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A HISTORY OF THYROID SURGERY*

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FROM the beginning, fatalities attendant upon injuries to the neck emphasized this region as the most vulnerable in the human body. Lesions here are conspicuous. It is only natural that these, especially enlargements of the thyroid gland, should have attracted early medical attention.

In the time of Celsus,¹ the thyroid gland as a normal structure was not recognized. Enlargements called *goïetre* or *hernia guttures* were considered independent new formations, either parenchymatous or cystic in character.

In communities where *goitre* was endemic it was considered an inoperable and frequently fatal affliction. Death was commonly the result of respiratory obstruction. Surgical relief was invoked for disfigurement, *dyspnœa* or *dysphagia*.

No other condition has attracted more attention or has been given more careful study than diseases of the thyroid gland. Little of primary importance has been discovered as to the cause, and nothing really new has been added to the therapy of *goitre* in the past forty years. A better understanding of the rôle played by iodine, whose beneficial effects have been known for more than a hundred years, and which has been used as a prophylactic and therapeutic remedy for nearly that long, thanks to Plummer, is now more rationally and widely used.²

Moritz Schiff, a physiologist of Geneva, in 1856, showed by experiments on dogs that total extirpation of the thyroid gland produced a sequence of ill effects which led to death. His work was overlooked for more than twenty-five years. Neither Sick, Reverdin nor Kocher made reference to Schiff when they first reported the phenomena of surgical thyroid deprivation.

Schiff, in 1884, demonstrated the symptoms of thyroid deprivation could be averted by making thyroid transplants before performing complete extirpation of the gland. He proved the thyroid gland had a secretion which is necessary to life. He paved the way for the administration of thyroid extract in the treatment of *myxœdema* which was introduced in 1891 by Murray and Howitz.³

Frederich Von Müller, in 1893, demonstrated an increased metabolism in *exophthalmic goitre*.⁴ His work led to the study of metabolism in all forms of *goitre*. The basal metabolic rate has become a cardinal index of the physiological status of the thyroid gland. It is an essential diagnostic and prognostic criterion.

Eugen Bauman, in 1895,⁵ isolated from the thyroid gland an iodine-containing compound which he called "*iodothyryn*." He considered this the active principle of the gland.

* Read before the Historical Section of the Medical Society of the City and County of Denver.

Kendall, with thyroxin, made a more exact contribution to the thyroid physiology and therapy.⁶

Ivar Sandström, in 1880, discovered the parathyroid glands. He named them "glandulæ parathyroideæ." A. Kohn,⁷ in 1895, established them (Epithel Körperchen) anatomically, genetically and functionally distinct from the thyroid gland.⁷

Eugene Gley, in 1897, proved by animal experiment their physiological importance, and that their complete removal was the cause of post-operative tetany.⁷

The foundation of scientific surgery upon a thorough knowledge of anatomy, pathology and physiology, and their reciprocal dependence, is exemplified in the development of surgery of diseases of the thyroid gland. Surgery of the thyroid gland is a composite of contributions of the civilized world, the French, Swiss, Germans, Slavs, Italians, English and Americans playing stellar rôles.

From the dawn of medical history, on through the early centuries, there were many handicaps common to all surgery. Little anatomy and nothing of pathology, physiology or bacteriology was known. In addition, there were the purely surgical difficulties, the control of pain, of hæmorrhage and of infection. When these were mastered, surgery became a respected science rather than an inexorable art.

In certain diseased conditions of the thyroid gland the greatest and most lasting benefit was, and still is, secured by surgery. No operation has been more highly standardized and no other productive of more brilliant results than the present so-called thyroidectomy; more properly termed partial or subtotal thyroid lobectomy. The evolution of the technic of thyroid surgery has converted one of the most hazardous into one of the safest surgical procedures.

The early operations were accompanied by a frightful mortality; 41 per cent. in 1850. Recent statistics show a fraction of 1 per cent. The dangers of the earlier operations were hæmorrhage, thrombosis of the jugular and subclavian veins, air emboli, injuries to the recurrent laryngeal and vagus nerves, damage to the trachea or œsophagus. The sequelæ were mediastinitis with or without abscess formation, phlegmon and fistula of the neck, erysipelas, pyæmia, tetanus, inflammation of the lung and pleura, tetany and cachexia strumipriva.⁸ Death was due to hæmorrhage, either primary or secondary, or to the then almost inevitable sepsis.

