Management of Head and Neck Cancer: Surgical and Nonsurgical

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Abstract
It is right time to review the management of head and neck squamous cancer (HNSC) because of fundamental changes in both diagnostic and therapeutic modalities. Head and neck cancer affects area highly associated with the individual’s identity and can produce profound alteration in appearance, speech, and swallowing. Due to morbidity, disfigurement and problems of disease control clinicians used to have lot of reservations in treating complex HNSC cases. The field has taken a new vigor by incorporating important basic advances in understanding of cancer, new modalities of treatment and management of functional deficits. Although much progress has been made in understanding the molecular genetics of HNSC for novel diagnostic and therapeutic interventions, they are still far to go before becoming standard of care for head and neck cancer.

Keywords: Oral squamous cell carcinoma, surgical management.

The anatomic and functional complexity of the head and neck region and the invasive nature of the disease make their management extremely challenging. Multidisciplinary approach that encompasses surgical, medical and ancillary expertise should be adopted. This approach necessitates not only adequate resection of the tumor but also timely reconstruction and adjuvant treatment. A comprehensive head and neck surgery team would consist of a head and neck surgeon, medical oncologist, reconstructive surgeon, neurosurgeon, radiation oncologist, prosthodontist and nutritionists experienced in head and neck oncology.

MANAGEMENT
The management of head and neck cancer begins with comprehensive history and complete head and neck examination, which includes an office-based endoscopy for evaluation of upper aerodigestive tract (UADT). A number of treatment options are available like surgery, radiotherapy, chemotherapy or combination of these. Choice of initial treatment modality depends on site and stage of tumor (Tumor factors), factors related to the patient (Patient factors) like physical and social status. Institutional factors like resources, expertise and treatment philosophy adopted by multidisciplinary team also play important role.

ORAL CAVITY
Surgery is the modality of choice in treating early stage disease of oral cavity (i.e., stages I and II). Although radiotherapy (RT) is equally effective in treating early carcinoma of oral cavity, surgery as single modality is preferred for following reasons:
1. Surgery requires less treatment time as compared to radiotherapy.
2. It holds radiotherapy in reserve for the treatment sites which are not amenable to surgical treatment in case of second primary of UADT.
3. Helps to avoid significant morbidity like xerostomia and dysphagia.
4. Locoregional control rates are similar to the radiotherapy alone.
Defects usually left after resection of the early oral cavity cancers do not require extensive reconstructive techniques. They can be closed primarily, or skin grafted or left for granulation. Surgery is combined with postoperative adjuvant radiotherapy or chemoradiotherapy in advanced disease (stage III and IV). Wide excision of tumor in all dimensions with adequate margins and appropriate neck dissection is essential in local-regional control of disease. Adjuvant radiotherapy or chemoradiotherapy improves loco-
regional control and disease free survival.\textsuperscript{1} Chemotherapy in neoadjuvant setting has shown promise; however, its use is presently limited to institutional trials.\textsuperscript{2}

The factors that influence the choice of surgical approach for a primary tumor of the oral cavity are the size of the primary, its depth of infiltration, the site of the primary (i.e. anterior or posterior, location), proximity/invasion of the tumor to the mandible or maxilla, dentition, presence or absence of trismus, expertise and preference of individual surgeon.

Various surgical approaches for oral cavity lesions are:

a. Peroral
b. Mandibulotomy (midline/Paramedian)
c. Lower cheek flap
d. Visor flap
e. Upper cheek flap.

Small primary tumors of the oral tongue, floor of mouth, gum, cheek mucosa and hard or soft palate are suitable for peroral excision (Figs 1A and B). T3 and T4 lesions of tongue with deep infiltration or crossing midline are resected with mandibular swing or lingual release.\textsuperscript{3,4} Main advantage of the lingual release over mandibulotomy is avoidance of the mandibular osteotomy with its complications of malunion or nonunion which occur more in radiated patients.\textsuperscript{5} Care should be taken to place osteotomy site between the tooth roots, however if there is dental crowding extraction of one tooth is preferred. Orthopantomogram usually assists in planning the osteotomy site. Commercial availability of mini plates has improved reconstruction of the mandible with reduced morbidity.

