The operation of thyroidectomy has always attracted the surgeon's interest
Edvard Munch: *The Seducer II 1913*
Oil on canvas
Munch Museum, Oslo.
Photo: Munch Museum (Svein Andersen/Sidsel de Jong)

The history of thyroidectomy

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SECTION OF ENDOCRINOLOGY, PATHOLOGY AND SURGERY

Goitre was observed by the Romans as their influence extended into Alpine regions and had been depicted by artists for centuries. Anatomical definition of the thyroid awaited Leonardo da Vinci in about 1500 and Andreas Versalius in 1543. The term 'thyroid' (*Latin: shield-shaped*) is attributed to Bartholemeus Eustacius of Rome while in London Thomas Wharton named it as 'glandular thyroidoeis' in his Adenographia in 1656. Frederick Ruysch of Leyden suggested that the gland secreted fluid into the veins and, in the late eighteenth century, Caleb Hillier Parry of Bath (Figure 1) who identified exophthalmic goitre in 1786 before Graves' description of 1835, described it as a vascular reservoir to prevent engorgement of the brain[1]. Parry's account was published posthumously in 1825. Early attempts to treat thyroid enlargement and overactivity were horrifying and associated with a very high mortality and morbidity due to haemorrhage, asphyxia, hospital gangrene and air embolism. They were naturally confined to the most severe cases in which asphyxia and cachexia were seen as the alternative to more active management. Early surgical accounts are confounded by the inclusion of reports on the management of neck swellings, such as cysts and suppurating glands, and the crudities of surgical methods which included the use of fingers for dissection and finger nails for the removal of tissue. Even in the sixth century AD, the effects of recurrent nerve damage on the voice after surgical intervention were recognized.

More specific thyroid operations were developed in Salerno in the twelfth and thirteenth centuries and accounts were published by Roger Frugardi in 1170, using setons, hot irons and caustic powders—often with fatal results. Technical improvement did not occur until the middle of the nineteenth century. In the interim, appalling results led in 1646 to the imprisonment of a surgeon for his work and to a total ban on the operation by the French Academy of Medicine in 1850[2].

Thyroidectomy came of age because of technical developments and the vision of its pioneers. The use of ether in 1846, antisepsis in 1867 and the first effective artery forceps in 1870 allowed unhurried and safer dissection. Local anaesthesia and steam sterilization became practicable in the 1880s. Gradually, the ineffectiveness of

Figure 1 **Caleb Hillier Parry (1755–1822)**

treatment with methods such as setons, trocar and cannula drainage and the injection of steam gave way to a more logical understanding of the effects of enlargement and malfunction. For a while, it was fashionable to divide the isthmus in the belief that tracheal compression and asphyxia could be prevented but, eventually, the lateral compressive forces of a large goitre producing a scabbard deformity of the trachea were understood. In 1896, Bernhardt Riedel reported the dense hard goitre which bears his name and is found in 0.5% of goitres in the UK. In this condition, division of the isthmus for relief of dyspnoea may be effective, unlike the situation in multi-nodular goitre. In 1902 and 1904, de Quervain's thyroiditis was described and with it the pain and inflammation, sometimes accompanied by transient thyrotoxicosis, which characterizes its presentation. However, unlike the struma lymphomatosa described by Hakara Hashimoto in 1912, de Quervain's thyroiditis is not usually associated with late myxoedema.

The mechanical complications of goitre then, as now, predominated due to the relative rarity of invasive thyroid cancer. Debulking by enucleation was initially popular but was then abandoned because it was ineffective and dangerous. Attempts to suppress the gland by superior thyroid artery ligation were first used by William Blizard in 1811. Although relatively easy due to the lateral approach, this operation also fell into disuse because of minimal long-term benefit.

If surgery was in its infancy until the second half of the nineteenth century, so too was medical treatment. The

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Figure 2 **A group of Honorary Fellows visiting the Royal College of Surgeons of England in 1913.** *Left to right back*: J Nicolaysen, G W Crile, F D Bird, F J Shepherd, R Bastianelli, W J Mayo, I I W Cushing. *Front*: J B Murphy, W Körte, H Hartmann, E Fuchs, A von Eiselberg, T E Kocher, T Tuffier

discovery of iodine in the burned ash of seaweed in 1811 had led to the successful treatment of some goitres by 1820. However, toxicity complicated the picture and its value in early small goitre, though recognized by Theodor Billroth in Vienna in 1877, was frequently disputed. It was certainly not found to be at all effective in large glands. Virulent thyrotoxicosis claimed many young lives and was best managed by 6 months in bed with a variety of drugs being tried including: the milk of thyroidectomized goats; serum from various thyroidectomized animals; extracts of all kinds of glands; injection of steam and boiling water; compression and, from 1902; irradiation; and, later, even insulin therapy.

