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Indications

- A therapeutic neck dissection is performed for well-differentiated thyroid carcinoma with evidence of nodal involvement (either clinical or radiographic evidence confirmed by fine-needle aspiration) in either the central and/or lateral neck.
- A prophylactic central neck dissection may be considered for large papillary thyroid cancers (T3 or T4 lesions) or when extrathyroidal tumor extension is present. A prophylactic central neck dissection is also performed when treating medullary thyroid cancer.
- A reoperative neck dissection is performed when a nodal recurrence is identified following a previous thyroidectomy and/or lymphadenectomy.

Preoperative Preparation

Neck dissections are considered clean operations and the risk of infections is <1%. Due to the low risk of infection, prophylactic antibiotics are typically not required, unless the upper aerodigestive tract (i.e., trachea or esophagus) is entered. Antibiotics should be considered in reoperative fields or fields that have been previously radiated due to compromised blood flow to the region.

Since a neck dissection is only done in patients with metastatic cancer, these patients are at a higher risk for deep venous thrombosis than other thyroid operations. Because of this increased risk, intermittent pneumatic compression devices should be used on all patients. The use of chemical deep venous thrombosis prophylaxis should be implemented only after careful consideration, as the risk of bleeding postoperatively may outweigh the risk of developing a venous thromboembolism in this population. In selected high-risk patients, a preoperative dose of 5000 units of subcutaneous unfractionated heparin for prophylaxis is usually given up to 2 hours preoperatively. Since these patients are ambulatory in the immediate postoperative period, prolonged prophylaxis postoperatively is rarely indicated.

Accurate preoperative imaging is key to determining the appropriate extent of the operation. Preoperative ultrasound with lymph node mapping is essential to determine the location of the nodal disease and to plan the appropriate extent of resection. For patients with large necks, bulky disease, or prior neck operations, additional imaging with a contrasted neck CT may help to clarify the location of all diseases. However, caution must be used when interpreting neck CT scans as radiological findings may not necessarily represent true pathologic disease.

Intraoperative localization is essential to ensure a complete resection is performed. Ultrasound is particularly helpful in the operating room once the patient is positioned on the operating room table to orient the surgeon to the anatomy and delineate the extent of dissection that is needed. Adjuncts such as blue dye or a charcoal suspension can also be injected preoperatively under ultrasound guidance into the area of interest or intraoperatively to help guide dissection, particularly when the lesion is in a reoperative field. Ultrasound can also be used after the resection is completed to ensure that all disease seen on imaging preoperatively has been appropriately removed.

As for any major operation, the patient should be prepared with age-appropriate laboratory tests, including electrocardiogram and chest radiographs, when indicated based on comorbidities. Preoperative evaluation is accomplished in conjunction with the anesthesiologist prior to surgery. An assessment of the patient's disease, comorbidities, and treatment goals is required. If an operation is going to be

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performed in the central neck, it is valuable to get a baseline calcium and parathyroid hormone (PTH) level to assess the function of the parathyroid glands, as they will be put at risk with a dissection in this area. For patients with differentiated thyroid cancer, preoperative testing with thyroglobulin levels can be used as a baseline to assess the response to surgery.

Assessment of the patient's vocal function preoperatively is essential. A more formal vocal cord assessment with fiberoptic laryngoscopy is appropriate if there are any voice changes, if the patient has had a prior neck operation, or if the tumor is near the recurrent laryngeal nerve (RLN) or the vagus nerve (CN X).

Preoperative planning includes obtaining informed consent from the patient. It is appropriate to explain to a patient why a neck dissection is being performed and what, if any, alternative forms of therapy might be employed. The patient must understand the risks of the surgery as well as the expected recovery after surgery. Risks of a central neck dissection include injury to the recurrent and superior laryngeal nerves and the parathyroid glands as well as a risk of bleeding or infection. For a lateral neck dissection, it is essential to also discuss possible injuries to CN X, phrenic, spinal accessory (CN XI), hypoglossal (CN XII), and cervical sensory nerves, as well as the risk of a chyle leak or seroma.

Pitfalls and Danger Points

Scarring Due to Prior Surgery

Reoperative neck dissections can be technically challenging due to the distorted anatomy and fascial planes. Preoperative marking with blue dye or charcoal suspension and intraoperative ultrasound can assist in identifying pathologic nodes. If necessary, a fresh incision can be made directly over a localized lymph node to avoid an extensive dissection through a reoperative field to reach the area of interest.

