VALUE OF RADICAL THYROIDECTOMY IN THE TREATMENT OF THYROID CANCER

BY

MARCEL DARGENT, M.D.*From the Professor Léon Bérard Centre, Lyons*

[WITH SPECIAL PLATE]

In 1939, in collaboration with Marcel Bérard, an attempt was made to remove in one block the cancerous thyroid lobe together with the muscles, the lymphatics, and the veins of the neck on the same side. It was felt that such a one-stage block-dissection was justified by four indisputable pathologico-anatomical facts: (1) the high incidence of unilateral tumours of the thyroid parenchyma without involvement of the opposite lobe; (2) the possibility of spread of the growth along the cervical aponeuroses and, more particularly, the sheaths of the infrahyoid muscles; (3) the frequent invasion of the lymphatics and the risk of development of malignant cervical lymphadenopathy; and (4) the frequent invasion of the venous drainage of the gland, and even of the internal jugular vein.

These, therefore, were the principles of the operation. In practice it was not often indicated. Out of 208 cases of thyroid cancer operated upon at the Lyons Centre from 1940 to 1955 block removal was performed in only 50. These 208 cases form part of a series of 237 cases of thyroid lesions operated upon during this same period. Altogether the block operation was carried out in 57 of the 237 cases, so that in 7 of them there had been a diagnostic error.

The material available in a cancer centre is not suitable for comparisons to be made with other operations. Most cases of thyroid cancer are not referred to us at the beginning, such cases being nearly always subjected to subtotal thyroidectomy or even total unilateral thyroid lobectomy in a general surgical ward in the course of treatment of nodular goitre. Quite often, also, advanced cases of generalized cancer are referred to us when they are already beyond the stage when surgery can be contemplated. We are therefore left with lesions whose malignant nature can be determined on clinical grounds—obvious characteristics of the tumour or the recurrence, the existence of cervical lymphadenopathy, and the presence of one or more metastases. Such cases, representing 24% of those seen, have been treated by radical thyroidectomy.

Comparison of our results with those reported by other workers is difficult, since the indications for this radical operation as described by Crile, Wilson, Frazell, Hayes Martin, and others are seldom stated. We can therefore only give an account of our own experience in endeavouring to determine the place of this operation in the treatment of thyroid cancer.

Extent of Operation

It is not necessary to describe anew the technique, already defined (Dargent and Bérard, 1940); extirpation of the lobe, the surrounding muscles, and all planes of the neck on the corresponding side, the internal jugular vein included, constitutes the standard operation. Ligation of the jugular veins, and, more particularly, of the internal jugular, must be done at the outset if the risk of neoplastic embolism is to be avoided. Since 1946 we have applied the

principle of the conservation of the external branch of the spinal accessory nerve, tracing it from the upper part of the neck, and following it from top to bottom in the sternomastoid muscle, immediately after ligation of the jugulars below the clavicle. Conservation of this nerve is possible only if there are no adherent lymph nodes at the upper part of the carotid sheath.

Contrary to some workers (Hayes Martin, for example), we do not include the submaxillary region in this dissection of the neck. We have never found any lymphadenopathy or seen any recurrences in that area.

In a few cases the operation was extended to other structures. (1) In four cases both thyroid lobes were removed, in two of them leaving only a thin slice of thyroid parenchyma on one side. Total thyroidectomy was considered justifiable because of the existence of bilateral lesions in the glandular parenchyma in one of these cases, and in the parenchyma and cervical lymph nodes in the other. In this latter case bilateral radical thyroidectomy was carried out in two stages with an eight-day interval. In the other two cases there was only a unilateral lesion, but the whole gland was extirpated because there were bone metastases; these were to be treated later with radioactive iodine. (2) In one case the operation was extended to the mediastinum, in which a primary cancer had developed, whereas the affected lymph nodes were situated at the level of the neck. The tumour, which was adherent to the superior vena cava, was approached through a sternotomy. (3) In three cases the common carotid artery was resected as well. In one of these cases it was already evident that a bilateral tumour existed. (4) In one case partial and in another total resection of the trachea was performed. In one of these some of the normal tissue left was used to form a temporary tracheotomy; in the other case total laryngectomy was also necessary. (5) Twice a piece of the oesophageal wall had to be resected, continuity being immediately restored by suture. (6) In 13 cases the dissection involved the recurrent laryngeal nerve and sometimes the vagus nerve itself, owing to their invasion by tumour growth. (7) In one case the operation included the internal third of the clavicle, which was invaded by a metastasis or, more likely, by direct extension of the tumour in the muscle sheaths.

