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Lateral neck dissection

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Elective neck dissections have become the standard of care for patients with squamous cell carcinoma of the upper aerodigestive tract with no clinical nodal metastases but with an increased risk (ie, >15%) for subclinical (pathological) metastases. The most significant role of elective neck dissections is in identifying patients with occult pathological nodal metastases who will benefit from radiotherapy and thus decrease the rate of regional recurrence and increase survival in these patients. Over the years, elective radical neck dissections have been replaced by modified radical and selective neck dissections. Lateral neck dissection, including levels II–IV, is currently the elective treatment of choice for patients with laryngeal and hypopharyngeal primary cancers. The preoperative evaluation, indications and contraindications, surgical technique, and common complications of lateral neck dissection will be detailed.
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Cancer of the hypopharynx and larynx (especially the supra-glottic larynx) is commonly associated with metastases to the regional lymphatics. When such metastases occur, they are believed to cause a 50% decrease in the estimated survival of these patients. Prevention of these metastases is therefore a crucial goal in the management of these patients. Although radiation is frequently used, when the treatment of the primary tumor is surgical, then surgery is the preferred elective modality for the regional lymphatics as well.

Radical neck dissection has been the preferred elective treatment for patients with carcinoma of the larynx and hypopharynx, but it has been replaced by the more conservative procedures such as modified radical neck dissections and selective neck dissections. The rationale for performing selective neck dissections is based on the predictable patterns of lymphatic spread of squamous cell carcinoma (SCC) of the upper aerodigestive tract, allowing treatment to commence with the removal of the first echelon of lymphatic drainage. If this echelon(s) does not harbor metastatic disease, the incidence of metastases in other levels of the neck is then believed to be extremely low, and thus the value of elective treatment at those levels of the neck is less obvious. Shah[1] studied the patterns of cervical node metastases from SCC of the larynx in 262 radical neck dissection specimens and found occult-positive adenopathy mostly at levels II–IV, whereas levels I and V were rarely involved (ie, 14% and 7%, respectively). He suggested lateral neck dissection of levels II–IV as the preferred elective treatment in these patients. His recommendation is in agreement with Li et al,[2] who studied 384 neck dissection specimens by serial sections and found that the majority of the metastatic nodes in 74 patients with laryngeal carcinomas occurred at levels II–IV (other levels were involved mainly if enlarged nodes were present at levels II–IV). Recently, the Brazilian Head and Neck Cancer Study Group[3] prospectively compared selective lateral neck dissection (levels II–IV) with type III modified radical neck dissection as part of elective treatment for patients with supraglottic and transglottic SCC of the larynx. In their study, selective neck dissection was converted to a modified radical neck dissection if frozen-section analysis of suspicious lymph nodes confirmed the presence of metastatic SCC. After a mean follow-up of 42 months, the authors found no difference in the outcome between patients treated with either modality. Their study further supports the use of lateral neck dissection that includes levels II–IV as an effective treatment for patients with T2 to 4 SCC of the transglottic and supraglottic larynx. Accordingly, lateral neck dissection that includes levels II–IV of the neck is considered to be the ultimate elective treatment for patients with laryngeal and hypopharyngeal cancer.[4]

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Indications

1. Advanced (T4) previously untreated glottic cancer treated by total laryngectomy
2. T3 to 4 laryngeal cancers recurring following radiotherapy and treated by total laryngectomy
3. T2–T4 supraglottic cancers treated surgically either by preservation surgery or as salvage surgery following radiation failure (the status of the primary tumor does not effect the need for a neck dissection)
4. All hypopharyngeal cancers treated surgically (usually by total or partial laryngopharyngectomy)
5. Bilateral lateral neck dissections, indicated for all patients with tumors crossing the midline

Contraindications

There are no distinct contraindications. Clinical adenopathy is considered a contraindication, mandating a more aggressive surgical treatment, but lately selective neck dissections have been used for patients with small N1 metastases and, if followed by radiation, the results were reported similar to more comprehensive nodal resections.[5]

Unquestionably, for nodal stage >N1, lateral neck dissections is not appropriate and a radical or modified radical neck dissection is indicated.