Nerve Injuries

Several important nerves are at risk with a neck dissection (hypoglossal, vagus, phrenic, spinal accessory, and recurrent laryngeal). The key to avoiding injury to these nerves is to understand their anatomic pathways and the key landmarks that can facilitate their identification. When dividing tissue in the lateral neck, it is important to dissect out the tissue completely so that you can clearly see what you are dividing so that you can avoid inadvertently dividing a nerve. Use of an intraoperative nerve monitoring system can facilitate the identification of the nerves and ensure their function at the end of the case.

Injury to the Thoracic Duct

The thoracic duct is located low in the left neck and inserts into the internal jugular vein. The walls of the thoracic duct are very thin and can be easily injured during a left lateral neck dissection. It is important to be looking for this duct as you dissect lateral to the internal jugular vein in Level IV of the left neck. If the duct is injured, you will see clear fluid accumulating in the wound. The fluid becomes cloudy only after the patient has had a fatty meal, so intraoperatively the fluid will rarely be milky in color. If you are concerned about an injury, you can administer heavy cream down a nasogastric tube and that will turn the fluid milky in color to facilitate identification. If the duct is injured, it is important to carefully ligate it with a suture or small clip. If you are concerned that it is not effectively ligated, you can reinforce the area with a muscle flap from the adjacent sternohyoid muscle. If there is concern about an injury to the thoracic duct, you should always leave a drain postoperatively.

Seroma

Fluid accumulates in the operative space after any neck dissection. Swelling typically peaks around day 5. Drains can be used postoperatively to monitor how much fluid accumulates, but most patients do not require a drain or can have it safely removed the next day. Cutting small lymphatics is what leads to seroma formation. The key to minimizing seroma formation is to look for major lymphatic channels and to ligate, clip, or seal the lymphatics as they are divided. At the end of the surgery, having the anesthesiologist perform a Valsalva maneuver can help you to identify any potential lymphatic leaks that need to be addressed prior to closing.

Documentation

Neck dissection operations may be elective when done for clinically occult metastases, therapeutic for clinical apparent metastases or may be a salvage procedure when the patient's neck was previously treated with surgery and/or radioactive iodine and residual or recurrent disease is identified. Your documentation must clearly state if the dissection was prophylactic or therapeutic and if it was a reoperation.

A neck dissection is defined as a compartment-oriented removal of all the fibroadipose tissue and lymphatic tissues en bloc from a given compartment within the neck while preserving critical structures. "Berry picking" (i.e., selective removal of single, grossly involved nodes) is not a compartment-oriented dissection. When documenting a lymph node dissection, it is important to outline exactly which nodal basins were removed. It is also important to

document which nerves were identified and if they were able to be preserved.

Operative Strategy

The lymph nodes of the neck are divided into six levels:

- Level I is bound by the stylohyoid muscle posteriorly, anterior belly of the contralateral digastric muscle anteriorly, mandible bone superiorly, and hyoid bone inferiorly.
  - Level IA (submental triangle) bound by the anterior bellies of the digastric muscle and hyoid bone.
  - Level IB (submandibular triangle) containing the submandibular gland and its nodes.
- Level II encompasses the skull base to the hyoid bone. The posterior border is marked by the posterior border of the sternocleidomastoid muscle (SCM) and anterior border by the stylohyoid muscles, respectively. Lymphatic tissue obtained anterior and posterior to CN XI corresponds to Levels IIA and IIB accordingly.
- Level III extends between the hyoid bone and inferior border of the cricoid cartilage. The anterior boundary is marked by the sternohyoid muscle and posteriorly by the SCM posterior margin.
- Level IV is framed by the inferior border of the cricoid cartilage superiorly and the clavicle inferiorly. The anterior margin is the sternohyoid muscle and posterior border is the posterior border of the SCM.
- Level V extends from the posterior border of the SCM anteriorly and trapezius muscle posteriorly. It stretches from the mastoid tip to the clavicle and is subdivided by a line from the inferior border of the cricoid cartilage into Level VA superiorly and Level VB inferiorly.
- Level VI encompasses the central compartment of the neck bound by the carotid arteries in the lateral aspect, hyoid bone superiorly, and inferiorly by the suprasternal notch. Level VII is in the superior mediastinum and is considered a thoracic component.

