



NECK DISSECTION

Oncology

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KEYWORDS

INTRODUCTION OF LYMPH NODES

Lymph node status is the single most important prognostic factor in head and neck cancer because lymph node involvement basically decreases overall survival by 50%.

Appropriate management of the regional lymphatics plays precious role in the treatment of the head and neck cancer patients.

Removal of the at risk lymphatic basins serves two important purposes:-

1. It allows the removal and identification of occult metastasis in patients in whom cervical metastasis are a risk, which is referred to as an elective neck dissection.
2. It allows the removal of disease in patients in whom metastasis are highly suspected based on imaging, clinical examination or fine needle aspiration, which is referred to as a therapeutic neck dissection.

Staging

Neck staging under the AJCC/TNM (2010) staging for head and neck cancers:

(Excluding nasopharynx and thyroid)

N0	NO regional nodes metastasis.
N1	Metastasis in a single ipsilateral lymph node, 3 cm or less in greatest dimension.
N2	Metastasis in a single ipsilateral lymph node, more than 3 cm but not more than 6 cm in greatest dimension; or metastasis is in multiple ipsilateral lymph nodes, none more than 6 cm in greatest dimension; or metastasis is in bilateral or contralateral lymph nodes, none greater than 6 cm in greatest dimension.
N2a	Metastasis in a single ipsilateral lymph node, more than 3 cm but not more 6 cm in greatest dimension.
N2b	Metastasis in multiple ipsilateral lymph nodes, none more than 6 cm in greatest dimension.
N2c	Metastasis in bilateral or contralateral lymph nodes, none more than 6 cm in greatest dimension.
N3	Metastasis in a lymph node more than 6 cm in greatest dimension.

Lymph node levels: anatomy and nomenclature

- The head and neck are drained by a rich network of interconnected lymphatics. The regional lymph node classification is intended to provide a standardized nomenclature for clinical reporting and analysis of treatment.
- The patterns of lymph node metastases, as determined by Lindberg (1972) and by the Memorial Sloan-Kettering Hospital (1981) classified the lymph node groups into seven levels.
- Further modifications and updates of nodal classification have classified few levels into sublevels and the classification (AAOHNS; American Academy Of Otolaryngology-Head And Neck Society)
- The cervical lymph nodes are classified into the following levels:
 - (I) Submental (IA), Submandibular (IB)
 - (II) Upper Jugular (IIA & IIB)
 - (III) Middle Jugular
 - (IV) Lower Jugular
 - (V) Posterior Triangle
 - (VI) Central Compartment
 - (VII) Superior Mediastinal

- Each lymph node group has specific anatomic, clinical and radiological boundaries as described below:

(S: Superior, I: Inferior, M: Medial, L: Lateral, Cr: Cranial, C: Caudal)