Preoperative evaluation

No specific radiologic examinations of the neck are warranted for patients with clinically N0. Sonography of the neck with a possible fine-needle aspiration biopsy may be helpful in providing a preoperative diagnosis of metastatic carcinoma. However, if the positive node is <2 cm (which is commonly the case in a patient with no clinical adenopathy), several surgeons may still perform a lateral neck dissection followed by radiation. Thus, preoperative diagnosis of positive adenopathy (N1) by sonography combined with fine-needle aspiration biopsy will not necessarily change our treatment plan, and their routine use is questionable. Position emission tomography scans are currently studied as part of a preoperative workup of patients with head and neck SCC for detection of occult cervical and distant metastases. Nevertheless, even if the scan is suspicious for metastatic disease in the neck, a lateral neck dissection with postoperative radiation therapy for the pathologically positive neck is probably adequate, and thus the role of preoperative position emission tomography scan is also argued. In the future, if position emission tomography scan, especially when combined with a computed tomography scan, will prove to be a sensitive tool for detection of occult regional metastases, then better selection of patients for elective neck dissections may be accomplished.

The role of computed tomography and magnetic resonance imaging for the preoperative evaluation of patients with SCC of the larynx and hypopharynx with clinically N0 neck is questionable. Evaluation of the primary site is usually indicated, and the neck is thus evaluated at the same time. Once again, because most metastases >2 cm are clinically detected, lateral neck dissection will still remain the treatment of choice in most patients with clinically N0.

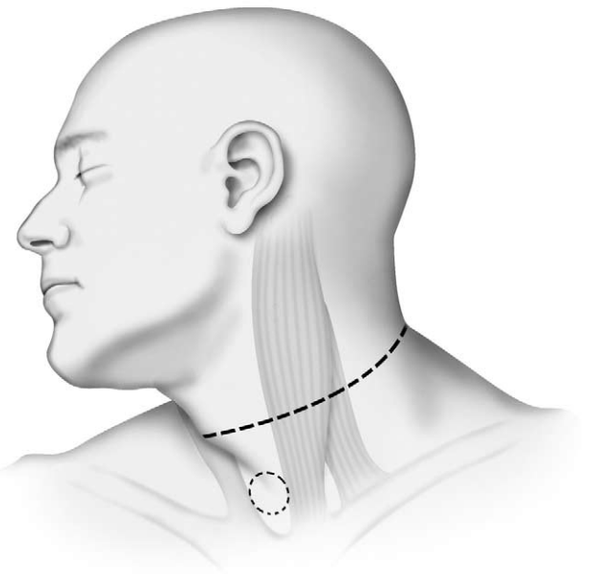

Figure 1 A transverse incision at the level of the thyroid cartilage, within a skin crease from one side of the neck to the other (reaching the hairline and curving up just a little). A laryngectomy stoma is pointed out in the midline below this incision (starting at least 1.5 cm below the transverse incision).

Operative technique

A single transverse incision within a skin crease is used, usually the same incision used for the laryngectomy (Figure 1). Skin and platisma flaps are elevated superiorly to the inferior border of the submandibular gland and the hyoid bone. Inferiorly, the margins are the clavicles and the sternal notch. Via this incision, there should be access to the lateral border of the strap musculature anteriorly and to the posterior border of the sternocleidomastoid muscle (SCM). Sharp dissection of the inferior border of the submandibular gland is then performed. Once the gland is identified, it is retracted superiorly, and the digastric muscle is exposed. Care is taken to preserve the fascia of the gland and prevent its prolapse postoperatively. The soft tissues superficial to the posterior belly of the digastric muscle are divided, separating it from the parotid gland. The hypoglossal nerve is then identified lying deep to the digastric muscle (Figure 2). A plexus of veins usually lies superficial to the nerve, and care must be taken to avoid injury to these vessels putting the nerve at risk when trying to cauterize them. The hypoglossal nerve is then traced backward, where the internal jugular vein (IJV) is identified; at this stage, the spinal accessory nerve may be identified as it passes across the IJV posteriorly toward the SCM muscle (Figure 3).