Early surgery was imperative surgery resorted to only when the patient was *in extremis* from impending asphyxia or with a disorganized cardiovascular system. This was prior to the days of anæsthesia, before the antiseptic era, and, equally important, it was long before the development of adequate surgical instruments for the control of hæmorrhage, notably the hæmostatic forceps.

The improvement in surgical technic proceeded by stages, beginning with the introduction of general anæsthesia by J. C. Warren, October 16, 1846.⁹ The next great advance followed Lister's epoch-making discovery of antiseptics, 1867.⁹ Antisepsis was soon superseded by asepsis, 1870. Pasteur had

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previously advocated dry sterilization of instruments and dressings.⁹ Buchner⁹ introduced the boiling of instruments in 1878 and in 1886 Schimmelbuch,⁹ of von Bergman's clinic, inaugurated the practice of cleansing and disinfecting the hands.⁹

The hæmostatic forceps was developed from the prehistoric dental forceps. It first came into general use in the central European clinics in 1870 as the Schiebervorrichtung of Fricke.¹⁰ The efficient control of hæmorrhage by means of the hæmostat replaced the crude cautery, the artery hook, the ligature carrier, the mass ligature and the crushing forceps. By these the field of surgery was vastly extended, delicate and deliberate operations became possible, elective surgery was born.

Before surgery as an elective procedure for diseases of the thyroid gland was advocated, there were a variety of methods of attacking the gland: the insertion of hair setons and canula to cause the disappearance of the tumor by suppuration,¹¹ incisions with drainage, the introduction of extracutaneous or subcutaneous mass ligatures, the application of chemical or the actual cautery, dissection cauterization, morcellement, evidentment, the injection of iron, turpentine or iodine. About the middle of the nineteenth century, ligation of the thyroid arteries to induce ischemic atrophy, enucleation of nodules and cysts, transfixing ligatures with ecrasement and partial resection were recommended.

Roger Frugardi, of Salerno, 1170,¹² transfixed large goitres with shoe laces and permitted the ligated masses to slough.

Roger and Roland practiced the introduction of setaceum. When the goitre was adherent they encircled the mass with a shoe-lace ligature which was left firmly tied for two or three hours. The mortified mass was then cut away.¹³

Guy de Chauliac tunneled tumors with the actual cautery. Through the channel thus made he passed a heavy seton.¹⁴

The cure by the King's touch was practiced for over five hundred years, 1100 to 1600. Andre Dulaurens mentions that his king, Heinrichs IV, cured 1500 annually. Dulaurens, if nothing else, was an exemplary courtier.¹⁵

The first operation for goitre is credited to Albucasis, a Western Arabian of Cordova, Spain, about the year 1000. He used a crucial incision.¹⁶

Benjamin Gooch, 1770, reports two cases, both died of hæmorrhage. In one an unsuccessful attempt to control the hæmorrhage was made by digital compression exercised by relays of persons for eight days and nights.¹⁷

Adolph F. Vogel, 1771, operated on a case through a circular incision.¹⁸

The operation by Pierre Joseph Desault on May 20, 1791, is worthy of the first place in surgery of the thyroid gland if not in point of time, certainly in matter of technic.¹⁹

Jacquelin Hyon, female, aged twenty years, for seven years had trouble with her thyroid gland. In 1784, a mass formed in the right lobe, small at first then rapidly enlarged and became cystic. In 1788, it was lanced and drained of a yellowish serous fluid. The gland became adherent to the trachea.

