ON TUMORS OF THE PARATHYROID GLANDS.*

FRANCIS HARBITZ.

(*Professor of Pathology, University of Christiania, Norway.*)

The normal functions of the parathyroids are now in certain respects well known, as a result particularly of a number of physiological experiments. In the Norwegian medical literature there has recently appeared a rather important contribution by Tanberg,[1] who studied systematically the results of incomplete and complete extirpation of the parathyroids in cats (controlled by careful microscopic examination), and this investigator has differentiated the acute and the chronic tetany which is seen to develop under these conditions. Clinical observations in cases where the thyroid and the parathyroids have been removed at operation confirm the correctness of these results, and make it appear probable that these ductless glands, which must be regarded as essential to life, have a similar function in the lower animals as in man.

On the other hand, pathological and clinical observations have hitherto been unable to contribute to a marked extent toward our enlightenment as regards the functions of these organs. So far there are few definite observations recorded regarding pathological changes in the glands and the interpretations of these changes are vague. As an example may be mentioned the great variety of opinions regarding the significance of hemorrhages of the parathyroids. Some regard these as merely incidental, especially in small children, and without importance except as an agonal phenomenon,[2] while others regard them as a direct cause of death, as in tetany. A like difference of opinion exists regarding the significance of the degenerative and atrophic as well as the hyperplastic processes that are occasionally encountered in the parathyroids.

The significance of the tumors and tumor-like formations

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that are occasionally found in these glands is still less clearly understood. Indeed, they are mentioned so seldom, at least in the older literature, that scarcely more than ten or fifteen cases have been reported, and even a few of these are of an uncertain character. A review of these cases reveals the fact that the majority have been found accidentally at autopsy, and that no significance in relation to the cause of death has been attributed to them, nor in fact to the cause of symptoms, except in rare instances, and then not symptoms of a character that would have any bearing on the functions of the glands.

I have so far been able to find the following cases reported:

De Santi[3] (1900) found a large vascular tumor of the thyroid gland in a man 58 years of age; it was removed at operation, because the man suffered from hoarseness, dyspnea, and cough. Microscopical examination showed that the tumor consisted of parathyroid tissue. Further facts are not given.

Benjamins[4] (1902) describes a tumor in a man 57 years of age, removed at operation, and the size of a child's head, which, from its situation and structure, came from the parathyroid gland. The tumor was round, definitely circumscribed, of slow growth, showed no invasion of the surrounding tissue and no metastasis. It was normal solely on account of its mechanical disturbance.

Erdheim[5] (1903). — At autopsy of an 18-year-old boy there was found incidentally at the side of the thyroid gland a small, soft, oval, light red tumor, 2½ x 1½ centimeters in size. In structure it resembled the parathyroid. The tumor was diagnosed as an adenoma.

Huls[6] (1904). — In an old woman who died of concussion of the brain there was found in the atrophied thyroid gland a round tumor, size 2½ x 2½ x 2 centimeters, which was definitely circumscribed and resembled the parathyroids in structure.

McCallum[7] (1905). — In a 26-year-old man, who died of chronic nephritis, there was found, near the lower pole of the right lobe of the thyroid, a round tumor about 2 centimeters in diameter. The tumor was well encapsulated, of a soft consistency and yellowish white in color. It was a real adenoma with a structure typically that of the parathyroids.

Weichselbaum[8] (1906). — In a woman who died of pneumonia the upper left parathyroid was found to have become changed into a flat tumor (4.3 x 3.6 x 1 centimeters) which was soft and of a grayish red color. The tumor contained typical thyroid cells, also some oxyphicle cells; some of the cell groups contained lumina. Weichselbaum regards the tumor as an adenoma or simple hypoplasia.

During the discussion Askanazy reported that he had also found a tumor of the parathyroid in a case of osteitis deformans.

Verbitz[9] (1907) found at autopsy a diffuse hypoplasia of one of the parathyroids (2½ x 1¾ x 1½ centimeters), with new growth of epithelial tissue and especially of the oxyphile cells. He regards the growth as an adenoma.

