

# Morphological Study of Human Parathyroid Glands – A Postmortem Study

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## Abstract

**Context:** The parathyroid gland, the last major organ to be recognized in humans is an essential endocrine gland. The hormone secreted by the parathyroid gland provides a powerful mechanism for controlling extracellular calcium and phosphate concentration.

Detailed morphological knowledge of parathyroid gland is essential for proper diagnosis and management of parathyroid diseases.

**Materials & Methods:** A cross sectional, analytical type of study was conducted in the department of Anatomy, Dhaka Medical College, on parathyroid glands of 60 (sixty) Bangladeshi people in different age groups. Total 207 (two hundred and seven) parathyroid glands were taken from these 60 (sixty) cadavers. The samples were collected from the unclaimed dead bodies were under examination in the Department of Forensic Medicine of Dhaka Medical College, Dhaka. The samples were divided into three different age groups ranging from 15 to 75 years. The groups were group A (10-30 years), group B (31-60 years) and group C (61-90 years). All samples were studied morphologically.

**Results:** In the present study of 60 cadavers, 207 parathyroid glands were identified in relation to posterior border of thyroid lobe. In this study the mean SD length of parathyroid glands ranged from  $3.36 \pm 1.11$  to  $9.25 \pm 1.71$  mm, breadth of parathyroid glands ranged from  $2.50 \pm 0.58$  to  $5.33 \pm 1.53$  mm and thickness of parathyroid glands ranged from  $1.25 \pm 0.50$  to  $2.83 \pm 0.29$  mm.

**Key words:** Morphology, parathyroid gland.

## Introduction:

The parathyroid glands were first described and named in 1852 by the great English naturalist Sir Richard Owen after careful dissection of a rhinoceros. In 1863, Virchow noted the presence of glandular structures adjacent to the thyroid in man. Sandstrom dissected and histologically examined these adjacent glandular structures in a number of mammalian species, and determined that they

showed a different histologic pattern than the thyroid tissue. Gley rediscovered the parathyroids and confirmed Sandstrom's work in 1891. For many years the parathyroids were known as Sandstrom's glands<sup>1</sup>.

Throughout the late nineteenth century there was considerable confusion about the function of the parathyroid as compared to that of the thyroid. Most experimental extirpations of the thyroid caused tetany and death because the parathyroids were damaged or removed simultaneously. By 1908, MacCallum & Voegtlin had solved this confusion by showing that extirpation of the parathyroids alone led to tetany, and in the next year these investigators showed that administration of calcium prevented tetany in parathyroidectomized animals. Thus ended the 50-year period of anatomic discovery and the realization that the endocrine function of the parathyroids was related to calcium homeostasis<sup>1</sup>.

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The parathyroid glands are small endocrine glands<sup>2</sup>. The upper parathyroid glands are somewhat smaller than the lower ones<sup>3</sup>. These are yellowish-brown, ovoid or lentiform structures, usually lying between the posterior lobar borders of the thyroid glands and its capsule. They are commonly 6 mm long, 3-4 mm across, and 1-2 mm from back to front<sup>4</sup>.

**Materials and Methods:**

The present study was performed on post mortem parathyroid glands of 60 (Sixty) Bangladeshi people of different age groups ranging from 15 to 75 years. Total 207 (two hundred and seven) parathyroid glands were taken from these 60 (sixty) cadavers. The study was done from January 2008 to December 2008.

**Grouping of the Samples**

For convenience of description in relation to age the collected samples were divided into three groups (according to Panijan, et al<sup>5</sup>).

**Table-I**  
*Grouping of the Samples in relation to age*

Group	Age in years	No. of samples	No. of parathyroid glands
A	10-30	27	93
B	31-60	28	98
C	61-90	5	16

**Variables Studied**

- Length of parathyroid glands
- Breadth of parathyroid glands

- Thickness of parathyroid glands
- All the measurements were determined in mm. scale.

**Procedure of the Study**

Measurement of length, breadth and thickness of each parathyroid gland:

The parathyroid glands are of different size and shape. For this reason, during measuring the length, breadth and thickness, three measurements were taken for each parameter and from these three measurements the maximum length, breadth and thickness were taken. A laminated graph paper was taken which was about 10 inches ´ 8 inches. This laminated graph paper contains 80 big squares. Each big square contains 25 small squares. The parathyroid gland was placed on this graph paper where each small square was of 2.5 mm ´ 2.5 mm. Then the length, breadth and thickness were measured by counting the square it acquired. A hand lens was used for magnified view and easy measurement. An mm line scale was used to measure the length and breadth of each small square and was found 2.5 mm ´ 2.5 mm.