General Indications

Total radical thyroidectomy was performed in 57 cases: in 50 for cancer and in 7 for non-neoplastic lesions. In 31 of the 57 cases there was a definite thyroid tumour with one or more indications of localized malignancy without remote metastases; in 10 of the cases there was unilateral recurrent-nerve paralysis. Among these 31 cases were 7 in which an erroneous diagnosis had been made as follows. (1) Two cases of thyroid tuberculosis with homolateral cervical lymphadenopathy. (2) Three cases of pharyngolaryngeal cancer of spino-cellular type, with cervical lymphadenopathy and recently developing goitre due to a haematocoele or to ordinary congestion, in one of them accompanied by paralysis of the recurrent laryngeal nerve. In these three cases the cancers could not be seen endoscopically, but their presence was revealed by the lymphadenopathy. In one case cure was obtained after eight years, radiotherapy being given in addition to surgical treatment. (3) A case of breast cancer in which there were apparently primary supraclavicular and carotid lymphadenopathy and a very limited primary lesion with co-existing unilateral goitrous enlargement. (4) A case of achromic naevocarcinoma of the abdominal wall, with recent goitrous development, unilateral haematocoele, and paralysis of the recurrent laryngeal nerve mistakenly connected with the thyroid lesion, whereas it was an early manifestation of a metastasis at the base of the skull. The possibility of these sudden goitrous enlargements, when they coincide with a cancer arising from another site and are accompanied by cervical lymphadenopathy or paralysis of the recurrent laryngeal nerve, being mistaken for thyroid cancer cannot be too strongly stressed.

There remain in this group, then, only 24 cases of actual thyroid cancer, clinically typical, and eight of which also had paralysis of the recurrent laryngeal nerve. Of the 24 cases, 23 had a strictly unilateral tumour and lymphadenopathy.

In six cases the lesion was a recurrence of a thyroid cancer incompletely operated upon from three weeks to 45 years previously; five times out of six the recurrence was situated on the same side as the original lesion.

In 12 cases of thyroid tumour the malignant nature of the growth was signified by the existence of remote metastases. In eight cases there were bone metastases, in one of them situated in the fourth dorsal vertebra and giving rise to paraplegia, in one in the second lumbar vertebra with signs of increased density of bone, and in three in the sterno-clavicular area; in two cases there were pulmonary metastases, in one case ocular metastases, and in one diffuse lymph-node metastases. Surgical intervention was decided upon in 10 of the cases following the teaching of Léon Bérard that the presence of distant lesions does not necessarily contraindicate a radical operation on the thyroid itself. The other two cases were subjected to total thyroidectomy. The opposite lobe, even if healthy or merely adenomatous, was always removed, so that fixation of radioactive iodine by the metastases could be attempted.

In four cases what appeared to be a primary tumour of the neck was present; in three of these an attempt at concentration of radioactive iodine by the growth was unsuccessful. In three of the cases an exploratory incision showed that in each case the lesion was a lymphadenopathy secondary to a small cancer of the thyroid lobe in the early stages and of papillary type. The fourth case was even more unusual, the lesion consisting of a large neoplastic mass developing in the internal jugular vein following the irruption of a tumour in the median thyroid vein; the lobar lesion was detected only during the operation.

In one case there was a tumour of the mediastinum, which was detected only after the appearance of a left cervical lymphadenopathy and which had proved resistant to radiotherapy. This case necessitated a sternotomy in order to remove the primary lesion, and wide dissection of the neck.

In one case a large infected ulcerated tumour of the neck, including the vessels, had completely replaced the right thyroid lobe.

In one case there was an apparently idiopathic paralysis of the recurrent laryngeal nerve. After numerous clinical examinations a small, deep-seated, hardly perceptible papillary cancer was found situated close to the left side of the trachea (Special Plate, Fig. 1).