**MANAGEMENT OF MANDIBLE**

Invasion of the mandible has significant implications for both prognosis and postoperative rehabilitation. Presently there is no imaging modality that provides accurate assessment of the early bone invasion. A combination of the orthopantomogram and CT scan has high sensitivity (81\%) and specificity of (88\%).\textsuperscript{6} SPECT and MRI have also shown promise with sensitivity of 90\% but their limited availability curtails their routine use.\textsuperscript{7} Early mandibular involvement is difficult to detect preoperatively. Our approach to the evaluation of the mandible includes high degree of suspicion, 3-dimensional CT (Fig. 2) scan and assessment of the mandibular periosteum at the time of resection.

If there is gross involvement of the mandible clinically and radiologically the standard of care is segmental mandibulectomy (Fig. 3) and preferred reconstruction for such lesions is vascularized-osseous free tissue transfer. But in certain elderly edentulous cases where lesions are located posteriorly it can be left unreconstructed with acceptable cosmetic results. Most of the clinicians are in dilemma when the lesions are close or about the mandible. We prefer to do a marginal mandibulectomy and it is widely accepted approach when there is no clear evidence of bone erosion.\textsuperscript{8} This operation involves partial resection of the mandible, i.e either the superior half (Fig. 4) of the mandible or the lingual cortex. Locoregional control and survival rates compare well to that of the segmental mandibulectomy.\textsuperscript{9,10} Bone height should be assessed before embarking on the procedure of marginal mandibulectomy. Edentulous patients
seem to have decreased bone height and less resistance to the advancing tumor front. Once invasion of the neurovascular canal has occurred the tumor tends to spread to the skull base along the inferior alveolar nerve. In such a situation we prefer to do a hemimandibulectomy with resection of the inferior alveolar nerve as high as possible.

Special mention needs to be made of the gingival–buccal cancers in Indian population because of the peculiar habit of keeping the tobacco quid in the lower gingivobuccal sulcus. On one hand there may be early lesion (Fig. 5) which may need just mucoperiosteal stripping while on the other hand full thickness cheek composite resection is required for the advanced lesions (Figs 6 to 7B). Reconstruction in such huge defects can be accomplished by bipaddle pectoralis major myocutaneous flap (Fig. 8) or bipaddle free tissue transfer like anterolateral thigh or rectus abdominis free flap.

**Neck**

The management of clinically N0 neck is still controversial and depends on the approach to the primary lesion. N0 neck both clinically and on USG examination can be observed or electively dealt by selective neck dissection. Supraomohyoid neck dissection (clearance from level I to III) is indicated if USG suspicious, thick lesion, cheek flap is raised for approach and poor follow is expected. If frozen section is positive completion modified neck dissection is required. N+ needs to be addressed by modified or radical neck dissection depending on nodal status. Bilateral neck needs to be addressed if the primary disease is in midline or extending across midline (including middle third mandible). However, “skip metastasis” involving Level III and Level IV is well-known in oral tongue cancers in up to 15% of patients. In addition, adjuvant radiotherapy is recommended if occult disease is identified.
ORO PHARYNGEAL CANCERS

The treatment of or pharyngeal carcinoma is aimed at maximizing cure with least possible functional morbidity. Therefore T1 and T2 lesions are treated with radical radiotherapy and chemoradiotherapy is the treatment of choice in advanced T3, T4 tumors. Some early, lateral placed and verrucous lesions can be resected only if surgical resection is associated with reasonable functional outcome. It is also preferred with postoperative radiotherapy in select advance cases, e.g. infiltrative lesions of base tongue, tonsil and lesions involving the mandible and as a salvage procedure for residual neck nodes following chemoradiotherapy.

Soft Palate

Soft palate tumors relatively uncommon and become symptomatic once tumor achieves substantial size. Overall 5-year rate survival with unilateral disease is 70.8% and drops to 51% with midline or bilateral lesions. Very small lesions of soft palate, especially of uvula can be resected perorally with out much functional disability. But larger lesion
involving significant areas are treated with radiotherapy since the morbidity of initial surgery is significant. Surgical treatment of even small lesion results in a large defect with functional difficulties. Even radiotherapy leaves a palatal defect which can cause nasal escape and regurgitation, the associated morbidity is usually better than after resection. Advanced soft palate lesion have poor prognosis.

