Section 6 – THYROID AND PARATHYROID

Chapter 65 – Thyroidectomy

Eugene N. Myers

Although thyroid disease has been recognized since the earliest recorded history, consistent techniques of surgery on the thyroid gland, with a few exceptions, date back only 100 years. Kocher in 1895 reported 900 cases of thyroidectomy for benign goiter with an operative mortality rate of just higher than 1%. An advocate of safe, meticulous surgery, he won the Nobel Prize in Medicine in 1909 for his contributions to thyroid gland surgery. Crile, Lahey, and the Mayo brothers founded their internationally famous private clinics largely on their ability to perform thyroid surgery safely.[1]

Carcinoma of the thyroid is an uncommon disease that accounts for approximately 1% of all cancers. It is estimated that 8000 to 9000 new cases occur every year in the United States. Nonmalignant thyroid abnormalities, such as adenoma and thyroiditis, are quite common. Thyroid nodules are found in approximately 4.2% of the population in the United States. The incidence of either benign or malignant thyroid disease is higher in females and increases with age. A solitary nodule in the thyroid gland may be benign or malignant and demands evaluation (Fig. 65-1).

Figure 65-1 A mass in the thyroid that contained papillary, follicular, and anaplastic carcinoma.

PATIENT SELECTION

Clinical evaluation of a patient with a mass in the thyroid gland begins with a careful history and physical examination. The typical finding is an asymptomatic mass in the thyroid gland. Pain, dysphagia, and rapid enlargement of a mass in the thyroid gland are signs more typical of the development of a malignancy.

The age and sex of the patient are very important in decision making because benign nodules tend to be more prevalent in women in the 20- to 40-year-old age group. In this group, the risk of cancer is approximately 5% to 10%. However, a mass in the thyroid gland in males, in patients younger than 20 years, in those older than 40 years, or in those of advanced years is associated with an increased incidence of cancer. Although symptoms such as difficulty swallowing, stridor, and hoarseness suggest cancer, patients with a large goiter or substernal thyroid may also have difficulty swallowing and respiratory obstruction. Hoarseness is almost invariably associated with cancer.[2]

Thorough physical examination is very important. The usual mass in the thyroid is well circumscribed and nontender and moves with swallowing. A characteristic finding of cancer is a mass greater than 2 cm in diameter with a very hard consistency and fixation to the skin or the underlying tissues. Direct or indirect laryngoscopy in the outpatient setting is of utmost importance to detect vocal cord paralysis. The neck should also be thoroughly examined for the presence of cervical lymphadenopathy. The presence of enlarged lymph nodes associated with a mass in the thyroid is suggestive of cancer of the thyroid gland. It is not uncommon for a patient to have a mass in the lateral aspect of the neck without an obvious mass in the thyroid gland and to have a mass in the thyroid gland discovered only after the neck mass has been excised and diagnosed as metastatic cancer of the thyroid. A similar sequence of events occurs when fine-needle aspiration biopsy (FNAB) of the metastatic lymph node is performed and the diagnosis of thyroid cancer is made.

A mass in the thyroid gland in children will usually prove to be well-differentiated papillary cancer because benign tumors in the pediatric population are unusual. Medullary carcinoma may also appear in the pediatric age group. There is usually a familial history of this cancer, and these tumors may have the same aggressive behavior as seen in adults.

Proper management of a patient with a mass in the thyroid gland is controversial, particularly a young adult with a solitary thyroid nodule. Each of the following situations is an indication for thyroid surgery:

- An individual in the pediatric age group with a mass in the thyroid gland
- An individual with a mass in the thyroid gland who underwent radiation therapy in childhood
- An individual with a mass accompanied by an elevated calcitonin level
- An individual with a mass in the thyroid gland with recent onset

- An individual with a mass in the thyroid gland associated with pathologic cervical lymphadenopathy

Physical findings suggestive of malignancy include a hard nodule, especially if larger than 2 cm, paralysis of the ipsilateral recurrent laryngeal nerve, and the presence of associated palpable cervical lymphadenopathy. Patients with these signs warrant lobectomy regardless of the FNAB, thyroid scan, or ultrasound findings.

The risk of cancer in a solitary thyroid nodule in an individual in the pediatric age group increases with decreasing age (Fig. 65-2). Papillary adenocarcinoma is the type most commonly encountered. These patients should undergo total lobectomy. Total thyroidectomy is advocated if the lesion is diagnosed as malignant on frozen permanent section. Patients who prove to have medullary carcinoma should undergo total thyroidectomy and bilateral neck dissection.

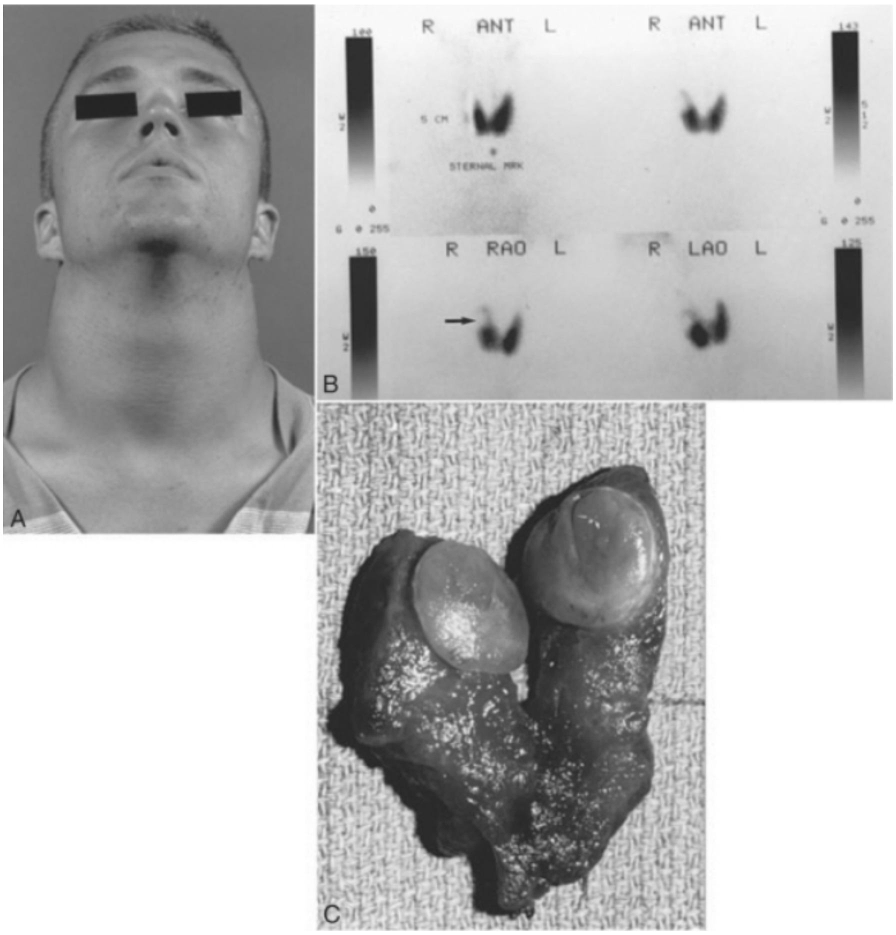

Figure 65-2 **A,** A mass in the thyroid was found on routine preseason physical examination of a 16-year-old football player. **B,** Cold nodule in the upper pole of the right lobe of the thyroid gland *(arrow)*. **C**, Specimen demonstrating papillary cancer in the thyroid.

Patients with a history of exposure to radiation therapy in childhood who have a palpable mass should undergo total thyroidectomy. A third of abnormalities in the thyroid gland in patients with a history of radiotherapy will be malignant. A patient with a history of head and neck radiation therapy is more likely to have multifocal cancer, is considered to be in the high-risk category, and should undergo total thyroidectomy.[3]

Patients with a mass in the neck or an abnormal thyroid scan associated with an elevated serum calcitonin level will have medullary carcinoma. Because of the association with other endocrine tumors (e.g., multiple endocrine neoplasia type II [MEN-II]), screening for pheochromocytoma is required preoperatively. Calcitonin assay is appropriate in younger people (<40 years old) with a mass in the thyroid gland that is suggestive of malignancy (vocal cord paralysis or enlarged neck nodes) and in individuals with a family history of medullary carcinoma.[4]

Thyroid surgery in the geriatric age group can be performed safely with low morbidity as in younger patients. The chance for success is determined by analysis of individual risk factors and potential benefits, and careful preoperative preparation is essential because of the high rate of comorbid conditions.[5]

Patients in the older age group who have a rapidly expanding mass in the thyroid, especially if associated with pain and vocal cord paralysis, must be suspected of having anaplastic cancer or lymphoma of the thyroid gland. Many of these patients will require urgent tracheotomy to relieve airway distress, at which time a biopsy specimen should be obtained. Radical resection of anaplastic cancer is not usually feasible because of extensive infiltration of surrounding structures. Patients with anaplastic thyroid cancer (ATC) have a poor prognosis with a median survival of less than 6 months. Most patients suffering from ATC die of uncontrolled local tumor invasion causing suffocation. Although patients with ATC can rarely be cured, every effort should be made to control the primary cancer to improve the quality of their remaining life. Surgery or radiation therapy used alone is seldom sufficient to control the disease; however, a combination of these modalities may improve local control. Tennvall and colleagues[6] prospectively evaluated a combined regimen consisting of hyperfractionated radiotherapy, doxorubicin, and when feasible, debulking surgery in 55 consecutive patients with ATC. Five patients survived for 2 years and in only 13 patients (24%) was death due to local failure.