The fascia of the SCM muscle is now retracted anteriorly with several hemostats (Figure 4). Dissection over the undersurface of the SCM muscle proceeds all the way to its posterior border, which is located roughly an inch posterior to the IJV (Figure 5). Care is taken to prevent

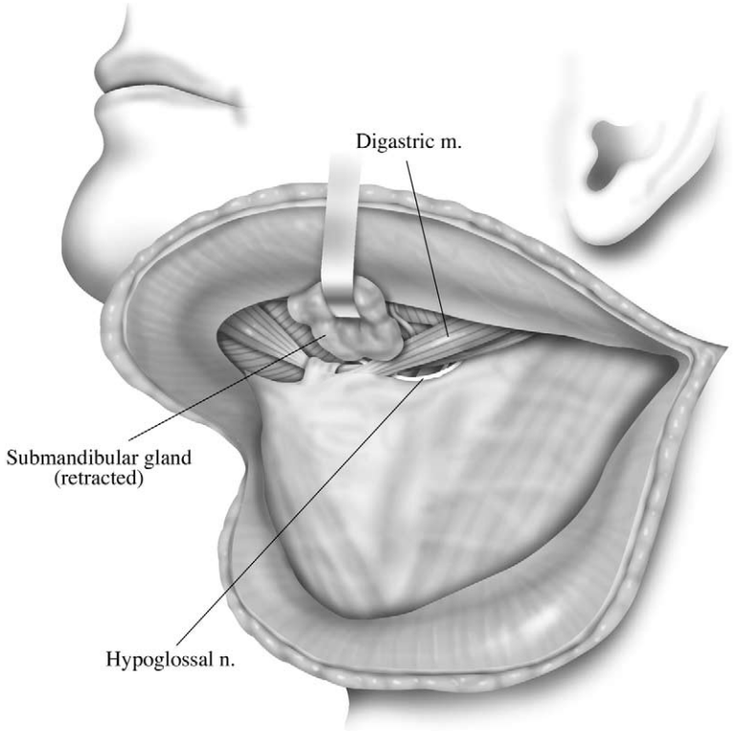

Figure 2 The region of the posterior belly of the digastric muscle and the upper end of the internal jugular vein—the hypoglossal nerve passing from a under the muscle (retracted superiorly along with the submandibular gland) curving toward and then parallel to the internal IJV (the IJV passing upwards toward the jugular foramen).

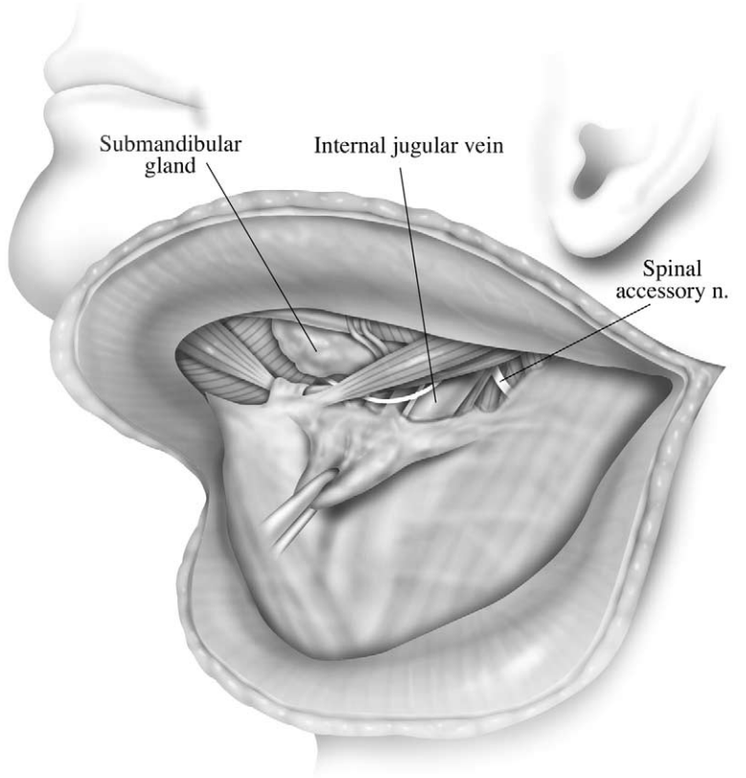

Figure 3 The spinal accessory nerve is shown crossing the IJV superficial to it and emerging from the jugular foramen running to the SCM muscle (running laterally and inferiorly).