Desault, through an anterior median longitudinal skin incision, exposed and double ligated the superficial vessels, then cut between the ligatures. The superior and then the inferior thyroid vessels were exposed, ligated and cut. The five-inch tumor was then grasped with a hook and pulled downward, mesially and laterally to mobilize the gland. It was then dissected free from the trachea, to which it was intimately adherent. For nearly sixty years this was considered an impossibility by the Swiss and German

surgeons. The patient's wound suppurated but she recovered and left the hospital in thirty days. Desault's case was the first in which the dissection was deliberate, the first in which the gland was dissected free from the trachea. He executed the essentials of thyroidectomy as it is understood today. It was many years before Desault's technic was improved upon.

Guillaume Dupuytren, January 1, 1808,²⁰ operated on a female, aged twenty-eight, who for eight years had a nodular three-lobed tumor of the thyroid gland. The central lobe four inches in diameter had been removed through a transverse incision by an unnamed surgeon of Paris. (This is the first mention of a transverse incision.) In the following six months the lateral lobes of the tumor had grown to such a size that respiration, deglutition and the circulation became greatly embarrassed. On three successive occasions the patient consulted and was examined by Dupuytren. Each time he refused to operate. The patient threatened suicide if no attempt was made to relieve her. Dupuytren capitulated to her insistent demands for relief. In Hotel Dieu on January 1, 1808, she was operated on. The teguments of the anterior surface of the middle of the neck were raised in a large transverse fold, then cut perpendicularly. The incision was enlarged to the symphysis of the chin above and to the sternum below. The tumor was exposed, the superficial vessels were for the most part avoided, others were double ligated and cut between the ligatures. The tumor was then retracted to the left and the right lobe was freed, its arteries were double ligated and cut between. The left lobe was treated in like manner. Then both lobes were elevated and under traction the adherent isthmus was dissected free from the trachea and removed. The trachea was markedly flattened. A sheaf of ligature threads was left hanging out of the inferior angle of the wound. The operation was long and tedious but was practically bloodless. The tumor weighed two and one-half pounds. The patient died thirty-six hours later.

Dupuytren called attention to the sensitiveness of arteries and recommended tying first the ligature on the side corresponding to the brain in order to avoid causing pain when tying the second or distal ligature. He was the first to observe the flattening and distortion of the trachea and stated that this was due to the prolonged pressure by tumors of the thyroid gland. A second time within a decade the French blazed the trail in thyroid surgery but years elapsed before that path was followed.

Paul Jule Tillaux,²¹ on May 1, 1881, reports an interesting case with exophthalmos. A male, aged thirty-three, presented a marked pulsating thyroid with an audible bruit and a palpable thrill. There were decided pressure symptoms on the recurrent nerve and the trachea. Exophthalmos was progressively increasing. The pulse was rapid and a cardiac thrill was present. The patient's temper was irritable, he had nervous agitation with choreiform movements. On May 18, 1881, the patient was prepared for operation, chloroform anæsthesia was just begun when patient was seized with severe dyspnœa, breathing became harsh and cyanosis extreme. Operation postponed. Tillaux consulted the Society of Surgeons. The members were divided as to advisability of operating. The patient's condition was desperate and seemed doomed if denied the chance for relief. Tillaux, on May 21, 1881, with morphia and chloral analgesia under the Lister carbolic vapor spray, made a U-shaped incision. Hæmorrhage was controlled with hæmostatic forceps. (The first mention.) The sternomastoid and hyoid muscles were cut transversely at the turn of the transverse section of the skin incision which was over the lower third of the tumor. The tumor was exposed. On attempting to disengage and enucleate from below, the capsule was ruptured. Friable débris under pressure escaped. This diminished the size of the tumor, which extended downward beneath the sternum and laterally beneath the sternomastoid muscles. The capsule was dissected free from the trachea above and cut away. The cul-de-sac beneath the sternum was cleared of débris. Wound was closed and drained through the inferior angle. Lister dressing applied. Operation time one and one-half hours. He was placed in a specially prepared carbolized vapor room. Wound healed in ten days. Then erysipelas set in; he recovered from this on June 20, 1881. On July 27 he died from lung metastasis. Pathological

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report by Bernard:—Sarcoma. This case was probably an exophthalmic goitre with sarcomatous degeneration.

Sir William Blizard,²² of Edinburgh, in 1811, was the first to ligate the superior thyroid artery for therapeutic purpose. The patient died one week later of secondary hæmorrhage and hospital gangrene.