Lymphoma of the thyroid may also be manifested as a rapidly enlarging mass in the neck, respiratory distress, vocal cord paralysis, hemoptysis, and dysphagia. Biopsy is usually performed at the time of tracheotomy. Distinction between undifferentiated carcinoma and lymphoma is often difficult on frozen section evaluation. Therefore, appropriate therapy is decided after the final diagnosis is made with immunohistochemical techniques. Lymphoma of the thyroid is usually treated with chemotherapy or radiation therapy, or both, with generally good results if the disease is localized to the thyroid gland.

The role of neck dissection in the management of cancer of the thyroid is controversial, as is the amount of thyroid tissue to be removed. In patients with single or multiple cervical metastases, selective neck dissection is performed with preservation of the spinal accessory nerve, the internal jugular vein, and the sternocleidomastoid muscle. Dissection of the central compartment (level VI) is carried out at the time of thyroidectomy once the diagnosis of cancer of the thyroid is made. Care must be taken to avoid the possibility of inadvertently removing the parathyroid glands or injuring the recurrent laryngeal nerves.

Shaha and coworkers,[7] in an interesting analysis of 1038 patients, stated that the most important prognostic factors in survival of patients with differentiated thyroid cancer are age, grade, extracapsular extension, distant metastasis, and the size of the tumor. The patients were divided into low-, medium-, and high-risk categories. Ten- and 20-year survival rates were 99%. Locoregional distant recurrence rates were 5%, 9%, and 20%. The authors concluded that low-risk patients could be treated by thyroid lobectomy. Patients in the high-risk category required surgical treatment and administration of ^{131}I because of extensive thyroid cancer and the presence of distant metastasis.

Beenken and associates[8] analyzed their series of 208 patients with well-differentiated thyroid cancer (WDTC) and concluded that total thyroidectomy may provide a survival benefit for intermediate-risk patients. This group includes patients younger than 45 years with unfavorable tumor-related prognostic factors and patients older than 45 years with favorable tumor-related prognostic factors. Although the optimal extent of thyroidectomy in this group remains controversial, there was a trend in their series toward better survival in patients treated with total thyroidectomy. A recent study published by Esnaola and coauthors[9] indicated that total thyroidectomy maximizes the quality-adjusted life expectancy in low- and high-risk patients.

Shaha and coworkers[10] reviewed the patterns of failure in differentiated carcinoma of the thyroid on the basis of risk groups and found that the overall incidence of recurrence in the low-risk group was just 13% versus 50% in the high-risk group. The incidence of distant metastasis in the low-risk group was just 2% as compared with 34% in the high-risk group. Understanding of the patterns of treatment failure in different risk groups affirms the need to plan treatment strategies according to individual risk groups and intraoperative findings.

PREOPERATIVE EVALUATION

Routine laboratory blood tests are generally of little value in diagnosing an asymptomatic solitary thyroid nodule. Thyroid function studies are usually normal. Elevated thyroxine (T_4) or triiodothyronine (T_3) levels in a patient with a solitary thyroid nodule may indicate the presence of a hyperfunctioning adenoma, which has a very low incidence of malignancy. Low thyroid hormone levels in a patient with a solitary nodule are generally of little diagnostic value.

Serum thyroglobulin levels are typically elevated in patients with WDTC but are usually normal or decreased in patients who have anaplastic or medullary carcinoma. If elevated thyroglobulin levels are demonstrated in well-differentiated cancer, thyroglobulin testing should be repeated postoperatively because elevation of thyroglobulin may be a predictor of tumor recurrence. Hall and colleagues[11] stated that advanced tumor stage at diagnosis and a stimulated thyroglobulin level greater than 20 pmol/L 3 months after total thyroidectomy were independent predictors of disease recurrence. Patients with a thyroglobulin level greater than 20 pmol/L are at increased risk for recurrence and may be candidates for more intensive follow-up or additional treatment.

A more specific indicator of malignancy is the serum calcitonin level, which is elevated in 75% of patients with medullary thyroid carcinoma.[2] If there are either symptoms or a family history suggestive of medullary carcinoma, serum calcitonin levels and evaluation for MEN-II are suggested.

Radionuclide Scanning

Radionuclide scanning with iodine or technetium has been a standard diagnostic procedure; however, this test is not diagnostic of cancer. When a cold nodule is identified, the most that can be said is that the finding is abnormal. In a patient who has a history of previous thyroid surgery, the scan may be useful in determining the amount of residual thyroid tissue present.

Campbell and Pillsbury[2] performed a meta-analysis in which they reviewed 10 reports in the literature that correlated the results of radionuclide scans in patients who had solitary thyroid nodules with the pathology reports after surgery. The meta-analysis revealed that 17% of cold nodules, 13% of warm or cool nodules, and 4% of hot, hyperfunctioning nodules were malignant. The cumulative data suggest that for clinically detected solitary thyroid nodules, although nonfunctioning nodules are most likely to be malignant, “warm” or “hot” nodules may also occasionally be malignant. Because the vast majority of solitary cold nodules are benign, this focuses attention on the inability to distinguish benign from malignant lesions with radionuclide scans.

Ultrasound

Although ultrasonography can differentiate between a cystic and a solid nodule, we believe that this is of minimal value in differentiating benign from malignant lesions. There are, however, two areas in which ultrasonography may be useful. One is in the accurate follow-up evaluation of the size of the nodule in patients who have had an FNAB that was benign, and the other is its value in helping to accurately perform FNAB. Ultrasound-guided FNAB may increase diagnostic reliability, especially in patients in whom the nodule cannot be palpated because of its small size, in those with a multinodular goiter, or in individuals with a short or muscular neck.

Fine-Needle Aspiration Biopsy

FNAB has come into widespread use in the diagnosis and management of patients with a solitary nodule in the thyroid gland. The technique is safe and cost-effective. Cytologic evaluation may be useful, and it may diagnose a lesion as being either absolutely benign or absolutely malignant. It may also be reported as being nondiagnostic, which indicates the need for repeat FNAB for diagnosis. Cytopathology may not always be able to distinguish carcinoma from adenoma, but reports such as a follicular lesion or an atypical or Hürthle cell lesion would be an indication for thyroid lobectomy to make the most accurate diagnosis.

In the meta-analysis carried out by Campbell and Pillsbury[2] of nine studies in which the results of FNAB cytology were compared with those of histology after surgery on the same patients, the false-negative rate (the percentage of benign cytology readings that were found to be cancer at surgery) ranged between 0.5% and 11.8%, with an average of 2.4%. This study suggests that 1 in 40 patients with a cytology report of a benign lesion can be expected to have cancer. The false-positive rate (the percentage of malignant cytology readings that were found to be benign at surgery) for these studies ranged between 0% and 7%, with an average of 1.2%, so the gland may be expected to be benign at surgery in 1 in 100 patients with a diagnosis of malignancy. Therefore, the overall degree of accuracy is higher than 95%, thus suggesting the efficacy of this technique. FNAB is also useful in patients who have a history of the onset of sudden pain with a concomitant increase in the size of the nodule and in whom hemorrhage into a cyst is suspected. Aspiration of such lesions by FNAB is useful in establishing a diagnosis, as well as in collapsing the mass.

FNAB is carried out with the patient under local anesthesia. The skin is prepared with an alcohol wipe, and the mass is grasped between the thumb and forefinger. A 22-gauge needle attached to a 20-mL syringe pistol is inserted into the mass, and suction is applied to the aspirating syringe after the needle has passed through the skin to avoid aspirating epithelial cells into the needle. The needle is then moved in and out in different quadrants to get an adequate sampling of the mass. The suction is released, and the needle is withdrawn. The aspirate is smeared on glass slides and immersed in 95% ethanol for Papanicolaou staining. The specimen is then studied by the cytopathologist. If the specimen is inadequate or the diagnosis is in question, additional samples may be taken for diagnosis while the patient is still in the office. There is usually little, if any bleeding with this procedure. In some centers, FNAB is carried out under ultrasound guidance to be certain that the most representative areas of the mass are sampled.[12] The

Mayo Clinic experience, however, showed that only 3 of 439 patients who had benign findings on FNAB were found to have malignancy during a 6-month follow-up period.[13]

Patients who have no evidence of malignancy on FNAB and no other finding suggestive of malignancy may be given a trial of thyroid suppression. The objective is to reduce thyroid-stimulating hormone (TSH) levels to below normal. Forty percent to 60% of patients with benign adenoma will experience resolution of the nodule. The patient is advised to undergo repeat ultrasound or ultrasound-guided FNAB in 6 months unless there are objective signs or an increase in size of the mass in the interim. Some patients with an obvious mass will opt to have surgery for cosmetic reasons or because they are concerned about malignancy, even in the event of benign FNAB findings.

Computed Tomography

Computed tomography (CT) scanning is not of much value in the usual patient with a solitary nodule. Its routine use is discouraged by endocrinologists because the contrast material contains iodine, which interferes with postoperative radioactive ^{131}I studies. CT scanning may be of considerable help in determining tracheal infiltration in patients with a large mass believed to be malignant (Fig. 65-3). It may also be useful in determining the amount of tracheal and esophageal deviation, compression, or invasion of these structures, as well as substernal extension (Fig. 65-4). Moreover, CT scanning may identify previously undetected cervical lymph node enlargement.