Finally, in one case there was a suspicious-looking goitre with cervical lymphadenopathy coexisting with a breast cancer. The latter had been surgically removed and histologically confirmed. Biopsy of a cervical lymph node and exploratory dissection of the neck led to the detection of a papillary cancer of the thyroid.

Types of Lesion

Histologically, there is a substantial number of papillary and of orthoplastic pleomorphic epitheliomata, as is shown in Table I. There are a few rare types of sarcoma, as a plasmocytoma and an osteosarcoma (Table I).

It may be of interest to note the number of cases in which the surgical specimen showed invasion of the venous lumina—that is, in which this was not merely apparent histologically. It has already been shown that in one case the first pathological finding was a tumour in the internal jugular vein, which proved to be an orthoplastic pleomorphic cancer. In another case the endojugular tumour contained partly calcified arteries opening into the venous circulation. This was a cancer with clear Hürthle cells (Special Plate, Fig. 2).

Lymph-node invasion is very common; it is a constant finding in cases of papillary and of anaplastic cancer (Plate, Fig. 3). As has already been pointed out, this was the most

TABLE I.—*Pathological Findings in 50 Cases of Thyroid Cancer Treated with Radical Thyroidectomy*

Histological Types	No. of Cases	With Venous Invasion	With Lymph-node Invasion
Orthoplastic epitheliomata	32	8	25
Vesicular	1	0	1
Trabecular	6	1	4
Papillary	10	2	9
Hürthle-cell	2	2	2
Pleomorphic (trabecular, vesicular, papillary)	13	3	9
Anaplastic epitheliomata	9	1	9
Malpighian epithelioma ..	1	0	1
Sarcomata	8	3	5
Histiocytoma	3	1	3
Haemangiosarcoma	2	0	0
Osteosarcoma	1	0	0
Lymphosarcoma	1	1	1
Plasmocytoma	1	1	1
Total	50	12	40

frequent indication for the radical operation. The figures cited in no way prejudice those for actual invasion by thyroid cancer, since the cases dealt with here are selected ones. A curious finding in a case of orthoplastic pleomorphic epithelioma was the existence of an apparent lymph-node enlargement which was in reality a fibrocytoma of the neck.

Finally, although histological invasion of the sterno-thyroid musculature is common, we saw in one case a nodule of growth in the posterior belly of the digastric muscle (Plate, Fig. 4).

The incidence of involvement of the recurrent laryngeal nerve has not yet been determined—the frequent finding of a recurrence at the site of previous trauma having clouded our judgment in this respect. On at least three occasions involvement of the nerve at its point of entry into the larynx instead of where it crosses the inferior thyroid artery was unexpectedly encountered.

Results

On the whole results (Table II) are encouraging: 16 out of 34 patients were alive after three years, 11 out of 29 after five years, and 4 out of 18 after 10 years. More detailed

TABLE II.—*End-results at 3, 5, and 10 Years After Operation*

Histological Types	Total Cases	At 3 Years		At 5 Years		At 10 Years	
		No. of Cases	Alive	No. of Cases	Alive	No. of Cases	Alive
Orthoplastic epitheliomata	32	21	16	18	11	10	4
Vesicular	1	1	1	1	0	1	0
Trabecular	6	3	2	3	1	1	0
Papillary	10	6	4	4	3	3	1
Hürthle-cell	2	2	1	2	1	0	0
Pleomorphic (trabecular, vesicular, papillary)	13	9	8	8	6	5	5
Anaplastic epitheliomata	9	6	0	5	0	3	0
Malpighian epithelioma	1	1	0	1	0	1	0
Sarcomata	8	6	0	5	0	4	0
Total	50	34	16	29	11	18	4

analysis shows that the results are disastrous as regards anaplastic cancer or sarcoma, and that only in cases of orthoplastic papillary or pleomorphic cancer, with relatively slow spontaneous enlargement, is there a possibility of long-term survival.

Out of the 12 cases in which there was invasion of the venous channels, seven patients were followed up for five years or more, and only three survived. This fact is extremely important, because, although two of these surviving patients were not free from eventual metastases or recurrences, one survived for eight and a half years before dying from intercurrent disease (cardiopathy).