A comprehensive or therapeutic lateral neck dissection involves clearance of all nodal and fibroadipose tissue from Levels I to V and may either be a radical neck dissection (RND) or modified radical neck dissection (MRND). An RND includes resection of the ipsilateral SCM, CN XI, and internal jugular vein (IJV). MRND preserves one or more of these structures: MRND type I preserves the CN XI, MRND type II preserves CN XI and either the IJV or SCM, and MRND type III preserves all three structures. An extended neck dissection includes additional lymphatic or nonlymphatic groups not usually included in the comprehensive neck dissection.

A comprehensive MRND is rarely indicated for the treatment of thyroid cancer, as involvement of Level I is quite rare. Most patients with thyroid cancer are treated with a more selective lateral neck dissection. Selective lateral neck dissections are classified according to the cervical lymphatic regions that are resected. A selective neck dissection is done for limited cervical metastases. It involves the removal of <5 nodal basins from Levels I to V and is directed by the patterns of lymphatic drainage from the primary tumor, while preserving CN XI, the IJV, and the SCM. For patients with thyroid cancer, patients frequently have removal of Levels III, IV, IIA, and VB. Disease in VA and IIB is uncommon and removal of nodes from this area is not required in most patients.

A bilateral central neck dissection encompasses resecting lymph nodes from only Level VI, including the prelaryngeal and pretracheal nodes, and both right and left paratracheal lymph node basins. A central neck dissection may be unilateral or bilateral. If disease is identified in the lateral neck, it should be assumed that there is also disease in the central neck and a dissection of both regions should be performed.

Operative Technique

Position the patient supine on the operative table with a pillow or inflatable pressure bag under the shoulders to obtain the proper angle for surgery. Extend the neck and turn the head to the opposite side for unilateral neck dissections. Cushion the occiput on a donut pillow against the upper end of the table. Elevate the head of the table for surgery. Shave, prep, and drape the patient's neck and upper chest. Surgical draping must provide access to the clavicle inferiorly, the trapezius most posteriorly, and the tip of the earlobe superiorly. Place five towels onto the skin; one horizontally across the angles of the mandible, two from each shoulder to the midline, and another two from each angle of the mandible to the corresponding shoulder. Cover the patient's torso and extremities with a sheet, and use a second open sheet to cover everything except the field of operation. Use general anesthesia but do not use muscle relaxants so the surgeon can be aware of the degree of contraction when approaching the main nerves in the neck, locating and preserving these nerves. A nerve monitoring system can be utilized to facilitate identification of the recurrent laryngeal nerve, CN X, as well as CN XI. Appropriate placement of the endotracheal tube is essential for monitoring of the recurrent laryngeal nerve or CN X. Using a video-based laryngoscope can ensure proper placement of the electrodes between the vocal folds.

The incisions used vary, and are influenced by the site of the underlying tumor and laterality of the dissection to be performed, as well as the experience and preference of the

surgeon. The criteria for choice of incision include the following:

- Access required to resect the primary tumor
- Maximizing exposure to the field
- Preserving vascularity of the skin flaps
- Anticipating the potential for postoperative radiotherapy
- Acceptable cosmetic result

Central Compartment Neck Dissection

The boundaries of a central neck dissection are as follows:

- Superiorly: the hyoid bone
- Inferiorly: the innominate artery
- Laterally: the ipsilateral carotid artery
- Anteriorly: the superficial layer of the deep cervical fascia
- Posteriorly: the deep layer of the deep cervical fascia