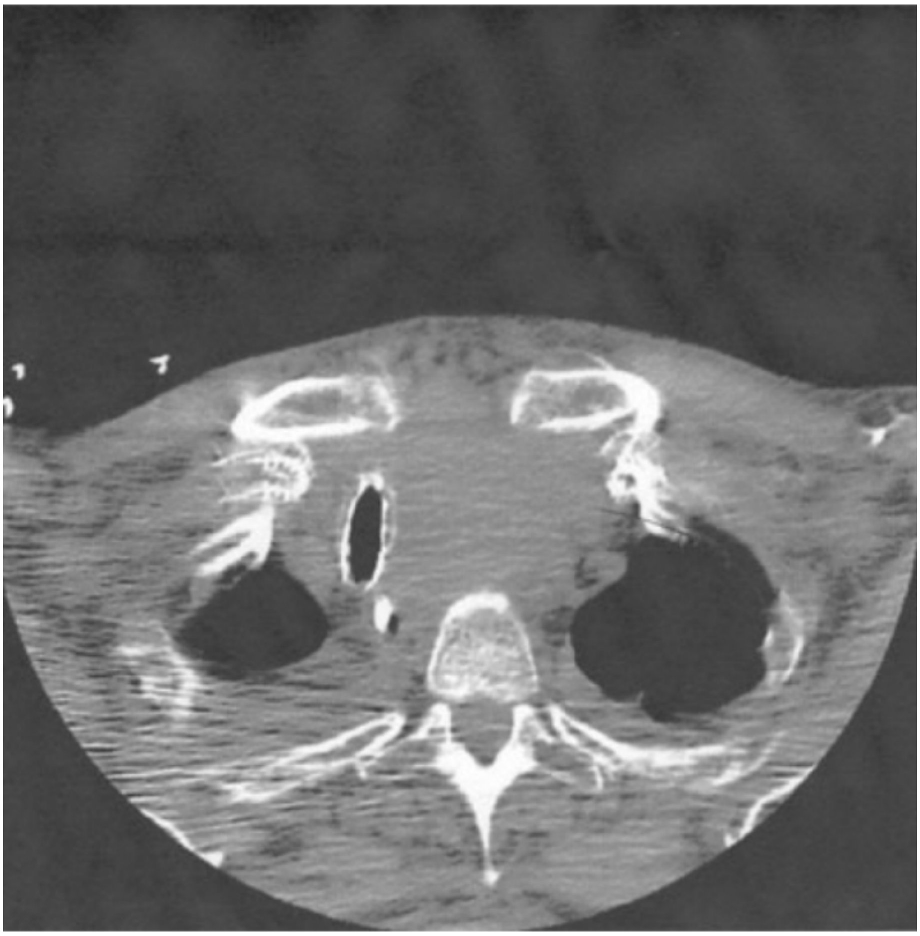

Figure 65-3 Computed tomography scan demonstrating tracheal deviation and compression by Hörthle cell carcinoma. The patient was treated by insertion of a tracheal stent and two vascular stents.

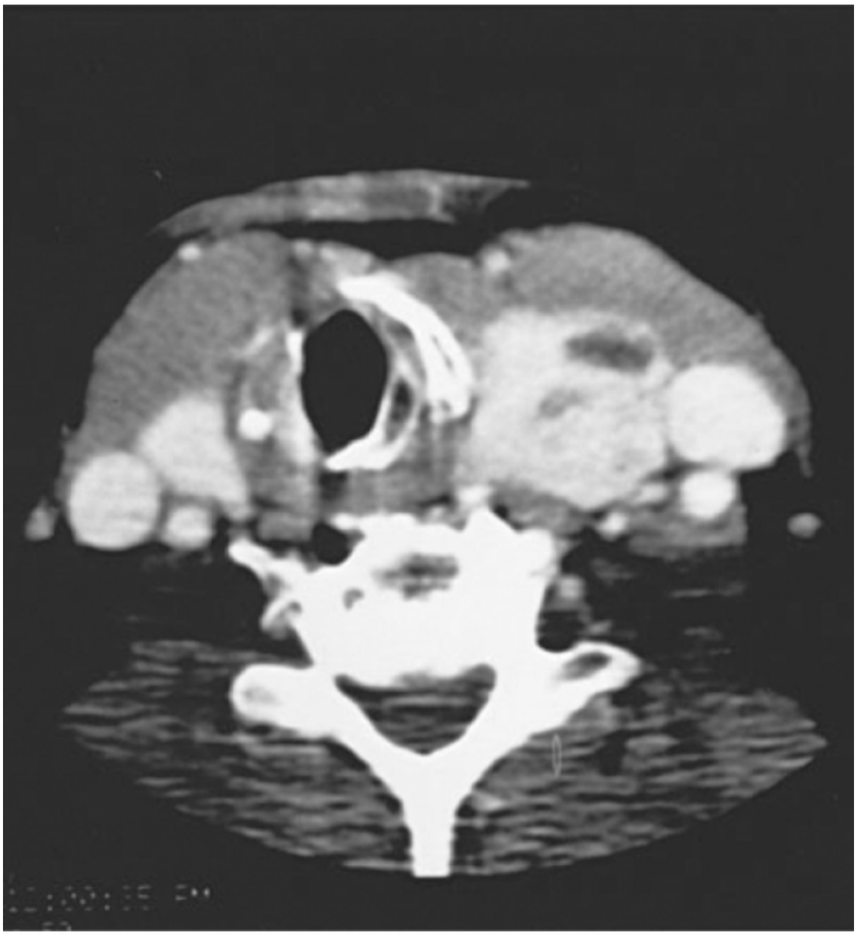

Figure 65-4 Computed tomography scan demonstrating a large substernal goiter.

Positron Emission Tomography–Computed Tomography

Routine follow-up of patients with WDTC includes whole-body ^{131}I scintigraphy and serum thyroglobulin assay. Limitations in detecting local-regional recurrence or distant metastasis occur when progressive dedifferentiation of thyroid carcinoma cells leads to loss of iodine-concentrating capacity. Recent reports indicate the utility of positron emission tomography (PET) in the detection of a variety of malignant tumors. Frilling and associates[14] underlined the superiority of ^{18}F-fluorodeoxyglucose (FDG) PET in the management of patients with WDTC in whom failed concentration of ^{131}I interferes with standard follow-up and treatment in cases of tumor recurrence. They also found PET-CT to be very sensitive in the search for distant metastasis in the setting of negative ^{131}I scanning.

The recent advent of PET-CT follow-up of patients with malignant tumors throughout the body or those with colon and breast cancer has increased referrals for thyroid nodules. We now routinely have patients referred for evaluation of previously unknown tumors in the head and neck, especially the parotid and thyroid gland, that were detected by follow-up PET-CT scans in patients with colon and breast carcinoma. These patients undergo ultrasound-guided FNAB to rule out distant metastasis and are often operated on to remove these tumors (Fig. 65-5).

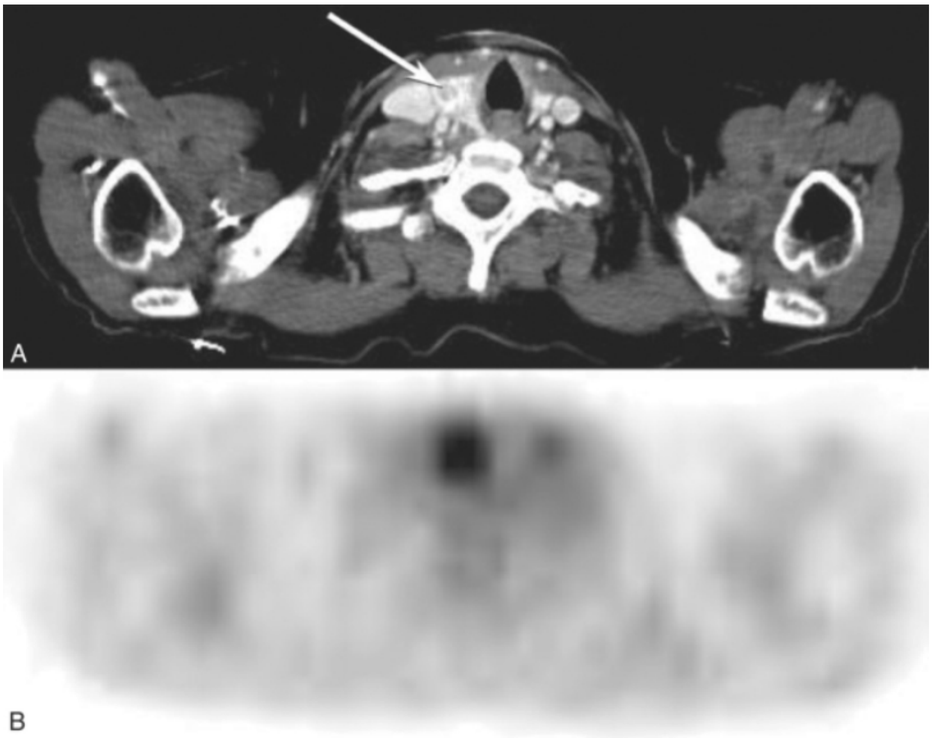

Figure 65-5 Combined positron emission tomography–computed tomography (PET-CT) performed for surveillance of breast cancer identified a suspicious thyroid nodule. **A,** The CT portion of the examination showed a subcentimeter hypodense thyroid nodule *(arrow)* that would not merit tissue sampling by CT criteria alone. **B,** The corresponding PET image shows focal uptake, which is sufficiently suspicious to prompt ultrasound-guided fine-needle aspiration biopsy despite the lesion's small size.