H. G. Jameson,²³ of Baltimore, May 10, 1821, ligated the left superior thyroid with animal ligature. Patient cured. This was the first ligation in the United States.

H. Earle,²⁴ in St. Bartholomew Hospital, in a case of exophthalmic goitre on August 2, 1823, ligated the right superior thyroid artery and on September 11, 1823, ligated the left superior thyroid artery. On January, 1824, was reported restored to health.

Luiga Porta,²⁵ in 1835, ligated the thyroid arteries to induce ischemic atrophy of the thyroid gland. His first two single ligations in which he tied only one superior artery were without effect. In the third case both superior arteries were tied with marked, though temporary, benefit which lasted about four months. Porta concluded to secure permanent benefit both superior and inferior arteries on the same side should be ligated. July, 1850, through a single longitudinal incision, going between the sternomastoid and sternothyroid muscles, he exposed and ligated both arteries. This was the first ligation of the inferior thyroid artery. Porta proved the arteries of the opposite lobe are not capable of maintaining an adequate circulation in the lobe of the ligated side; further, ligation of the superior and inferior arteries in the same side may produce a radical effect.

Patrick Heron Watson, of Edinburgh,²⁶ considered the pioneer in Great Britain in 1874, reported five successful operations for thyroid disease with the following technic which had been used in 1861 by E. S. Cooper, of the United States:²⁷ long median incision, muscles separated, fascia of the gland exposed, superior pole mobilized with the finger. A threaded aneurysm needle was then passed beneath the gland from the mesial aspect of the upper pole to the middle of the lateral aspect of the lobe. This manœuvre was repeated with the remaining portions of the gland. The ligatures were tied and the mass was cut away with a curved scissors. This was over sixty years after the classic technic of Desault.

J. A. W. Hedenus, of Dresden,²⁸ in 1821, records six successful operations for extensive thyroid diseases. This record was not excelled for nearly seventy years. The success of Hedenus was a stimulus to surgery of the thyroid in Germany, but his followers for years failed to grasp the essentials of his technic. Hedenus used a vertical mid-line incision, exposed the gland, ligated the superior then the inferior thyroid arteries, freed the gland, transfixed and double ligated the isthmus. The mass ligation of the isthmus was practiced in Switzerland and Germany for many years following Hedenus. In modified form it is still used. Hedenus advised careful, gentle dissection to the posterior capsule of the gland, avoiding unnecessary and all rough handling of tissues, double ligation of the individual vessels as they are approached. In substernal goitre he used a sling of heavy thread passed through the tumor to facilitate delivery from beneath the sternum.

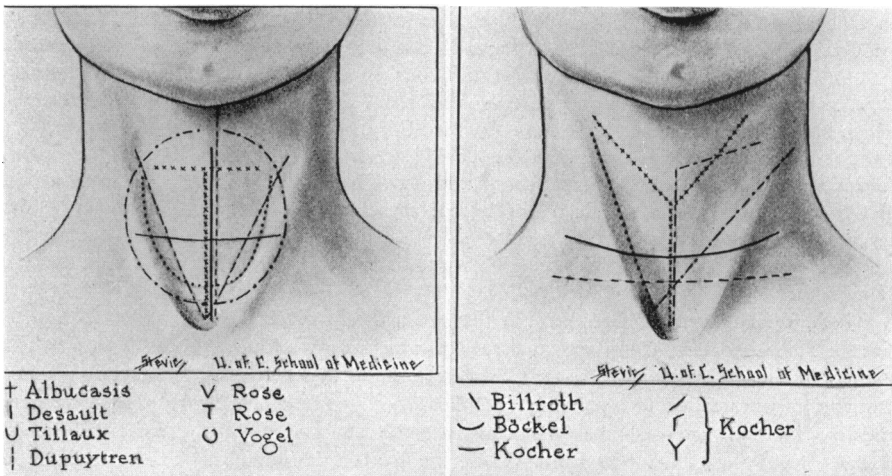
Victor Von Bruns, 1851 to 1864, had twenty-eight cases, mostly of cystic degeneration of the thyroid; however, two were carcinoma. One operation required four hours to complete. The instruments he used were several bistouries, dressing forceps, a scissors, one blunt aneurism needle, one hooked and one fenestrated forceps, several hooks, ligature rods, silk and catgut ligatures, water and sponges. Today, even the most resourceful operator would refrain from attacking even a simple goitre with so meagre a set-up.²⁹