A compartment-oriented approach is the customary method for the removal of the prelaryngeal, pretracheal, and both the right and left paratracheal nodal basins in a bilateral central neck dissection. A central neck dissection can typically be performed through the same incision as the thyroidectomy. The incision is placed about 1 cm below the cricoid cartilage near the isthmus of the thyroid. The cricoid cartilage is a better landmark than the sternal notch given the variability in location of the thyroid based on neck anatomy. If the nodal involvement extends into Level VII in the upper mediastinum, a lower incision may allow better access to the disease. The incision can be extended to the borders of the SCM for a large goiter or into the lateral neck if a concurrent lateral neck dissection will be performed. The skin is divided sharply and the subcutaneous tissue and platysma are divided with cautery. Once the platysma is divided, it is grasped with straight clamps and elevated, and the strap muscles are retracted inferiorly exposing the subplatysmal plane. This avascular areolar tissue is opened using cautery or a knife and the dissection is carried superiorly to expose the thyroid cartilage and inferiorly down to the suprasternal notch. During this dissection, you remain superficial to the anterior jugular veins. Hold apart these skin flaps with self-retaining retractors or suture each to the overlying surgical drape to keep in place during the dissection. Divide the midline fascia of the sternohyoid and sternothyroid muscles and retract them laterally; take care to recognize and divide the small crossing veins between the anterior jugular veins, typically located above the cricoid cartilage and near the sternal notch. You can separate the sternohyoid muscle from the sternothyroid muscle, which can facilitate your lateral retraction. If needed, you can transect the sternohyoid and sternothyroid

muscles to facilitate exposure to the central neck. A central neck dissection can be done in conjunction with the thyroidectomy or may be done after a previous surgery if the lymph nodes were not recognized prior to the first operation. Once the thyroid has been removed, you identify and dissect the RLN caudally at the posterior suspensory ligament of Berry (lateral thyrohyoid ligament) with an atraumatic technique along its entire course minimizing manipulation and traction. There is huge variability of the position of the RLN, and the course and relationship to neighboring anatomical structures. You can palpate the RLN as a cord-like structure against the trachea, and it can be visually identified by its small vessels running on its surface. The left RLN usually lies deep to the inferior thyroid artery in the tracheoesophageal groove, while the right RLN ascends more obliquely, particularly in the lower third of the neck. Be familiar with variations in RLN, which include passing anterior to and between branches of the inferior thyroid artery.

With gentle traction, dissect en bloc the fibroadipose tissue anterior and medial to the RLN and its branches, medially to laterally. Be familiar with the significant positional variability of the parathyroid glands. Although the position may be inconsistent, they are usually symmetric. The glands are mustard in color and must remain along with its primary blood supply from the superior branch of the inferior thyroid artery. Bleeding within this area will make it troublesome to identify the parathyroid glands, so ensure careful hemostasis. Be familiar with the significant positional variability of the superior parathyroid glands (undescended, parapharyngeal, retropharyngeal, retrotracheal, or within the mediastinal compartment). The glands are usually posterior to the RLN and 1–2 cm superior to the junction of the nerve with the inferior thyroid artery, and within 1 cm of the entry point of the RLN into the ligament of Berry. Preserve the glands in situ and keep the blood supply intact leaving them viable. The inferior parathyroid glands, located anterior to the RLN, is most often found in the anterior mediastinal compartment in the thyrothymic tract. They can also be found inside the thyroid capsule on the inferior portion of the thyroid lobes. Tease the inferior parathyroid glands laterally ensuring viability by preserving the pedicle. If there is a concern for devascularization, parathyroid autotransplantation is performed after confirmation with intraoperative frozen section to reduce the risk of inadvertent autotransplantation of a nodal metastasis. To accomplish this, dice the gland into 1 mm cubes and insert them into the SCM. The position of the autotransplant should be marked with a permanent suture and/or a small clip.

The central compartment contents should be cleared laterally from the strap muscle and carotid artery and caudally toward the sternal notch including thymic tissue if the gland contains palpable abnormal nodes. There are typically additional paratracheal nodes present posterior to the RLN, especially on the right, and this area needs to be mobilized and

removed as well. The area posterior and lateral to the RLN should be carefully dissected and any nodal tissue removed. A common place that nodal disease is missed is just posterior to the RLN near its insertion into the cricothyroid muscle.

Before closing the wound, ask the anesthetist to perform a Valsalva maneuver to elicit unsecured bleeding vessels and to look for lymphatic leaks. After ensuring hemostasis, reapproximate the strap muscles at the midline with absorbable interrupted sutures followed by the platysma. Close the skin incision with an absorbable suture. You may also close the skin wound with nonabsorbable suture, which is removed in the OR or on postoperative day #1, and is reinforced with wound closure strips or with a surgical glue.