Among the 12 patients operated upon in spite of metastases, there was one survival of four and a half years—a case of trabecular cancer with paraplegia due to metastasis

in the fourth dorsal vertebra. Radiotherapy following thyroidectomy enabled the patient to walk for two years. Another patient is alive after three years, and two others have survived two years. There is one recent cure (six months). In two cases subjected to total thyroidectomy in order to assist concentration of radioactive iodine the metastases continued inactive, though in the more favourable case of the two the patient did not survive beyond 18 months.

The failures are represented by the following.

(a) *Post-operative Deaths*.—There were three post-operative deaths: one from acute pulmonary complications on the fourth day; one from acute mediastinitis; and one after a sudden rise in temperature on the fifteenth day, probably due to a serious hormonal disturbance, since a similar episode on the eighth day had responded strikingly to A.C.T.H. therapy.

(b) *Recurrences and Early or Late Metastases*.—All patients with sarcoma had an early recurrence and died within a year. In the case of malignant plasmocytoma there was an unmistakable diffuse recurrence of the tumour on the upper lip; in that of osteosarcoma the recurrence was mainly confined to the oesophagus.

In the two cases of haemangio-endothelio-sarcoma death was due to intracranial metastases. In one case these occurred at the level of the sclerotic before the operation, and continued with meningeal localization. In the second case they were also meningeal. At the fifth month the patient sought advice for a so-called "wen" of the scalp, corresponding to a loss of tissue from the vault of the skull. This was noted clinically but not controlled radiographically. The tumour consisted of blood-clot containing red-cells. A few days later death occurred from meningeal haemorrhage. One of the characteristics of this type of lesion is that it gives rise to haemorrhagic metastases.

The three cases of histiocyte-sarcoma terminated in rapid death within two to three months, from cerebral metastases with acute intracranial hypertension in one case, and from mediastinal recurrence in the others. The outcome was similar in the case of lymphosarcoma.

The only case of Malpighian epithelioma also suffered local recurrences, which appeared very early in the trachea and oesophagus. This introduces the highly controversial question of the origin of these lesions; thus the growths in the trachea and oesophagus may themselves have been primary lesions. As early as 1913 Herrenschmidt referred to forms with tracheo-oesophageal invasion.

All the cases of anaplastic epithelioma had recurrences or rapid metastatic spread. In actual fact two cases out of six which had been followed up for more than three years already had metastases at the time of operation. In one recent case, in which death occurred within six months, there was an extremely painful calcifying metastasis in the second lumbar vertebrae. A radical thyroid operation, perhaps owing to the effect on the parathyroid glands, completely relieved the pain.

In cases of orthoplastic epithelioma the frequency of recurrence and of metastasis was much more varied, and long periods of survival have been, and still are being, noted.

In the one case of vesicular cancer in this series the radical operation did not prevent serious recurrences four years later. This does not indicate the real period of survival, as in this case the first operation for goitre was performed 45 years earlier, and two recurrences had already been operated upon.

Among the three cases of trabecular cancer, the patient with paraplegia due to metastasis in the fourth dorsal vertebra survived 4½ years after radical thyroidectomy. In the case of endothoracic tumour, stripping the growth from the vena cava was most difficult. In spite of favourable radiographs,

investigation of the mediastinum with radioactive iodine showed that active foci persisted. Death occurred after 2½ years, post-mortem examination revealing a malignant bud in the vena cava (see Figs. A and B; also Special Plate, Fig. 5).

In the six cases of papillary cancer the results were good. Nevertheless there were two deaths in the first three years due to pulmonary metastases. One of these two cases is interesting in that both lobes of the thyroid were involved from the outset. It was felt that the total thyroidectomy carried out in two stages accelerated the development of diffuse pulmonary metastases. In a further case there was a delayed recurrence; the patient had already been operated upon for a recurrence after partial thyroidectomy nine years previously. Another recurrence took place more than five years after the radical thyroidectomy, and since the patient was elderly and the lesion, which was adherent to the clavicle and to the veins at the base of the neck, appeared inoperable, it was decided to tie the arteries supplying the opposite lobe and give radioactive-iodine treatment. This was found to be impossible, however, as the suppression of thyroid function resulted in a severe reactivation of the local recurrences, which had remained dormant for 14 years.