Levels	Anatomical boundaries
Level I: Submental & Submandibular <ul style="list-style-type: none"> • Contains lymph nodes in submental (IA) and submandibular triangles (IB). • Nodes within the triangular boundaries of the anterior belly of digastric muscles and the hyoid bone inferiorly. • They drain FOM (floor of the mouth), anterior oral tongue, anterior lower (mandibular), alveolar ridge, lower lip. 	I: Hyoid bone A(M): Anterior belly of contralateral digastric muscle P(L): Anterior belly of ipsilateral digastric muscle
Level I B: Submandibular <ul style="list-style-type: none"> • Nodes within triangular boundaries of the anterior and posterior bellies of the digastric muscle and the body of the mandible superiorly. • Submandibular gland is included in the specimen when submandibular triangle is cleared • They drain oral cavity, anterior nasal cavity, and soft tissue of midface and submandibular gland. 	S: Body of mandible I: Posterior belly of digastric muscle A(M): Anterior belly of digastric muscle P(L): Stylohyoid muscle
Level II: Upper Jugular <ul style="list-style-type: none"> • Lymph nodes along the upper third of IJV and adjacent spinal accessory nerve from skull base to lower level of hyoid level. • Contains lymph nodes in the level IIA (anterior to spinal accessory) and level IIB (posterior to spinal accessory) • They drain oral cavity, nasopharynx, oropharynx, hypopharynx, larynx and parotid gland. 	Level II A S: Skull Base I: Horizontal plane at inferior border of hyoid A(M): Stylohyoid muscle P(L): Vertical plane by spinal accessory nerve Level II B S: Skull Base I: Horizontal plane at inferior border of hyoid A(M): Vertical plane at inferior border of hyoid P(L): Lateral border of Sternocleidomastoid
Level III: Middle Jugular <ul style="list-style-type: none"> • Lymph nodes along the middle third of iJV from lower level of hyoid bone above to inferior border of cricoid cartilage below. • They drain oral cavity, nasopharynx, oropharynx, hypopharynx and larynx. 	S: Horizontal plane at inferior border of hyoid I: Horizontal plane at inferior border of cricoid A(M): Lateral border of sternohyoid muscle P(L): Lateral border of sternocleidomastoid
Level IV: Lower Jugular <ul style="list-style-type: none"> • Lymph node along lower third of IJV from lower level of lower border of cricoid cartilage above to clavicle below. • They drain hypopharynx, larynx, thyroid and cervical oesophagus. 	S: Horizontal plane at inferior border of hyoid I: Clavicle A(M): Lateral border of Sternohyoid muscle P(L): Lateral border of Sternocleidomastoid

<p>Level V: Posterior Triangle</p> <ul style="list-style-type: none"> Lymph nodes along the lower half of spinal accessory nerve and transverse cervical artery. Contains lymph nodes in the level VA (spinal accessory) and level IIB (transverse cervical) Supraclavicular nodes are also included in this group They drain nasopharynx, oropharynx and posterior scalp and neck. 	<p>Level VA</p> <p>S: Apex of convergence of SCM and trapezius I: Horizontal plane at inferior border of cricoid A(M): Posterior border of sternocleidomastoid P(L): Anterior border of trapezius</p>
<p>Level VI: Anterior Compartment</p> <ul style="list-style-type: none"> Lymph nodes include the pretracheal, paratracheal, pretracheal (Delphian), parathyroidal and lymph nodes along recurrent laryngeal nerve. They drain glottis, subglottic larynx, and apex of pyriform sinus, thyroid and cervical oesophagus. 	<p>S: Hyoid bone I: Suprasternal notch A(M): Common carotid artery P(L): Common carotid artery</p>
<p>Level VII: Superior Mediastinal</p> <ul style="list-style-type: none"> Lymph nodes include the pretracheal, paratracheal and oesophageal groove They drain thyroid and cervical oesophagus. 	<p>S: Suprasternal notch I: Innominate artery A(M): Sternum P(L): Trachea, oesophagus, prevertebral fascia</p>

Other Nodal Group Described

Retropharyngeal Lymph Nodes

Not apparent in clinical examination.

Anatomic: Posterior to nasopharynx and oropharynx

Boundaries: carotid sheath

ONCOLOGIC RELEVANCE OF LYMPH NODES LEVELS

The patterns of Lymph node Metastases, as determined by Lindberg (1972) and Jatin Shah (1990), are predictable: These patterns are as follows:

Level IA	FOM, Oral Tongue, Anterior Part of Mandibular Alveolar Ridge, Lower Lip
Level IB	Oral Cavity, Ant Nasal Cavity, soft tissue and structures of midface, Submandibular Gland, Maxillary Sinus
Level II	Oral cavity, Nasal cavity, nasopharynx, oropharynx, hypopharynx, larynx, parotid
Level III	Oral cavity, Nasopharynx, Oropharynx, Hypopharynx, Larynx
Level IV	Hypopharynx, larynx, cervical oesophagus
Level V	Nasopharynx, oropharynx
Level VI	Thyroid, larynx(Glottis, Sub-glottis), Cervical oesophagus, apex of pyriform fossa