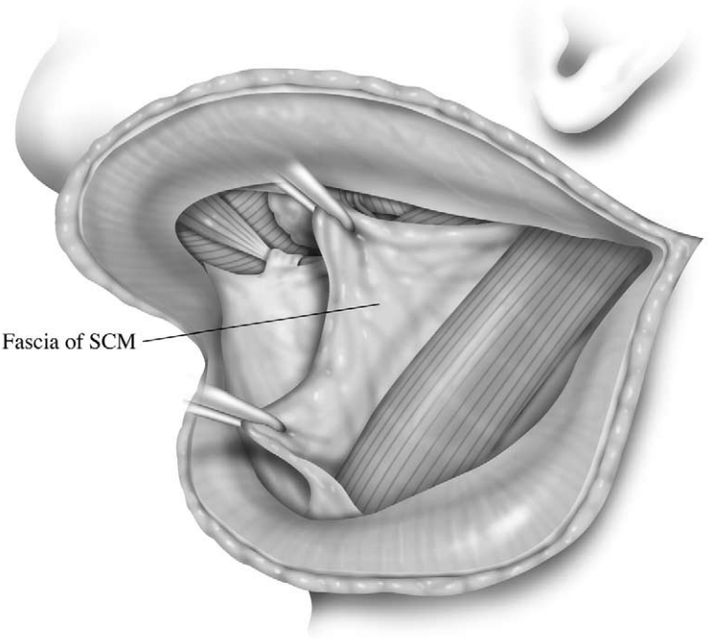

Figure 4 Four hemostats are clamped on the fascia of the SCM pooling it anteriorly. A monopolar cautery is used to dissect the retracted fascia from the muscle.

unnecessary trauma to the muscle and to preserve its fascia in its entirety. Dissection proceeds through the entire length of the SCM. Vessels supplying the SCM arising in the occipital and superior thyroid artery are cauterized. Superiorly, the spinal accessory nerve is identified entering the SCM. To safely identify the nerve at this point, dissection around its entry zone (to the SCM) is performed with hemostats across the direction of the expected nerve, cutting only transparent tissues until the nerve is identified. The tissues superficial to the nerve are then divided along its length, and the nerve is then freed from the surrounding tissues with a knife and sharp

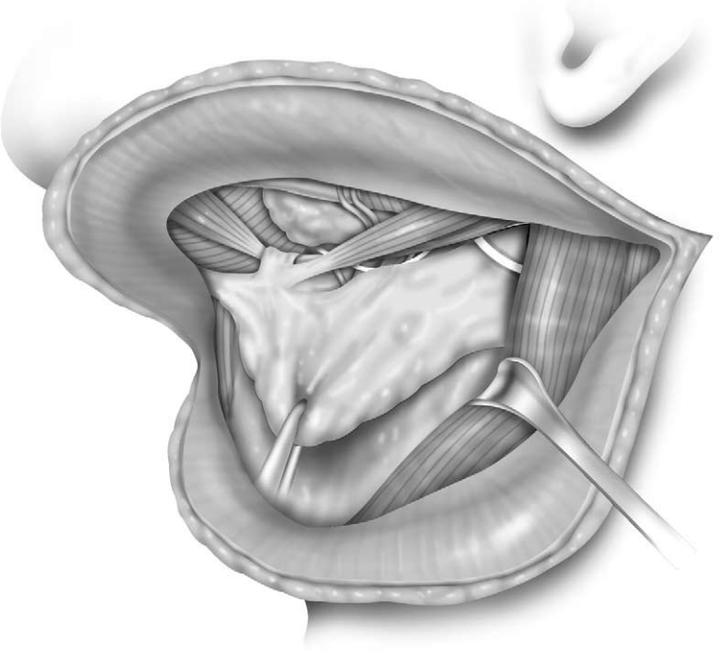

Figure 5 Dissection underneath the SCM muscle is shown. This dissection proceeds posteriorly to the posterior border of the SCM, which lies about an inch posterior to the shadow of the IJV.