Langhaus[10] (1907) mentions in his Group VI. the parastruma previously described by Th. Kocher, Jr., and he now adds four "parastrumas" of his own which apparently have their origin from the parathyroids. They were large nodular growths, characterized by small light eosin-staining cells, rich in glycogen; also large clear polyhedral cells with occasional lumina in the epithelial cell groups, and papillæ in some places. At other places were structures resembling the ordinary colloid tumor of the thyroid. Langhaus for this reason finds it difficult to exclude the possibility of involvement of the thyroid. The tumors that were within the thyroid were usually very large and occasionally malignant. In one case there was carcinomatous as well as sarcomatous tissue with metastasis in the lymph glands and lungs; in another case metastases in the scapula, in another involvement of the blood vessels. Kocher, Sr., suggests as a term for these tumors "Parastruma Carcinomatos Sarcomatosa." He regards it as established that these tumors originate in the parathyroids and believes one should always bear in mind a parastruma when one encounters a hard, nodular, not very large tumor near the jugular, which gives definite symptoms (dyspnea, hoarseness, pain or swelling).

From the work of Langhaus, Kocher, Sr.,[11] and Kocher, Jr.,[12] one can hardly feel convinced that these tumors really originate in the parathyroids. The tumors lay within the thyroid and their origin must therefore have been in these glands. Langhaus also admits that their structure approaches that of a tissue that in every way resembles the thyroid. The anatomical evidences brought forward, cell formations, glycogen content, etc., can hardly be considered as convincing. The nine cases mentioned cannot, therefore, with certainty be considered as parathyroid tumors, in our opinion and in the opinion of others (Cf. Aschof's text-book, Vol. II., chapter by Gierke).

Thompson and Harris[13] (1908). — In a 23-year-old woman there was removed at operation a large tumor (15 x 10 x 6 centimeters, weight, 250 grams) which was nodular, firm, of variable structure, which on the whole, however, corresponded to that of the parathyroids. It also contained small cysts, with papillar and compact groups of cells atypical in structure.

Strada[14] found one of the parathyroids hyperplastic and considerably enlarged in a case of osteomalacia.

Erdheim and Bauer.[15] — In a 45-year-old woman, who died of nephritis and with moderate degree of osteomalacia, there was found an adenoma of one of the parathyroids.

Finally, there has recently appeared an important treatise on tumors of the parathyroids by Molineus.[16] In three cases of osteomalacia (or osteitis deformans) there were found tumors in these glands: (a) In a 74-year-old woman, a tumor, size 2.7 x 1.7 x .7 centimeters in the parathyroid gland; (b) in a 59-year-old woman one of the parathyroids was found transformed into a tumor-like mass, size 2.7 x 1.8 x .8 centimeters, and (c) in a woman 48 years old all four of the parathyroids were enlarged to about 2 centimeters in diameter. Microscopically there were found hyperplasia of the small fat-free oxyphile cells; also in two cases small circumscribed adenoma-like structures, composed largely of oxyphile cells and with colloid spaces. Molineus adds that in two other cases of osteomalacia no hyperplasia of the parathyroids was found.

Todyo and Hohlbaum have also described hyperplasia, and Weichselbaum found tumors of the parathyroid in two cases, 18 and 19 years old respectively, of late rickets.

Thus we see that there has already been described a considerable number of tumors of the parathyroids. Most of the cases have been accidental discoveries at autopsy, and small tumors in a single parathyroid, the size averaging from two to two and one-half centimeters in diameter, the consistency soft and the color a grayish red (Erdheim, Hulst, McCallum, Verbitz, Weichselbaum). In a few cases the tumors were larger and because of pressure on the surrounding structures (trachea, nerves, etc.) they were removed by operation (De Santi, Benjamins, Thompson and Harris) and yet the last cases were so few and so meagerly described as regards structure that one can hardly draw any certain conclusions from them as to whether the point of origin was really the parathyroid; this applies also to the interesting and important reports by Langhaus and the Kochers. In some cases the growth has been so small and involved the entire organ so uniformly that it has rightly been questioned whether there was only hyperplasia of the organ and no real tumor. There is, to be sure, no sharp distinction between these two, and there seem to be cases which are associated with an enlargement of one, several or all of the parathyroids