The First Echelon Lymph Nodes of Various Sites are:

Oral cavity	I,II,III
Larynx, pharynx	I, III, IV
Thyroid	VI, VII, IV
Parotid	Pre-auricular, II, III, V(upper)

EVOLUTION OF NECK DISSECTION

- George Crile* (1906) first described an en bloc dissection of the cervical lymphatics with preservation of the spinal accessory (SAN) and improvements in anesthesia, blood transfusion and the development of antibiotics led to its further popularization by *Hayes Martin*.
- Hayes Martin And Colleagues* (1951) reported a series of 1450 radical neck dissections (RND) in a landmark paper. He included the sternocleidomastoid and internal jugular vein in the resection and condemned Crile's preservation of the accessory nerve as oncological unsound. Such an extensive resection was regarded as excessive for the N0 neck, but by the early 1960s regional failure rates of >50 percent were reported in early tongue cancers treated surgically.
- Oswaldo Suarez* (1963) described a technique for cervical lymphadenectomy that has become a modified RND (MRND).
- Bocca And Colleagues* the technique of modified radical neck dissection with preservation of the non-lymphatic structures was popularized by *Bocca* and colleagues as a less morbid procedure more suitable for the N0 neck, and became the treatment of choice

for patients whose occult metastasis rate would be expected to exceed 20 per cent.

- Lindberg And Colleagues* (1972) landmark study that established the clinical rationale for selective neck dissection (SND). He demonstrated that metastases from subsites within the head and neck follow predictable patterns to specific lymph node levels within the neck.
- Jatin Shah And Colleagues* (1990) Memorial-Sloan Kettering Cancer Center evaluated the histologic patterns of lymph node metastasis in patients undergoing elective and therapeutic RND for head and neck cancer on the basis of these patterns of metastasis, elective dissection of select lymph node levels most at risk was offered as an alternative to elective MRND.
- Extra capsular spread (ECS) was identified as the most important negative prognostic factor.
- Pathologic findings on END, including ECS and multiple positive lymph nodes, became indications for postoperative RT and chemotherapy.
- 1990: several studies demonstrated that SND was effective as MRD and RND when used to electively treat and stage the clinically negative neck.
- Further studies suggested that SND can be used safely in patients with limited, clinically positive lymph node disease
- Gould And Colleagues* (1960) sentinel lymph node biopsy (SLNB) using an intraoperative frozen section of a facial lymph node during parotid surgery to determine whether a neck dissection should be performed for malignant tumors. Currently, SLNB with the use of a radiotracer is accepted as the standard of care in the treatment of breast cancer and melanoma. SLNB in HNSCC is accurate for staging the N0 neck.

CLASSIFICATION OF NECK DISSECTIONS

Neck dissection describes a procedure involving the en bloc removal of some or all of the lymphatic organs of the head and neck. The terminology for describing neck dissections was standardized by the American Academy of Otolaryngology-Head & Neck Surgery in 1991, and modified in 2002 & 2008. The classification, as currently endorsed by both the AAOHNS and the American Society for Head and Neck Surgery, is as follows:

- Radical neck dissection*
- Modified radical neck dissection*
- Selective neck dissection*
- Extended radical neck dissection*

Radical neck dissection (RND)

RND refers to the removal of all ipsilateral cervical lymph node groups extending from the inferior border of the mandible to the clavicle, from the lateral border of the sternohyoid muscle, hyoid bone, and contralateral anterior belly of the digastric muscle medially, to the anterior border of the trapezius.

Included are levels I-V. This entails the removal of three important, non-lymphatic structures: the internal jugular vein, the sternocleidomastoid muscle, and the spinal accessory nerve.

Indications and contraindications for radical neck dissection

Indications for radical neck dissection:

- Significant operable neck disease (N2a, N2b, N3) with tumour bulk near to or directly involving spinal accessory nerve and/or internal jugular vein.
- Extensive recurrent disease after previous selective surgery or radiotherapy
- Clinical signs of gross extranodal disease

Contraindications for radical neck dissection:

- Untreatable primary tumour or unresectable neck disease (i.e. encasement of internal carotid artery, brachial plexus, prevertebral fascia)
- Patient unfit for major surgery
- Distant metastases
- Simultaneous bilateral neck dissection (preserve one internal jugular vein!)