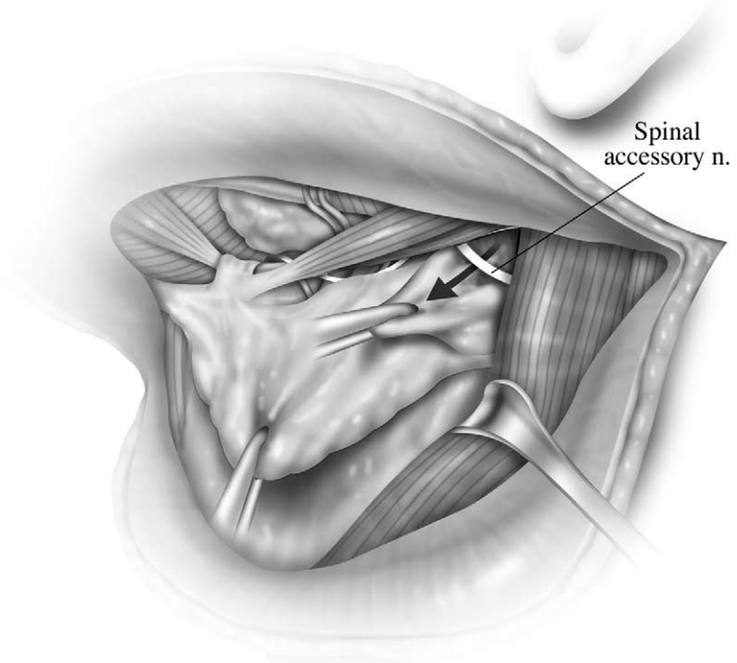

Figure 6 The triangle between the SCM, digastric muscle, and spinal accessory nerve is cleaned from all fibrous fatty tissue. The deep margins are the splenius capitis laterally and levator scapulae medially. The fibrous fatty tissue of this "submuscular recess" is transferred anteriorly underneath the nerve (ie, completely separated from the tissues around it).

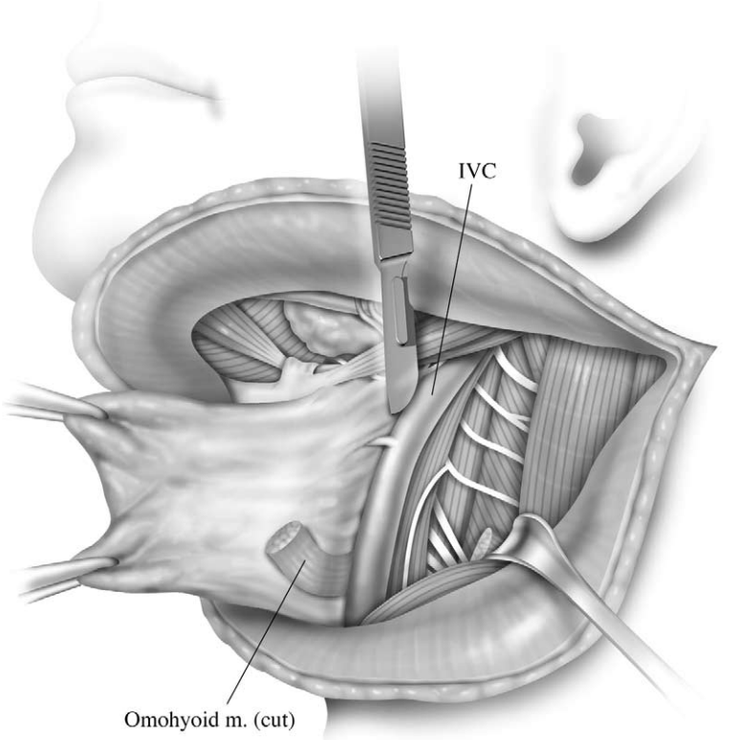

Figure 7 The tissues superficial to the cervical plexus, the brachial plexus and the phrenic nerve are dissected anteriorly, without damaging these nerves, all the way to the IJV. The lower end of dissection is the clavicle. At the inferior part of the dissection, the transverse cervical vessels are noticed (and usually ligated).