SURGICAL TECHNIQUE

Three specific techniques are discussed:

- Thyroid lobectomy
- Total thyroidectomy
- Surgery for substernal goiter (SSG)

Thyroid surgery is usually performed with the patient under general anesthesia. However, for a select group of patients, local anesthesia may be preferable. Hisham and Aina[15] reported a series of 65 consecutive patients who underwent either thyroid lobectomy and isthmusectomy or total thyroidectomy under local anesthesia with light intravenous sedation. The patients were discharged 6 hours postoperatively. Thyroid surgery under local anesthesia offered the best alternative to general anesthesia in patients with poor cardiac function or in pregnant patients.

Perioperative antibiotics are not required. Patients are placed in the supine position, and endotracheal intubation is carried out. There has been concern in the past about whether intubation is possible in patients who have had substernal thyroid or massive goiters, given the narrow caliber of the trachea or displacement of the trachea from a unilateral mass. Intubation is almost always possible, and the anesthesiologist should be encouraged to consider this a normal case and not make it unnecessarily difficult or dangerous by using an exotic technique. Rarely, the airway is so distorted that intubation is not possible and tracheotomy is necessary.

After endotracheal intubation has been achieved, a rolled blanket is positioned under the patient's shoulders and the head placed in a donut-shaped head holder. This is an important maneuver in this procedure because extreme extension of the head brings the thyroid gland into the operative field. The entire face, neck, and upper part of the chest are prepared with povidone-iodine (Betadine) solution, and sterile drapes are applied to provide a sterile field. Placement of the incision in a skin crease is very important to make the scar as inconspicuous and acceptable as possible. It should be made approximately one finger breadth above the clavicles and carried approximately to the anterior edge of the sternocleidomastoid muscle bilaterally (Fig. 65-6).

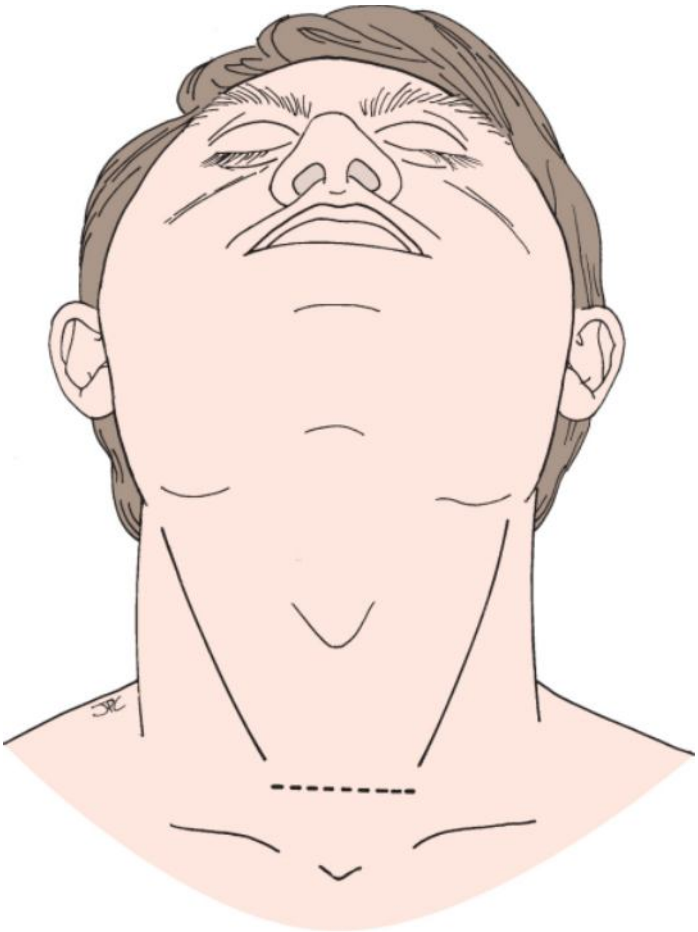

Figure 65-6 Incision placed in a skin crease in the root of the neck above the clavicle.

Jancewicz and colleagues[16] studied the optimal position for a cervical collar incision. They observed that migration of a proposed cervical collar incision does occur. An inappropriately placed incision may lead to excessive scarring if it is too low or to an unusually prominent appearance if it is too high. On the basis of their study they believe that a good place to make such an incision is one finger breadth above the sternal notch with the patient in the neutral, upright position before the patient is anesthetized and then placed into extension.

The best time to plan the incision is before the patient is placed into extension and preferably while in the sitting position. If the incision is planned when the patient is in the extended position, the scar will come to rest over the clavicles, which may produce a stretched or prominent scar that can be disguised only by clothing or jewelry. In a patient who has a long, slender neck, the incision must be placed somewhat more superior to be able to achieve adequate exposure.

The incision may be made with a cold knife, electrocautery, a Shaw scalpel, or a harmonic scalpel. Shemen[17] reported use of the harmonic scalpel in making an incision and achieved safe and expeditious control of the feeding vessels of the thyroid gland. The procedures were completed in 50% less time than when the conventional technique was used. Siperstein and coworkers[18] used the harmonic scalpel for control of thyroid vessels and found that this technique was safe and shortened operative time by 30 minutes.

The incision is carried down through the platysma muscle. Once the platysma has been incised, the tissues are shifted laterally and the platysma muscle is incised lateral to the end of the skin incision; the incision is then carried into subcutaneous tissue. This is done bilaterally and results in 50% more exposure in the wound while minimizing the incision. It should be done very precisely and with good countertraction on the soft tissue so that the large anterior jugular veins will not be entered (Fig. 65-7). Lahey clamps are then applied to the superior aspect of the incision, and the superior cervical flap is undermined in the plane between the platysma muscle and the strap muscles. The inferior flap is then undermined in the same plane. Hemostasis is obtained. Large vessels should be ligated with 2-0 silk suture. Small bleeding points may be electrocoagulated. Self-retaining retractors should then be placed in the wound to secure adequate exposure.

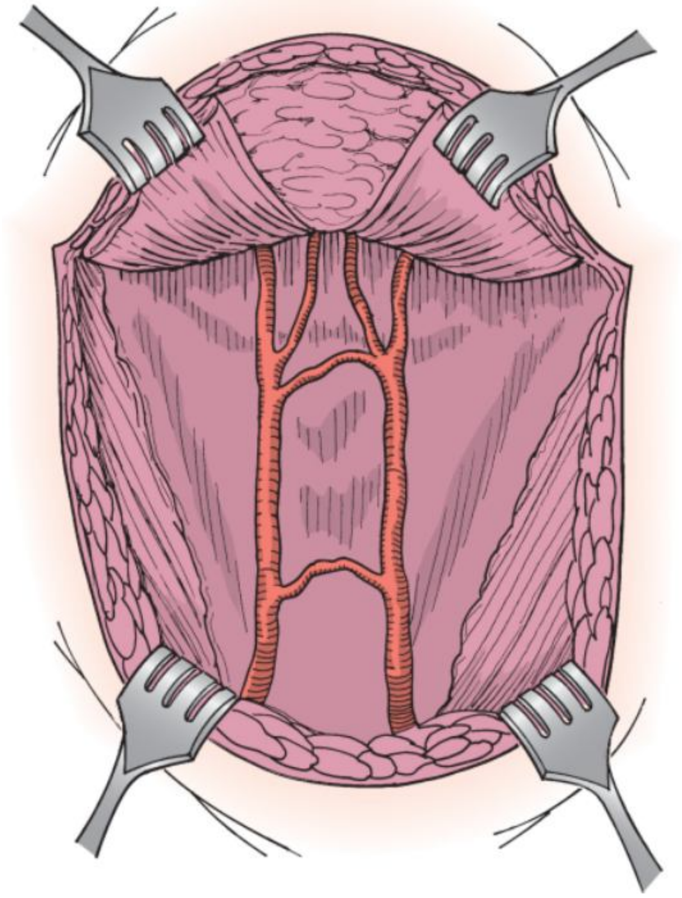

Figure 65-7 Cervical flaps are undermined while taking care to avoid the anterior jugular veins.

Thyroid Lobectomy

Surgeons performing total thyroid lobectomy should work from the side of the dominant thyroid mass. The strap muscles are divided in the midline (Fig. 65-8A) and are then undermined with small blunt-tipped dissecting scissors (Fig. 65-8B). We have not found it necessary to divide the strap muscles to gain adequate exposure except in cases of massive goiter. If the strap muscles are adherent to or infiltrated by tumor, the muscle should be removed with the tumor. When sufficient undermining has been carried out, Green retractors are used to retract the strap muscles (Fig. 65-8C). This procedure is carried out on both sides; each lobe should be palpated to determine whether other nodules are present. The trachea is then identified and skeletonized to expose the trachea and thyroid isthmus (Fig. 65-8D). The isthmus is cross-clamped and divided with electrocautery, and the cut edges are oversewn with 2-0 silk suture.