(rickets and other diseases affecting the bones). Most of the reported cases, however, should be regarded as tumors, as adenomas or "struma" of the parathyroids, since they possess the typical characteristics, clinically and anatomically, of benign tumors. Concerning malignancy, infiltrating growth, and metastases, mention is made only in the reports of Langhaus and the Kochers. But in these cases, as mentioned previously, we are not certain that we are really dealing with tumors of the parathyroids.

To the literature as detailed I can now add two new cases of tumors of the parathyroids, one being an instance of symmetrical tumors. An interesting feature of these cases is also found in the fact that in one case osteomalacia was present, in the other paralysis agitans, so that the question of an etiological relationship at once presents itself.

Case I. — Adenoma (struma) of the parathyroid, with osteomalacia. In a woman 26 years old, who suffered from osteomalacia, there was accidentally discovered a tumor of the neck which proved to be an adenoma of the parathyroid gland. There was a history of anemia in early youth; she had four children, the first two at intervals of two years, the last with one year interval. Last birth was in the latter part of 1912. The child was breast fed but died a few weeks later. Later she had an attack of nephritis and early in the spring of 1913 showed symptoms of osteomalacia. The latter disease at first affected the extremities, causing fractures of one hip, humerus and a rib; it increased gradually and finally involved the entire skeletal system, causing death July 31, 1914. In April, 1914, there was an oophorectomy made by Prof. P. Bull, but apparently without marked effect.

At autopsy there was found as the immediate cause of death pulmonary tuberculosis (caseous bronchopneumonia). There was also a chronic interstitial nephritis, associated with pyelitis and calcareous concretions of phosphates and carbonates. There were marked changes in the osseous system. The ribs were very brittle, osteoporotic, and could be easily cut with a knife. They contained a grayish red marrow. The right femur and left humerus were greatly shortened, thick and plump, partly on account of the outgrowth of uncalcified porous bone around the diaphysis, partly on account of several fractures with large calluses and displacement of the fractured parts. The bones were soft, porous, and could easily be cut with a knife. The cortex was thin, brittle and easily broken. The medullary cavity was large and filled with a grayish red marrow; it also contained several large smooth-walled cysts, especially in the region near the calluses. The cysts were 5.6 up to 7 centimeters in

diameter and filled with a thin serous or brownish fluid. In the spongy calluses there were, besides the uncalcified bony structure, numerous small cysts filled with a mucoid fluid; also hemorrhages and a number of small brown spots. Microscopically the osseous system showed a marked atrophy of bone substance, due to bone resorption as evidenced by a large number of osteoclasts (on the other hand there were comparatively few signs of halisteresis and no definite perforating canals). There was a marked new formation of bone, with scattered numerous small bone particles at places where the bone marrow had become richly cellular. Corresponding to the brown spots there was a very richly cellular osteogenetic tissue formation, with numerous large spindle-shaped cells and many giant cells (osteoclasts), so that the tissue in many places resembled sarcoma of the spindle-celled types, but there was no evidence of tumor formation such as have been found and described in osteomalacia by Molineus.

The thymus was small, the adrenals, liver, and pancreas normal.

The thyroid glands were symmetrically developed, a trifle small in size. The structure appeared normal. Immediately adjacent to and a short distance below the gland there was an oval tumor, 3½ x 3½ x 2 centimeters, of a grayish yellow color and very soft, being almost pseudofluctuating in consistency. It was sharply defined from the surrounding tissue by a connective tissue capsule extending into the substance of the thyroid. In other words, it corresponded exactly to the location of the parathyroid. The cut surface of the tumor was somewhat even and granular. In the cortex were spaces filled with fluid.