Dr. Charles Harris, of New York, in 1807, through a long mid-line incision, successfully extirpated a huge goitre of twenty-two years' standing by enucleating the mass piece by piece with his fingers and a knife; only two small arteries required ligation. The patient was well in three weeks.³⁰

W. W. Greene, of Portland, Maine, is erroneously credited by some with the first radical extirpation of a goitre in the United States. By 1871, he had three successful

cases.³¹ His first case was reported in 1866: Mrs. K., aged forty-five, tumor right lobe of thyroid, twenty-six years' standing, had never given her trouble until a year and one-half ago. Since then it had grown rapidly in size. Pressure symptoms were marked; dyspnœa, dysphagia and syncope. "Under ether anæsthesia a single lateral straight incision over the tumor from inferior maxilla to the clavicle was made. The sternomastoid muscle which spread over the tumor like a riband together with several fasciæ was divided on a groove director going to the capsule of the tumor, which, on being raised, bled profusely. The bleeding was controlled by digital pressure of an assistant. The tumor was covered with a network of large, delicate-walled veins which bled fearfully. With the fingers the tumor was separated, and the areolar attachments and the pedicle which contained three large arteries was reached. Each was tied separately with silk. When the last strand was tied the hæmorrhage ceased. The internal jugular vein which had been torn was also ligated. Wound was cleansed, closed by interrupted sutures. Patient recovered in thirty days. Weight of tumor twenty-four ounces. Time of operation twenty-two minutes."

Paul Sick, in 1867,³² is credited with the first total extirpation of the thyroid gland and for being the first to observe the symptoms of operative thyroid deprivation.



Jacque L. Reverdin, on September 13, 1882, read a paper before the Geneva Medical Association on hitherto undescribed sequelæ of complete thyroidectomy. He called the condition "myxœdema ex-extirpatione gland thyreoideae" (myxœdema opératoire).³³ Reverdin was the first to differentiate the aponeurotic or surgical from the anatomical capsule. This is an important contribution to surgery of the thyroid.

Theodor Kocher,³⁴ in 1883, before the Twelfth German Surgical Congress, reported his results in 100 thyroidectomies, thirty of which developed symptoms of thyroid deprivation called by Kocher "cachevia strumi priva." He therefore counselled strongly against extirpation.

It is incomprehensible that the work of Schiff done in Geneva twenty-five years before should have been unknown to these two masters of thyroid surgery.

The phenomena was explained by Kocher as (1) a disturbance of the blood supply of the brain consequent to removal of the thyroid gland which at that time was supposed to exercise a controlling influence on cerebral circulation, (2) the removal of the thyroid gland altered the blood causing qualitative changes in the nutrition of the brain. Several years passed before it was the acknowledged result of disturbed physiological secretion.

Theodorus Billroth,³⁵ April, 1861, while at Zurich (1861-1867) performed twenty

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operations for thyroid disease, eight of which died of sepsis. This experience caused him to give up the operation. In 1867, he was called to Vienna, where, with the improved management in the treatment of wounds by the method of Lister, he again took up the operation.

Billroth used a lateral incision parallel to the inner border of the sternocleidomastoid muscle. He divided the sternohyoid, omohyoid and sternothyroid muscles transversely. In 1870, the artery forceps came into general use, which greatly facilitated his technic and improved his operative results. His clinic was cursed with post-operative tetany and injuries to the recurrent laryngeal nerve. In thirty-one cases he reported 30 per cent. of nerve injuries. Post-operative tetany gave rise to much discussion. Weiss,³⁶ in 1883, advanced the hypothesis that it was due to hyperæmia and irritation of the anterior horn cells of the spinal cord consequent to the ligation of the inferior thyroid arteries which increased the flow of the blood through the vertebral arteries; also, as highly probable irritation of the sympathetic nerves due to the ligation of the many vessels which stimulated the vascular centers in the cervical spinal cord and medulla. Billroth dissented from these opinions and suggested that it was due to the division of numerous nerves supplying the thyroid gland. The latter work of Sandström and Gley proved for all time the anatomical and physiological importance of the parathyroid glands.

