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From “Horrid Butchery” to “Supreme Triumph”: The Birth of Modern Thyroid and Parathyroid Surgery

Thyroidectomy and parathyroidectomy are two cornerstone operations of current general surgery training. These cases are considered great fun by most residents because they are fast, bloodless, and require delicate dissection that is rewarded with beautiful anatomy. In most centers, thyroid and parathyroid operations are now outpatient procedures, with patients staying just a few hours after surgery, or at most overnight. These operations have become so routine that it is easy to forget they were once considered among the most challenging cases that a surgeon could undertake. The development of safe thyroidectomy required decades of struggle that vexed some of America and Europe’s most accomplished surgeons. The first successful parathyroidectomy for primary hyperparathyroidism took place less than a century ago. This module traces the origins of modern thyroid and parathyroid surgery, with an emphasis on some of the illuminating pitfalls and failures that occurred along the way.

Thyroidectomy

Goiter was one of the earliest reported medical conditions, and the writings of many ancient physicians included detailed descriptions of unfortunate men and women suffering from the ill effects of thyroid enlargement. Remedies for the treatment of goiter included the ingestion of seaweed and sea sponges. Some braver (or more foolhardy) physicians used mechanical means to reduce the size of goiters, which included heated metal for cauterization, open drainage techniques, and string ligation to choke off pedunculated outgrowths of thyroid tissue. In the centuries leading up to the introduction of anesthesia and antisepsis in the mid- to late 1800s, a few surgeons attempted thyroid resection,

with typically disastrous results. Bleeding was the most feared complication of thyroid surgery, and those patients who did not die from massive intraoperative hemorrhage usually succumbed to sepsis afterwards. In his 1920 volume The Operative Story of Goitre, famed Johns Hopkins surgeon William Halsted reported that in his review of the medical literature, he could find only 8 documented cases of successful thyroid operations (where the patient survived) between 1596 and 1800, and 69 more such cases between 1800-1850. The overall mortality rate was 41%. The operation was considered so dangerous that the French Academy of Medicine banned it outright in 1850. Samuel Gross, a celebrated Philadelphia surgeon who achieved great renown for his operations on the bladder, bones, and gastrointestinal tract, found thyroid resection too hazardous for his taste. In 1866, he wrote the following:

“No sensible man will... attempt to extirpate a goitrous thyroid gland. Every step he takes will be envisioned with difficulty, every stroke of his knife will be followed by a torrent of blood and lucky will it be for him if his victim lives long enough to enable him to finish his horrid butchery.”

Even following the advent of anesthesia and antisepsis in the second half of the 19th Century, thyroidectomy continued to pose a great challenge to even the most skilled surgeons. Theodor Billroth (1829-1894) of the University of Vienna was a true pioneer the field of gastrointestinal surgery. Among the many “firsts” that transpired during the single most extraordinarily productive decade of his practice included the first successful esophagectomy (1871), laryngectomy (1873), and gastrectomy (1881). The standard reconstruction after gastrectomy still bears his name. In the area of thyroid surgery, however, Billroth’s record was largely one of ignominy. Early in his career, Billroth set out to conquer the resection of goiter much as he had done for other operations. Of the first 20 patients in whom he performed thyroidectomy, 8 died, placing his results squarely in the norm for other surgeons of the era (~40% mortality rate). Billroth was so discouraged that he abandoned the operation for several years, and

when he resumed performing thyroidectomies he was able to reduce his mortality rate to a more acceptable 8%. Even so, his rate of unilateral recurrent laryngeal nerve injury was 25%, and the percentage of his patients requiring tracheostomy after surgery was 10.5%; his patients also suffered a high rate of postoperative tetany due to injury to the parathyroid glands. Billroth never achieved renown for this operation, and would ultimately never leave the shadow of his former protégé, Theodor Kocher of Switzerland, who would become the most celebrated thyroid surgeon of the era.

Originator of the eponymous clamp and maneuver, Theodor Kocher (1841-1917) was born in Bern, Switzerland and spent nearly 50 years practicing there as the head of the Surgical Clinic at the University of Bern. During his surgical training, as was typical of the time, he traveled throughout Europe and studied with the most prominent surgeons of the day, including Theodor Billroth in Vienna. Kocher returned to Bern and began perfecting the technique of safe thyroidectomy. Over the next several decades he was able to reduce his initial 14.8% mortality rate to an eventual rate of 0.18%, with recurrent laryngeal nerve injury rates of less than 1%. He did so by developing and obeying a set of operative principles for thyroidectomy that still hold true today: perform meticulous dissection to limit bleeding; identify and preserve the recurrent laryngeal nerves and parathyroid glands; replace thyroid hormone appropriately to avoid postoperative hypothyroidism. His contributions to the technical and physiologic understanding of thyroid surgery were considered significant enough that in 1909 he became the first surgeon to be awarded a Nobel Prize in Medicine.