**Tonsillar Complex**

Asymptomatic nature of this disease causes many patients to present in T3 and T4. Since surgical resection of the tonsillar complex cancers offers no curative advantage, irradiation largely has become the first line treatment for early tonsillar carcinomas. Morbidity is minimized and reserves the surgery for salvage. It has improved 5-year disease free survival to 85 to 100% for T1 lesions and 80 to 90% for T2 lesions. The treatment approach for the T3 and T4 tonsillar carcinomas that provides the greatest chance of cure is combined surgery and radiotherapy. Debate continues if the surgery is to be used upfront or for salvage. In order to minimize significant morbidity associated with major resection of the oropharynx, chemoradiotherapy with surgical salvage has been advocated. Important disadvantage with the radiotherapy up front is that it changes the sensitivity of clinical examination to the extent that early detection of the residual or recurrent disease may not be possible and once detected the disease may have extended beyond the scope of surgical resection. If radiotherapy fails to control the disease less than 25% patients are salvagable surgically.

**Base of Tongue**

Most of the centers favor the use of radiation or chemoradiation for early (T1 and T2) base of tongue. Patients with exophytic growths, significant comorbidities, not willing to accept functional deficits of subtotal or total glossectomy are best treated to radiotherapy or chemoradiotherapy, reserving surgery for salvage. In patients with ulceroinfiltrative tumors, infiltration of deep musculature and large volume disease crossing midline the best chance of achieving locoregional control is radical surgery followed by adjuvant chemoradiation. Tumors that extend to the supraglottis may require supraglottic laryngectomy or even total laryngectomy. Alternate approach to such lesion is chemoradiotherapy. This approach avoids mutilating surgery which often is futile exercise.

Reconstruction of such defects is usually accomplished by pedicled pectoralis major myocutaneous or free tissue transfer from anterolateral thigh or rectus abdominis flap.

**LARYNGEAL CANCER**

The goal of treating laryngeal cancer should focus on adequate oncologic chance of cure while attempting to minimize the morbidity. It is head and neck surgeon’s duty to evaluate all laryngeal cancer patients for organ preservation from their initial visit. Certain key principles should be strictly adhered to in determining the patient’s eligibility for open organ preservation surgery.

1. Organ preservation surgical procedure should be employed when complete (R0) resection of the tumor can be accomplished.
2. Confident prediction of the extent of the tumor. Diligent endoscopy, dynamic study of larynx and CT scan aid in mapping the lesion accurately.
3. Cricoarytenoid joint is the functional unit of the larynx. It consists of the artenoid and cricoid cartilages with associated musculature and superior and recurrent laryngeal nerves for that unit should be preserved.
4. A chronic and inefficient cough and inability to walk up two flights of stairs without breathlessness indicate poor ability of the patient to tolerate organ preservation surgery.

**Transoral Laser Resection**

Early laryngeal cancer is curable disease with single modality therapy of radiation or surgery. Surgery for the early cancer...
of the larynx has evolved from partial open laryngectomy to the endoscopic laser resection. Laser resection has provided a paradigm shift in the treatment of early laryngeal cancer. After Steiner's landmark report in 1993, transoral laser resection has become an established treatment option for early laryngeal cancer. Endoscopic resection of early cancer provides an acceptable cure rate with close follow-up if possible and appropriate adjuvant therapy is provided when indicated. Laser resection often uses piecemeal resection compared with the standard en bloc resection. This is possible because of the use of magnification of the microscope and characteristic properties of the CO2 laser. Several studies have reported local control rates for T1 and T2 disease in the range of 77 to 92% and 66 to 88% respectively. Most patients only need overnight stay, tracheotomy is completely avoided, aspiration is not at all a significant problem and tube feeding if required is usually for dysphagia and that too for few days. Other potential complications of open surgery like wound dehiscence, infection, emphysema, cutaneous fistulas is rare.

Transoral laser resection is not indicated for the surgeon without experience, training and skill in the endoscopic approaches.

**Conservative Laryngeal Surgery**

Indications for conservative surgical procedures have changed because of the endoscopic CO2 laser surgery and chemoradiation protocols for organ preservation. For us, the indications for open conservation surgery in patients historically felt to be candidates for this approach are:

1. Early laryngeal cancer where endoscopic exposure is inadequate.
2. Patients with anterior commissure cancer who fail radiotherapy.
3. Young patients where radiotherapy needs to be avoided.
4. T2b glottic cancers.
5. Cancer of posterior larynx where full arytenoidectomy is needed.