Microscopically there appeared a uniform and regular structure (Figs. 1 and 2). A stroma of delicate vascular connective tissue, in the substance of which were compact, round, oval or elongated clusters of epithelial cells. The cells appeared to be very much alike, having round or oval nuclei uniform in size and rich in chromatin, surrounded by more or less protoplasm, which stained evenly though not deeply with eosin. In the periphery of these epithelial clusters the cells often formed into rows, yet there was no real glandular alveoli. In some there were larger cells, rich in protoplasm, but having the same uniformly-sized nuclei, being at times so confluent that the nuclei presented the appearance of bands. There was no colloid substance, no cysts nor papillæ. The tissue throughout was richly cellular, though the cells were uniform in size and typical. The structure on the whole was suggestive of a beginning adenoma of the hypophysis in a case of acromegaly; yet the cells in such tissue are usually smaller in size.

Summary. — We are therefore dealing with a tumor of one of the parathyroid glands, large, soft, richly cellular, with the structure of an adenoma, since there are no signs of atypical growth. The epithelial cells are quite regular,

rather large, inclined to be acidophilic or oxyphilic, though not markedly so. On the other hand, they do not resemble the glycogen-containing cells usually found in the parathyroids (chief cells), whose appearance is so strikingly similar to those of the adrenal cortex and in hypernephroma.

Now, has this tumor any direct etiological relation to the disease known as osteomalacia?

The experimental and physiological observations made by McCallum and by Erdheim tend to support the possibility. They found that the parathyroids are at least directly concerned in calcium metabolism. When the parathyroids are extirpated there is a marked increase of calcium in the urine, stools, and milk, and a decrease in the blood (McCallum). There is likewise a diminished amount of calcium in the enamel and particularly in the dentin of the teeth (Hohlbaum,[17] Erdheim[18]), the teeth becoming brittle and easily broken. In parathyroidectomized rats ossification ceases, spontaneous fractures occur easily, while the newly formed calluses though large in growth have a small calcium content. Just how this relationship is brought about is unsettled. McCallum and Voegtlin believe that the increased output of calcium salts from the body causes an acidosis which may result in tetany.

The pathological observations that would tend to support the view as regards the relationship between diseases of the parathyroid and osteomalacia are still very few and conflicting.

Erdheim and Bauer (loc. cit.) found in a forty-five-year-old woman, who died of nephritis and suffered from osteomalacia of intermediate degree, an enlargement of the upper right parathyroid which measured five millimeters in diameter, and had a typically adenomatous structure (large number of chief cells). This hyperplasia was regarded as a result of an increased function of the parathyroid, which caused a disturbance of calcium metabolism. Hohlbaum made a similar observation in a case of osteomalacia. Likewise Schmorl has found hyperplasia of the parathyroid in

one of every four individuals examined. A somewhat similar observation was made by Todyo,[19] who undertook a systematic investigation of the relation of the parathyroids to osteomalacia and osteoporosis. In twenty-four normal individuals he found hyperplasia in four and, on the other hand, there was hyperplasia in six of seven cases of senile osteomalacia and in eight of eleven cases of senile osteoporosis, and in one case of osteitis deformans. The hyperplasia involved one, several or all of the parathyroid glands and consisted in a proliferation of cells and the formation of cells which took a deeper stain than the chief cells. To this may be added the interesting discovery of Molineus (loc. cit.) of tumors in three cases of osteomalacia, or rather osteititis deformans. Molineus believes that there is a relationship between osteomalacia and the tumors, although no direct relationship because (among other reasons) cases of similar hyperplasia have been found without osteomalacia and osteomalacia has occurred unassociated with hyperplasia. Neither is their etiological relationship concerned with the formations of a particular type of cell.

Finally, to this may be added certain observations on the parathyroids made in cases of rickets. The opinion in regard to hyperplasia of the parathyroids in cases of rickets is voiced by Escherich and Jamase. The relationship has been anatomically considered by Weichselbaum and Erdheim. Hyperplasia occurs regularly in spontaneous rickets of white rats, and in two cases of late rickets in individuals eighteen and nineteen years old Erdheim found rather large tumors of the parathyroid. Schmorl observed hyperplasia in one case of rickets, while in three other cases the glands were normal.