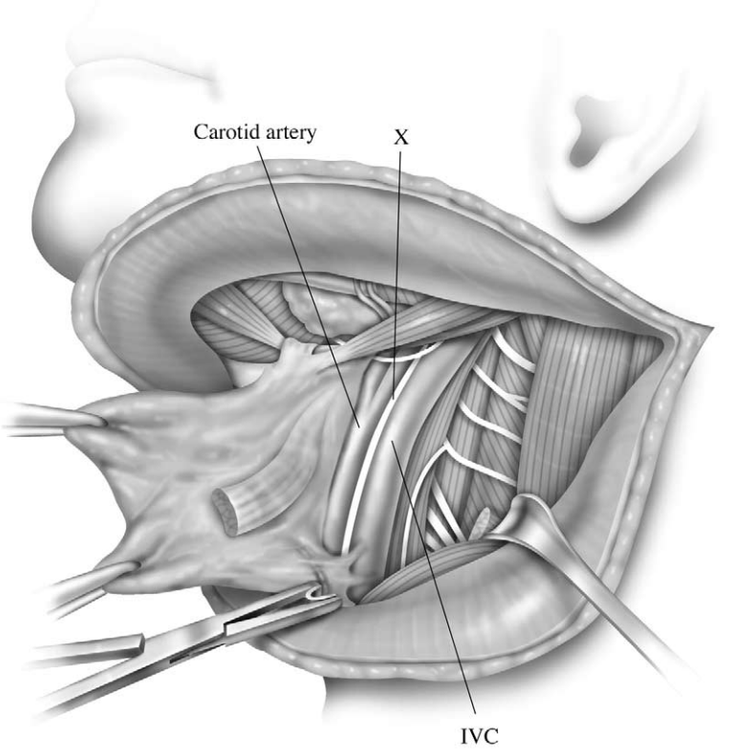

Figure 8 The carotid artery and X cranial nerve are dissected away from the specimen with a sharp knife; then, the IJV is dissected from the deep fascia of the neck through its entire length, again with a sharp knife. This allows a thorough cleaning of all fibrous fatty tissues surrounding the IJV. The lower end of the IJV is shown and the neck dissection specimen is free through the entire length of the IJV except its lowermost end. The tissues lateral to the IJV (and medial to the phrenic nerve) are separated from the IJV and clamped with silver clips before cutting. The thoracic duct(s) is shown within this tissue being clamped.

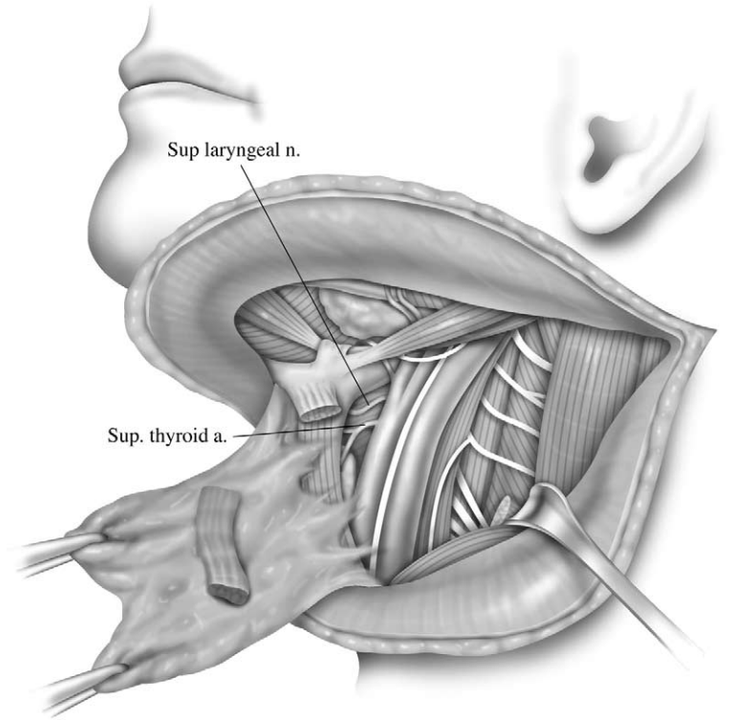

Figure 9 The specimen is turned anteriorly, and the area of the thyro-hyoid membrane is demonstrated. The fatty tissue around the superior laryngeal nerve and vessels is demonstrated (the shadow of the nerve/vessels is shown).