Up to 1849, operation was reserved for the most severe cases of goitre and was associated with a 40% mortality[3]. Liston, who had done five thyroid operations, wrote in 1846 that it was '... a proceeding by no means to be thought of'. In the 1860s, Theodor Billroth undertook thyroidectomy in Zurich but there was a high mortality from sepsis. He did little thyroid surgery after he moved to Vienna until 1877 when antisepsis had become established. Only then was the mortality, in his hands, reduced to about 8%. Theodor Kocher was appointed to the Chair of Surgery in Berne in 1872 and began his landmark surgery with the use of antiseptic techniques, arterial ligation and precise dissection within the capsule. His operations were undertaken, initially, through an oblique incision along the anterior border of the sternomastoid or by a vertical midline approach. The initial mortality was 13 of 101 patients of his own, but Kocher also collected data on 268 operations carried out since 1877, finding that mortality for non-malignant goitre had fallen to 12% and for malignant goitre to 57%. As more survivors were seen, recurrent laryngeal nerve injury, myxoedema (*cachexia strumipriva* 1883) and tetany were identified as serious post-operative complications, encouraging a more cautious resection and a more precise technique by extra capsular dissection. By the time Kocher was awarded the Nobel Prize in 1909, the mortality for surgery of simple goitre in his hands had fallen to less than 1%. However, not all surgeons were aware of, or practised, these improvements. In 1892, Mathieu Jaboulay of Lyon was still advocating exothyropexy (exteriorization of the gland) and, in 1896, cervical sympathectomy for toxic patients.

In the 1890s, European advances in thyroidectomy were taken to the USA by William Halsted of Baltimore, Charles Mayo of Rochester and George Crile of Cleveland, Ohio, and subsequently developed by Frank Lahey. In 1938, he advised lateral ligation of the inferior thyroid artery to avoid nerve injury and recorded a palsy rate of only 0.3%[4]. These men whose names live on in the instruments we use today were also important pioneers. In the era before the First World War, surgery was truly an international discipline, as may be seen from a photograph of a group of Honorary Fellows visiting their college, the Royal College of Surgeons of England, in 1913 (Figure 2). Included in this view are George Crile, William Mayo, Harvey Cushing, Anton von

Eiselberg and Theodor Kocher. This was in the year after Thomas Dunhill had made his memorable visit to the Royal Society of Medicine (RSM) as part of a tour of the UK and the USA, during which he met James Berry, William Halsted and Charles Mayo.

Thomas Peel Dunhill began work on the intractable problems of goitre and thyrotoxicosis in Melbourne at the turn of the century and, in 1910, he had done 312 operations, of which 200 were for exophthalmic goitre. This was at a time when treatment of this condition attracted a formidable mortality. Dunhill had read Frank Hartley's paper from New York[5] in 1907 recommending operation on both lobes for toxic patients. Subsequently, he adopted this technique of using total lobectomy on one side and subtotal on the other. He used cautious, precise technique, sometimes staged, under local anaesthesia at first and later under light general anaesthesia. He practised total lobectomy by a pericapsular dissection technique which is even now considered by many to be the optimal method of resection. Despite accepting the most seriously ill patients, many of whom suffered from uncontrolled atrial fibrillation, he achieved a mortality of less than 3%—a standard which was treated with disbelief and even derision by his hosts at the RSM[6] when the mortality for the operation in London hospitals was up to 30%. Later, Dunhill described operation on retrosternal goitre by splitting the sternum.

The discussion at the RSM was chaired by James Berry whom we remember at every thyroidectomy. His ligament overlies that most dangerous territory between the inferior thyroid artery and the point where the recurrent laryngeal nerve enters the larynx when it passes forwards just behind the thyroid capsule and is crossed by a particularly inconvenient branch from the superior thyroid pedicle. James Berry, who had a short leg and a cleft palate, nonetheless had a considerable reputation as a surgeon and teacher but he could not match Dunhill's results. Even in 1901, he had pointed out how forbidding was the operation for exophthalmic goitre—'surgery worse than useless'. In 1912, when Dunhill visited with his hundreds, he had done only 60 cases of thyrotoxicosis at the Royal Free Hospital. Meanwhile, at St Thomas' Hospital, thyroid operations were being done in small numbers with a mortality of 33%.