The experimental observations recently reported by Bieling[20] are likewise of interest; when rickety children were fed parathyroid from sheep there was a marked increase in the deposit of calcium salts and phosphates, and a markedly increased ability to retain these salts. The feeding of thymus from calves and hypophysis from cattle gave, on the other hand, no results.

Case II. — In a child about a year old, who suffered from universal ichthyosis and died in convulsions there was found, besides intense hyperemia of the brain and membranes, an old rickets, together with hyperplasia of the lymphatic tissue (enlarged swollen thymus, weight 30 grams, and swollen lymph glands), and a marked hyperplasia of the parathyroids (Fig. 3). Three of the latter were dissected out. They were of pea size, measured 3 x 3, 4 x 2½, and 2 millimeters and were composed of an unusually large number of epithelial cells, which were polyhedral, had small nuclei and showed no marked affinity for acid stains.

These observations on cases of osteomalacia and rickets also support, to a certain extent, the theory that the parathyroids have some significance in the pathogenesis of these diseases, but in what manner and to what extent remains a question. The hyperplasia of the cells of the parenchyma would seem to indicate a hyperfunction. But the inconstant findings (adenomas, hyperplasia, or normal organs) prohibit definite conclusions being drawn as regards etiology. Neither do the observations hitherto published allow conclusions being formed as to which type of cells formed in the gland under normal and pathological conditions should be considered as being the active agent. Todyo found in his hyperplasias, associated with senile osteomalacia and osteoporosis, particularly an increase of the small indefinitely outlined cells with densely staining nuclei, which may also be demonstrated in a normal proliferation of parathyroid tissue, arranged in columns around masses of chief cells. Molineus found practically the same structure, with numerous oxyphilic cells and an adenoma-like arrangement. But considering all the evidence at hand one can hardly determine definitely the kind of cell changes.

We must, however, conclude that there does exist a certain relation, direct or indirect, between osteomalacia and the parathyroids. But we must bear in mind that one meets with cases of osteomalacia without any accompanying hyperplasia of the parathyroids, and, on the other hand, hyperplasia occurs without osteomalacia (compare relation between tumors of the hypophysis and acromegaly). The question must be further investigated and the greatest possible number of observations made.

I may add another interesting observation of multiple tumors of the parathyroids associated with another disease to which has also been ascribed a relation to the parathyroids, namely, paralysis agitans.

Case III. — Symmetrical multiple tumors (adenoma) of the parathyroid glands. A 75-year-old man, carpenter, was obliged to give up work about three years ago on account of increasing tumor and stiffness. The tumor began about ten years ago in the right arm, then extended to the left side and finally it became necessary to feed him. His gait became more and more unsteady, and he would fall easily. On Feb. 20, 1911, he suddenly had a stroke of paralysis of the right side. In the left arm there were twitchings with "pill-rolling." He died after lying in a comatose condition for three days. He had been considerably addicted to alcohol

The autopsy, performed about sixteen hours after death, revealed in the main the following findings:

A large corpulent man, length 181 centimeters, weight 102.3 kilograms. Heart large with a great amount of subepicardial adipose tissue. Weight 560 grams. The musculature flabby, yellowish brown, with no certain evidences of fatty degeneration. The coronaries markedly sclerosed, but with no marked narrowing.

The lungs were adherent to the pleura with fibrous adhesions. Hypostatic edema of the dependent portions, bronchitis and a marked bronchopneumonia. Small areas of sclerosis in the pulmonary artery.

No significant lesions in the mouth or neck. The thyroid gland was of about normal size, weight 30 grams; nothing abnormal in shape or structure. Microscopically the stroma appeared to be markedly thickened and sclerosed with some degree of hyaline degeneration. The parenchyma consisted of colloid spaces of variable size, mostly large and oblong and lined with a single layer of squamous epithelium. No special proliferation of the epithelium of the gland (Fig. 4).

