

# Neck Dissections – An Adelaide Perspective

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The neck dissection is possibly unsurpassed as the operation that best defines a head and neck surgeon. Performed well, it is an operation that delineates the exquisite anatomy of the head and neck. When complicated it provides challenges that search out the qualities defining a surgeon wishing to undertake surgery at the highest levels.

In Head and Neck malignancy, neck dissection provides the best prognostic information for the patient who has no disease in the neck but a high suspicion of cervical metastases from an upper aero digestive tract primary malignancy. The operation addresses the most significant prognostic factor in management of head and neck malignancy. This is because, metastatic disease of the neck, is the single most significant factor determining outcome as it can reduce survival by fifty percent.

The Royal Adelaide Hospital is based in Adelaide, South Australia. It is South Australia's largest accredited teaching hospital and provides the people of South Australia and adjacent states and territories with outstanding medical care and rehabilitation. The hospital is associated with the University of Adelaide Medical School as well as the faculty of health sciences at both the University of Adelaide and University of South Australia.

It was founded in 1840 and has an international reputation as one of Australia's finest public teaching hospitals. It offers training positions across the medical specialties as well as in otolaryngology head and neck surgery. The Department of Otolaryngology Head and Neck Surgery at the Royal Adelaide Hospital is one of the oldest in Australia. It was founded by William Anstey Giles, a General Surgeon who developed an interest in otology on his return from Austria. Anstey Giles was also one of the founding fathers of the Royal Australasian College of Surgeons. The current department of otolaryngology head and neck surgery has been a major contributor to research and training and comprises of ten consultant surgeons, two emeritus surgeons, and

an honorary physician. The junior staff comprise an international clinical fellow, senior registrars, junior registrars and interns as well as an international research fellow. The position of research fellow has usually been occupied by surgeons from developing nations. This has included surgeons from Sri Lanka, including Doctors Chaminda Perera, Premalal De Mel, Ravi Kirehane, and Prasadika Jayasekara.

The consultants at the Royal Adelaide Hospital Department of Otolaryngology have enjoyed international prominence. Professor PJ Wormald is an internationally acclaimed endoscopic sinus and skull base surgeon. The head and neck department has international acclaim for its work with Trans Oral Laser Microsurgery and more recently with Trans Oral Robotic Surgery. The department performs resections of major oral, oropharyngeal, and laryngeal cancers as well as cutaneous malignancies of the head and neck and sino-nasal malignancies. The department performs approximately 250 major head and neck cases a year, including about 80 neck dissections.

## NECK DISSECTION

The operation of neck dissection is a well described operation that has been performed for well over a hundred years. The first systematic description and series report was provided by George Crile in 1906. The operation he described, has been essentially unchanged when performed to treat neck disease with definitive significant metastatic disease in the neck. The operation has been modified by Suarez and Bocca in the nineteen sixties and seventies to minimise some of the major morbidity associated with radical neck dissection. These modifications have initially concentrated on the prevention of injury to the accessory nerve. As the anatomical patterns of lymphatic spread have become better understood, further modifications of neck dissection have occurred. The pattern of cervical nodal spread was best described by Lindberg from the MD Anderson Medical Centre in a paper in 1972. Since then depending on the stage of the primary disease,

the neck dissection operation has been modified to select for the most likely nodal levels that may be involved. This practice of selective neck dissection has been shown to be oncologically safe and associated with a reduced morbidity in the neck, particularly with injury to the accessory nerve.

Initially, these selective neck dissections were described by the anatomical areas that were dissected, as a supra-hyoid or supra-omohyoid neck dissection and often classified as a functional neck dissection, because of the preservation of the function of the accessory nerve. However over a period of time it was recognised that a more systematic classification of neck dissection was required. The initial work from Memorial Sloan Kettering and Jesus Medina was later formalised by a joint committee from the American Joint Cancer Committee. It led to the division of the neck into five lateral levels and a central compartment. The five levels of the neck are further sub divided, with sub classifications of level 1 into level 1a and 1b, Levels 2 to 2a and 2b and levels 5 to 5a and 5b and the extensions of the levels into Level 6, particularly to address nodes associated with thyroid malignancies.