Important as was Billroth's work in thyroid surgery³⁷ (in the early 'eighties he did more than any other surgeon), his chief influence was the interest he aroused in, and the stimulus he gave to, that galaxy of very able assistants, who later became famous surgeons: Wölfler, von Mikulicz, von Eiselsberg, von Haberer, Kocher. Each made valuable contributions not only to surgery of the thyroid gland, but also to other fields of surgery, notably that of the gastro-intestinal tract. The justifiable pride of the illustrious master was excelled only by the undying loyalty of his renowned assistants.

Anton Wölfler first called attention to the danger of injuring the recurrent nerve when ligating the inferior thyroid artery. He revived the practice of ligating the thyroid arteries as a preliminary to the more radical operation. Ligation was previously performed to induce ischæmic atrophy in the gland. This procedure was found to be contra-indicated in cystic, colloid, degenerated and calcareous types of goitre. It did produce striking improvement in the hyperplastic and pulsating vascular enlargements.

Von Eiselsberg, in 1892, was among the first to experiment with parathyroid transplants.³⁸

Johann von Mikulicz Radecki³⁹ rigidly followed the teaching of his master, Billroth. He noted the frequent sequelæ of recurrent nerve injury, of tetany and cachexia strumi priva. These were not understood at that time, but attributed largely to rough handling of the tissues and injury to the thyroid nerves. Compression of the trachea, when present, not only persisted but occasionally increased after removal of the lobe in the unilateral operations. To relieve this embarrassing situation, removal of the opposite lobe became necessary at the first or at a subsequent operation. Radical excision, described by Reverdin and Kocher as the cause of thyroid deprivation, was fully appreciated by Mikulicz as an operation to be avoided and justified only in cases of malignant disease of the thyroid. To obviate these unpleasant complications, Mikulicz devised his operation of bilateral resection, the so-called melon schnitt lobectomy, leaving only that portion of each lobe which is in relation with the posterior capsule and the inferior thyroid artery.

Mikulicz mobilized both lobes, ligated both superior thyroid arteries and the superficial branches of the inferior thyroid arteries, freed the anterior and lateral surfaces of the trachea, avoided dissecting too far posteriorly for fear of injuring the recurrent nerve. He then split the lobe longitudinally, removed the melon-shaped section, leaving only that portion of the gland and its capsule in the groove between the trachea and

oesophagus. This bilateral partial resection marked a decided advance in technic. It eliminated the complications which were hitherto common. With unessential modification it has been adopted wherever thyroid surgery is done. Commenting on his experience with the bilateral resection method he said: "I have had no complications and the convalescence was smooth. Whatever the function of the thyroid gland, be it a regulator of cerebral circulation, a blood-building organ, a gland with an essential secretion with important sympathetic nerve connection, the bilateral resection leaves a portion to continue to supply those functions. Damage incident to extirpation to the posterior lying structures, especially the recurrent laryngeal nerve, is most surely avoided." Had the rôle of parathyroid been known at this time he might have added: these structures are preserved.

A. Lücke,⁴⁰ of Berne, the predecessor of Kocher, was the authority on goitre before 1870. He advocated and practiced the parenchymatous injection of iodine. This procedure was attended with alarming and occasionally fatal consequences: iodism, paralysis of the recurrent laryngeal nerve, sudden death from embolism and thrombosis, œdema and closure of the glottis.⁴¹ For a time he opposed ligation of the thyroid arteries and excision except for freely movable or pedunculated tumors. He revised his opinion for in 1872 he published a report of ten cases, mostly of adenomata, with only one death.

