that in our case the bowel showed no ulceration but a healthy condition of the mucous membrane may have contributed to the favourable result.

THE SCIENCE COMMITTEE

OF THE

British Medical Association.

REPORT XCII.

OBSERVATIONS ON THE PARATHYROIDS AND ACCESSORY THYROIDS IN MAN.

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[PRELIMINARY COMMUNICATION.]

SANDSTRÖM, who in 1880 first described the parathyroid glands, concluded from his observations that these bodies were embryonic, their microscopical appearance being similar to that of the thyroid gland in its first stage of development. This view was independently advanced by Baber, and remained unchallenged for over ten years until the experimental work of Gley, Moussu, Vassale and Generali, Kohn, Edmunds and others claimed a greater importance for the glands. Briefly put, the conclusion of these observers is that the parathyroids are not merely embryonic rests of thyroid tissue, but organs with a proper function, the loss of which entails a speedy death. Other workers, however, among whom are Hürthle and Zielinska, adhere to the older view, and more recently Vincent and Jolly have cast serious doubt on the reliability of past experimental work.

At the present time the conflict of opinion is sharp. Our lack of knowledge of the anatomy, distribution, histological variations and pathology of the glands debars us from correctly appraising their value, renders attempts at their complete removal uncertain and the results of the operation inconclusive. It therefore seemed to me that an investigation of these aspects was essential to a settlement of the question, and could not fail to bring to light facts of importance. I have accordingly been working on these lines for the past few years, and have examined the parathyroids in a number of human beings and in over seventy different species of animals. The present preliminary communication is to record some of the facts elicited by an examination of nearly sixty human subjects.

MODE OF INVESTIGATION.

The procedure adopted was the following: The subjects, which were not specially selected, except in so far as to include a variety of diseases, were examined as soon after death as practicable. A median incision was carried from the chin to the sternum; the sterno-hyoid, sterno-thyroid, omo-hyoid, and, if necessary, sterno-mastoid muscles, were reflected, and the thyroid gland exposed. This, or one of its lobes with the corresponding part of the isthmus, was freely removed, together with all the connective tissue, fat, etc., in the neighbourhood, and a search for suspicious-looking glandular bodies made in the tissues remaining from the jaw to the sternum. The structures excised were at once dissected, and every gland without exception preserved for future microscopical examination. The thyroid itself was carefully cleaned, and all bodies found on its surface retained for similar purpose. A sketch having been made of the thyroid to record the position, size, appearance, etc., of the specimens, the glands were placed in one of various fixatives, precautions being observed to facilitate the identification of each at later stages. The thyroid itself was fixed entire for twenty-four hours, and then cut into thin slices 2 to 3 mm. thick, and the surfaces of each slice examined with a magnifying lens. Every section which showed at any place any deviation from the usual vesicular appearance of thyroid tissue was retained for microscopical identification. This detailed examination ensured, I be-

lieve, that, with the exception to be mentioned immediately, no parathyroid either embedded in the thyroid or on its surface or in its neighbourhood could escape detection, while few if any lying between the jaw and sternum would be overlooked. The exception referred to is that of the parathyroid which Welsh calls the posterior superior parathyroid, and which he has shown to bear a very constant relation to the oesophagus and pharynx, lying almost invariably on the posterior wall at or near the junction between the two. Accepting this observation, I restricted my attention to parathyroid glands other than this constant one.

NUMBER OF PARATHYROIDS.

The number of the parathyroids in man, as in many animals, is stated to be two on each side. I find the number to be very variable. Excluding the above-mentioned posterior superior parathyroid, I have found on one side of the neck one parathyroid to be present in less than half the cases, two in about one-quarter the cases, in a few cases three, in two cases four, in two cases five, and in one case six parathyroids. In a few subjects no parathyroid at all was found. Other observers have failed to discover any gland in certain individuals, and I am inclined to doubt the conclusion that this result necessarily implies imperfect search.

POSITION.