Modified radical neck dissection (MRND)

Refers to removal of the same lymph node levels (I-V) as the radical neck dissection, but with preservation of the spinal accessory nerve, the internal jugular vein, or the sternocleidomastoid muscle.

- Type I Preserves SAN
- Type II Preserves SAN and SCM, sacrifices IJV

(Jatin shah's cancer of the Head & Neck)

Preserves SAN, IJV
(Stell & Maran's Head & Neck Surgery 4th)

Type III Preserves SAN, SCM, IJV

Selective neck dissection (SND)

- Preserves one or more lymph node groups that are removed in RND
- The SAN, IJV and SCM are routinely preserved. The specific levels removed are listed in parentheses (i.e. SND [I-III]).
- These were originally recommended for N0 neck. Now they are also being advocated for N+ neck.

Types of Selective Neck Dissection

- i. **Supra Omo-Hyoid Neck Dissection:** I, II, III removed
- ii. **Extended SOHND:** I, II, III and IV removed. This is recommended for oral tongue lesions for 'skip metastases' to level IV.
- iii. **Lateral Neck Dissection (Jugular Neck Dissection):** II, III, IV removed. This is recommended for lesions of hypopharynx and larynx.
- iv. **Anterior-Lateral Neck Dissection:** I, II, III, IV and V removed. This is recommended for oropharyngeal lesions when surgery is used for treatment of primary.
- v. **Posterior-Lateral Neck Dissection:** II, III, IV, V removed. This is recommended for posterior scalp lesions.
- vi. **Central Compartment Neck Dissection:** VI is removed (i.e.

Lymphatics from hyoid to suprasternal notch and laterally up to carotid arteries). Recommended in differentiated Ca Thyroid.

Extended radical neck dissection

- Involves removal of one or more additional lymphatic and/or non-lymphatic structures(s) relative to a radical neck dissection.
- These may include parotid nodes, Level VI, Level VII, Digastric muscle, Retropharyngeal Lymph Nodes, Hypoglossal Nerve, External Carotid Artery, Skin of Neck, etc. All additional structures should be identified within parentheses.

Comprehensive neck dissection

- Procedures that dissect all five levels (RND and MRND) are commonly referred to as 'comprehensive neck dissections'.
- Removes all lymph node groups would be included in a classic RND. SAN/IJV/SCM may or may not be preserved.

Functional neck dissection

- Surgery similar to modified radical neck dissection type III.

PREOPERATIVE PREPARATION

1. Patient should be prepared as for any major operation, with adequate evaluation by the anesthesiologist before taking up for surgery.
2. Patient's operative field should be shaved and consent should be taken before surgery.
3. Patient undergoing for unilateral neck dissection usually does not require tracheostomy. A tracheostomy may be indicated when the primary tumor is dissected in continuity with the neck or in cases where mandible is split to gain access.
4. It may also be advisable to perform an elective tracheostomy in patients who are undergoing a bilateral neck dissection.
5. Prophylactic antibiotic regimes of 24 hour's duration covering aerobic, anaerobic and gram-negative based on local sensitivity test is mandatory for clean-contaminated surgery.

INTRAOPERATIVE PREPARATION

1. The patient is laid on operating table in supine position and intubated.
2. Head of the patient is turned to the opposite side and hyperextended, resting on a head ring.
3. A sand bag or a towel is placed under the shoulder in order to obtain desired surgical position of the neck.
4. The upper end of the operating table is elevated approximately 30 degree, which decreases the amount of blood loss during surgery.