Thyroidectomy became a standard general surgical operation in the decades following Kocher's pioneering work. Here in the US, fledgling medical centers such as the Mayo Clinic, Cleveland Clinic, and Lahey Clinic rose to prominence largely on the high volume of thyroid operations that they performed. The Midwestern "goiter belt", the result of widespread iodine insufficiency, provided especially large numbers of patients with thyroid enlargement for surgeons at these institutions. Thyroidectomy, once a feared and even banned

operation, could now be performed successfully, with negligible mortality rates and increasingly lower rates of injury to the recurrent laryngeal nerves and parathyroid glands. Famed Hopkins surgeon William Halsted, who also struggled with achieving acceptable outcomes for his patients undergoing thyroidectomy during his illustrious career, devoted an entire book to the history of thyroid surgery. In The Operative Story of Goitre, published in 1920, he observed that “The extirpation of the thyroid gland typifies, perhaps better than any operation, the supreme triumph of the surgeon’s art... is there any operative problem propounded so long ago and attacked by so many which has cost so much thought and endeavor and so many lives before its ultimate solution was achieved?”

Parathyroidectomy

In contrast to the thyroid gland, the history of which dates back to antiquity, the parathyroid glands were a more recent addition to medical knowledge and practice. The parathyroid glands themselves were not identified until 1849, when famed British anatomist Richard Owen found them during his autopsy dissection of an Indian rhinoceros from the London Zoo. The first description of parathyroid glands in a human was provided by Swedish medical student Ivar Sandstrom in an 1880 report. His finding initially caused no ripples in the medical firmament, a disappointment that reportedly caused Sandstrom such distress that he took his own life in 1889. It was not until the 1890s that Sandstrom’s contributions to the body of anatomic knowledge were posthumously recognized. During the next few decades the physiologic function of the tiny, seemingly innocuous parathyroid glands became better understood, as researchers and clinicians in the US, Europe, and Canada demonstrated the important effects of these glands on calcium homeostasis.

The first parathyroidectomy likely occurred in 1917, although the patient’s diagnosis and clinical history are somewhat murky; British surgeon John Bland-Sutton was called to see a female patient with symptoms of airway compromise

and ended up urgently exploring her neck. There he found and removed “a rounded body, as big as a cherry, situated below the lower angle of the thyroid gland on the left side of the trachea. It had the microscopic features of a parathyroid.” It remains unclear whether the patient actually had parathyroid disease and whether the resected parathyroid tumor had anything to do with her preoperative symptoms. Nearly a decade later, the first documented operation for primary hyperparathyroidism took place in Vienna.

The patient was a 33 year-old streetcar driver named Albert Jahne, who had suffered 5 years of increasingly severe musculoskeletal aches and pains. He was evaluated at the University of Vienna, where in 1925 he came under the care of surgeon Felix Mandl. After attempting various unsuccessful remedies for Jahne’s progressively worsening condition, Mandl decided to explore Jahne’s neck in order to identify and remove a suspected parathyroid tumor. The operation took place under local anesthetic, in Jahne’s hospital bed. Mandl identified 3 normal parathyroid glands and resected a 2.5 cm left lower parathyroid tumor. Jahne’s symptoms resolved, as did his hypercalcemia, and he was eventually able to leave the hospital with some of his old strength and energy restored. He unfortunately recurred a few years later, and Mandl eventually performed an unsuccessful neck reexploration in 1933. Jahne ultimately succumbed to his disease in 1936.

Across the Atlantic Ocean, surgeons at the Massachusetts General Hospital were presented with a similar patient to Albert Jahne, one who would provide further lessons on the anatomy and surgical localization of the parathyroid glands. Captain Charles Martell was a robust, vigorous sailor who in his early 20s began suffering from musculoskeletal aches and pains. Over the next few years he lost several inches in height and experienced fractures from seemingly minor traumatic injuries. He eventually was evaluated at the Massachusetts General Hospital and found to have profound hypercalcemia with concurrently elevated parathyroid hormone levels. While his doctors accurately diagnosed his condition as primary hyperparathyroidism, they had tremendous difficulty curing him of his disease. His parathyroid tumor proved extraordinarily

difficult to find. He underwent 6 total cervical operations between 1926 and 1933, none of which was successful in lowering his calcium or PTH levels or improving his symptoms. It was not until surgeons Edward Churchill and Oliver Cope explored Martell's mediastinum and removed a 3 cm parathyroid adenoma adjacent to the superior vena cava that some measure of success could be claimed. By then, however, Martell was so debilitated from the ravages of his biochemical disease that he never made a full recovery. Not long after his final parathyroid operation, he died during a urologic procedure to remove a kidney stone. He remains, however, the first and best-known American patient with primary hyperparathyroidism, and his story is still told by surgeons as an example of how elusive the parathyroid glands can be.

In the decades since Kocher won the Nobel Prize for describing safe thyroidectomy and the first operations for primary hyperparathyroidism were performed, numerous advancements have been made in endocrine surgery. These have included improvements in biochemical testing, radiologic localization, operative techniques and technologies, understanding of the pathophysiology and natural history of thyroid and parathyroid disease, and the identification of genetic syndromes involving these and other endocrine organs. Despite all these innovations, however, the same principles put forth by Kocher and others who made the pioneering discoveries in thyroid and parathyroid surgery still hold true today: be precise and meticulous, avoid bleeding and injury to surrounding structures, and make sure to have a fundamental understanding of the relevant anatomy as well as the biochemical and hormonal effects of the disease in question. What are now routine, outpatient operations were bloody, difficult, and even potentially life-threatening not that long ago, and the advancements that made them safe and commonplace should be remembered as among the most significant in the development of modern surgery.

Sources

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