This classification of the neck into levels has helped to classify and accurately document the kind of surgical neck dissection performed on a patient. A comprehensive neck dissection clears all five levels of the neck. The originally described Radical Neck Dissection is comprehensive and removes the Accessory Nerve, the Internal Jugular Vein and the Sterno Cleido Mastoid.

The Modified Neck Dissection can be comprehensive removing all five levels, with the preservation or removal of the three structures that are variably dealt with in a neck dissection, namely the Accessory Nerve, the Internal Jugular Vein and the Sterno Cleido Mastoid muscle. The modified neck dissection can be comprehensive and extended, to include the parotid gland or the carotid artery or the overlying skin.

Selective neck dissections are modifications of the original operation where levels to be dissected are determined by the likelihood of involvement depending on the primary site of malignancy.

### **INDICATIONS FOR NECK DISSECTION**

The indications of a neck dissection are clearly elaborated in the literature. The Royal Adelaide Hospital has a general principle of performing elective

neck dissection to assess the possibility of clinically and radiologically occult metastasis. Generally speaking all tumours of the upper aero digestive tract except early lip cancer and early laryngeal cancer would be considered for a neck dissection if a surgical treatment plan is to be undertaken. So called, elective or staging neck dissections are also performed for squamous cell carcinomas of the parotid gland. This disease is common in Australia and New Zealand and it most likely represents metastases in parotid lymph nodes from cutaneous squamous cell carcinoma.

Generally speaking therapeutic neck dissection in patients with proven clinical or radiological metastases will involve a comprehensive neck dissection with an aim to preserve the accessory nerve as a minimum. Although there is a low threshold to remove the sterno cleido mastoid muscle and the internal jugular vein; there would be an intention to preserve these, if the tumour burden in the neck is small and there is no radiological evidence of extra capsular spread, and no clinical evidence of extensive nodal disease at the time of surgery.

### **PREOPERATIVE ASSESSMENT OF THE NECK IN HEAD AND NECK CANCER**

At the Royal Adelaide Hospital, preoperative assessment of the neck in the patient with head and neck cancer patient begins with a detailed history and examination. As documented in the literature, palpation alone is not accurate. All our patients would have a minimum of CT of the neck and chest as part of a preoperative evaluation. The classical findings of multiple nodes at a level, nodes which have become round and lost their reniform shape and nodes with a central area of necrosis, would be considered as suspicious of being malignant.

Increasingly, patients are being evaluated with positron emission tomography (PET) scans. This is particularly useful in patients who have neck disease and an unknown primary. It is also particularly useful in staging the patient prior to non surgical organ preservation and chemo radiation protocols of treatment as a baseline assessment of the patient prior to treatment. CT PET scans have assisted us in directed biopsies in the patient with the unknown primary. It has also demonstrated an increasing number of patients with positive disease with the new epidemic of P16 positive, HPV16 related oropharyngeal cancers.

Finally, histological confirmation is made by ultrasound guided Fine Needle Aspiration Cytology. This allows sampling of solid and cystic components of a neck lump and the central and peripheral compartments of a neck node to minimise the risk of false negative aspiration biopsies. If the fine needle biopsy is negative a core biopsy is taken, and excision biopsy is left as a last resort.

Patients are also evaluated by our multidisciplinary team including speech pathologists and dieticians. This is particularly useful in those patients with weight loss, as the literature suggests that a poor nutritional status correlates with poor wound healing and post surgical recovery.

### **THE ADELAIDE TECHNIQUE OF NECK DISSECTION**

The operation is performed under general anaesthesia with the patient appropriately draped and prepared. The patient's neck is extended using a bolster under the shoulder and the head turned away to display the side to be dissected. The patients are given a preoperative dose of a broad spectrum antibiotic such as cephalothin as antibiotic prophylaxis.