5. A disinfectant surgical solution is applied, to prepare the operative field before draping the patient.
6. Draping may vary according to hospital custom, in general two horizontal and two vertical drapes are fixed to the skin.
7. A scrub nurse and two surgical assistants, one in front of the surgeon and one at the patient's head.
8. The choice of incision for a specific lesion is based on a variety of factors, including personal preference of surgeon, previous radiotherapy or surgery.

Number of incisions described below:-

- Schobinger
- Horizontal-T(hetter)
- Mcfee
- Lateral utility
- Utility
- Visor
- Extended thyroid
- H-incision

Variations of the classical Y-incision (Crile), such as then Gluck, Schobinger, Conley or Martin incision, were used commonly for the excellent exposure they provide, but have the drawback of a trifurcation point or narrow flaps which are prone to breakdown, especially in previously radiated necks. Other alternatives such as the utility incision, hockey stick incision and the apron flap also give good exposure, while avoiding trifurcation points.

The McFee incision with two horizontal limbs limits exposure, but has a low incidence of wound dehiscence.



Visor Incision



Mc Fee Incision



Schobinger Incision



STEPS FOR ALL NECK DISSECTION

1. Positioning the patient with a shoulder roll or on a Mayfield head holder with slight extension.
2. Desired incision is drawn using a marking pen or ink. Choice of incision design is guided by the need for access to the cervical lymphatic basins contained in levels.
3. Incision is made with blade no. 10 through the skin down to and through the platysma muscle. During incision, the assistant helps apply adequate traction and countertraction to the skin.
4. Skin flaps are elevated using the platysma muscle as identification of the correct plane. Keeping the platysma muscle into elevated skin flap ensures appropriate blood supply to the skin flaps and also increases the strength of the wound in the postoperative period.
5. If the assistant places double skin hooks or rake retractor under the platysma and applies upward traction, also countertraction should be applied to the specimen and still using knife.
6. Dissection along the subplatysmal plane results in very little bleeding.
7. When the upper skin flap is raised, care should be taken to preserve the marginal branch of facial nerve, the marginal branch supplies the muscle of the corner of the mouth, while the cervical branch supplies the platysma muscle that crosses the mandible and inserted into the corner of the mouth.
8. Both branches emerges from the lower pole of the parotid gland and curve around the angle of the mandible, cross the facial vessels and then run parallel, approximately at a finger breadth- to the body of the mandible.
9. At the level of the submandibular gland the marginal mandibular branch is found immediately superior and cervical branch lateral to the gland. Both branches curve upwards and cross the mandible.
10. The facial vein can be divided and retracted superiorly to protect the nerve as the fascia over the submandibular gland is dissected.
11. Facial vein can be sutured superiorly to retract and protect the nerve during the remaining dissection.
12. Subsequently, attention is dissected to identify the spinal accessory nerve.
13. An incision is made through the fascia along the anterior edge of the SCM.
14. The external jugular vein will be ligated at this point.
15. The dissection is carried down to the level of the posterior belly of the digastric, which can be retracted superiorly with a right angle retractor.
16. Assistant using right angle retractors at right angle to each other can effectively retract the SCM laterally and the posterior belly of the digastric superiorly, offering an excellent view of the operative field.
17. The spinal accessory nerve will become visible with careful dissection, spreading in the direction of the nerve course anterior-superior to posterior-inferior.
18. The nerve should be handled carefully since manipulation alone can lead to long term dysfunction.
19. Using vein retractor to protect the nerve, cautery and blunt dissection are used to dissect the node bearing tissue from level II B.
20. The deep cervical fascia overlying the splenius capitus, levator scapulae and scalene muscles should be preserved.
21. Dissection proceeds posteriorly while keeping the spinal accessory nerve in view.
22. The cervical plexus rootlets coursing from the posterior edge of the SCM.
23. Then anterior-posterior approach is used with a releasing incision [Schobinger or Lahey], the spinal accessory nerve can be identified exiting the posterior edge of the SCM, and then the skin flap can be elevated keeping the nerve in view.
24. This approach allows a more comprehensive removal of level V, likely to use in the presence of bulky, clinical neck disease.
25. Again, dissection of the posterior triangle should be kept superficial to the deep cervical fascia.
26. Subsequently, the nodal contents are brought underneath the SCM while retracting it superiorly.
27. Retracting the contents anteriorly, the contents are sharply dissected across the IJV.
28. As the node bearing tissue is dissected from the inferior portion of the vein, the omohyoid muscle will typically be divided.
29. Dissection continues across the carotid artery.
30. The hypoglossal nerve is identified typically 1-2 cm above the carotid bifurcation.
31. Once the hypoglossal nerve has been identified, then dissection proceed anteriorly up to the submental area following the anterior belly of the omohyoid to the hyoid then clearing the nodal tissue along the anterior belly of digastric.
32. Level I is cleared by dissected to the level of the mylohyoid. This is best performed with cautery to control troublesome bleeding from the arterial branch to the mylohyoid muscle.
33. Once the posterior edge of the mylohyoid is identified, a right angle retractor is placed and the muscle is distracted anteriorly exposing the lingual nerve as the content of the submandibular triangle, where attachments were previously freed from the inferior branch of the mandible are distracted inferiorly.
34. The submandibular duct is ligated and transected.
35. The attachments of the lingual nerve to the submandibular gland are then divided.
36. Finally, the facial artery is encountered again and divided which allows the specimen to be delivered.