**Ethical Clearance:**

This research work was approved by the Ethical Review Committee of Dhaka Medical College, Dhaka.

**Results:**

- **Length of parathyroid glands:**  
Length of parathyroid glands is shown in Table-II
- **Breadth of parathyroid glands:**  
Breath of parathyroid glands is shown in Table-III
- **Thickness of parathyroid glands:**  
Thickness of parathyroid glands is shown in Table-IV

**Table -II**  
*Length of parathyroid glands (mm)*

Age group	Right side			Left side		
	Superior Mean±SD	Inferior Mean±SD	P value	Superior Mean±SD	Inferior Mean±SD	P value
A	4.78±2.29 (n=27)	6.93±2.04 (n=23)	<0.01**	4.76±1.79 (n=21)	7.77±2.54 (n=22)	<0.001***
B	3.91±1.94 (n=28)	6.31±1.95 (n=21)	<0.001***	4.40±1.65 (n=26)	6.52±2.17 (n=23)	<0.001***
C	3.75±2.06 (n=4)	8.00±2.00 (n=3)	<0.05*	5.00±1.87 (n=5)	8.00±2.16 (n=4)	>0.05 <sup>ns</sup>
	<i>P value</i>	<i>P value</i>		<i>P value</i>	<i>P value</i>	
A vs B	>0.10 <sup>ns</sup>	>0.10 <sup>ns</sup>		>0.10 <sup>ns</sup>	>0.05 <sup>ns</sup>	
A vs C	>0.10 <sup>ns</sup>	>0.10 <sup>ns</sup>		>0.50 <sup>ns</sup>	>0.50 <sup>ns</sup>	
B vs C	>0.50 <sup>ns</sup>	>0.10 <sup>ns</sup>		>0.10 <sup>ns</sup>	>0.10 <sup>ns</sup>	

Comparison between sex, between length of superior and inferior parathyroid glands of right and left side done by unpaired Student's 't' test, and comparison between groups done by One way ANOVA (PostHoc), ns = not significant, \*/\*\*/\*\* = significant. Group A : Age 10 30 years, Group B : Age 31 60 years, Group C : Age 61 90 years

**Table -III**  
*Breadth of parathyroid glands (mm)*

Age group	Right side			Left side		
	Superior Mean±SD	Inferior Mean±SD	P value	Superior Mean±SD	Inferior Mean±SD	P value
A	3.07±1.22 (n=27)	3.48±1.30 (n=23)	>0.10 <sup>ns</sup>	2.83±0.93 (n=21)	4.02±1.52 (n=22)	<0.01 <sup>**</sup>
B	2.70±1.02 (n=28)	3.60±1.11 (n=21)	<0.01 <sup>**</sup>	2.83±1.08 (n=26)	3.93±1.27 (n=23)	<0.01 <sup>**</sup>
C	2.50±0.58 (n=4)	5.33±1.53 (n=3)	<0.05 <sup>*</sup>	3.60±1.71 (n=5)	5.00±1.41 (n=4)	>0.10 <sup>ns</sup>
	<i>P value</i>	<i>P value</i>		<i>P value</i>	<i>P value</i>	
A vs B	>0.10 <sup>ns</sup>	>0.50 <sup>ns</sup>		>0.50 <sup>ns</sup>	>0.50 <sup>ns</sup>	
A vs C	>0.10 <sup>ns</sup>	<0.05 <sup>*</sup>		>0.10 <sup>ns</sup>	>0.10 <sup>ns</sup>	
B vs C	>0.50 <sup>ns</sup>	<0.05 <sup>*</sup>		>0.10 <sup>ns</sup>	>0.10 <sup>ns</sup>	

Comparison between sex, between breadth of superior and inferior parathyroid glands of right and left side done by unpaired Student's 't' test, and comparison between groups done by One way ANOVA (PostHoc), ns = not significant, \*/\*\* = significant. Group A : Age 10 30 years, Group B : Age 31 60 years, Group C : Age 61 90 years