Lateral Compartment Neck Dissection

A variety of incisions can be used to adequately access the lateral compartment. The decision regarding which incision to use will relate to the anatomy of the neck as well as the location of the nodes that require removal. If a neck dissection is being done in conjunction with a thyroidectomy, the thyroidectomy incision can often just be extended along a natural skin crease into the lateral neck. If the incision is too low to adequately access Level II, then the incision can be curved up in a hockey stick fashion along the posterior aspect of the SCM or a counter incision can be made high in the neck overlying Level II. For other head and neck cancers, a wide apron flap incision (Gluck incision) or a Y-shaped incision (Martin incision) may be used. The extent of dissection generally depends upon the location of the nodal disease. The American Thyroid Association recommends that a lateral compartment neck dissection for thyroid cancer should encompass resection of fibroadipose and lymphatic tissue from Levels IIA, III, IV, and VB.

The first step of the procedure after incising through the skin, subcutaneous fat, and platysma muscle is to raise subplatysmal flaps leaving superficial veins and fascia of the SCM down. You should carry your dissection superiorly to the submandibular gland, but do not dissect superior to this gland as you can injure the marginal mandibular nerve. The marginal mandibular nerve runs approximately 1 cm anterior to the angle of the mandible and it crosses lateral to the submandibular gland and facial vessels. Inferiorly you should raise flaps to the level of the clavicle. Begin the dissection inferior to the superior belly of the omohyoid muscle and identify the IJV. Dissect along the IJV until you reach the anterior scalene muscle. You should use a sharp dissection technique instead of using electrocautery near all major neurovascular structures. Identify and leave the external jugular vein and greater auricular nerve overlying the SCM. Dissect the IJV along its length inferiorly to the junction with the subclavian vein. A Valsalva maneuver can assist in identify-

ing the thoracic duct as it empties into the IJV near the junction with the subclavian vein, when dissection is in the left neck. You should preserve the thoracic duct. If the duct is transected, carefully ligate it with a nonabsorbable suture. Ensure closure of the leak prior to closure of the neck wound. Suture ligate or place vessel clips on all soft tissue while dissecting across the inferior extent of Level IV to prevent additional chyle leaks.

The nodal packet is mobilized laterally from the IJV. Grasp this tissue with a Babcock clamp and identify the posterior cervical fascia deep to this tissue. Elevate the nodal tissue off the posterior cervical fascia as a single packet taking care to preserve the phrenic nerve, which is posterior to the plane of dissection and anterior to the scalene muscle. Resect the tissue superior to the nerve and inferiorly at the level of the subclavian vein. Keep the dissection of the nodal tissue from Levels III and IV superficial to the scalene muscle to preserve the branches of the cervical plexus, which lie on top of the muscle. Much of this dissection can be done bluntly and the nodal packet is kept intact.

Once the inferior extent of the dissection is complete, you can isolate the omohyoid muscle and elevate it with a Penrose drain so that the tissue can be carefully resected from around it (Fig. 128.1). Mobilize the nodal packet superior to the
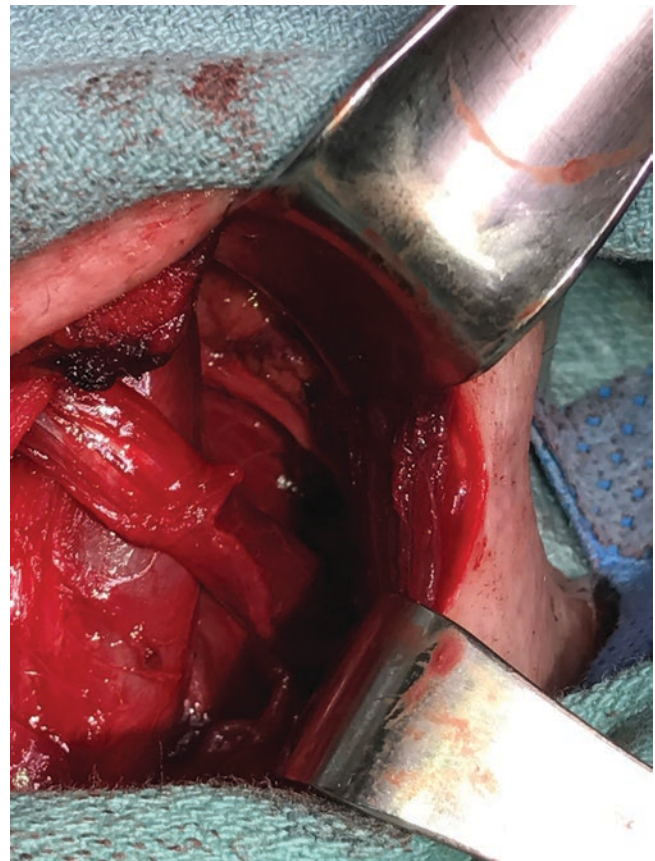

