Review Article

ADVANCES IN THE MANAGEMENT OF NECK DISSECTION: A REVIEW

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Abstract:
The proper management of neck in patients with head and neck malignancies is one of the unresolved oncologic questions. Cervical metastasis is one of the major risk factor and the best prognostic indicators for patient with head and neck cancer. Patients who present with tumors localized at the primary site without dissemination to regional lymph node enjoy an excellent prognosis and can be cured by appropriate use of surgery, radiotherapy or both. On the other hand once dissemination to regional lymph nodes takes place, the probability of 5 years survival, regardless of treatment, reduces to nearly one half of that seen in early staged patients. The purpose of this article is to study the current concepts in cervical lymph node metastases and development of various techniques in neck dissection to reduce morbidity while eradicating the pathology completely.

Keywords: metastasis, surgery, radiotherapy, morbidity.

Introduction

Cancer of the head and neck is common consisting around 15% of all human cancers in India. The term "head and neck cancer" traditionally refers to malignant tumors that arise in the mucosa of the upper aerodigestive tract including the oral cavity, pharynx, larynx, nasalcavity and paranasal sinuses. More than 90% of these are squamous cell carcinomas. Other infrequent tumors are those arising from the salivary glands, thyroid, soft tissues and skin. In spite of increasing awareness of both the public and physicians concerning the importance of early diagnosis, many patients still present for treatment with spread of the cancer to regional or distant sites. Reports from the American Cancer Society (ACS) indicate that over 40% of the patient with squamous carcinoma of the oral cavity and pharynx present with regional dissemination of the disease at the time of initial diagnosis. The proper management of neck in patients with head and neck malignancies is one of the unresolved oncologic questions. Cervical metastasis is one of the major risk factor and the best prognostic indicators for patient with head and neck cancer. Patients who

present with tumors localized at the primary site without dissemination to regional lymph node enjoy an excellent prognosis and can be cured by appropriate use of surgery, radiotherapy or both. On the other hand once dissemination to regional lymph nodes takes place, the probability of 5 years survival, regardless of treatment, reduces to nearly one half of that seen in early staged patients. The clinical importance of cervical lymph node metastasis in patients with head and neck cancer has long been recognized. As early as the mid 19th century, Chelius noted "Once the growth in the mouth has spread to the sub mandibular gland, complete removal of the disease (cancer) is impossible". This pessimism however, was challenged at the turn of the century because of newer approaches. George Crile Sr (1906) had emphasized the accessibility of cervical lymph nodes to examination and treatment. He also reported that cervical lymph node metastases remained localized to the neck for a period of time. He was the first to champion an anatomically based systematic operation called "Neck dissection". This operation has remained the gold standard in the management of patients with cervical lymph node metastasis. With improved understanding of the incidence and patterns of metastasis spread to the neck and the routine use of imaging studies, there has been an increase in the rate of elective, selective neck dissection in patients who are at high risk for developing metastasis, but who have no palpable abnormalities in the neck. Metastasis from an unknown primary site still remains a major concern. Adequate endoscopic evaluation of potential primary sites for the presence of occult lesions is greatly facilitated by the availability of fiber-optic flexible instruments. Surgery followed by adjuvant radiation therapy has become a standard practice in the management of patients with advanced head and neck cancers. Post operative radiation therapy has been shown to reduce local recurrence both at the primary site and in the

neck. The purpose of this article is to study the current concepts in cervical lymph node metastases and development of various techniques in neck dissection to reduce morbidity while eradicating the pathology completely.