From the lower outer margins of the lobes there were suspended two tumor-like bodies on either side; on the right side protruded from about the middle of the gland, slightly posteriorly, a cylindrical body, 4 x 1 centimeters in size, and below external to this a pea-sized body of similar appearance. On the left side were two bodies of hazel-nut size, one 1 x 1.2 centimeters, round, protruding from the lower outer border of the gland and another larger, more flat, 2 x 2½ centimeters in size. These were all soft brownish, with a glistening surface. The upper body on the left side was a trifle more compact than the other three. They were all attached to the thyroid by connective tissue capsules, but there was no structural relation to the thyroid. They corresponded in appearance and location to the parathyroid glands.

Microscopically there was in all the bodies a similar structure (Figs. 5 and 6). A tissue composed of compact, anastomosing rows of densely packed epithelial cells of about medium size with a round nucleus and

light vacuolized protoplasm. The epithelial rows were separated by numerous small, congested blood vessels with strands of connective tissue at intervals. The cell rows were everywhere compact. In the left upper body, however, there were oblong spaces within the rows, containing a granular mass. There were no really glandular structures, however, and no papillary excrescence. In the two lower bodies there was some infiltration of blood and in the connective tissue some blood pigment was found. The protoplasm of the cells was finely granular, at places highly vacuolized, at other places evenly stained with eosin to a moderate density. There were no definitely oxyphilic cells found.

This structure must be interpreted as simple adenoma of the parathyroid. There were no signs of atypical growth. On the other hand, the enlargement of the glands was too marked to be considered simply as hyperplasia. The stroma and glandular portion on the whole showed no signs of sclerosis, atrophy or inflammation.

The spleen was large, weight 280 grams, the trabeculæ were definitely outlined, the follicles appeared indistinct.

The liver was rather large, weight 1,800 grams, considerable blood and fat; microscopically there was a fatty infiltration and pigmentation. No sclerosis.

The kidneys were large, weight (both) 400 grams. Small depressions visible on the surface. Cortex thin. Microscopically there appeared an increase of interstitial tissue, in some areas the glomeruli were sclerosed, there was also sclerosis of some of the larger arteries.

The adrenals were large, weight 24.5 grams. In sections the stroma appeared of normal amount, and there was no cellular infiltration. The parenchyma of cortex and medulla appeared of normal structure, although there is a considerable fatty infiltration and congestion of the blood vessels.

The pancreas appeared normal in size and structure, weight 90 grams. There was no sclerosis, nor epithelial degeneration, but a slight degree of fatty infiltration.

The bladder, stomach, and intestines were normal.

There was considerable anteriosclerosis of the aorta. Weight of the brain 1,300 grams. No changes noticeable in the brain and membranes. In the posterior part of the left nucleus lentiformis there was a focus of softening, otherwise nothing abnormal.

The cerebral arteries were considerably sclerosed, but not narrowed. The sclerosis was distributed in patches.

The hypophysis was normal in size. Microscopically most of the cells were chromophilic, some oxyphilic, some eosinophilic. Others were more indifferent with regard to affinity for stains and were indistinctly outlined. Between the glandular and the nervous portion was a large cyst-like space, lined by a single layer of flat epithelium, and containing a serous partly colloid substance. The nervous portion of the gland appeared to be normal.

Diagnosis. — (Paralysis agitans) Adiposity. Chronic alcoholism? Fatty infiltration of the liver. Dilatation and hypertrophy of the heart and fatty infiltration of the myocardium. Anteriosclerosis of the aorta and cerebral arteries. Focus of softening of the left nucleus lentiformis. Beginning bilateral broncho-pneumonia. Cyanosis. Adenomata of the parathyroids, multiple and symmetrical. Interstitial arteriosclerotic nephritis.