This is inconstant, and there is rarely symmetry between the two sides. The most frequent site is on the lateral surface of the thyroid gland, at or near its posterior border beneath the inferior thyroid artery (that is, at the junction of the middle and lower thirds of the thyroid); more than one-third the total number of parathyroids found lay in this locality. A corresponding position, but at the junction of the superior and middle thirds of the thyroid, and therefore above the inferior thyroid artery, constituted the next commonest site, for here over a quarter of the number revealed themselves. Another fifth had taken up positions at the inferior pole of the thyroid or in the adjacent connective tissue; others lay buried in the substance of a thyroid lobe, giving no sign of their presence on the surface. Lastly, in a few instances the gland was found at the oral pole of the thyroid, in a few on the tracheal surface of the thyroid, discoverable only after dissecting the latter from the trachea. In one case a parathyroid found shelter behind the upper part of the sternum. In no dissection did I find a glandule at any great distance anterior to the thyroid gland.

APPEARANCE.

The parathyroid cannot be identified with certainty except by microscopical examination. In its more typical appearance and at its commonest sites it may be recognized with a high degree of probability, but many specimens which I believed to be either lymphatic gland, accessory thyroid, or fat, disclosed in the event parathyroid structure, and, per contra, glands whose features suggested a parathyroid nature proved to be lymphatic, thymic, or thyroid. The most characteristic form for the parathyroid to exhibit is that of an elongated, slightly flattened, ovoid body, of a pale pink hue, with a smooth surface, on which ramify a few branching vessels. Part of it has the yellow appearance of ordinary adipose tissue, and there is frequently a distinct line of demarcation between the pink and yellow. Sometimes the gland presents few features save those of a nodule of fat; on other occasions fat is entirely absent, and the appearance is that of a lymphatic gland or thymic residue. In others, again, the gland is dark and brownish, suggesting an accessory thyroid, while rarely it is absolutely black, like many bronchial glands. A few specimens were found to consist of thyroid and parathyroid tissue, of lymphatic and parathyroid tissue, or of thymus and parathyroid tissue. In one instance thyroid, parathyroid and thymus tissue appeared in the same section. In every case, however, the parathyroid tissue was isolated by interposing connective tissue. In size the parathyroid varies from little more than a pinpoint up to nearly 2.5 cm.

AGE.

A reference to the ages of the subjects examined shows that parathyroids occur in greatest number in the first year of life, and that from that period to old age they are found with progressively decreasing frequency. Under

1 year of age as many as four, five, or six parathyroids were discovered; between 1 year and 10 years the greatest numbers found were three and four; above 10 years the number never exceeded two. In subjects beneath the age of 20 I never failed to find parathyroids; above 20 they might be absent.

RELATION TO ACCESSORY THYROIDS.

Accessory thyroids were frequently found. Their three commonest sites are the three commonest sites of occurrence of the parathyroids. They are rarely found in subjects beneath the age of 1 year; thereafter they appear more commonly and attain a maximum between the ages of 30 and 60. The relation between the number of parathyroids and the number of accessory thyroids shows a striking fall with increasing age. Within the first twelve months after birth I found parathyroids to be more than seven times as common as accessory thyroids; between the first and fifth years three and a half times; between the sixth and tenth one and a half times; while between the eleventh and twentieth years equality is established. From the last-mentioned year onwards the preponderance goes to the accessory thyroids, and with every successive decade up to the seventh becomes more marked.

Although the present series of subjects examined is the largest recorded, its number is not great enough to allow statistics drawn from it to be accepted without any reserve. On the other hand, the relationship between the parathyroids and age, between the parathyroids and accessory thyroids, and between accessory thyroids and age, is so clear as in my mind to be strong evidence against admitting for the parathyroids that physiological value attached to them by so many experimenters.

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REPORT XCVIII.

THE INFLUENCE OF INCREASED BAROMETRIC PRESSURE ON MAN—SATURATION OF THE TISSUE FLUIDS WITH NITROGEN.