#### **INCISION AND FLAP**

The incision that we prefer is a U-shaped utility (lateral apron) flap. A hockey stick incision is used in appropriate patients, if access to the anterior neck, particularly level I is easy. The flap is raised in a subplatysmal plane. If a subplatysmal plane cannot be raised because of tumour adherence to the platysma then the overlying skin is removed. This is because we feel that the platysma, being part of the panniculus carnosus is a muscle of the skin and involvement of platysma would suggest involvement of the skin and therefore overlying skin is resected. The resulting skin defects can be reconstructed using either a deltopectoral flap or a pectoralis major myocutaneous flap or free flap as required.

The flap is raised in the sub-platysmal plane, superficial to the external jugular vein and the Greater Auricular Nerve to the level of the hyoid. At the level of the hyoid the superficial layer of the cervical fascia investing the submandibular gland is identified. The fascia is incised and the flap is now elevated deep to this fascia. At this level the common facial vein or posterior facial vein is identified and raised with the flap. This protects the Marginal Mandibular division of the Facial Nerve which lies in a plane deep to

platysma and superficial to the superficial layer of investing cervical fascia overlying the submandibular gland. The nerve can be identified crossing superficial to the facial vein where the vein crosses the inferior border of the ramus of the mandible to enter the face.

The U-shaped utility or lateral apron flap and in selected patients the hockey stick incision and associated neck flap that is elevated, gives a clear demonstration and access to the various anatomical structures of the neck during neck dissection. It is ideal for a comprehensive neck dissection with sacrifice of the sterno mastoid muscle, the internal jugular vein, and the accessory nerve, the so called radical neck dissection, or a comprehensive dissection preserving all of those structures. It is also our preference for selective neck dissection as it gives the option of revisiting the neck should there be a recurrence and the need to convert the neck to a more radical clearance, required at a later date.

On occasion a selective neck dissection will be performed using a skin crease incision about 3 cm. below and parallel to the lower border of the mandible. This allows later operation on the neck to be performed by a McPhee incision, with the lower incision running just above and parallel with the clavicle.

#### **STEPWISE CLEARANCE OF LEVELS OF THE NECK AND CONLEY'S TUNNELS**

The operation is then performed essentially with the aim of dissecting from posterior and inferiorly, working forwards and upwards. At the Royal Adelaide Hospital we describe these steps of surgery as following Conley's tunnels. Although not definitively described in the literature by John Conley, in an article on complications on neck dissections in 1972, he described steps in a neck dissection to help identify and prevent injury to structures in the neck. These steps have been passed on by generations of Australian head and neck surgeons and are fondly called Conley's tunnels of dissection. These tunnels are essentially, firstly along the anterior border of the sterno cleido mastoid. Secondly along the Omo-hyoid between the Omo-hyoid and the sterno cleido mastoid. Thirdly, along the posterior border of the sterno cleido mastoid and anterior to the Trapezius and the Splenius Capitis where the accessory nerve is identified, fourthly along the inferior border of the mandible, and fifthly along the digastric muscle.

After elevation of the flap we proceed anteriorly initially to define the level I nodes and in particular the tissues of the submental triangle. These are included with the fascial tissues overlying the strap muscles and the mylo-hyoid above the hyoid, and the sterno hyoid below the hyoid. These tissues are then raised to the edge of the anterior border of this sterno cleido mastoid. At the anterior border of the sterno cleido mastoid, the omo-hyoid muscle is identified. By finger dissection or by the use of a large blunt forcep such as a curved Black's forcep, a tunnel can be fashioned between the omo-hyoid and the sterno cleido mastoid muscles. The omo-hyoid muscle acts as a protective barrier against injury to the internal jugular vein. The finger or curved Black's forceps is directed posteriorly towards the supraclavicular fossa beyond the posterior and inferior most fibres of the sterno cleido mastoid muscle as it attaches to the clavicle. As elegantly described in RJ Last's book on anatomy, the sterno cleido mastoid muscle has four heads, two heads of attachment to the mastoid and occipital bones superiorly, and two heads of attachment to the sternum and sternal end of the clavicle, as well as the more lateral aspect of the clavicle. All of these fibres are divided under the introduced Black's forceps or by an introduced square of gauze. This again ensures protection of the internal jugular vein.