Summary. — We are thus dealing with a case of paralysis agitans, when there happens to be present symmetrical tumors of the parathyroids, which, clinically, had caused no local disturbance. The question arises whether or not the tumors had any etiological relation to the disease from which this man had suffered for many years, *i.e.*, the paralysis agitans. This question has been much discussed during the past year, especially from a clinical standpoint. The subject has been touched also by Norwegian colleagues, namely, by H. J. Vetleson[21] and Carl Schiötz,[22] and both of these have maintained that there exists such a relationship and that the explanation must be sought in an insufficiency of secretion of these organs, despite the fact that hypertrophy and hyperplasia has been found in several cases. Vetleson compares the symptoms of paralysis agitans with those of tetany present in animals in whom the parathyroids have been extirpated (compare experiments of Tamberg) and sees an analogy to myxedema in the changes in the thyroid. This idea was first advanced by Lundberg in 1904 and by Berkeley, who claims to have had good results by feeding patients suffering from paralysis agitans with parathyroid gland substance. But these conclusions are merely hypothetical and it is only during the past year that systematic anatomical work has been undertaken in order to substantiate the theory of this etiological relationship. The results have been very unsatisfactory and it seems difficult to confirm the theory of an insufficiency of the parathyroids as the cause of paralysis agitans.

Thompson[23] reported extensive investigations in 1906. He examined the parathyroids carefully in nine cases of paralysis agitans and invariably found these glands normal

as regards size, shape, number, and structure. This result Thompson concluded speaks against a chronic progressive hypoparathyroidism.

Camp (1907) reports rather incomplete investigations of the parathyroids in two cases apparently with negative result (reported by Vetleson).

Roussy and Clune[24] also reported four cases with negative results.

To these may be added Vetleson's Case 3 (loc. cit.), which also showed on the whole negative result, and a recent report by Bluwstein,[25] who found the parathyroids normal in three cases of paralysis agitans. In one case of paralysis agitans — in a fifty-two-year-old man — which I examined post-mortem a few years ago, the parathyroids were small with some degenerated epithelial cells, but with no microscopical evidence of chronic or acute inflammation; on the whole the findings were negative. From what has been presented it can scarcely be said that the theory that pathological changes in the parathyroids are of significance in the pathogenesis in paralysis agitans is substantiated by demonstrable anatomical changes (such as the atrophy and signs of chronic inflammatory changes of the thyroid in myxedema and as a rule in criticism); usually there has been found normal or hyperplastic glands; and our case of multiple adenomata in the four glands would seem rather to indicate a hyperfunction — hyperparathyroidism — than a hypofunction of the glands in paralysis agitans.

Case IV. — Tumor of the parathyroid glands. In a 32-year-old woman, who died four weeks after giving birth to a child of pulmonary and laryngeal tuberculosis, there was found a very large thyroid gland. The gland was uniformly enlarged, each lobe of hen's-egg size, weight in all 95 grams. Microscopically the structure appeared normal; colloid space lined with a single layer of flat epithelium; in some areas the alveoli were small and filled with a rather serous looking fluid. At the lower pole of the left lobe, loosely bound by connective tissue to the thyroid gland, there were two flat soft bodies. One was round, pea-sized and proved to be composed of typical thyroid tissue. The other was the size of a bean, oblong in shape, 11 or 12 centimeters long and 5–6 centimeters wide, of a yellowish white color, sharply defined by a fibrous capsule. Microscopically the tumor proved to be composed of an epithelial parenchyma exactly

similar to parathyroid tissue. Strands of connective tissue separated the structure into lobes, these being again similarly subdivided into alveoli, filled with densely packed epithelial cells, with clearly defined margins and small densely-staining nuclei, the protoplasm taking a deep eosin stain. In the connective tissue capsule surrounding the tumor were deposited rests composed of normal parathyroid tissue and having the shape of elongated alveoli, giving the appearance of having been stretched out in the substance of the capsule.

Summary. — We must conclude from the findings that this tumor is a real adenoma of the parathyroid because of the size and because of the presence of rests of normal parathyroid tissue in the capsule of the gland. The tumor was, however, found accidentally and it is unlikely that it had any etiological relation to the disease which was the cause of death.

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DESCRIPTION OF PLATE XXII.

FIG. 1. — Photomicrograph of tumor in parathyroid gland in osteomalacia.