C. Böckel, of Strasburg,⁴² reported a case of sarcoma of the thyroid in which he performed a thyroidectomy using a transverse or single flap incision. In order to secure greater exposure he dissected the flap upward. Mention of transverse incision has been made before, but Böckel's was the first report describing it. The transverse incision was a long time coming into general use. Credit is usually given to Kocher. While he popularized it he did not use it until some years after Böckel's report.

August Socin,⁴³ of Basel, practiced the intraglandular enucleation of adenoma, a modification of the procedure of Porta. This operation was a blunt or finger dissection of the adenoma from within the gland. It was a rough and incomplete operation. Primary and secondary hæmorrhage and infection were more common than with the cutting operation of excision.⁴⁴ Kocher was opposed to this technic because it was not usually complete, the capsule was rarely seen and the many remaining nodules took on rapid growth.

Theodor Kocher,⁴⁵ a pupil of Langebeck and Billroth, in 1872, at the age of thirty-one, succeeded Lücke at Berne. He was conversant with and stimulated by the operative success of his predecessor. Kocher was a born student and keen observer. He accepted only those new ideas which after personal trial had proven their merit. He was among the first Continental surgeons to adopt the principles of Lister and did much to popularize the method. He was foremost in simplifying the process and in developing the aseptic technic.

Kocher studied the anatomy, especially the circulation of the thyroid, and demonstrated by the injection of colored fluids the vascular distribution to the gland and within the larynx and trachea. This established the reason for the catarrhal inflammation and œdema of the trachea which frequently follows thyroidectomy.

In his first two years as chief of the surgical clinic at Berne he performed thirteen thyroid operations. He said: "There are three types of operations for thyroid disease: (1) total extirpation, (2) partial thyroidectomy or resection, (3) enucleation."

He was then using the median and the oblique lateral incisions of Billroth, whose technic he closely followed. He removed the gland piece by

piece and with cysts sutured the capsule to the skin, leaving the wounds open. August 1, 1874, he did his first total extirpation on a girl, aged eleven. A few weeks after the operation she developed marked change in character, became dull, sluggish and sullen. He stated: "It is a question whether there is a connection between mental deterioration and extirpation of the thyroid gland." Reverdin's report, in 1882, on two cases with "myxœdema ex-*extirpatione gland thyræoideæ*" prompted Kocher to reëxamine all of his operated goitre cases, 101 in number. Seventy-seven were alive, seventeen did not report. Of the sixty remaining, five had carcinoma of the thyroid, two died of unrelated intercurrent illness, nineteen reported by mail. Those with unilateral excision were for the most part enjoying good health. The thirty-four total resections examined personally were less favorable. "One had tetany, sixteen showed varying grades of progressive mental and physical deterioration and changed physiognomy (old facies). They were sensitive to cold, anæmic, sluggish of speech and movement, showed general œdema and had peculiar skin changes and falling hair." He compared this condition to cretenismus and called the syndrome "cachexia strumipriva." This experience caused Kocher to take a decided stand against extirpation and it was years before he performed bilateral resection.

This first example of follow-up study was illuminating not only to Kocher but to the entire medical world. The importance of critical follow-up studies should be emphasized in every hospital and clinic as one of its most valuable educational functions. The value of follow-up studies is a vital contribution to the medical and surgical profession scarcely second to Kocher's outstanding work in goitre.

Following the suggestion of Kocher, between 1880 and 1890 the school children of the canton of Berne were examined. Kocher urged the Swiss Government to boil the drinking water and to add iodine as a goitre-preventive measure. McCarrison years later in the Punjab confirmed Kocher's stand. More recently in the United States similar studies and recommendations were carried out by the Marine.⁴⁶

In 1877, Kocher substituted fine silk for catgut. In 1878, he changed from the straight median to the oblique, and, in 1882, to the winkel or angulated incision. If circumstances demanded, he made it a Y-shape by adding another arm. He dissected the gland from the trachea which ten years before he considered difficult.

In 1890, he discarded all other incisions for the transverse or collar incision made in one of the natural folds of the skin. About the same time he gave up the use of antiseptics in his operation wounds, having used solutions of carbolic acid, zinc chloride, bismuth, bichloride of mercury and adopted the more simple aseptic technic. He also shifted from the extracapsular to the intracapsular attack on the gland, performing what he called an enucleation resection, leaving the healthy gland tissue in relation with the posterior capsule to avoid injury to the recurrent nerve.