Fig. 128.1

omohyoid muscle up to the bifurcation of the carotid artery. Identify CN XII at the superior extent of the lateral dissection as it crosses superior to the carotid bifurcation. CN XI, which divides Level II into Levels IIA and IIB, is identified superior to the greater auricular nerve that originates posterior to the SCM. As the dissection is carried superiorly, ligate or preserve the facial artery and vein. Dissect free the node-bearing adipose tissue from Level IIA. If macroscopic nodal disease is identified at Level IIA, you should proceed with the removal of nodal tissue from Level IIB.

Medially you should identify the carotid sheath which envelopes the IJV, common carotid artery, and CN X. It is interposed between the superficial and prevertebral layers of the cervical fascia. Additional nodal tissue is often present within the sheath and needs to be removed with the specimen. Open the sheath and dissect anteriorly along CN XII and the digastric muscle. CN XII crosses superior to the bifurcation of the carotid artery, near the facial vein. Preserve the neurovascular contents in the carotid sheath while dissecting along the IJV. Remove the fascia from the IJV by passing the scalpel along the wall of the vein up and down along its entire length. With the blade pointing away from the IJV wall, move the scalpel obliquely with respect to the vein until it is completely released from its fascial covering. Continue the dissection over the carotid artery. Identify CN XI, which is encountered approximately 2 fingerbreadths below the posterior belly of the digastric muscle. Remove the nodal tissue from the nerve and digastric muscle. Branches of the occipital artery may be encountered and need to be ligated close to the muscle. Free the dissected tissue from the SCM as far as CN XI and elevate anteriorly lateral to the deep cervical muscles.

Dissect inferiorly along CN XI and divide the tissue at this level to incorporate all of Level VB but preserve Level VA posterior to CN XI (Fig. 128.2). Given the lymphatics coursing through this tissue, divide it with a sealing device or tie it with a suture. Send the node-containing tissue to pathology as a single specimen containing Levels IIA, III, IV, and VB (Fig. 128.3). Drain insertion should be done selectively if at all, as it will not prevent seroma formation or bleeding. If there is concern for a chyle leak, place a drain and have the patient eat a fatty meal to ensure that the fluid does not change to a milky consistency. Attach drains to a bulb and initiate suction immediately to prevent clot formation while closing the skin. Perform the closure of the wound as described in the *Central Compartment Neck Dissection* section above.

Avoiding Postoperative Complications

Skin flap loss can be disastrous, leading to exposure of the vital structures. This can largely be prevented by avoiding
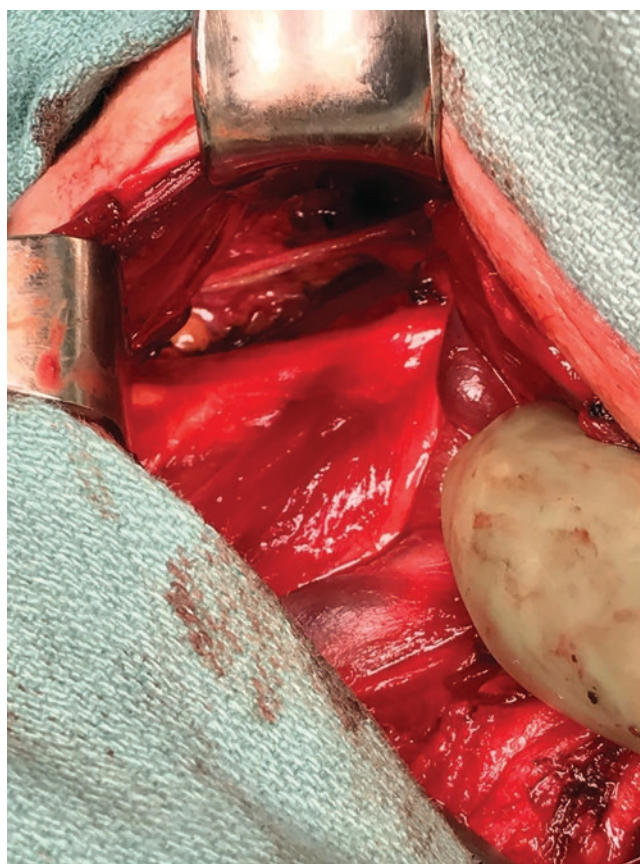