After division of the sterno cleido mastoid muscle, the fascial tissues surrounding the carotid sheath are teased to identify the internal jugular vein. The vein is carefully dissection to its adventitia to ensure that there is no opportunity for the adherent carotid fascia or its contents to be included in the division of the internal jugular vein. In particular one must avoid including the adherent Vagus nerve when placing ligatures around the Internal Jugular Vein. If the vein is to be divided the vein is isolated by 2/0 silk ligatures. Our general means of dealing with the internal jugular vein is double ligating the vein with the 2/0 silk sutures and we use a 4/0 silk suture on an atraumatic needle to place a transfixion suture. This transfixion suture is particularly important for the remaining distal and proximal ends of the internal jugular vein to prevent any opportunity of haemorrhage. Dissecting around the internal jugular vein, particular of the left hand side has to be careful to avoid injury to the thoracic duct and to prevent a chylous leak and fistula formation. On occasions the thoracic duct will enter the internal jugular vein

or the junction of the internal jugular vein and the subclavian vein by multiple channels. Again one must be aware of this and our preference is to ligate the vein higher on the left hand side then on the right hand side to avoid injury to the thoracic duct. If injury is suspected, the anaesthetist is asked to perform a valsalva manoeuvre to confirm and identify the leak. Always attempt to correct the leak early in the operation. This may involve using adjacent sterno mastoid muscle tissue or adjacent areolar tissue in the supraclavicular fossa to oversew the channels that are leaking. Our preference again is to use 4/0 silk in an atraumatic needle to oversew these tissues as this braided material provides a good closure of these channels and also does promote some inflammatory reaction to help seal this area in the long term. At this stage the supraclavicular fossa is dissected to identify the lowest point of dissection which is demarcated by the transverse cervical vessels in the root of the neck and the supraclavicular fossa. The transverse cervical vessels being identified, the prevertebral fascia and deep plane of the neck dissection is determined.

Dissection then moves to the posterior part of the neck. The great auricular nerve is identified as it cups around the posterior border of the sterno cleido mastoid. In more than 95 percent of cases, at approximately a centimetre above this, at Erb's point the Accessory Nerve may be identified. It is identified by carefully teasing a variable amount of fat and fascial tissue. The accessory nerve is followed carefully through the sterno cleido mastoid. This dissection and establishment of the course of the accessory nerve allows the identification of the top end of the internal jugular vein superiorly and the posterior extent of the neck dissection inferiorly. Once the accessory nerve is identified as a general rule, unless there is nodal disease encompassing the accessory nerve, all attempts are made to preserve the accessory nerve. Accessory nerve injury is the single most debilitating complication that patients complain about in neck dissection.

The accessory nerve is followed, as one would follow and preserve the facial nerve in parotid surgery, using a pair of Halstead artery clips. The nerve is dissected and the overlying muscle is divided either by monopolar or bipolar diathermy. Our preference is bipolar diathermy to prevent injury to the accessory nerve. The nerve is followed carefully and the muscle fibres transected. As fibres of the sterno cleido mastoid are divided superiorly, the

fibres of the posterior belly of Digastric is identified in the depth of the wound. The digastric fibres can be retracted by a Langenbeck retractor to identify the top end of the internal jugular vein. Again careful teasing and dissection of areolar tissue of the cervical fascia around the carotid is performed to avoid incorporation of the Vagus nerve into any ligatures used to ligate the top end of the internal jugular vein. Our preference is to use 2-0 silk tie to double tie the proximal end and use a 4/0 silk transfixion suture on the proximal end of the internal jugular vein. Once the vein is ligated then the superior remnant of the sterno cleido mastoid muscle that has been divided to expose the accessory nerve can be dissected off the mastoid. The dissected remnant will be passed under the mobilised accessory nerve and delivered with the remaining segment of the sterno cleido mastoid.