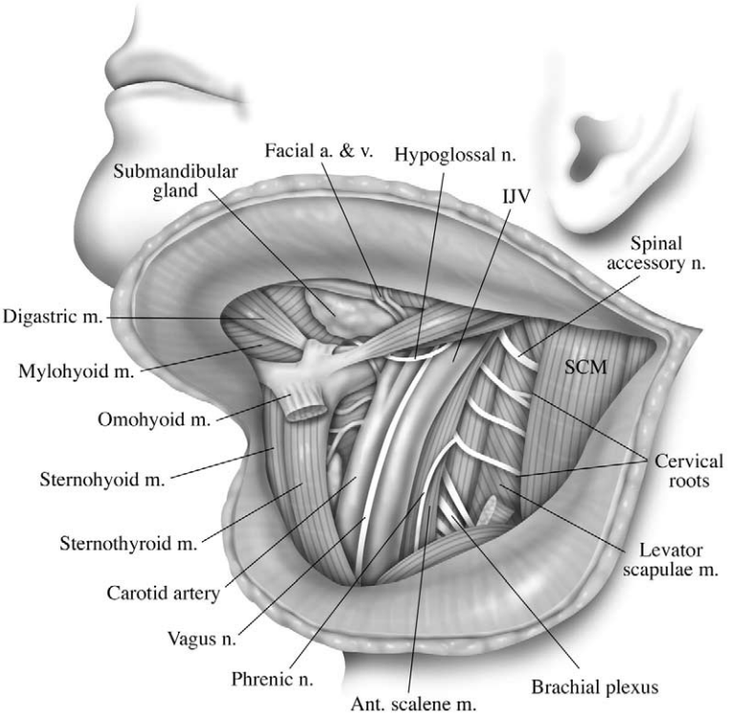

Figure 10 The anatomy of the neck after a lateral neck dissection is shown—the submandibular gland and digastric muscle above, the SCM posteriorly, the clavicle inferiorly, and the strap muscles medially. The cranial nerves VII (marginal and cervical branches), X, XI, XII are shown as well as as the cervical plexus, brachial plexus, and phrenic nerve. The carotid artery and IJV are shown through their entire length. The superior thyroid artery is shown emerging from the external carotid artery and turning downwards. The superior laryngeal nerve and vessels are also demonstrated.

scissors. The submuscular recess (level IIb) lays posterosuperior to the nerve between the SCM and the digastric muscle and is now fully exposed. The contents of this recess are now dissected. The deep limit of dissection is the "muscular carpet" formed by the splenius capitis muscle posteriorly and the levator scapulae anteriorly. The direction of dissection should change at this point according to the anatomy of these two muscles, keeping in mind the "valley" between them to prevent dissection deep to the levator scapulae. A branch of the occipital artery may cross this recess, and clamping of this vessel may be necessary. Once dissection is completed, the contents of the recess are passed deep to the spinal accessory nerve anteriorly (Figure 6).

At this point, dissection of the contents posterior to the IJV proceeds superficial to the cervical plexus superiorly and the brachial plexus and the phrenic nerve inferiorly (Figure 7). Once the fascia lying superficial to the brachial plexus is reached, blunt dissection of this region is recommended. The entire specimen is retracted anteriorly and the carotid sheath is approached. If a monopolar cautery was used, sharp dissection with a knife is recommended at this point to prevent injury to the tenth cranial nerve. Dissection separates the contents of the neck from the common carotid artery, the vagus nerve, and the IJV (in this order). Branches of the IJV, namely the thyroid and facial branches, are ligated and cut, and the IJV is dissected through its entire length with a sharp knife (Figure 7). At the infero-lateral part of the vein, silver clips are used when cutting the fatty tissue to prevent chyle leak from the thoracic duct or other lymphatic channels (Figure 8). Dissection proceeds anteriorly, and the fascia over the carotid sheath is again dissected. Proceeding anteriorly toward the strap muscles, the superior thyroid artery is now identified and preserved. At the area of the thyro-hyoid membrane, the fatty tissues harboring the internal branch of the superior laryngeal nerve are left intact (Figure 9)., and the specimen is further separated. The specimen is completely dissected away from the visceral compartment of the neck and removed.