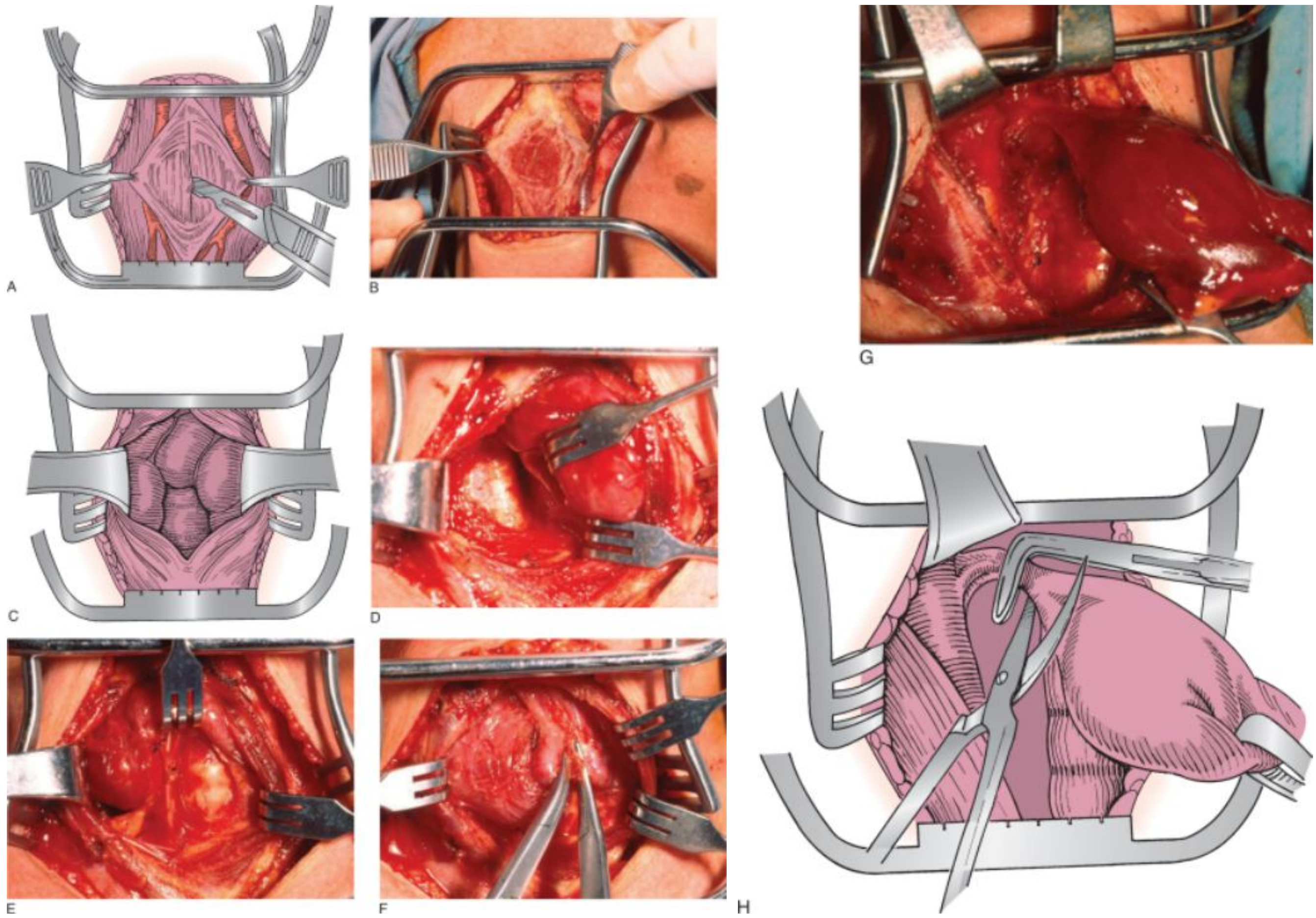

Figure 65-8 **A,** Incision of the strap muscles in the midline. **B,** Undermining of the strap muscles. **C,** The strap muscles are retracted and the trachea and thyroid isthmus are identified. **D,** The triangle bounded by the trachea, the carotid artery, and the lower pole of the thyroid lobe is identified, and the recurrent laryngeal nerve is located in the triangle. **E,** Dissection of soft tissue off the recurrent laryngeal nerve. **F,** Identification and transection of Berry's ligament. **G,** The thyroid lobe is pedicled on the superior thyroid artery. **H,** The superior thyroid artery is cross-clamped, divided, and doubly ligated.

A Kitner sponge on a Kelly clamp is then used to gently separate any remaining strap muscle fibers and loose areolar tissue from the thyroid lobe. The gland is next mobilized from the deep tissues into the wound (Fig. 65-8E). Care is taken to identify and gently separate the parathyroid glands from the thyroid gland. The typical golden brown color of the gland and its location near the inferior thyroid artery make the inferior parathyroid gland easy to identify. The carotid artery is identified laterally by blunt dissection (Fig. 65-8E). The carotid artery, the trachea, and the lower pole of the thyroid gland form the triangle in which the recurrent laryngeal nerve will be identified (Fig. 65-8F).

We do not use the inferior thyroid artery as a landmark for identification of the recurrent laryngeal nerve because it is inconstant in its relationship with the nerve. Having identified the triangle, blunt dissection with the closed tip of the dissecting scissors is carried out in the triangle along the tracheoesophageal sulcus until the nerve is identified. Occasionally, a nonrecurrent inferior laryngeal nerve may be found coming directly off the vagus nerve. This anomaly occurs infrequently on the right side and is said to be associated with an anomalous retroesophageal right subclavian artery. It occurs even more rarely on the left side and then only in the setting of situs inversus. There are usually small veins, as well as branches of the inferior thyroid artery, in the area near the nerve. We believe that every time a vein or an artery is identified during thyroidectomy it should be clamped, divided, and tied at that time rather than running the risk of clamping the vessel and leaving the clamp in place because there is a high risk that the clamp could come off, the vessel would not be tied off, and postoperative hemorrhage would result. Searching for the lost vessel or the presence of the clamp lying loose in the wound may also set the stage for injury to the recurrent laryngeal nerve.

With gentle traction on the thyroid gland, dissection along the recurrent laryngeal nerve is carried superiorly. This is done by grasping the tissue surrounding the nerve, retracting it from the nerve, and then moving the closed scissors up along the nerve and opening them gently to spread the tissue overlying the nerve (Fig. 65-8G). Branches of the inferior thyroid artery will need to be cross-clamped, divided, and ligated to mobilize the thyroid gland.

Once the recurrent laryngeal nerve is seen entering the foramen in the cricoid cartilage, traction is exerted on the gland to retract it away from the trachea. Berry's suspensory ligament is then transected (Fig. 65-8H). This maneuver dramatically releases the thyroid gland from the trachea. Dissection is continued superiorly until the gland itself is pedicled on the superior thyroid artery. The artery and vein should be skeletonized by blunt dissection, separation of the overlying soft tissue, and retraction of the gland superiorly. This helps prevent injury to the superior laryngeal nerve. Right-angled clamps are used to doubly clamp the artery and vein, the pedicle is transected, and the gland is delivered. The superior thyroid artery is doubly ligated with 2-0 silk suture. Leaving dissection of the superior thyroid artery as the last maneuver protects against injury to the superior laryngeal nerve.

The specimen is then sent to the pathology department appropriately marked along with sufficient clinical history for frozen section diagnosis. If this is a completion thyroid lobectomy, frozen section is unnecessary. All bleeding points are ligated, and the wound is irrigated. A Hemovac drain is inserted approximately 1 cm lateral to the lateral extent of the incision on one side and placed in the thyroid compartment. The strap muscles are then approximated in the midline with chromic catgut suture. The wound is closed with subcutaneous catgut suture and running 6-0 mild chromic or fast-absorbing catgut suture in the skin. Care should be taken during closure to not inadvertently put a ligature around the Hemovac drain within the wound. The Hemovac drain should be fixed to the skin approximately 0.5 to 1 cm lateral to the incision so that it is camouflaged and blends with the incision itself. Adhesive is then applied to the skin, and Steri-Strips are applied. If the frozen section is benign or deferred, the patient is allowed to recover from anesthesia, extubated, and taken to the recovery room.

If the frozen section diagnosis is cancer, the wound is reopened and the remaining lobe is removed. Unfortunately, diagnosis will be deferred in a small percentage of the patients, particularly those with a follicular lesion. Cheng and coauthors[19] reported that the selective use of frozen section to complement FNAB cytology findings of suspicious or follicular lesions was efficacious, especially in the subset with papillary carcinoma, and allowed one-stage total thyroidectomy. Tan and colleagues[20] reported that there was no definite impact of the timing of surgery on the rate of complications after completion thyroidectomy. Erdem and associates[21] analyzed their series of patients who underwent lobectomy elsewhere and were referred for completion thyroidectomy when WDTC was diagnosed. They pointed out that many WDTCs are multicentric, with the incidence of residual cancer being 22% to 64%. Failure to perform completion thyroidectomy may leave cancer in place. The authors advocate completion thyroidectomy because of decreased recurrence rates and increased efficacy of ^{131}I. This operation can be done safely with low morbidity and is not significantly different from primary total thyroidectomy. Randolph and Daniels[22] used ^{131}I lobe ablation as an alternative to completion thyroidectomy for minimally invasive follicular carcinoma of the thyroid. This was done with minimal morbidity 3 to 6 months after lobe ablation. Whole-body ^{131}I scanning was performed.