Posterior plane of dissection now commences anterior to the Splenius Capitis superiorly and the Trapezius below. The splenius capitis is identified high in the neck as its fibres run in a direction perpendicular to the overlying sterno cleido mastoid and there is usually a definitive condensation of fascia between the two muscles. The trapezius is relatively easily identified when following the accessory nerve inferiorly and when the prevertebral fascia is identified during ligature or identification of the inferior end of the Internal Jugular Vein.

The envelope of tissue that includes the fascia investing the lymph nodes of level 5a and 5b as well as level 2a and 2b is then dissected and raised from the prevertebral fascia. Our preference is to use a knife to raise this envelope above the level of the cervical plexus. This envelope is retracted forward by the assistant. Forward dissection then allows identification of the carotid artery, the Vagus nerve and the ligated internal jugular vein. The ligated internal jugular vein is often a useful anatomical structure presenting itself as a ballooned “sausage” of blood. Whilst dissecting this composite of sterno cleido mastoid and cervical fascia including lymphoid tissue of the neck and the “sausage” of blood that is within the internal jugular vein, one must be aware of tributaries to the internal jugular vein. In particular the Middle Thyroid Vein and superiorly the Facial vein. These need to be carefully ligated. Further troublesome points of bleeding are seen in association with the hypoglossal nerve. There are often veins that accompany the arteries that hook the hypoglossal downwards. They need to be carefully

addressed and if identified early can be clipped or else dealt with by bipolar diathermy to avoid injury to the hypoglossal nerve. The hypoglossal nerve is often identified crossing the external and internal carotid arteries deep to the digastric muscle high in the neck. The specimen is dissected and now joined with the initial anterior dissection of the neck with removal of cervical fascia associated with the anterior based strap muscles. The dissection now concentrates on Level 1b. The key to dissection is good retraction from the assistant to demonstrate the floor of the submandibular triangle. The anterior dissection aims to free the tissues from the posterior edge to the mylo hyoid muscle. If possible attempts should be made to not injure the neurovascular bundle to the mylo hyoid but almost always troublesome bleeding leads to formal ligation or bipolar diathermy.

Once the posterior edge of the mylohyoid is identified a Langenbeck retractor can be then placed to retract this anteriorly to expose the floor of the submandibular triangle. A retractor is often required to superiorly retract the mandible and by this retraction, the lingual nerve is identified in the floor of the submandibular triangle. The facial artery is dissected and preserved if possible with care taken to consider direct branches from the facial artery into the submandibular gland. These branches can be the source of secondary bleeding following surgery. The mobilised submandibular gland can then be retracted inferiorly causing u-shaped deflection of the lingual nerve as traction is placed on the fibres from the lingual nerve to the submaxillary ganglion.. Again careful dissection is required as there is a vessel where the lingual nerves extends branches to the submaxillary ganglion. Our preference is to use bipolar diathermy with this and to ensure that the lingual nerve is not injured. This then causes the nerve to retract superiorly and the specimen now hangs by its connection to the floor of the mouth by submandibular duct. The duct is ligated with a 2/0 vicryl ligature and the specimen is then excised and delivered out of the neck.

## **MODIFIED NECK DISSECTION**

A comprehensive neck dissection with preservation of internal jugular vein, accessory nerve and sterno cleido mastoid muscle is performed through a similar incision, either a large U- shaped utility incision or a hockey stick incision. The sterno cleido mastoid muscle is retracted by the use of Babcock tissue

holding forceps. The incision is continued into the cervical fascia and onto the surface of the muscle. The sterno cleido mastoid is carefully dissected from a superior to inferior extent. Quite often tail of parotid tissue superiorly needs to be divided to find the space between the sterno cleido mastoid and the mandible. A plane of dissection followed towards the posterior aspect of the sterno mastoid muscle superiorly. One will identify the accessory nerve at approximately the junction of the upper quarter and the lower three quarters of the sterno cleido mastoid muscles, travelling medially at an angle from this junction toward the superior aspect of the Internal Jugular Vein and the palpable transverse process of the atlas. This forms the superior most extent of neck dissection. The level 2b nodes are identified at this stage just posterior to the accessory nerve in the groove between the sterno cleido mastoid and the posterior belly of the digastric. This tissue is then removed either by itself or in continuity with level 2a by mobilising the nerve and transferring the tissue under the accessory nerve.

