

# DIFFERENT SHAPES OF THE HUMAN PINEAL GLAND – A STUDY ON 60 AUTOPSY CASES

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## Abstract

**Context:** The pineal gland has been described as an endocrine or neuroendocrine gland; however, its functions in humans are still to be defined. Different shapes of the human pineal gland have been identified. Due to its small size and different shapes recognition of this gland is much critical. Besides, due to its cellularity it may be mistaken for a neoplasm. Hence, a sound knowledge on different shapes of the pineal gland is essential for neurosurgeons, radiologists and pathologists for better diagnosis and management of pineal disorders.

**Methods:** A descriptive study was done in the Department of Anatomy, Dhaka Medical College, Dhaka, from July 2009 to June 2010, to see the morphological shape of the human pineal gland. The present study was performed on 60 human pineal glands collected from whole human brains of unclaimed dead bodies that were under postmortem examination in the Department of Forensic Medicine, Dhaka Medical College, Dhaka. The pineal gland was collected from the brain by meticulous dissection. Then, the shape of the pineal gland was observed under the magnifying glass.

**Results:** In the present study, pea-shaped pineal glands were found 60% in group A, 30% in group B, 5% in both group C and D, while pine cone shaped were found 25% in group A, 37.5% in group B, 25% in group C and 12.5% in group D. Besides, fusiform shaped glands were found 18.2% in group A, 63.6% in group B, 9.1% in both group C and D, where as piriform shaped found 66.7% in group B, and 16.7% in both group C and D. Moreover, cone-shaped glands were found 28.6% in group B, 57.1% in group C and 14.3% in group D.

**Key words:** Human pineal gland, Shape of pineal gland, Autopsy.

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## Introduction:

The pineal gland (or pineal body) has been described as an endocrine or neuroendocrine gland; however, its functions in humans are still to be defined<sup>1</sup>. Researchers also stated that the pineal gland is a small endocrine gland in the vertebrate brain. It produces the serotonin derivative melatonin, a hormone that affects the modulation of wake/sleep patterns in the circadian rhythms and seasonal functions<sup>2</sup>. Pineal pathology especially pineal tumours (pineocytomas/ pineoblastomas) may manifest as consequence of their pressure effects and consist of visual disturbances, headache, mental deterioration, and sometimes dementia-like behaviour etc.<sup>3</sup>. One of the important goals of the neurosurgery is

recognition of normal pineal structure in the cerebral hemisphere. However, sometimes small tumours, cysts or even brain matter can be mistaken for localization of the pineal gland. Hence, due to its small size and different shapes recognition of this gland is much critical<sup>4</sup>. Besides, due to its cellularity (in relation to the cortex and white matter), it may be mistaken for a neoplasm<sup>5</sup>. It is also important for radiologists and pathologists to differentiate the normal pineal from any neoplastic growth, secondary metastasis, cyst or even aneurysm whenever investigating the diseases of the pineal gland or of any other related structure in the cerebral region<sup>5-7</sup>. Therefore, sound knowledge on different shapes of the pineal gland is essential for

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neurosurgeons, radiologists and pathologists for better diagnosis and management of pineal disorders. The present study was aimed to see the variations in shape of the pineal gland and compare with the previous studies and available text references.

### Methods:

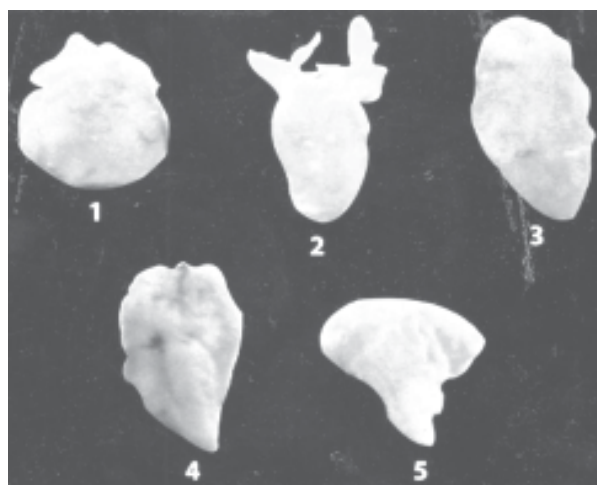
A descriptive study was done in the Department of Anatomy, Dhaka Medical College, Dhaka, from July 2009 to June 2010, to see the morphological shape of the human pineal gland. The present study was performed on 60 human pineal glands collected from whole human brains of unclaimed dead bodies that were under postmortem examination in the Department of Forensic Medicine, Dhaka Medical College, Dhaka. After the legal formalities, whole of the human brain was collected within 24-36 hours of death. During collection of the samples, appropriate age, sex and the cause of death were noted from the morgue's record book. The samples were brought to the Department of Anatomy, Dhaka Medical College, Dhaka. The samples were tagged immediately bearing code numbers for subsequent identification. Soon after collection, each sample was gently washed with tap water on a dissection tray. Blood and blood clots were removed as far as possible.

*Preservation of brains:* After collection of whole brain, 100ml of 40% formaldehyde solution was injected by using a 50cc syringe into the brain through the surfaces (superolateral and inferior surfaces). Then it was preserved in 40% formaldehyde solution for 15 days. After 15 days the pineal glands were collected from the preserved brains and the pineal gland fixed in 10% formol saline solution.

