A Postmortem Histological Study on Percentage Volume of Parenchyma and Stroma of the Human Parathyroid Glands

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ABSTRACT

A cross-sectional descriptive study was performed in the Department of Anatomy, Dhaka Medical College, Dhaka, from January to December 2008, on post mortem parathyroid glands of 60 Bangladeshi people in different age groups. A total of 207 parathyroid glands were identified in relation to posterior border of thyroid lobes and collected from those 60 cadavers. The samples were collected from the unclaimed dead bodies within 24 hours after death that 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 three groups are group A (10-30 years), group B (31-60 years) and group C (61-90 years). From each group, 20 best prepared slides were taken for examination. The percentage volume of parenchyma (glandular portion) and stroma (fibrous part with blood vessels and fat) were estimated by the point counting technique with Zeiss-I integrating eyepiece under the light microscope at low magnification. The mean SD percentage volume of parenchyma varies 64.88 2.75 to 65.90 2.33 in group A, 56.40 12.57 to 59.10 3.87 in group B and 38.80 2.77 to 41.50 2.38 in group C. In contrast, the mean SD percentage volume of stroma varies 33.50 2.27 to 34.88 2.95 in group A, 40.30 3.83 to 41.56 4.16 in group B and 58.50 2.38 to 61.20 2.77 in group C. The percentage volume of connective tissue stroma was found to increase with increasing age with simultaneous decrease in glandular parenchyma.

Key words: Parathyroid gland, histology, parenchyma, stroma

Introduction

The parathyroid glands are small endocrine glands, usually lying between the posterior lobar borders of the thyroid glands and its capsule. The parenchyma of the parathyroid glands consists of three types of cells; the chief cell, the oxyphil and water-clear cell, which are embedded in fibrous stroma containing blood vessels with varying amounts of fat cells, depending on the patient's age and amount of body fat. 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, as because the parathyroids were damaged or removed simultaneously. MacCallum and Voegtlin had solved this confusion by showing that extirpation of the parathyroids alone led to tetany, and administration of calcium prevented tetany in parathyroidectomized animals. Thus ended a long period of time between anatomic discovery and realization that the endocrine function of the parathyroid gland was related to calcium homeostasis. However, basic features like volume of functioning glands and stroma and their functional correlation are still in controversy. Moreover, it has been observed by reviewing the literature and the texts that several works have been done on functional...
with xylene, infiltrated and embedded in paraffin. Paraffin blocks were cut at 5 μm thickness and were stained with routine Harris’ haematoxylin and eosin (H & E) stain.

Estimation of percentage volume proportions of parenchyma and stroma:

20 best prepared slides were taken from each age group. The percentage volume proportions of parenchyma and stroma of parathyroid gland was determined with the point counting technique described by Aherne and Dunnill9. Point counting Zeiss I integrating eyepiece was prepared in a transparent plastic sheet and was placed into the eyepiece. This eyepiece contains a point network of 25 points spaced at 70 μm, arranged within a circle which delimits the counting field. The light compound microscope which was used for the microscopic measurement was OLYMPUS CHB, made in Tokyo, Japan. The point counting was done at low magnification ( 10 objective 10 eyepiece). The position of each point falling on any structural component was recorded for each field. Then the eyepiece was rotated 90° keeping the field constant. Again the position of each point was recorded. Thus 50 points were recorded for each field. Five such fields or 250 points were studied on each section. The total number of points fitting each component was summed up and expressed as a percentage of the total number of points fitting the structural component of parathyroid glands. This percentage represents the percentage volume proportions of parenchyma and stroma.

Statistical processing of data

The data collected were processed and statistical analyses were done by using SPSS version 11.0. Comparison between superior and inferior parathyroid glands of right and left side was done by unpaired Student’s ‘t’ test, and comparison between different age group was done by One way ANOVA (PostHoc).

Ethical Clearance

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

According to Rosai10 the average percentage of stroma in the adult parathyroid is about 40%. According to Gartner and Hiatt2, the connective tissue stroma in older adults may occupy up to 60% of the gland. Ross and Pawlina3 stated that the connective tissue is more evident in the adult, with the development of fat cells that increase with age and ultimately constitute as much as 60-70% of the glandular mass. Bevelander and Ramaley11 stated that the connective tissue stroma in older adults may occupy up to 50-80% of the gland volume. MacSween and Whaley12 stated that stroma constitutes up to 30% of the normal adult gland. The findings of the present study have got similarity with the findings of the Gartner and Hiatt2, Ross and Pawlina3, Rosai10, Bevelander and Ramaley11. However, the amount stated by MacSween and Whaley12 is lower than that of the present study. The difference in value may attribute racial variation or difference in sample preparation and histological technique.

Conclusion

In the present study, the percentage volume of connective tissue stroma was found to increase with increasing age with simultaneous decrease in glandular parenchyma. Further studies with larger samples and highly sophisticated technical backup, e.g. computerized stereotechnique, are recommended.

Table-I: Grouping of the sample in relation to age

<table>
<thead>
<tr>
<th>Group</th>
<th>Age limit in years</th>
<th>Number of person</th>
<th>Number of collected parathyroid glands</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>10-30</td>
<td>27</td>
<td>93</td>
</tr>
<tr>
<td>B</td>
<td>31-60</td>
<td>28</td>
<td>98</td>
</tr>
<tr>
<td>C</td>
<td>61-90</td>
<td>5</td>
<td>16</td>
</tr>
</tbody>
</table>
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References