Total Thyroidectomy

If after thyroid lobectomy the pathologic diagnosis is WDTC, a contralateral lobectomy is carried out. Extreme caution is taken on the contralateral side to preserve the parathyroid glands, particularly if those on the first side have not been clearly identified. Although the issue remains controversial, we believe that it is best to perform total thyroidectomy to eradicate all vestiges of thyroid tissue. This removes all possible areas of cancer because it is well known that microscopic cancer may exist in the contralateral lobe, and it helps considerably in the postoperative management of differentiated thyroid cancer by radioactive iodine (^{131}I) scanning and treatment.

If cancer is diagnosed, the central compartment (paratracheal level VI) nodes are removed as thoroughly as possible while making every effort to preserve the parathyroid glands. The recurrent laryngeal nerve must be kept in view at all times to avoid injury. In the absence of palpable or otherwise demonstrable positive metastatic nodes, dissection beyond the central compartment is not required. If there are palpable or otherwise demonstrable nodes, selective or modified radical neck dissection is performed.

In cases in which fixation of the gland to the underlying structures or associated recurrent laryngeal nerve involvement is apparent, the possibility of invasion of the recurrent laryngeal nerve, trachea, larynx, or esophagus should be suspected. Although invasion of local and regional structures is common with anaplastic carcinoma, invasion by WDTC is unusual. When WDTC does invade the upper aerodigestive tract structures, it causes considerable morbidity and mortality. Life-threatening airway problems, hemorrhage, and suffocation can be the consequences of invasion of the airway by thyroid cancer.[23] There are no clear guidelines regarding the extent of surgery for patients with cartilage invasion only. Shave resection is defined as removal of all macroscopic disease without formal resection of the full thickness of the adherent trachea or larynx.[24] The rationale for shave resection for locally invasive WDTC stems from the belief that the residual cancer can be successfully treated with ^{131}I. Fear of the morbidity of a failed repair or anastomotic leak after formal tracheal resection with reconstruction is another reason why shave resection is sometimes preferred. This, coupled with the unproven benefits of more extensive surgery with reconstruction, has been used to support shave resection over formal tracheal resection. No survival benefit has been demonstrated with extensive resection versus shave resection. In addition, shave resection has been associated with relatively low rates of recurrence.[24]

Total thyroidectomy may be carried out for benign or malignant disease. Frigulietti and colleagues[25] reported a retrospective study of 1789 patients who underwent total thyroidectomy from 1990 to 2000. Patients treated by total thyroidectomy included those with multinodular goiter and chronic thyroiditis when there was bilateral involvement of glandular parenchyma posterior to the middle thyroid vein and when there were doubts on frozen section analysis. They also recommended the use of total thyroidectomy for multinodular goiter. In patients with Graves' disease, total thyroidectomy was indicated because of severe hyperparathyroidism, severe ophthalmopathy, or allergic reactions to antithyroid medications. Mittendorf and McHenry[26] also reported on the efficacy of total thyroidectomy for thyrotoxicosis. Indications for surgery in patients with Graves' disease were massive enlargement of the thyroid gland with compressive symptoms from substernal extension.

Extracapsular spread and invasion have been shown to have negative prognostic significance in WDTC; however, they can be treated successfully. Extrathyroidal invasion is highly associated with a risk for local recurrence, development of metastases to the cervical lymph nodes and distant sites, and death. Intraluminal invasion of the larynx, trachea, or esophagus appears to have a more grave prognosis than extraluminal cartilage invasion does.[23]

Surgery for Substernal Goiter

SSG was first described by Haller in 1749.[27] Crile described SSG as a situation in which the goiter went down to the aortic arch.[28] Although the term remains somewhat ill defined, Katlic and coworkers[29] characterized SSG as having greater than 50% of its mass inferior to the thoracic inlet. Indications for surgery include compression of adjacent structures, prevention of the same, and diagnosis.[30]

The majority of SSGs originate from downward extension of a cervical goiter along the fascial planes of the neck, through the thoracic inlet, and into the mediastinum. The blood supply of an SSG arises primarily from the interior thyroid artery. Absence of a palpable mass in the neck does not exclude SSG. Sometimes a cervical component is not enlarged because the bulk of the gland is in the mediastinum.

Unlike a goiter in the neck, which can grow to enormous proportions and remain asymptomatic, SSG is symptomatic early in its course. The clinical symptoms are attributed to compression of the adjacent aerodigestive tract and the mediastinal great vessels at the thoracic inlet. Shortness of breath while lying in bed and difficulty swallowing, even pills, are the most common symptoms. Patients with SSG are vulnerable to acute airway obstruction, which generally arises from hemorrhage in the gland.

CT scanning is a valuable source of information about SSG because it will demonstrate the relationship of the goiter to the trachea, the esophagus, and the great vessels and heart. We have had many cases in which SSG extended to the aorta, which we removed through a cervical approach, and one that went posterior to the heart and required a combined transcervi-cal and partial medial sternotomy approach. Patients should be seen in consultation by a thoracic surgeon for examination and review of the CT scan. The patient's best interest is served by having thoracic surgical colleagues standing by in the possible, but unlikely event that a medial sternotomy is necessary.

An SSG can virtually always be removed through a cervical incision. The important consideration is that the neck must be placed in extreme extension to mobilize the gland out of the mediastinum. Both recurrent laryngeal nerves must be identified. The inferior and superior thyroid arteries are ligated. Before any attempt at mobilization of the thyroid gland from the mediastinum, Berry's ligament is transected bilaterally. Transection may be facilitated by dividing the isthmus in the midline to separate the thyroid gland from the larynx and trachea and permit upward traction on the substernal component of the thyroid gland. There are instances in which an SSG is actually linked to the thyroid lobe by a very small isthmus of thyroid tissue, or it may in fact not be attached to the thyroid lobe at all. At this point the surgeon's finger can be introduced into the superior mediastinum and a cleavage plane developed around the capsule of the gland to separate the gland from the soft tissues. At the same time that the gland is being mobilized from below, gentle but firm traction should be exerted in the superior direction to deliver the thyroid gland from the mediastinum. The exception to this technique may be cancers with extracapsular extension and adherence to vital structures. This condition can be anticipated by imaging and preoperative diagnosis of cancer by FNAB. In these circumstances, medial sternotomy may be required for identification and control of vascular structures.

Endoscopic Thyroidectomy

In recent years, endoscopic surgery has emerged as an option for thyroid and parathyroid abnormalities. Surgeons in Japan and Italy have provided leadership in this field. It appears to be driven by patient demand for either a smaller scar on the neck or in fact no scar at all.

Gagner[31] described the first endoscopic subtotal parathyroidectomy with constant gas insufflation for hyperparathyroidism in 1996 and achieved good clinical and cosmetic results. Ikeda and colleagues[32] developed novel techniques for endoscopic thyroidectomy that involved use of the anterior chest approach and the axillary approach with CO_2 insufflation. They compared these two types of endoscopic procedures with conventional open surgery. Their indications for endoscopic thyroidectomy included a thyroid tumor less than 6 cm in diameter and benign follicular adenoma diagnosed on FNAB. Patients with a history of thyroiditis or previous neck surgery and irradiation were excluded. All patients in the axillary group were satisfied with the cosmetic results, whereas those in the anterior chest wall or open cervical group complained about the cosmetic appearance.

Nakano and coworkers[33] modified the anterior chest wall technique. They did not use gas insufflation. Two Kirschner wires were attached to a winching device and inserted horizontally beneath the skin to lift the neck skin. A specially made retractor was passed through the tunnel on the chest wall into the neck. The final pathology diagnosis was follicular adenoma in 34 patients, minimally invasive follicular carcinoma in 4 patients, and adenomatous goiter in 4.

Bellantone and associates[34] carried their technique a step further to include removal of the central neck lymph nodes during minimally invasive video-assisted thyroidectomy for small papillary carcinoma. The procedure is gasless and carried out through a 2-cm incision above the sternal notch. The authors encountered unexpected lymph nodes in the central compartment. After thyroidectomy, these nodes were removed uneventfully and sent for frozen section. In the case of positive lymph nodes with frozen section, dissection of the central compartment was completed. Kitagawa and colleagues[35] operated on a series of patients with FNAB-positive papillary carcinoma. They used a totally gasless anterior neck skin-lifting technique through an incision on the chest wall. They performed hemithyroidectomy or subtotal thyroidectomy, as well as lymph node clearance of the lateral and central compartments, without incident.

Takami and Ikeda[36] classified minimally invasive thyroid procedures as follows:

1. Minimally invasive—mini-incision
2. Video assisted
3. Completely closed endoscopic
   - Supraclavicular approach
   - Axillary approach
   - Anterior chest approach
   - Breast approach

Park and coauthors[37] reported a series of 100 patients who underwent endoscopic thyroidectomy via a breast approach. Incisions were made in both upper circumareolar areas. Subcutaneous tunnels were dissected up to the neck through which endoscopes were placed. CO_2 insufflation was used. The remaining dissection was carried out under visual endoscopic guidance. The incisions on the breast yielded a satisfactory cosmetic result with minimal scarring. Shimazu and colleagues[38] described an axillary, bilateral breast approach. This led to acceptable scars on the breast, and the axillary approach eliminated the scar from the parasternal port, as occurs with the pure breast approach.

Management of the Neck

Although the techniques for neck dissection are described in Chapter 78, some concepts should be understood. Despite the fact that in multivariate analyses cervical lymph node metastasis has no prognostic importance in dealing with papillary carcinoma of the thyroid, now that we have improved diagnostic tools such as ultrasound, PET scanning, and thyroglobulin studies, we are recognizing recurrences in the neck more frequently. The question of how to manage the neck in WDTC remains controversial.