The dissection is then performed similar to a radical neck dissection. However, the access is difficult requiring significant retraction of the sterno mastoid and this can be performed either by using Langenbeck retractors or advancing Babcock retractors on the sterno cleido mastoid muscle. The envelope of cervical fascia containing lymph nodes is now peeled off the prevertebral fascia from posteriorly forwards and from superiorly downwards. The landmark for the inferior extent of dissection being the transverse cervical vessels. The fascia is then peeled off the carotid artery, the vagus nerve and the internal jugular vein. Dissection continues forwards to include the perimysium of the strap muscles.

The submandibular triangle is dealt with similar to the radical neck dissection by dissecting the tissues from the posterior border of the mylohyoid, identifying the facial artery and mobilising the facial artery and by retraction of the mylohyoid and facial artery and mandible to find the floor of the triangle and to preserve the lingual nerve, and eventually defining the submandibular duct to deliver the specimen.

### **COMPLICATIONS OF NECK DISSECTIONS**

The main issues relate to the accessory nerve, the marginal mandibular division of the facial nerve and the lower cranial nerves and vessels and lymphatic channels that course through the neck. The lower

cranial nerves of concern are the Hypoglossal nerve, the Lingual nerve and the vagus nerve and its superior laryngeal and recurrent laryngeal branches. All attempts are made to preserve these. Marginal mandibular branch nerve injury can result in significant cosmetic blight as well as impact on oral continence. Accessory nerve injury causes significant disability both from the burden of weight of a drooping shoulder as well as restricted shoulder mobility. This may interrupt routine daily activities and in a country like Australia, leisure time activities such as golf, bowling and tennis. Injuries to the cervical plexus may cause a Horner's syndrome can be seen in patient with extensive neck nodal disease fixed to the prevertebral fascia.

The other significant problem that can be encountered with neck dissections is a chylous leak and fistula. This can be a protracted problem and we encourage searching for a possible leak at the time of surgery by performing a Valsalva on the table. If a leak is identified, deal with it by oversewing with 4-0 silk. A suspected leak after surgery can be confirmed by administering an oral fat challenge and identifying fat in the drain. If a leak is discovered following surgery then involve a dietitian to prescribe a low fat, medium chain triglyceride diet. There may be a protracted period of time until it dries up.

Other complications include wound break down. This has been increasingly noted in patients who have salvage neck dissection following chemo radiation therapy protocols. Although there is some variation in literature in terms of incidence of complications in patients who have had chemo radiation protocols, our general experience is that these are high.

Post operatively patients are in hospital for two or three days until their wound drainage stops. Usually drains are removed on the third or fourth post operative day when drainage is less than 50ml over a 24 hour period. Neck wounds are usually closed with 3/0 vicryl suture to the subcutaneous tissue and a dissolving 3/0 Monocryl subcuticular suture with Dermabond glue as both an assistant to wound closure as well as acting as wound dressing. The patient does not need to return for suture removal.

### **SUMMARY**

This is an editorial view of surgical practice at the Royal Adelaide Hospital in the operations of neck dissection. The topic is dealt with extensively in the literature and some are listed as resources for

this paper. Neck dissection is the operation par excellence in the demonstration of the anatomy of the head and neck, and when done well is satisfying to the surgeon and more importantly is therapeutic and of prognostic significance to the patient. It provides a resolution to metastatic neck disease and is a good staging procedure providing best assessment of the extent of disease in the neck.

It is an operation that needs careful consideration in terms of assessment before surgery and in preparing patients for surgery as well as an operation that needs to be increasingly considered for early tumours of the head and neck. In good hands, it is the less morbid and less toxic treatment than adjuvant chemo radiation. It can prove to be definitive treatment for early head and neck malignancies. It is also the definitive procedure for recurrences after chemo radiation protocols.