In the two cases of Hürthle-cell tumour, in both of which venous invasion had been found, there was one failure due to the occurrence of pulmonary metastases at the sixth month.

Among the nine cases of pleomorphic cancer, in which it was impossible to decide whether the growth was predominantly vesicular rather than trabecular or papillary, there were few failures. Only one patient died of cancer; he had bone metastases at the time of operation, and concentration of radioactive iodine was unobtainable in spite of total thyroidectomy. This case may be added to the other, more recent, case not included in these follow-up results and already referred to.

There was one case of recurrence five years after radical thyroidectomy and ending fatally 6½ years later from mediastinal pulmonary metastasis. This, again, is a case in which operation for a recurrence was needed 16 years after an initial partial thyroidectomy and five years after reoperation for a first recurrence. As with the papillary form of cancer, local recurrence after radical thyroidectomy has always occurred on the side operated upon, in the scar, and never on the opposite side.

Finally, one patient died after ten years from diffuse bone metastases which for four years were successfully treated with radioactive iodine. He had had a left radical thyroidectomy and complementary radiotherapy. In this case there had never been a local recurrence, but six years later a functionally active right acromioclavicular metastasis developed which concentrated the isotope spontaneously. This phenomenon was utilized several times in order to treat the bone lesion.

These, then, are the actual results of radical thyroidectomy. There was never any question of complementary

FIG. A.—Radiograph showing mediastinal thyroid tumour.

FIG. B.—Same case as Fig. A, one year later.

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FIG. 6.—Case 2: Radiographs of index finger of right hand—(a) January 3, 1955, typical of its appearance throughout time hyperparathyroidism was operative; (b) February 3, 1956, two months after removal of parathyroid tumour. Note marked refilling of subperiosteal erosions and beginning re-formation of tuft of terminal phalanges. Improvement still continuing.

FIG. 7.—Case 2: Radiograph of skull on January 3, 1955. Note typical fuzzy appearance of hyperparathyroidism. This was maintained till the second operation, two months after which it started to regress.

M. DARGENT: RADICAL THYROIDECTOMY FOR CANCER OF THYROID

FIG. 1.—Specimen removed at radical thyroidectomy for small deep-seated cancer adherent to trachea with apparently idiopathic paralysis of recurrent laryngeal nerve. (Three-quarters size.) FIG. 2.—Low-power view of section of internal jugular vein filled with a tumour bud with calcified arteries. (Patient cured eight years.) FIG. 3.—Predominantly papillary micronodular cancer; cervical lymphadenopathy; venous invasion. *a*, lymphadenopathy; *b*, endojugular bud; *c*, tumour nodule. (Half size.)

FIG. 4.—Specimen removed at radical thyroidectomy with total laryngectomy for cancer, showing infiltration of muscles. *a*, left lobe; *b*, passive congestion of laryngeal mucosa; *c*, tumour nodule in omohyoid. (Half size.) FIG. 5.—Operative specimen from same patient as Figs. 4 and 5 in text. *a*, cervical lymphadenopathy; *b*, mediastinal tumour. (Half size.)

radiotherapy, but it was applied as a routine to the scar whenever there was lymph-node invasion. In the unfavourable cases it did not, however, prevent local recurrence.

Conclusions

Radical thyroidectomy has limited indications. Its elective indication is papillary or pleomorphic orthoplastic cancer of slow evolution and with cervical lymphadenopathy. In such cases it is the operation of choice and gives the possibility of a ten-year cure without recurrence. Where recurrence follows a partial thyroidectomy the radical operation should still be attempted even if it is necessary to sacrifice the carotid artery or a nerve, as has sometimes happened in cases of recurrence of papillary cancer. It should be noted that, as in the case of other relatively slow-growing cancers, there may be a fresh local recurrence in the scar.

The indication for bilateral radical thyroidectomy seems to be a particularly clear one. The sudden suppression of thyroid function, in spite of compensatory medication, does not prevent metastasis or local recurrence. Where the operation has been aimed at inactivation of the metastases it has not been successful.