Historical Background
Treatment of cancer in general has followed a pattern – an all out attack by a single modality and an eventual evaluation resulting in disenchantment followed by a renewed search for new or better methods of treatment, combinations of methods and innovations.. For most of the 20th century, complete or radical dissection of neck has been the principal tool in the management of squamous cell carcinoma that metastasizes to cervical lymph nodes from primary carcinomas of head and neck. In 1906, the classic operation described by Crile [1] was designed to remove en bloc all the cervical lymph node channels and nodes that drain the primary site in head and neck. Because of problems with anesthesia and postoperative mortality rates of about 10%, the procedure was not accepted enthusiastically [2]. About this time experiments with radium and roentgen rays suggested that this type of energy had a destructive effect on tumor cells. The prospect of curing cancer by irradiation was hailed as a promising substitute for surgery. The early reports however failed to substantiate the expectations from irradiation in controlling metastasis [3]. With advances in anesthesia, better surgical technique, the use of blood replacement and the introduction of antibiotics, radical surgery had no further limitations. The concept of the radical neck dissection became a routine treatment of metastasis in continuity with resection of the primary tumor and as an individual procedure. End results of surgical treatment show a glaring contrast in the results in the group with or without cervical metastasis on admission [2]. Survival rates decreases by 50% when nodal metastases are present. Furthermore,

the presence of cervical lymph adenopathy has been correlated to increase the rate of distant metastasis [4]. Experimental studies of lymphatic drainage by Rouvier [5] (1938) and clinical studies of nodal distribution by Lindberg have enabled reliable prediction of the lymph node groups most likely to be involved with metastatic disease for different locations of the primary tumor. In order to establish a common language between the clinician and the pathologist Head and Neck Service at Memorial Sloan-Kettering Cancer Center has described a leveling system of cervical lymph nodes. This system divides the lymph nodes in five groups or levels. Sixth and seventh regions were later added to categorize the lymph nodes in the anterior neck and upper mediastinum respectively [6]. Byers R (1990) at the M.D. Anderson hospital did further sub-classification of this leveling system. Level I was divided into IA (submental lymph nodes) and IB (submandibular lymph nodes), Level II is divided into IIA (subdigastric) and IIB (jugulodigastric lymphnodes at the base of the skull). Level III remains unchanged. Level IV is divided into IVA (lower jugular) and IVB (supraclavicular). Level V remains undivided [6]. American Joint Cancer Committee (AJCC) (1988) put forth nodal staging criteria based on clinical examination, which was modified by AJCC (1990). This new nodal staging criteria incorporate information gained by imaging with either CT or MRI [7]. In 1990, J.P Shah, Frank C. Candela, Anil K. Poddar [8] did retrospective review of 501 previously untreated patients of squamous cell carcinoma of oral cavity to ascertain the prevalence of ipsilateral neck node metastases (NM) by neck level. Detailed analysis of each group based on the primary site revealed a prevalence of NM in level IV of 3% for elective dissection performed in N_0 neck and 17% for immediate therapeutic dissection and subsequent therapeutic dissection performed for N+ neck. Tongue,

retromolar trigone and cheek did not have NM in level V in any group. In 1996, Myers proposed a hypothesis for head and neck squamous cell carcinogenesis, which resembles the multistep colorectal carcinogenesis model given by Vogelstein and Fearon [9]. Eiji Nakayama [10] (1997) described usefulness of CT in detection of metastatic lymph node in squamous cell carcinoma of tongue. A case of Squamous Cell Carcinoma of tongue was reported with emphasis on a typical finding of cervical lymph node metastasis visible on CT. The appearance of a high density mass on CT with a CT value lower than that of calcification may be a reliable finding of metastasis because it demonstrates the presence of marked Quatonization produced by squamous cell. In 1998, Cavalcanti and MW Vannier [11] described the role of 3D spiral C.P. in oral metastases. According to them, 3D CT can help to define further the extent of osteolytic involvement notes in initial 2D CT images, allowing better localization and visualization of the anatomical regions involved. In addition, using 3D computer graphic technology, life size medical models can be helpful in preoperative planning as well as in tumor surgery. They concluded that 3D CT is a useful adjunct for the management of maxillofacial tumors involving bone. K Yuasa [12] (2000) described the criteria for CT in differentiating cervical lymph nodes metastases in oral SCC and showed that the positive predictive value for CT is 90.8%. In 2002, Gagliardi et al [13] found that in rectal cancer MRI has 67% sensitivity, 71% specificity, and 69% accuracy in detecting malignant lymphadenopathy. In 2003, Fischbein et al [14] evaluated cervical lymph nodes in 21 patients with squamous cell carcinoma of head and neck. They found a significant longer time to peak, lower peak enhancement, lower maximum slope, and slower washout slope in tumor-involved lymph nodes compared with normal lymph nodes. They concluded that in