Dunhill served in France during the First World War, and afterwards was persuaded to take up a post at St Bartholomew's Hospital where in 1920 he produced his outstanding paper in an early edition of the *British Journal of Surgery*[7]. The illustrations were by A K Maxwell who travelled down from Glasgow to draw in the operating theatre, elegantly demonstrating the precision of extra-capsular dissection to safeguard adjacent structures. In the same year, Sistrunkt described his radical operation for thyroglossal tract, including resection of the middle third of the hyoid and block dissection of the base of the tongue. At the Royal Free Hospital, James Berry was followed by Cecil Joll who published a comprehensive book on thyroid surgery in 1932. He reported on over 2000 patients with goitre, including only two with abscess[8] but, interestingly, his book demonstrated subtotal lobectomy leaving very large remnants. This was a rather retrograde technique and one which did not prevent him from recording a relatively high incidence of nerve injury, although the risk of tetany was small. Joll's book also illustrates thyrotoxic crisis which was not uncommon then and which I remember as a student. I had until recently believed it to be of only historical interest but we must never forget our history. Within the last year, at least one patient has died due to the withdrawal of beta-blockade when the demands of another illness became the focus of attention and the untreated thyrotoxicosis led to post-operative death.

Cecil Joll was the teacher of Robert Victor Cooke, to whom I was houseman, and that tradition was continued through the exemplary surgery of Clifford Talbot and A John Webb.

We might justifiably conclude that, by 1920, the principles of safe and efficient thyroid surgery had been established, but these lessons have to be learned and re-learned with each generation. After the Second World War progress included safe positive pressure ventilation and better antithyroid drugs, such as propranolol which was introduced in 1965[9]. Today, the main issue which now confronts us is how to ensure that not only is the operation done well but that it is done appropriately and, in that, precise diagnosis is crucial. Ultrasound has refined our skills in clinical examination and computerized tomography scanning has refined our view of the airway.

Fine needle aspiration cytology (FNAC) which was described by Soderstrom in 1952[10] has been generally available since the 1970s. However, it is still not in universal use and the quality of many specimens, particularly those provided by occasional aspirators, leaves much to be desired. Improving the tissue diagnosis is an important advantage of FNAC, as is its role in the allocation of surgical priority. Cytologists are now very expert in the diagnosis of good quality slides but producing representative material of good diagnostic quality remains a challenge, particularly for aspirators who see few cases of thyroid disease. Surgical fields have been improved by more efficient anaesthesia and a better view thanks to magnification and a headlight when it is needed for difficult corners. The patient's recovery has been made easier by absorbable internal sutures, subcuticular prolene and the avoidance of drainage where possible[11,12].

High standards of surgery are certainly possible, but there is evidence that they are not always achieved and activity varies widely. In a study of one region[13], rates of intervention were shown to vary widely from 35

thyroidectomies per 100 000 of the population per year down to 13 in apparently similar populations—some patients appeared to be having inappropriate intervention. Reliable indicators of the quality of surgery are difficult to obtain but most modern thyroid surgeons consider that, if one side of the neck is entered, then the operation performed should preclude the need for further intervention in that territory since the risk of complications increases steeply with re-operation. One index of quality might, therefore, be the relationship of complete lobectomy to partial lobectomy and, in this study, the considerable range from 1.7 to 13 in that ratio suggests that technical approaches varied widely. At present, many surgeons carry out a relatively small number of thyroid operations and experience and opportunities for training are thereby diluted. Further studies undertaken during the last 2 years have confirmed this relatively unstructured service approach and the surgeon's most important challenge now is to apply the highest technical standards of diagnosis and operation in a way which ensures the best possible outcome for all patients. Authoritative advice on the diagnosis and management of thyroid conditions is now readily available[14–16]. Every patient undergoing thyroidectomy should be confident that:

- The resection has been planned in the light of an accurate pre-operative diagnosis
- The principles of complete lobectomy, including the isthmus and pyramidal lobe, will be observed
- The recurrent laryngeal nerve, the external branch of the superior laryngeal nerve and the cutaneous branches of the cervical plexus will be preserved
- The parathyroid glands will be protected.

These four principles are mandatory and they are discussed in more detail in later papers in this supplement. Continued education and subspecialization are necessary components of good quality and are essential if general standards are to rise to those of the best practitioners.

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