Four areas of special attention during neck dissection

- Lower end of internal jugular vein
- Junction of lateral border of clavicle with lower edge of trapezius
- Upper end of internal jugular vein
- Submandibular triangle

Complications**Injury to nerves:**

- **Marginal mandibular nerve:** marginal mandibular nerve injury commonly occurs when upper flap is elevated or during level I dissection [submental/submandibular triangle]. It may cause dysfunction of the lower lip depressor muscle that results in an asymmetric smile but no severe sequelae.
- **Greater auricular nerve:** The greater auricular nerve serves as an excellent landmark for the proper plane for elevation of the skin flap, because it lies lateral to the SCM. The nerve should be kept down on the SCM during flap elevation, and the decision of whether to preserve it can be made later. Sacrifice of this nerve during neck dissection leads to a sensory deficit of the auricle that usually diminishes with time. Neuroma of divided greater auricular nerve can occur.
- **Lingual nerve:** The lingual nerve is a branch of the mandibular division of the trigeminal nerve (Cranial nerve V) that carries general sensation from the anterior two thirds of the tongue. It also receives the chorda tympani nerve from the facial nerve, which carries taste from the same region of the tongue. Level I neck dissection incorporating submandibular gland Excision puts this nerve at risk for injury. Clinically, injury results in loss of taste sensation from ipsilateral anterior two third of the tongue and hypoesthesia or paresthesia of the half tongue with resultant difficulty with speech and deglutition.
- **Hypoglossal nerve:** Hypoglossal nerve injury is a rare complication of neck dissection. The nerve is susceptible to injury during dissection of level I, II, near the greater cornu of hyoid bone and adjacent to the carotid artery. Injury to nerve results in ipsilateral tongue weakness, deviation of the tongue to the affected side and difficulty with speech and swallowing.
- **Vagus nerve:** The Vagus nerve is at highest risk during ligation of the internal jugular vein, it is necessary to first identify the all of the structures in the carotid sheath. Vagus nerve injury results in aspiration, loss of sensation of the larynx, paralysis of unilateral vocal cord which is identified by a "breathy," weak voice.
- **Sympathetic chain:** Cervical sympathetic trunk lies posterior to the carotid sheath. The cervical sympathetic trunk is at danger when dissection is carried posterior to the carotid artery. Injury to the cervical sympathetic chain results in Horner's syndrome [i.e., ptosis, miosis, and anhidrosis], nasal congestion.
- **Phrenic nerve:** The phrenic nerve arises from C3, C4 and C5 and it courses between the anterior scalene muscle and its overlying fascia. As elevation of the contents of the posterior triangle proceeds from the trapezius muscle toward the carotid sheath, the cervical plexus contributions to the phrenic nerve or to a loop of the phrenic nerve itself may be injured. Phrenic nerve paralysis is considered a rare complication of neck dissection and leads to ipsilateral hemi diaphragm elevation with or without Mediastinal shift on chest radiograph, and it may contribute to postoperative pulmonary complications. Preservation of the fascial layer over the nerve and anterior scalene muscle is the primary method for prevention of injury. Fluoroscopic examination postoperatively confirms the diagnosis of phrenic nerve injury.