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In my last report,¹ it was stated that researches were in progress regarding the time relations of the saturation with gas which follows exposure to compressed air. It will be convenient to summarize here the chief results of our investigations relative to this problem.²

As stated in my earlier note, the urine secreted after drinking large quantities of warm water was used as a measure of tissue-fluid saturation. The subject of an experiment drank about a quart of warm water and after an interval of ten to fifteen minutes was compressed in our steel cylinder. Directly the desired pressure had been attained, he emptied his bladder; ten minutes later, more urine was passed and a sample collected in a glass bulb with rubber junctions, air and froth being carefully excluded. The junctions were then clamped and the sample preserved for analysis, the dissolved gas being pumped out by means of Hill's blood pump and measured in a finely graduated eudiometer tube. The composition of the gas was then determined by the ordinary potash and pyrogallate method. The accuracy of this process was tested by submitting a sample of boiled water to a vacuum in the Hill pump and proceeding exactly as in the urine analysis. No measurable gas was obtained, so that the error due to leakage may be regarded as inappreciable.

The object of completely emptying the bladder at each stage is to avoid the admixture of urine that had collected in the bladder while under a higher (or lower) pressure, since this would lead to serious errors. I think we have avoided this source of fallacy completely. Thus, if on arriving at a pressure of + 30 lb. the bladder is completely

emptied, then any urine passed, say, ten minutes later, must have been separated from the blood while under a pressure of + 30 lb., except the amount present in the renal tubules and pelvis. Unless the total quantity passed be very small the error due to urine from the last two sources is negligible.

A necessary preliminary was the determination of the mean quantity of nitrogen in our urine under normal circumstances. Six analyses were made, and the mean volume of dissolved nitrogen per 100 c.cm., reduced to 760 mm. Hg pressure and 0° C., was found to be 1.14 c.cm.

The individual observations, made at different times of day and under different circumstances—1.21, 1.19, 0.97, 1.10, 1.31, 1.07, 1.14—exhibit so small a range of variation that we feel entitled to conclude that in our own cases the coefficient of solubility for atmospheric nitrogen is between 0.11 and 0.12. Naturally, deviations from this value to the extent of ± 0.03 could not be regarded as necessarily significant. As will be seen below, our experiments show deviations for the most part well beyond these limits.

A typical example of our results is the following:

Experiment 31 (May 31st, 1906).

M. G., compressed to + 30 lb. in ten minutes (2.50 p.m.). The bladder was then emptied, and at 2.55 emptied again, 135 c.cm. of urine being passed, and Sample 1 was collected.

2.36. Decompression commenced.

3.20. (+ 15 lb.) the bladder was emptied again (320 c.cm.).

3.45. Decompression completed, bladder emptied again (310 c.cm.).

4.1. Another sample taken (135 c.cm. passed).

At 4.55 and 6.10 other samples were taken.

Analysis.

Sample.	Time and Pressure.	Percentage of Nitrogen.	Calculated N ₂ per Cent. supposing Urine followed the Pressure.
1	Passed after 5 mins. under 30 lb.	2.522	$1.1 \times 3 = 3.3$
2 and 3	Were spoiled	—	—
4	At normal pressure 16 mins. after decompression	2.373	1.1
5	70 mins. after decompression.	1.107	1.1
6	245 mins. later.	1.023	1.1

The mean results of our whole series of experiments are given in the next table.

TABLE I.—Urine Analysis from Hill and Greenwood's Individual Observations.

Pressure and Exposure.	Mean Percentage of Nitrogen Found.	Calculated Percentage supposing Urine followed the Pressure.
+ 0 (Normal)...	1.14	1.1
+ 30 lb. for less than 10 mins. ...	1.99	3.3
+ 30 lb. for more than 10 mins....	3.32	3.3
+ 45 lb. for less than 10 mins. ...	4.29	4.4
+ 45 lb. for more than 10 mins....	4.23	4.4
+ 30 lb. during decompression...	3.63	3.3
+ 15 lb. during decompression...	2.75	2.2
+ 0 lb. on decompression ...	1.99	1.1
+ 0 lb. 15 mins. after decompression ...	1.64	1.1
+ 0 lb. more than 15 mins. after decompression ...	1.13	1.1

A glance at this table makes it clear that although saturation of the tissue fluids with nitrogen up to the theoretical value is rapidly attained, desaturation is a slow process. Even with a decompression rate of twenty minutes for each atmosphere of positive pressure, equilibrium has not been established on leaving the air chamber, nor is it complete fifteen minutes later; that is