The surgical field following a lateral neck dissection is shown (Figure 10). Careful hemostasis is mandatory, and a suction drain (Jackson Pratt) is inserted and secured to the skin. The cut edges of the platisma are carefully adjusted and sutured with a 3-4 Vicryl (or other dissolving) suture (Ethicon; Johnson & Johnson, Somerville, NJ). The skin is sutured with 4-5 nylon sutures. No dressing is needed; the incision is cleaned and topical antibiotic ointment applied.

Complications

Intraoperative complications

1. Bleeding: Major bleeding during lateral neck dissection is rare; however, the IJV or one of its branches may

bleed profusely. Immediate ligation of the bleeding vessel is required.
2. Nerve injuries: Dissection superior to the inferior border of the submandibular gland may jeopardize the mandibular and cervical branches of the facial nerve. The hypoglossal nerve, phrenic nerve, and brachial plexus are at risk as well, and careful dissection around them is required. Dissection with minimal retraction of the spinal accessory nerve within the submuscular recess will lower the incidence of nerve injury. Minimal (or no) muscle relaxation during surgery will allow the operative team to be aware of proximity to the nerves and prevent their injury.

Immediate postoperative complications

1. Hematoma: Occurring especially during the immediate postoperative period, hematoma may be a life-threatening situation. Immediate exploration in the operating room is indicated. Once the bleeding vessel is ligated, careful cleaning of the surgical field prevents infection of the neck at a later stage.
2. Seroma: Appearing at a later stage, seromas are less dramatic and may resolve spontaneously when small. Large seromas may need drainage and a pressure bandage. Long-term suction drains (until minimal drainage is excreted) may lower the incidence of seromas.
3. Infection: Wound infections or frank abscesses are rare and treated with cleaning, antibiotics, and drainage of an abscess, if present.
4. Chyle leak: Lymphatic channels are localized on the lateral lower end of the IJV. During the surgical procedure, silver clips are used in this region to lower the incidence of chyle leak. If chyle is identified during surgery, all efforts should be taken to seal the leaking vessel. A valsalva maneuver may help locate the leak, and silver slips are usually used to seal it. Postoperatively, most leaks heal with the use of pressure bandage; however, large leaks (>500-1,000 mL per 24 hours) may require surgical exploration of the neck with clamping of the leaking vessel.
5. Cerebro-vascular incident: Rare after any neck dissection; however, in all patients undergoing this procedure, careful preoperative examination including ascultation of the carotid arteries is warranted. If a murmur is heard, the carotid artery should be studied and repaired before (or simultaneous with) the neck dissection. Careful retraction of the carotid artery during surgery will minimize this rare complication.

Late postoperative complications

1. Swinging scapula: After injury to the spinal accessory nerve, limitation of shoulder movements (mainly abduction over 90°) and asymmetry of the scapula (dropped inferiorly on the ipsilateral side) are noted. This complication is much less common after lateral neck dissection compared with modified radical neck dissection.
2. Jugular vein thrombosis: Complete obstruction of the IJV that has been extensively dissected in this procedure is caused by an intraluminal thrombus. Careful dissection with minimal injury (and ties) over the IJV during the surgical procedure will probably prevent "kinking" of the vessel and lower the incidence of this complication. Unless bilateral neck dissections are performed, no symptoms are anticipated.
3. Prolapsed submandibular gland: After dissection of the inferior border of the gland, especially if its fascia is resected with the surgical specimen, the gland will prolapse downward and appear as a neck mass. Recognition of this asymptomatic condition is necessary.

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