Fig. 128.2

Fig. 128.3

incisions that form a long, narrow, poorly vascularized flap. Preservation of the platysma and specific vessels such as the facial artery may help. Keeping the flap moist with saline-soaked sponges to prevent desiccation, periodically returning the flap to its anatomic position, and preventing prolonged skin flap retraction are maneuvers that can be employed to prevent flap loss.

Meticulous identification and dissection of the neurovascular bundles of the neck are essential to avoiding injury to these structures. Nerve monitoring systems are available which can facilitate the identification and confirm the functionality of the nerves during a dissection. Stimulation of a motor nerve will lead to contraction of the end muscle, which may be able to be palpated or seen visually or captured with an electromyographic (EMG) monitor.

Dissection from Levels IV and V must be meticulously performed to avoid injuring or ligating lymphatic tributaries leading to the left or right neck thoracic duct to prevent a chyle fistula. A Valsalva maneuver can be performed prior to closure to help elicit unsecured bleeding vessels and unwanted chyle leakage. If a chyle leak is encountered, it is critical to securely tie off the thoracic duct and ensure that the leakage is controlled prior to closing. Occasionally, a muscle flap is required to help seal off a leak. If there is a concern for a chyle leak, a drain should be placed in the wound bed to facilitate early identification and drainage of the area.

Postoperative Care

- Postoperatively a compression dressing can be used to promote wound coaptation and reduce the incidence of postoperative seromas, hematomas, and wound edema. Drains have historically been used for all neck dissections, but experience has shown that many patients can be managed effectively without drains. If drains are used, they are placed to bulb suction, to help facilitate drainage of the space, and to monitor for chyle or lymphatic leaks. The drains are maintained until output is low and there are no signs of chyle leakage. Drains usually can be removed the following day. An alternative to drain placement is to place a fibrin sealant within the dissected space and then to apply pressure to the neck to allow the tissues to coapt effectively obliterating the space.

- Physical therapy of the shoulder should be considered in all patients in whom CN XI was dissected, especially if both Levels VA and VB have to be dissected. This is particularly critical if CN XI had to be sacrificed or was injured during the dissection. Shoulder pain with movement ("shoulder syndrome") is not an uncommon complication of a lateral neck dissection, especially if Level VA has been removed. Loss of trapezius support allows the shoulder to droop, resulting in decreased shoulder mobility and pain. Exercises for range of motion should be undertaken to prevent shoulder fibrosis.

- Management of hypocalcemia postoperatively for patients undergoing a central neck dissection is similar to that after a thyroidectomy. Serum calcium and PTH levels are obtained postoperatively, and calcium supplementation can be given according to an algorithm or symptom-based treatment.

Complications

- A surgical bed hematoma occurring in the immediate postoperative period is often due to inadequate hemostasis during the procedure. The use of drains may facilitate earlier recognition of a hematoma, but will not manage or effectively prevent a hematoma as the drain often becomes nonfunctional due to clot. Once a hematoma is identified or suspected, exploration in the operating room is mandatory, which involves opening the surgical wound, irrigating to remove the clot, and identifying the bleeding vessel. Unfortunately, most of the times, no bleeding site is identified.

- A postoperative seroma may develop later in the postoperative course. Seromas most commonly manifest by about postoperative day 5. If swelling is mild, it can often be managed conservatively, and the swelling will subside over the next few days. If the patient is highly symptomatic, then a simple bedside aspiration under ultrasound guidance can relieve the pressure. Aspirations must be performed under sterile conditions or you risk converting a sterile postoperative fluid collection into an abscess.

- Profuse neck drainage, especially from the left-sided neck drains, suggests the presence of a chyle fistula. If a small leak is identified, it may cease with conservative management, such as medium-chain triglyceride diet, parenteral nutrition, and a pressure dressing. Occasionally, a high-output leak will require intrathoracic ligation of the thoracic duct, fibrin sealant placement, or flap closure.

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