the malignant lymph node there is a decreased transfer of contrast material to the tissue and a reduced volume of extracellular space. In 2005, Kademani and Dierks [15] gave straight-line incision that allows safe, rapid, and oncologically sound performance of a neck dissection, while providing improved esthetics. This technique may be used for access to level I to V lymph node groups to allow the performance of any type of neck dissection.

Surgical technique

Incisions

The fact that so many types of neck incisions exist is strong testimony that there is hardly one incision that fits all contingencies. The incision can be extended across the midline to the contra-lateral hairline if a cervical-apron flap is required for bilateral neck dissections. The incision is a particularly useful alternative for performance of modified or supraomohyoid neck dissection.

1) Technique for radical neck dissection

Raising the flaps

The skin is prepared in the standard manner and the skin incision marked out using a marking pen. The incision, as described previously, is based on personal preference but should provide suitable access to four corners of consternation, which define the limits of the dissection. Importance of this operation is not only to remove the palpable disease but also to understand where any other further occult disease may lurk.

Corners of consternation

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

The skin is incised in one movement with a number 10 blade down to and through the platysma muscle, the fibers of which tear apart if strong tension is applied. In posterior part of the neck, the fibers of sternomastoid muscle are inserted directly into the skin, which makes the dissection and

identification of the appropriate plane difficult and results in more bleeding. It is important to keep the platysma on skin flaps as it not only increases the strength of the wound in postoperative period, but also provides important blood supply to the flaps. In certain instances where extension of disease is onto, into or even through platysma, complete resection of platysma and overlying skin is required. In a double horizontal incision (Mac Fee), the lower flap and the lower half of the middle flap are raised from below, and upper flap from the upper half of the middle flap from above. Access is gained by retracting the middle bridging flap with tapes. Bleeding from the inner surface of the bridge flap should be stopped at this point. While raising the upper flap, one should try to preserve two branches of the facial nerve if possible. The most important of these is the marginal mandibular nerve and, somewhat less importance, is its cervical branch. The former supplies the muscles around the mouth and the later supplies the part of the platysma that crosses the mandible and is inserted into the corner of the mouth, so that division of either nerve will lead to a weakness of the lower lip. There are a number of ways to protect these nerves. The easiest way to preserve the branches of facial nerve is to cut through the deep investing layer of fascia at the level of the hyoid bone and to expose the capsule of the lower part of the submandibular gland. The fascia can then be elevated as a flap over the mandible, taking the nerve with it, and then is sutured superiorly. Care should be taken not to transfix the nerve and to use bipolar diathermy on the upper flap. If the extension of the disease is through the deep fascia and approaches the platysma, then nerve should be sacrificed. The flaps are elevated, the neck is exposed with access to the corners of consternation and the resulting skin flaps are sutured back to the towels using strong silk sutures.

2) Technique for Selective Neck Dissection

A selective neck dissection consists of preservation of one or more lymph nodes groups and all three non-lymphatic structures. Access to the appropriate lymph-node areas required for selective neck dissection will be governed by the personal preference of the surgeon, the numbers and location of levels to be accessed and dissected, as well as the site of any primary tumour resection and the mode of reconstruction.

a) Supraomohyoid neck dissection (levels I-III)