It is precisely to those forms of cancer which are already metastasizing but are still limited and growing slowly that this operation can be applied, leaving intact the healthy thyroid lobe, with complementary radiotherapy and with irradiation of any metastasis or, where possible, its removal. The results of such treatment are more encouraging than those of total thyroidectomy. *A posteriori*, it is true that with some anaplastic cancers or sarcomata it has proved useless. Punch biopsy of the thyroid gland is too risky, though it may be carried out tangentially where the tumour is large, but then only rarely. Where there is a definite sarcoma it is better to abstain from surgery altogether or to limit it to a partial operation in order to free the trachea or oesophagus, since in such cases radiotherapy is disappointing. But in other cases, even if radical thyroidectomy only serves as a palliative operation to free the respiratory and digestive tracts, it would still be worth while.

Only one point remains to be discussed: Should the operation be proposed as a matter of principle? *A priori*, the answer is No, since it would be necessary to confirm that every simple nodular goitre was malignant before dissection of the neck could be performed systematically. But when after a partial thyroidectomy for goitre it is learned that a cancer has been removed, early reoperation on the carotid sheath should be considered. Such an attitude does not often appear to be tenable, although the operation would certainly be of great value in such forms as papillary cancer. Even if it is carried out without delay after strumectomy it would still lose its character of an operation *en bloc*.

The psychological state of the patient must also be taken into account. A patient with cancer of the buccal cavity will more readily accept removal of affected lymph nodes as a matter of course, after radium treatment, than will a patient who has just been operated upon for what he had thought to be an ordinary goitre and who, a fortnight later, is asked to submit to another operation. That is why, on the whole, an expectant policy is more often adopted after subtotal thyroidectomy for early thyroid cancer. If during the operation examination by frozen section shows the existence of a

malignant lesion, a total extracapsular thyroidectomy with dissection of the recurrent laryngeal nerve should be carried out, but to subject a patient without warning to the mutilation following a block dissection of the neck is not to be advised. Here again it may be better to adopt a policy of "wait and see," particularly if probing of the carotid sheath with the finger reveals a suspicious nodule. But for the other varieties—lesions in the earliest stage, of the nodular type, operated upon for a simple goitre—this extensive prophylactic operation is not to be recommended.

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DISSECTION OF AORTA AS A COMPLICATION OF TRANSLUMBAR AORTOGRAPHY

BY

H. GAYLIS, Ch.M., F.R.C.S.

AND

J. W. LAWS, M.B., F.F.R., M.R.C.P.

*From the Departments of Surgery and Radiodiagnosis, the
Hammersmith Hospital and Postgraduate
Medical School of London*

Percutaneous lumbar aortography introduced by dos Santos, Lamas, and Pereira Caldas in 1929 has become established as a procedure of proved value, particularly in the investigation of vascular and renal conditions. Complications, some fatal, were soon reported, and were partly responsible for the delayed acceptance of aortography in Great Britain and the United States of America. Although the nature of the contrast medium (100% sodium iodide) was responsible for some of the complications in the early cases, it was soon found that complications occurred even when less toxic substances were used.

Complications usually resulted from the injection of the whole or greater part of the contrast medium into a visceral branch of the aorta, resulting in damage to the organ supplied by the vessel, occasionally associated with thrombosis of the vessel itself. The more serious complications include gangrene of gut from superior or inferior mesenteric arterial thrombosis (Wagner and Price, 1950; dos Santo, 1955), anuria and renal necrosis from injection into renal arteries (dos Santos, 1955), hypertension with retinopathy (Miller, Wylie, and Hinman, 1954), acute pancreatitis from injection into the coeliac axis (Robinson, 1956), paraplegia (Boyarsky, 1954), rupture of the aortic wall (dos Santo, 1955), and chylothorax due to damage to the thoracic duct (Maluf and McCoy, 1955).

We wish to describe a complication—aortic dissection—in which a part or the whole of the contrast medium is injected into the media of the aorta causing a dissection (of the aorta) analogous to a spontaneous dissecting aneurysm and giving rise to a characteristic