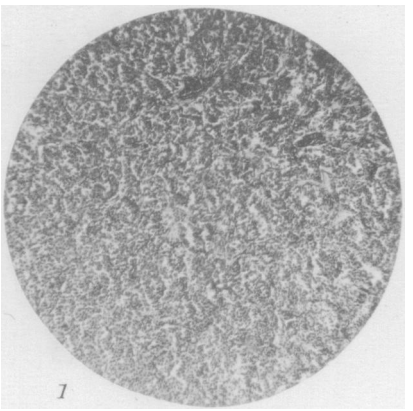
FIG. 2. — Photomicrograph of tumor of parathyroid gland in osteomalacia.

FIG. 3. — Photomicrograph of enlarged thyroid gland in rickets.

FIG. 4. — Photograph of thyroid glands in the case of four tumors of the parathyroid glands.

FIG. 5. — Photomicrograph of section of symmetrical tumor in paralysis agitans.

FIG. 6. — Photomicrograph of section of symmetrical tumor in paralysis agitans.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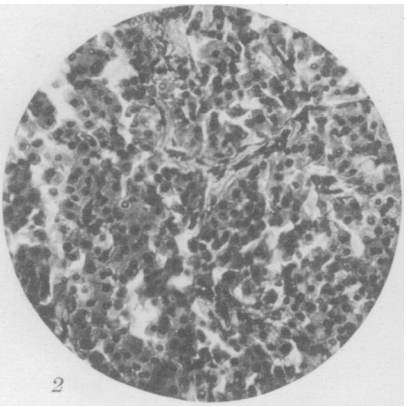
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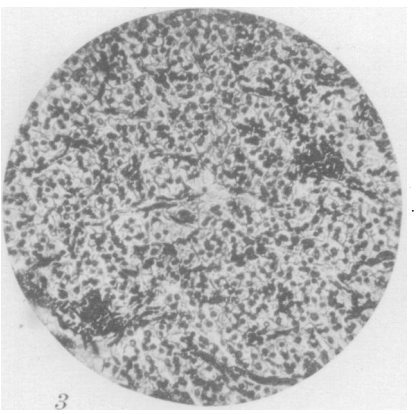
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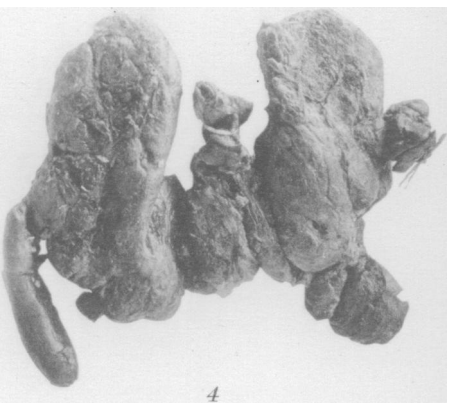
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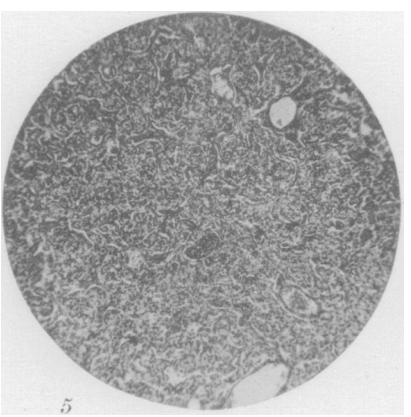
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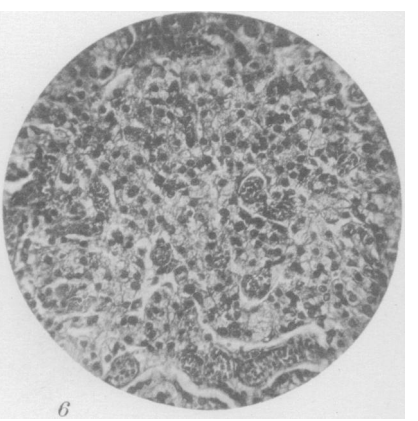
6

Harbitz

Parathyroid