Some valuable information can be obtained from the work of Shaha and coworkers,[39] who analyzed 1038 patients at Memorial Sloan-Kettering Cancer Center in New York. All these patients had WDTC. Figure 65-9 shows the incidence of cervical node and distant metastasis at the time of initial evaluation. This information should be quite helpful in making practical decisions in patients with WDTC. The authors suggest performing a modified neck dissection in patients with palpable cervical metastasis. More recent philosophy suggests that paratracheal (level VI) lymph node dissection should be carried out at the time of thyroidectomy.

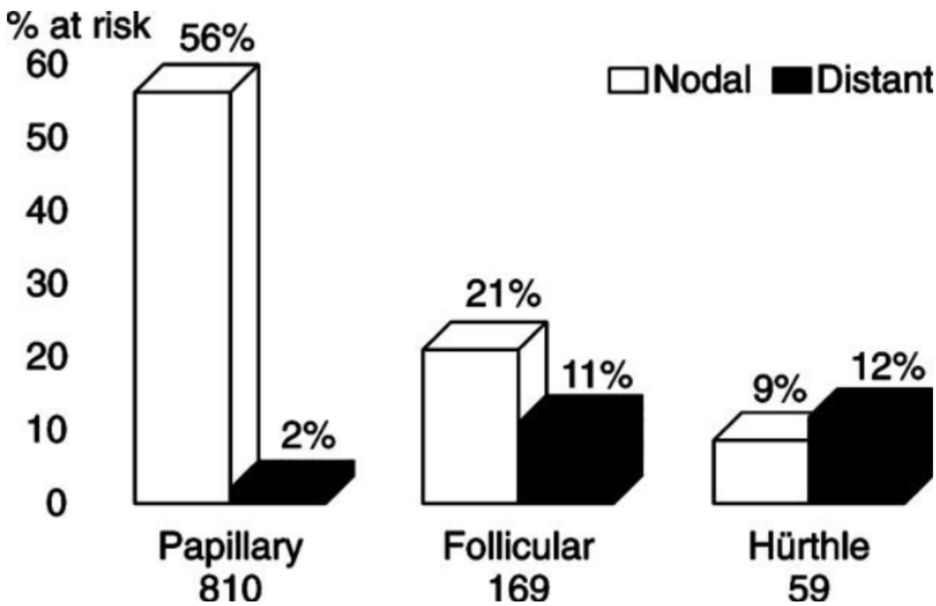

Figure 65-9 Incidence of cervical node metastasis and distant metastasis at initial evaluation.
(Reprinted from Shaha AR, Shah JP, Loree TR: Patterns of nodal and distant metastasis based on histologic varieties in differentiated carcinoma of the thyroid. Am J Surg 172:692-694, 1996, with permission from Excerpta Medica, Inc.)

Although the literature on thyroid cancer is extensive and varied, it appears that elective neck dissection is not indicated in WDTC. Selective neck dissection in levels II to VII or a modified radical neck dissection is the treatment of choice in patients with palpable metastases.[40] If the nodes of the central compartment are thought to be involved on the basis of preoperative imaging studies or examination at the time of surgery, paratracheal lymph node dissection should be carried out (level VI). Musacchio and associates[41] found that patients who underwent formal neck dissection at the initial operation for WDTC with suspected lymph node metastasis had a significantly lower rate of recurrence than did patients who underwent a “berry-picking” procedure.

Cheah and colleagues[42] examined the complications of neck dissection carried out for thyroid cancer. The most frequent complication was hypocalcemia, which was more common when neck dissection was combined with thyroidectomy than when it was not (60% versus 17%). In the group of patients who underwent thyroidectomy with concurrent neck dissection, the incidence of hypocalcemia was highest in those with central compartment dissection (75%), less with central compartment and modified radical neck dissection (67%), and even less with modified radical neck dissection alone (46%).

The presence of distant metastasis in patients at the time of initial evaluation for WDTC is a rare event. Shaha and coworkers[43] analyzed a series of 1038 consecutive patients at Memorial Sloan-Kettering from 1930 to 1985 and identified only 44 (4%) patients who had distant metastasis on initial examination. The incidence was higher in patients with follicular than with papillary carcinoma and in patients older than 45 years. The long-term survival rate in patients with distant metastasis was 40% (Fig. 65-10). This outcome presumes treatment with total thyroidectomy and ^{131}I. The most common sites of metastasis are the lung and bone. Shoup and coauthors[44] reported a series of 242 patients in whom distant metastasis was either the first site of recurrence or was detected at the time of discovery of the primary cancer. They concluded that long-term survival is possible in patients with distant metastasis from WDTC. Their institutional policy of treatment of patients with distant metastasis is completion thyroidectomy when necessary and follow-up treatment with radioactive iodine. Stojadinovic and associates[45] studied a series of 260 patients with metastatic WDTC, 59 of whom (23%) underwent operations for their distant metastasis. They concluded that solitary distant metastases amenable to complete resection are infrequent. Complete removal of metastases may be associated with improved survival in patients with localized distant metastasis. Palliative resection may be indicated to improve quality of life in patients with symptomatic distant metastasis.

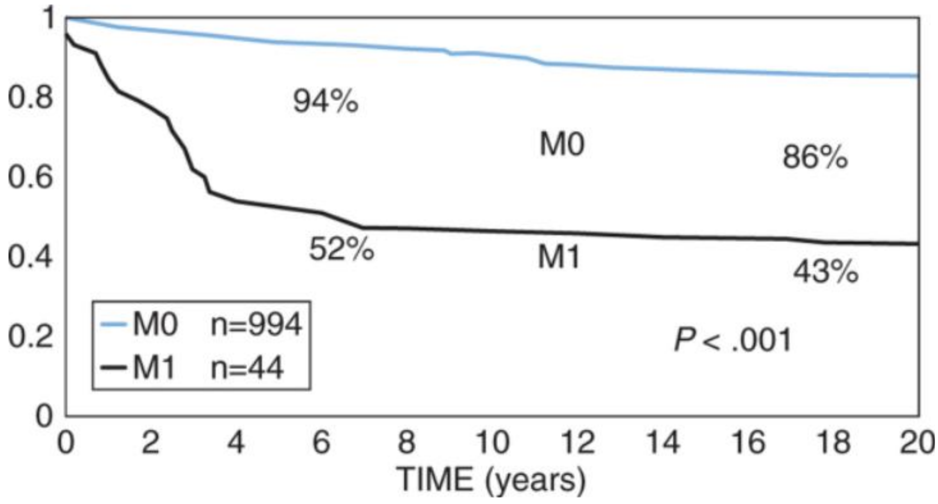

Figure 65-10 Overall survival in patients with or without distant metastasis.
(Reprinted from Shaha AR, Shah JP, Loree TR: Patterns of nodal and distant metastasis based on histologic varieties in differentiated carcinoma of the thyroid. Am J Surg 172:692-694, 1996, with permission from Excerpta Medica, Inc.)

POSTOPERATIVE MANAGEMENT

Postoperative care is best undertaken by nurses experienced with thyroidectomy patients because of the potential for airway problems. The Hemovac drains are attached to wall suction and are removed when drainage has stopped, typically within 24 hours. Perioperative antibiotics are not required in these cases because of the very low incidence of wound infection. In patients who have undergone lobectomy, calcium and phosphorus levels are not routinely determined postoperatively unless the patient is symptomatic or has previously undergone thyroid lobectomy. After total thyroidectomy, calcium and phosphorus levels are determined on the second postoperative day. Patients with symptomatic hypocalcemia are treated with calcium. Patients are quickly advanced to a regular diet, are ambulatory on the evening of surgery, and are usually discharged on the first postoperative day. In some centers there is a distinct trend away from draining the wound and to discharge the patient the same day.

COMPLICATIONS

Hematoma after thyroidectomy is generally detected in the first few hours after surgery. The diagnosis is made by noting ecchymosis of the skin of the neck and chest, an obvious mass in the anterior aspect of the neck, an abnormally large volume of blood in the Hemovac drain, or all of the aforementioned. If the patient has a tight dressing around the neck, respiratory obstruction may develop rapidly because of compression of the trachea by hematoma. Treatment of this condition is to immediately remove the dressing and open the wound. The wound can be evacuated quickly by removing the clots with suction or by hand, which alleviates the airway problem immediately. The patient is then taken back to the operating room, hemostasis is achieved under general anesthesia, and the wound is copiously irrigated and resutured over new drains because the drains invariably become clotted. This complication is quite unusual, and its occurrence is directly related to the absence of meticulous attention to hemostasis during surgery. Safety of the patient after thyroidectomy is also enhanced by nursing staff familiar with the care of such patients. The use of pulse oximetry for postoperative monitoring offers an advance in patient safety by placing immediately postoperative thyroidectomy patients near the nurse's station under direct observation.