Kocher, deliberate, deft and gentle, made precise anatomical dissection in every case. He cut the strap muscles, exposed the gland, double ligated the superior thyroid artery, placing a third ligature on the superior pole before delivering the lobe which was drawn upward, then, after clearly visualizing the inferior thyroid artery, ligated it at a point where it changes its course from the horizontal to the vertical, just mesial to the carotid artery.

His operations on intrathoracic goitre are important. He recognized pressure of the goitre as the cause of softening of the cartilages, distortion of the trachea and the consequent respiratory embarrassment.

Dupuytren, who first called attention to the distortion and softening of the trachea, thought the diminution of oxygen was the cause of the goitre. Tracheotomy was occasionally performed as a precaution against asphyxia. The necessity for this can be appreciated since long standing and very large adenoma were quite common.

Billroth's clinic was troubled with tetany and injury or paralysis of the recurrent laryngeal nerve, but had few recurrences of the goitre. Kocher, on the other hand, rarely saw tetany, had few recurrent nerve injuries but did have recurrences of the goitre.

In 1917, before the Swiss Surgical Congress, he reviewed his entire surgical experience in thyroid diseases, reporting .2 per cent. mortality in ordinary and 2 per cent. in exophthalmic goitre.

Kocher is deservedly acknowledged the leading authority on surgery of the thyroid gland.

W. S. Halsted, than whom no man in the United States did more to stimulate interest in thyroid diseases or more to develop a standardized technic, began his studies in 1879, while he was in Vienna, with his work on the development of the thyroid in fish. In 1887, he began his experiments with thyroid transplants in dogs.⁴⁷ This work resulted in the discovery of histological changes typical of hyperplasia, and a correct histological interpretation of exophthalmic goitre. He was the first to administer iodine to prevent post-operative or recurrent hyperplasia. In 1909, his work on the parathyroids and their relation to tetany is unsurpassed. He found that parathyroid homographs would not live unless a considerable deficiency was created and proved, the life of a dog could be maintained by a section of parathyroid one-fourth of a millimetre in diameter, which, if removed, would cause the animal to die of tetany.

Halsted's refined technic of thyroidectomy, developed in conjunction with W. G. MacCallum, is founded on precise anatomical and physiological principles. In this respect he ranks next to, if not equal to, Kocher. Halsted, in 1879, popularized the use of the hæmostatic forceps in the United States. In 1884, he was among the first to use transfusion of defibrinated blood. In 1885, he became the pioneer in local infiltration and conduction anaesthesia, which greatly improved mortality statistics in thyroid surgery.⁴⁸ In 1881,

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he introduced the rubber tissue drain and in 1890 rubber gloves replacing the cotton gloves recommended by Mikulicz.⁴⁹

C. H. Mayo has had more experience in thyroid surgery than any other man in the world. Reports from The Mayo Clinic have been an important factor in disseminating an understanding of the surgical technic and operative difficulties, which, in turn, greatly improved thyroid surgery.

The work of Crile, in Cleveland, Lahey, in Boston, and Bartlett, in St. Louis, is also a prominent factor in making thyroid surgery safe and in developing a type of operation in the United States which is quite different from that performed elsewhere.

The variety, length and direction of skin incisions used in the operations for goitre were many, before the simple transverse or collar incision became the incision of choice. The incisions are illustrated in the drawing shown in Figs. I and II and collectively resemble a spider web.

One is forcibly reminded of the criticism of Edm. Rose, who used a V- or T-shaped incision⁵⁰ when he stated the older operations for goitre in which the thyroid was attacked like an ordinary tumor, reminded him of working as in a spider web, ligating and repeatedly re-ligating the same vessels until the margins of the tumor were reached, where the large parent veins were torn and massive hæmorrhage occurred, obscuring the field. Blind mass ligatures applied to control this hæmorrhage caused frequent damage to the important structures.⁵¹

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