#### RESOURCES:

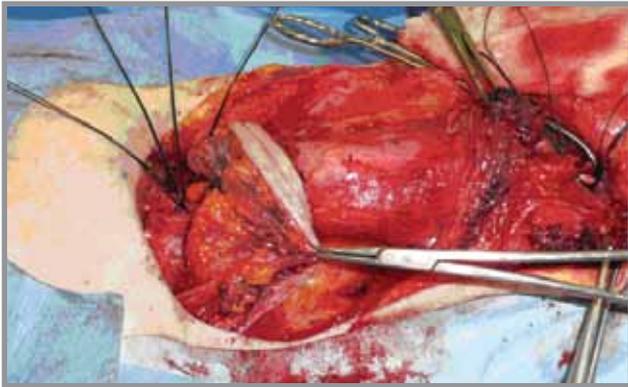
1. Ashok Shaha, "Radical Neck Dissection"  
Operative techniques in general surgery Volume 6 No 2 ( June 2004 pages 72-82)
2. Johan Fagan "Modified and radical neck dissection"  
Open access Atlas of Otolaryngology Head and Neck surgery  
<https://vula.uct.ac.za/access/content/group/ba5fb1bd-be95-48e5-81be-586fbaeba29d/Modified%20and%20radical%20neck%20dissection%20technique.pdf>
3. Medina JE, "A rational classification of Neck Dissections"  
Otolaryngology Head and Neck surgery 100 (1989 pages 169 – 176)
4. Lindberg R, "Distribution of cervical Lymph Node Metastasis from Squamous Cell Carcinoma of the Upper Respiratory and Digestive tracts" Cancer 290:4621449 – 1972
5. Shah JP, "Patterns of Cervical Lymph Nodes Metastasis from Squamous Cell carcinomas of the upper Aerodigestive tract"  
General Surgery (160:4 1990)
6. Robbins KT, Cleland G, Lavine PA, "Neck Dissection Classifications proposed by the American Head Society in the American Academy of Otolaryngology of Head and Neck surgery"  
Archives of Otolaryngology 2002 (128:751-70 2002)
7. Conley J, "Radical Neck Dissection"  
Laryngoscope 1975: 85 pages 81344 – 352
8. Morgan JE, Brau R, Suen JW, Hanna EW. « Surgical Wall complications after intensive chemoradiotherapy for advanced squamous cell carcinoma of the head and neck"  
JAMA Otolaryngology, Head & Neck Surgery January 2007 Volume 133.
9. Davidson BJ, Newka KA, Harter W, Picken CA, Cullan KJ, Sessions RB.  
"Complications from planned post treatment Neck Dissections"  
JAMA Otolaryngology Head and Neck Surgery, April 1999, Volume 125 Number 4.



Lateral Apron Flap Incision



Hockey stick incision extended to include parotidectomy



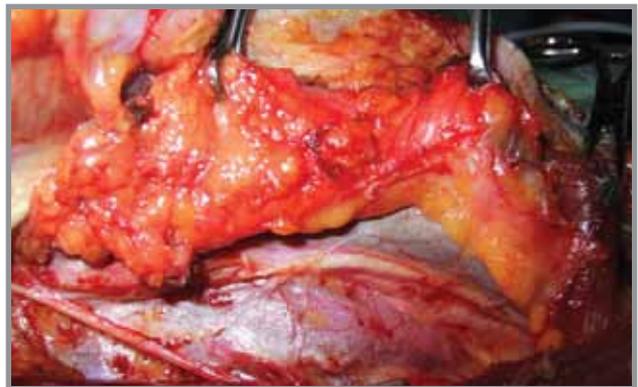
Radical Neck Dissection Image of Ligation of top and bottom of IJV



Radical Neck Dissection Image of Bed



Neck Dissection with preservation of Sternomastoid muscle showing Babcock Forceps applied to SCM



Neck Dissection with preservation of Sternomastoid muscle showing X, XI and Carotid and IJV



Neck Dissection with preservation of SCM, IJV and XI final specimen in situ



Neck Dissection with preservation of SCM, IJV, and XI final specimen



Neck Dissection with preservation of SCM, IJV, XI specimen cut into levels for pathology