- **Brachial plexus:** Lateral to the phrenic nerve beneath the fascial floor of the posterior triangle is the brachial plexus, which is wedged between the scalene muscles. This structure, like the phrenic nerve, is deep to the deep cervical fascia, and it should be easily preserved when gentle blunt dissection of the fat overlying the fascia is performed. Damage to brachial plexus results in weakness/paralysis of limb muscles.
- **Injury to thoracic duct:** Injury to the duct usually occurs during manipulation of the internal jugular vein in the left neck were it lies posterior to the vein. Thoracic duct arises from the cisternal chyli at the level of the second lumbar vertebra and rises into the neck between the aorta and the azygos vein. In the thorax it crosses to the left and after passing behind the aortic arch and left subclavian artery it lies on the anterior scalene muscles and phrenic nerve. The duct terminates most commonly in the left IJV although less commonly it may enter the left subclavian, left external jugular, left brachiocephalic (innominate) vein or right IJV. The right lymphatic duct drain terminates at the junction of the right subclavian vein and IJV. When dividing the lymphatic tissue low in the left neck, especially in cases where the internal jugular vein is divided, the tissue should be clamped and suture-ligated. Injury is manifested by appearance of milky fluid in the surgical field. Outcomes are improved if the injury is recognized intraoperatively. If injury is suspected or to confirm the repair intra-operative identification can be done by placing the patient in the Trendelenburg position or adopting a forced Valsalva manoeuvre, the anesthesiologist can hold a positive pressure breath to increase intrathoracic pressure. Injuries recognized intraoperatively should be managed with multiple nonabsorbable sutures under loupe magnification. Postoperatively there is high drain output from the left neck or by the appearance of milky fluid in the suction drains it can be confirmed by testing the triglyceride content of the drainage and comparing them to serum values. Many of these leaks controlled by conservative measures medium triglyceride diet, pressure, suction drainage. Surgical exploration is indicated in leaks greater than 300-400 ml/day or leaks more than 4-5 days. Chylous leaks can lead to electrolyte disturbances and malnutrition; consideration should be given to total parenteral nutrition (TPN) in the short term.
- **Injury to dome of pleura:** Injury to dome of pleura leads to pneumothorax (tension). This may occur when working low in the neck particularly if the lung apex is high as may occur in over inflation secondary to inadvertent one-lung intubation. Any tears in the pleura should be closed and their integrity tested by hyperinflating the lung, placing the patient in the Trendelenburg position and irrigating the area with clear fluid to observe bubbles. On table imaging may be necessary to determine the need for open chest drainage.
- **Stimulation of carotid bulb:** Carotid sinus sensitivity results from manipulation of the carotid body, and it typically manifests as acute Bradycardia and decreased cardiac output. Atropine can be given, but the best results are obtained by sub adventitial administration of a small amount (<1 cc) of plain 1% lidocaine.
- **Spinal accessory nerve:** The Spinal accessory nerve consists entirely of motor fibers to the SCM and Trapezius muscle. The exit point of the nerve from within the sternocleidomastoid muscle can be predicted by the rule of thumb that is located approximately 1 cm above Erb's point, the point where the great auricular nerve winds from behind the muscle on its trajectory to supply the skin of the face. Sacrifice or damage to the spinal accessory nerve leads to shoulder dysfunction. Pain and weakness of the shoulder are among the most common postoperative complications of neck dissection. Patients with signs of shoulder dysfunction should be referred for physical therapy.

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