**Table -IV**  
*Thickness of parathyroid glands (mm)*

Age group	Right side			Left side		
	Superior Mean±SD	Inferior Mean±SD	P value	Superior Mean±SD	Inferior Mean±SD	P value
A	1.85±0.59 (n=27)	2.04±0.62 (n=23)	>0.10 <sup>ns</sup>	1.90±0.77 (n=21)	2.36±0.64 (n=22)	<0.05 <sup>*</sup>
B	1.73±0.74 (n=28)	2.05±0.71 (n=21)	>0.10 <sup>ns</sup>	1.62±0.55 (n=26)	2.46±0.46 (n=23)	<0.01 <sup>**</sup>
C	1.25±0.50 (n=4)	2.83±0.29 (n=3)	<0.01 <sup>**</sup>	2.10±0.55 (n=5)	2.75±0.96 (n=4)	>0.10 <sup>ns</sup>
	<i>P value</i>	<i>P value</i>		<i>P value</i>	<i>P value</i>	
A vs B	>0.50 <sup>ns</sup>	>0.50 <sup>ns</sup>		>0.10 <sup>ns</sup>	>0.10 <sup>ns</sup>	
A vs C	>0.05 <sup>ns</sup>	>0.05 <sup>ns</sup>		>0.50 <sup>ns</sup>	>0.10 <sup>ns</sup>	
B vs C	>0.10 <sup>ns</sup>	>0.05 <sup>ns</sup>		>0.10 <sup>ns</sup>	>0.05 <sup>ns</sup>	

Comparison between sex, between thickness of superior and inferior parathyroid glands of right and left side done by unpaired Student's 't' test, and comparison between groups done by One way ANOVA (PostHoc), ns = not significant, \*/\*\* = significant. Group A : Age 10 30 years, Group B : Age 31 60 years, Group C : Age 61 90 years

#### Discussion:

In the present study the mean ± SD length of parathyroid glands ranged from 3.36 ± 1.11 mm to 9.25 ± 1.71 mm.

Gartner and Hiatt<sup>7</sup> stated that each parathyroid gland is about 5 mm in length. According to

Berkovitz<sup>4</sup> each parathyroid gland is 6 mm long. Henry and Thompson<sup>8</sup> described that the length of each parathyroid gland was about 5 mm. Greenfield et al<sup>9</sup> stated that each normal parathyroid gland was 5-7 mm long. Paloyan et al<sup>1</sup> stated that each parathyroid gland measure approximately 0.5 cm in length.

The findings of the Gartner and Hiatt<sup>7</sup>, Berkovitz<sup>4</sup>, Henry and Thompson<sup>8</sup>, Greenfield et al<sup>9</sup>, Paloyan et al<sup>1</sup> belongs to the range of the findings of the present study.

In the present study the mean  $\pm$  SD breadth of parathyroid glands ranged from  $2.50 \pm 0.58$  mm to  $5.33 \pm 1.53$  mm.

Gartner and Hiatt<sup>7</sup> stated that each parathyroid gland is about 4 mm wide. According to Berkovitz<sup>4</sup> each parathyroid gland is 3-4 mm across. According to Becker et al<sup>10</sup> each parathyroid gland ranges from 2-4 mm in width. Schwartz et al<sup>11</sup> observed that each parathyroid gland is 3 mm wide. Greenfield et al<sup>9</sup> stated that each normal parathyroid gland is 3-4 mm wide. Paloyan et al<sup>1</sup> stated that each parathyroid gland measured approximately 0.4 cm in width.

The findings of the present study has got similarity with the findings of Gartner and Hiatt<sup>7</sup>, Berkovitz<sup>4</sup>, Becker et al<sup>10</sup>, Schwartz et al<sup>11</sup>, Greenfield et al<sup>9</sup>, Paloyan et al<sup>1</sup>.

In the present study the mean  $\pm$  SD thickness of parathyroid glands ranged from  $1.25 \pm 0.50$  mm to  $2.83 \pm 0.29$  mm.

Gartner and Hiatt<sup>7</sup> stated that each parathyroid gland is about 2 mm in thickness. According to Berkovitz<sup>4</sup> each parathyroid gland is 1-2 mm from back to front. According to Becker et al<sup>10</sup> each parathyroid gland ranged from 0.5-2.0 mm in thickness. Greenfield et al<sup>9</sup> stated that each normal parathyroid gland is 0.5-2 mm thick. Paloyan et al<sup>1</sup> stated that each parathyroid gland measured approximately 0.2 cm in thickness.

The findings of the present study corresponds with the findings of the Gartner and Hiatt<sup>7</sup>, Berkovitz<sup>4</sup>, Becker et al<sup>10</sup>, Greenfield et al<sup>9</sup>, Paloyan et al<sup>1</sup>.

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