The recurrent and superior laryngeal nerves are vulnerable to injury during thyroidectomy. Every attempt must be made to identify and preserve the nerves. Unilateral paralysis is usually suspected in a patient who has a breathy voice and aspiration early in the postoperative period. Such patients should have laryngoscopy performed to confirm the presence of vocal cord paralysis. The nerve may have been cut, clamped, stretched, or heated when electrocoagulation was used in the area near the nerve. Any bleeding that occurs around the nerve should be controlled initially by pressure and then the bleeding point clamped, but only with the nerve under direct observation. Laryngeal electromyography can be carried out to predict return of function. If return of function is likely, nothing need be done unless the patient is very symptomatic from aspiration or is a professional voice user. Speech and swallowing therapy may be useful. Vocal cord medialization by injection of an absorbable substance may be useful. Patients whose electromyographic findings are class V have little chance for recovery, and early surgical intervention may be indicated, such as injection or medialization laryngoplasty.[46]

This complication is more likely to occur after a second thyroid operation. In patients with a history of having had one nerve paralyzed by previous surgery or trauma, additional caution must be taken during dissection of the remaining nerve. There is controversy over whether a nerve severed during thyroidectomy should be anastomosed. The vocal cord does not develop normal motion after immediate anastomosis, but tonus may be achieved in the thyroarytenoid muscle, thereby eliminating the necessity for thyroplasty or injection to medialize the paralyzed vocal cord.

Bilateral recurrent nerve injury will produce airway distress postoperatively. It is usually recognized minutes to hours after extubation, and immediate reintubation or tracheotomy may be necessary. It is generally possible to carry patients over the first day or two with continued endotracheal intubation rather than tracheotomy. These patients can then be extubated, and further surgery may not be necessary. In the near and longer term, if unable to tolerate the airway compromise associated with bilateral vocal cord paralysis, the patient is faced with the choice of wearing a permanent tracheostomy tube with a speaking valve or undergoing cordotomy or arytenoidectomy (see Chapter 41).

Intraoperative monitoring of the recurrent laryngeal nerve is finding increased acceptance during thyroidectomy and other surgical procedures that place this nerve at risk for iatrogenic injury. Such procedures include thyroidectomy, parathyroidectomy, tracheal resection, and anterior cervical spine surgery. Several techniques can be used for intraoperative monitoring, including hand-held nerve stimulators to observe contraction of the cricopharyngeus muscle and laryngeal electromyography with a hook wire or a needle electrode. Surface electrodes eliminate the potential dangers encountered with needle electrodes. The Xomed endotracheal tube with stainless steel electrodes that are in contact with the vocal cords (Medtronics Xomed, Inc., Jacksonville, FL) has been found to be reliable. Recently, a laryngeal surface electrode was introduced to enable another form of noninvasive monitoring. Yet another technique uses a concave surface electrode placed laryngoscopically against the posterior cricoarytenoid muscle. Responses from the recurrent laryngeal nerve during surgery confirm proper positioning of the electrodes.[47] However, until a prospective randomized trial documents the efficacy of continued intraoperative monitoring in reducing permanent nerve paralysis, its use cannot be routinely recommended.[48]

Hypoparathyroidism occurs in 1% to 5% of patients undergoing thyroidectomy. When a thyroid lobectomy is carried out, there is virtually no chance of hypoparathyroidism occurring, even though both ipsilateral parathyroids may have been removed inadvertently or their blood supply interrupted, unless the patient has previously undergone thyroid surgery. Kocher[1] pointed out the need to ligate the inferior thyroid artery as close to the thyroid gland as possible to avoid devascularization of the parathyroid. Because both the superior and the inferior parathyroid glands obtain their blood supply from the inferior thyroid artery, the blood supply will be preserved if this advice is followed. Sometimes the most difficult task is distinguishing the parathyroid glands from fat, lymph nodes, and thyroid nodules. The parathyroid glands are usually identified by their golden brown color and size, although their position is variable. Magnification may be useful in identification of the parathyroid gland.

Hypoparathyroidism may result from inadvertent removal of the glands, ligation of their blood supply, or a hematoma.[49] In experienced hands, the incidence of permanent hypoparathyroidism should be less than 2%.[50] Lin and coauthors[51] reported a 9% incidence in 220 patients whose parathyroid was inadvertently removed during thyroidectomy. In primary surgery the incidence was 7.7% and in repeat surgery, 20%. This complication has, in fact, been the most important deterrent to the use of total thyroidectomy in the treatment of patients with carcinoma of the thyroid.

We routinely determine baseline calcium and phosphorus levels before surgery. If only a thyroid lobectomy has been carried out, no further testing is done in the postoperative period unless the patient has previously undergone thyroid surgery. When a total thyroidectomy is carried out, blood for determination of calcium and phosphorus levels is drawn on the second postoperative day because hypocalcemia usually occurs 48 to 72 hours after the operation. It is prudent to ask the patient about subjective symptoms such as circumoral paresthesia or paresthesia of the fingers and toes. The patient should be checked for the presence of Chvostek's sign during this period. Carpopedal spasm, laryngeal spasm, seizures, or cardiac abnormalities may occur in more severe cases. The use of rapid intraoperative parathyroid hormone monitoring in parathyroid surgery may make monitoring of postoperative calcium simpler in years to come.

To treat tetany or other severe symptoms, the patient is given 1 ampule of 10% calcium gluconate infused over a 5- to 10-minute period. For moderate symptoms or for a calcium level less than 7 mg/dL, an intravenous drip of calcium gluconate, 4 ampules, and dextrose in water, 250 mL, is infused over a 4- to 8-hour period. The infusion is repeated, if necessary, with titration depending on signs, symptoms, and the serum calcium level, which is rechecked every 6 to 12 hours. Calcium carbonate is started orally and provides 2 g of elemental calcium daily. Administration of calcitriol (Rocaltrol; the active form of vitamin D) may be initiated at 0.25 mg twice daily, and the dose may be increased on an outpatient basis if necessary. Vitamin D should not be given if prompt return of parathyroid function is anticipated. Vitamin D and calcium can usually be tapered and discontinued within several months if viable parathyroid tissue has been preserved in the patient.

Hypothyroidism will occur after total thyroidectomy. Replacement therapy with levothyroxine sodium (Synthroid) may be initiated in the immediate postoperative period in patients with benign disease. In patients with WDTC, thyroid replacement may be withheld to facilitate subsequent ^{131}I testing and treatment. Many physicians, however, prefer treatment with liothyronine sodium (Cytomel), which is discontinued 1 week before the scan to avoid excessive symptoms of hypothyroidism. The patient can begin taking Synthroid after the scan is carried out, and the level can be monitored with thyroid function tests. Suppression therapy is given with the goal of keeping TSH levels less than 0.5 mg/dL so that any residual cancer cells will not be stimulated and thus hopefully preventing recurrence.

^{131}I scanning is necessary postoperatively to determine the completeness of the surgical procedure and to detect residual or metastatic disease. Small foci of residual disease or occult distant metastasis can be adequately treated with therapeutic doses of radioactive iodine. Current indications for administration of an ablative dose of ^{131}I include the following:

- Radioactive uptake greater than 2%
- A large amount of residual functioning thyroid tissue
- Invasion of local structures (trachea, larynx, esophagus) by cancer
- Metastatic foci

Patients who have carcinoma of the thyroid should undergo total thyroidectomy for several reasons. Some surgeons believe that total thyroid lobectomy or subtotal thyroidectomy is satisfactory for this disease.[52] Numerous reports attest to the fact that recurrences and fatalities are more frequent after less-than-total thyroidectomy in the treatment of WDTC.[53–55] The primary reason that some surgeons perform less-than-total thyroidectomy is fear of complications or injury to the recurrent laryngeal nerve and hypoparathyroidism. Their approach is justified by the finding that most patients do well with less extensive procedures. Approximately 80% of patients do well regardless of the extent of surgery, and about 5% do poorly regardless of the treatment administered. The remaining 15% benefit from total thyroidectomy followed by radioactive thyroid ablation if indicated by postoperative scanning. Total thyroidectomy eliminates microfoci and macrofoci in the contralateral lobe, thus reducing the risk for recurrent central neck disease. Complete surgical ablation of the thyroid gland provides the opportunity to effectively eradicate distant metastases, particularly pulmonary metastases, with ^{131}I. Treatment of distant metastasis with ^{131}I in the face of a large amount of remaining thyroid tissue is not as effective because of preferential uptake of ^{131}I by normal thyroid tissue. Serum thyroglobulin has proved to be quite useful in monitoring for recurrence in patients with WDTC. Hall and colleagues[11] observed that advanced-stage cancer at initial evaluation and a stimulated thyroglobulin level greater than 20 pmol/L 3 months after total thyroidectomy were independent predictors of cancer recurrence. Follow-up care consists of thyroglobulin assay and radioactive scanning.

PEARLS

- Patients with a mass in the thyroid gland should undergo fine-needle aspiration biopsy.
- Complete removal of the thyroid gland gives the patient the best chance to be cured.
- Identification of the recurrent laryngeal nerve offers the best opportunity to avoid injury to the nerve.

- Accurate identification and preservation of the parathyroid glands and their vascular supply should prevent postoperative hypocalcemia.
- A substernal goiter can almost always be removed through the neck.

PITFALLS

- Failure to identify the recurrent laryngeal nerves may lead to bilateral vocal cord paralysis, which will produce airway obstruction in the immediate postoperative period.
- Meticulous hemostasis is necessary to prevent the formation of a hematoma, which may result in airway obstruction and could be fatal.
- Incomplete removal of thyroid cancer predisposes patients to recurrence.
- An unsightly scar may result from selecting the incision site after the patient is placed in extension.
- Failure to perform total thyroidectomy in a patient with a history of exposure to radiation puts the patient at risk for recurrence because such patients are known to have multifocal disease in the thyroid.