For a selective Supraomohyoid neck dissection (and extended Supraomohyoid), the fascia overlying the sternomastoid muscle is mobilized anteriorly and the muscle retracted laterally. The fascia is dissected down to the posterior limit of the muscle, where the fascia is incised to expose the prevertebral fascia and the floor of the posterior triangle. This commences inferiorly and proceeds superiorly, dividing branches of the cervical plexus, and is taken up to the level of the digastric muscle. From this point, the dissection proceeds in a forward direction both superiorly and inferiorly to identify where the fascia approaches the internal jugular vein. This tissue, which includes the appropriate lymph nodes, is then folded over and dissected off the internal jugular vein, the appropriate tributaries are tied and the dissection continues anteriorly, leaving the omohyoid muscle behind. As the dissection approaches the submandibular triangle, the hypoglossal nerve is identified and preserved and the submandibular gland excised in the same manner as described previously.

b) Anterior or central (Level VI)

This operation is carried out in conjunction with a total thyroidectomy. The lymph-node bearing areas in the prelaryngeal and pretracheal areas are dissected and removed. In particular, those nodes that lie medial and lateral to the recurrent laryngeal nerve in the paratracheal space are removed when present. It is important when this dissection is carried out that levels II, III, IV and VII are palpated and any disease suspected in these areas should be confirmed on frozen section and treated with an appropriate extended selective or comprehensive neck dissection.

c) Superior mediastinum (Level VII)

This is usually carried out in conjunction with an anterior central compartment neck dissection (level VI) and total thyroidectomy. An upper median sternotomy (with a lateral extension at the angle of Louis if required) is made to facilitate access to the upper mediastinum. Lymphatic tissue is cleared to the level of the clavicle medial to both carotid arteries and the area dissected, including the thymus gland, down to the level of the brachiocephic vein. Care must be taken to preserve the recurrent laryngeal nerves when appropriate.

Discussion

In head and neck cancer, the presence of enlarged cervical lymph nodes has always presented a dilemma for the clinician since it almost always signifies advanced disease and a relatively poor prognosis for the patient. Cure rates for patients with cervical lymph node metastasis are nearly one-half of those achieved in patients who present with tumours localized at the primary site. The extent of nodal metastases in the neck clearly has an impact on prognosis. Patient with N_1 disease in the neck have better prognosis compared to those with N_2 or N_3 disease. In addition to this the presence of capsular rupture and extranodal spread has also an adverse impact on prognosis. Thus regional failure in the dissected neck depends on the extent of nodal disease.

Patients undergoing neck dissection for N_0 neck have the lowest risk of local recurrence compared to those with N_1, N_2 or N_3 disease. Patient with multiple level of involvement develop recurrence in the dissected neck twice as often as those with single level

involvement. Adjuvant post-operative radiation therapy however significantly improves regional control in the dissected neck. This improvement in regional control is seen in patients with limited neck disease (N_1) as well as in patients with extensive nodal disease (N_{2b}). Significant functional and esthetic morbidity following classical RND warranted the need for modifying the operation to reduce morbidity without compromising regional control rates or survival. MRND Type-I achieves that goal without an adverse impact on prognosis. Five year survival rates, regional failure rates and the location of recurrence are comparable for classical RND and MRND Type-I.

At present it is felt inadvisable to perform MRND Type-I for N3 disease. Clearly regional recurrence rate for patients undergoing classical RND for N3 disease is the highest inspite of post-operative radiotherapy. The current philosophy in the management of cervical lymph node in SCC of Head and Neck region is to perform a comprehensive MRND Type-I, preserving the SAN in patient with grossly enlarged lymph nodes as long as the nerve is not involved by metastatic disease. A selective neck dissection is recommended in patients who have at least a 10-15% risk of having micrometastasis in N_0 neck based upon the characteristics of primary tumour. Post-operative radiation therapy is recommended in all patients with multiple metastatic lymph nodes, extra nodal spread of tumour or where ominous histopathologic feature are present.

As per the study conducted at Memorial Sloan-Kettering Cancer Center from 1984-1994, the number of patients undergoing a classical RND has declined and an increasing number of patients are undergoing modifications in neck dissection for management of cervical lymph node metastasis.

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