypofunctional caused by primary atrophy, tuberculous destruction, adrenal cancer etc. or hyperfunctional caused by hyperplasia, adrenal tumours etc.². Exact knowledge of the normal morphometry e.g. the weight of the adrenal gland, may facilitate the surgeons, endocrinologists, pathologists and radiologists to adopt appropriate diagnosis

and treatment of various clinical conditions associated of the adrenal glands³, as adrenal weight may be affected by patients' gender, age, laterality of adrenal gland and presence of systemic disease⁴. Moreover, 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. It is also observed by reviewing the literatures and the texts that several works have been done on the morphological aspects of the adrenal glands in foreign countries, but sufficient attention has not been given in morphological experiment in our country. There is no existing record of any study regarding the adrenal glands' weight in Bangladeshi population. Therefore, it has been designed to see the weight of this important gland in different age groups and

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find out whether there is any variation with age in Bangladeshi people as well as with those of the western people.

Materials & methods

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

Group	Age limit in years	Number of samples	
		Right	Left
A	11-20	10	10
B	21-30	15	15
C	31-40	25	25
D	41-60	20	20

Materials

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. All the samples were collected from medicolegal cases

excluding poisoning, any cutting or crushing injury to the adrenal gland, gland found in one side and known case of adrenal disease.

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

Methods

After isolation, the samples were divided into three 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 Kangaroo et al. (1986)⁶.

Measurement of weight of the adrenal gland: The adrenal gland was taken and its outer surface was dried with blotting paper. Then the gland was weighed by means of a digital balance (SCIENTECH ZSA 210, made in USA) in grams.

Statistical processing of data: The collected data were processed and statistical analyses were done by one-way ANOVA test. All the statistical analyses were done by using the SPSS 11.0 version.

Table II: Weight of right and left adrenal gland in different age group

Group (n)	Weight (gm)		P value
	Right Mean±SD	Left Mean±SD	
A (10)	5.05±0.15 (4.90-5.30)	5.10±0.17 (4.80-5.40)	>0.10 ^{ns}
B (15)	4.92±0.11 (4.70-5.10)	4.99±0.11 (4.75-5.15)	>0.10 ^{ns}
C (25)	5.00±0.19 (4.70-5.10)	5.09±0.22 (4.90-5.60)	>0.10 ^{ns}
D (20)	4.93±0.10 (4.70-5.10)	4.97±0.09 (4.80-5.10)	>0.10 ^{ns}
	P value	P value	
A vs B	<0.05*	>0.05 ^{ns}	
A vs C	>0.10 ^{ns}	>0.05 ^{ns}	
A vs D	<0.05*	<0.05*	
B vs C	>0.05 ^{ns}	>0.05 ^{ns}	
B vs D	>0.05 ^{ns}	>0.05 ^{ns}	
C vs D	>0.05 ^{ns}	<0.05*	

*Figures in parentheses indicate range. Comparison between the right & the left and in between different age group were done by One-way ANOVA (PostHoc), ns = not significant, **/** = significant.*

Results

There was no difference found in between the right and the left adrenal glands in any age group (Table:II). For the right adrenal gland, the differences between group A & group B and group A & group D were statistically significant ($p < 0.05$). For the left adrenal gland, the differences between group A & group D and group C & group D were statistically significant ($p < 0.05$) (Table:II).

Discussion

Gardner, Gray and O'Rahilly (1969)⁷ stated that each of the suprarenal glands weighs about 3-6 grams. Lam, Chan and Lo (2001)⁴ studied adrenal glands of 333 Chinese cadavers (208 men and 125 women) and found the mean combined weight of adrenal glands as 11.8 gm (ranging from 5.8 to 19.9 gm). The left adrenal gland was often heavier than the right (mean weight was 6.1 gm and 5.7 gm respectively). Adrenal glands are often heavier in male younger age group (less than 60 years old) and patient with history of hypertension or lung cancer. Bagheri et al. (2004)⁸ studied on 20 adult people using PET/CT found each gland weighs about 4 gm, regardless of patients' age or sex. Singh et al. (2004)⁹ did autopsy examination on 2025 Indians (1449 males and 576 females) and reported that adrenal glands attained their peak weights at 40-50 years i.e. 9.7 ± 1.53 gm (right adrenal) and 11.3 ± 2.10 gm (left adrenal). According to Kumar, Abbas and Fausto (2004)¹, the weight of the normal adrenal gland is 4 grams but with acute stress, lipid depletion may reduce the weight. On the other hand, prolonged stress or dying from chronic illness may induce hypertrophy and hyperplasia of the cortical cells and thereby, increase the weight of the gland double or more. According to Glass and Mundy (2005)¹⁰, in adult, each gland weighs 5 gm. The left gland is marginally larger than the right. At birth the glands are

slightly comparatively larger and are approximately $\frac{1}{4}$ of the size of the ipsilateral kidney. By the end of the second month, the weight of the adrenal has reduced by 50%. The glands begin to grow by the end of the second year and regain their weight at birth by puberty. There is little further weight increase in adult life. Anand et al. (2005)¹¹ studied 40 adrenals and found the average weight of the gland to be 4.28 gm. Guyton and Hall (2006)² stated that each of adrenal glands weighs about 4 gm. Narongchai duo (2008)¹² performed autopsy of 499 Thai corpses and stated that the average weight of the right adrenals were 5 gm and 7.9 gm and the left adrenals 6 gm and 8 gm in male and female respectively in Thai population. They also found that adrenals' weight increased with the increasing body height and were heavier in females. The present study reveals the fact that there is no difference in weight between the right and the left adrenal glands and the findings of average weight of the gland are consistent with the previous studies except that of Lam, Chan and Lo⁴, Singh et al.⁹, and Narongchai duo¹², where the values were found higher.

Conclusion

Further studies with larger sample and high technical backup are recommended. The results of the present study can be used as a standard reference weight for the adrenal glands of Bangladeshi people and to determine the abnormal evidences in Forensic and Pathologic corpses.

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