*Procedure of collection of pineal gland from preserved brain:* After fixation of the whole of the human brain, the pineal gland was collected by the following steps:

At first, the fingers were placed in the medial part of the horizontal fissure of the left half of the cerebellum and it was separated. Thus the total of the superior and parts of the middle and inferior cerebellar peduncles were exposed. The thin layer of the white matter near the posterior

border of the cerebellum was picked up by using a blunt forceps. Exposing the superior cerebellar peduncles, the pineal gland was identified in between the depression of the superior colliculi and observed that it was attached to the dorsal surface of the brain, at the junction of the midbrain and the diencephalon and inferior to the splenium of the corpus callosum<sup>8</sup>. An incision of about 1-2 cm was given through the splenium of the corpus callosum to approach the pineal region. The pineal gland was taken out from the diencephalon with a careful semilunar cut<sup>9</sup>. The pineal gland was cleared up from other tissues. Then, the shape of the pineal gland was observed under the magnifying glass (Fig.1) and noted down.



**Fig.-1:** Different shapes of the pineal gland seen through magnifying glass (1. pea shaped, 2. pine-cone shaped, 3. fusiform shaped, 4. cone shaped, 5. piriform shaped).

*Common exclusion criteria:* i) Decomposed body, ii) any history of injury to the head, iii) any suspected pathology of the pineal gland seen by naked eyes, and iv) if the whole of the pineal gland is not available during dissection.

*Grouping of the sample:* For convenience, all the samples were categorized in four age-groups including A (15-30 years), B (31-40 years), C (41-50 years) and D (>50 years), according to Golan et al. (2002)<sup>10</sup> (Table-I).

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

**Results:**

In the present study, pea-shaped pineal glands were found 60% in group A, 30% in group B, 5% in both group C and D, while pine cone shaped were found 25% in group A, 37.5% in group B, 25% in group C and 12.5% in group D. Besides, fusiform shaped glands were found 18.2% in group A, 63.6% in group B, 9.1% in both group C and D, where as piriform shaped found 66.7% in group B, and 16.7% in both group C and D. Moreover, cone-shaped glands were found 28.6% in group B, 57.1% in group C and 14.3% in group D (Table-II, Fig. 2).

**Table-I**

*Grouping of the sample of the present study (n = 60)*

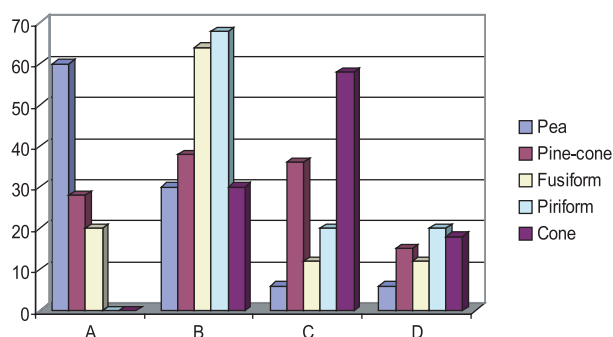
| Group | Age limit   | Number of samples |        |
|-------|-------------|-------------------|--------|
|       |             | Male              | Female |
| A     | 15-30 years | 09                | 09     |
| B     | 31-40 years | 17                | 08     |
| C     | 41-50 years | 08                | 03     |
| D     | >50 years   | 06                | 00     |

**Table-II**

*Shape of the pineal gland in different age group*

| Age group | Pea (n=20) | Pine-cone (n=16) | Fusiform (n=11) | Piriform (n=6) | Cone (n=7) | P value |
|-----------|------------|------------------|-----------------|----------------|------------|---------|
| A(n=18)   | 12 (60%)   | 4(25%)           | 2(18.2%)        | -              | -          | <0.05*  |
| B(n=25)   | 6 (30%)    | 6(37.5%)         | 7(63.6%)        | 4(66.7%)       | 2(28.6%)   |         |
| C(n=11)   | 1 (5%)     | 4(25%)           | 1(9.1%)         | 1(16.7%)       | 4(57.1%)   |         |
| D(n=6)    | 1 (5%)     | 2(12.5%)         | 1(9.1%)         | 1(16.7%)       | 1(14.3)    |         |

Figures in parentheses indicate percentage. Statistical analysis done by Chi-square (c<sup>2</sup>) test, \* = significant.



**Fig. 2:** Shape of the pineal gland in different age group.

**Discussion:**

Different shapes of different morphologic characteristics of the pineal gland were found depending on age in the present study. Kelly, Wood & Enders (1984)<sup>11</sup> noted the pineal gland as a cone-shaped appendage of the brain. Berkovitz & Moxham (1988)<sup>12</sup> stated that the pineal gland is a fusiform organ. According to

Williams et al. (1989)<sup>13</sup>, the pineal gland is a small, piriform, reddish-grey organ. Rogers & Jacob (1992)<sup>14</sup> stated that it is a pea-shaped structure. Fawcett (1994)<sup>15</sup> noted that it is a conical grey body. Reuters (2001)<sup>16</sup>, Docherty (2007)<sup>17</sup> and Nolte (2009)<sup>18</sup> found the pineal gland to be a small pine-cone shaped structure. Mescher (2013)<sup>19</sup> stated that the pineal gland is a flattened conical organ. According to Ross & Pawlina (2011)<sup>1</sup> and Gartner & Hiatt (2014)<sup>20</sup>, the pineal body is a small pine-cone shaped endocrine gland. The results of the present study are more or less similar with the previous studies and text references. Similar studies were done on human parathyroid glands<sup>21</sup> and adrenal glands<sup>22</sup> based on autopsy findings in the same teaching institution & hospital.

**Conclusion:**

Age related changes were found in morphological features of pineal gland. In young

adults, the shape of the pineal gland usually remains pea shaped. With increasing age, it becomes irregular and fusiform, piriform or cone/pine-cone shaped. To the best of our knowledge, this was the first ever experiment done in our country on pineal gland. The results of the present study can be used as a standard reference for the shape of the pineal gland of Bangladeshi people and to determine the abnormal evidences in forensic and pathological cases.

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