Laryngofissure with cordectomy entails resection of vocal fold through thyrotomy. This procedure is indicated for mid third mobile vocal fold lesions. Vertical partial laryngectomy can be successfully used for lesions without involvement of the anterior commissure. Other select T1 and T2 lesions including cancers involving anterior commissure are treated with frontolateral hemilaryngectomy or supracricoid laryngectomy (SCPL). Frontolateral laryngectomy removes vocal fold, anterior commissure, and anterior third of the vocal cord and overlying thyroid cartilage. SCPL preserves at least one cricoarytenoid unit. A five years disease specific survival rate 92 to 97% is reported for T1 and T2 lesions.

For advanced glottic carcinoma, T3 and T4, the local control rates for radiation therapy range from 40 to 60%. Local control rates for surgery are greater ranging from 84 to 96%, and the 2 years disease free survival is 79% for T3 and 58% for T4. Combination therapy is usually superior to the single modality alone. Total laryngectomy is the gold standard. While near total laryngectomy (NTL) by Pearson and supracricoid partial laryngectomy by Kitamura permits extirpation of the advanced cancer of the larynx and can be used in certain cases. The Pearson’s procedure does not eliminate the need of permanent tracheotomy, however both require careful patient selection and advanced surgical experience and skill. NTL is most suitable for resection of unilateral T3 and T4 laryngeal cancer or transglottic cancer without involvement of the interarytenoid region. One should be able to preserve at least one third of the contralateral cord so that a functional voice shunt can be formed after resection.

Surgery is preferred in supraglottic lesions in case of large volume disease, cartilage erosion, bulky nodes, gross pre-epiglottic space invasion and comorbidity not permitting chemoradiation.

Primary subglottic cancer is rare. Most of the lesions are extension from the glottic area. Presence of the disease in the subglottic space increases the risk of the paratracheal nodes and extralaryngeal spread. It is recommended that total laryngectomy, thyroidectomy, and paratracheal nodal clearance should be done followed by adjuvant radiotherapy or chemoradiotherapy for advanced lesions.

**HYPOPHARYNGEAL TUMORS**

Despite advances in the surgical and nonsurgical treatment, overall survival rates have not improved for patients with hypopharyngeal cancers. Surgery and radiotherapy as a single modality have similar results in stage I and II disease. However, radiotherapy is preferred over surgery due to its low morbidity and voice preservation. In stage III and IV disease, surgery plus postoperative radiotherapy and chemoradiotherapy have shown equal results regarding survival. Due to higher chance of laryngeal preservation, Chemoradiotherapy should be offered to patients with low volume disease. The best results are with combination of
surgery and radiotherapy and two thirds of patients are palliated if not cured of the disease.

**Surgical Treatment**

Hypopharyngeal cancers are unique in demonstrating high propensity for submucosal spread of the disease. Transoral CO₂ excision is advocated for early lesions of pyriform and posterior pharyngeal wall, particularly in Germany.²⁰ These lesions are resected with margin of 5 mm for smaller cancers and 10 mm for larger ones. Cases selection should be done properly. Only superficially infiltrative cancers with mobile vocal cords are suited for the resection. The technique is not widely performed because it is technically difficult and to perform and requires special expertise. Larynx preservation without jeopardizing survival appears feasible in patients with T3/T4 cancer of the hypopharynx. Surgery is the treatment of choice in patients with large volume disease, bulky neck nodes, cartilage erosion, extensive soft tissue involvement. Near-total laryngectomy/Total laryngectomy with partial pharyngectomy followed by adjuvant chemoradiotherapy is the usually required for such lesions. Reconstruction of defect depends on mucosal defect. If stretched mucosa is 3 cm primary closure is feasible, if mucosa inadequate – patch PMMC or free radial forearm flap is advocated.

T1 and T2 lesions of the postcricoid and posterior pharyngeal wall are best treated with radical radiotherapy. T3-4 Any N Large volume disease needs total laryngopharyngoesophagectomy with gastric pullup or free jejunal flap (Figs 9A to D) or tube pectoralis myocutaneous flap and postoperative radiotherapy.

**Chemoradiotherapy for Laryngeal Preservation**

Organ preservation in stage III/IV laryngeal/hypopharyngeal cancers seemed a reality with the landmark veterans affairs laryngeal study group²¹ and EORTC trials.²² The Inter-group study further strengthened these findings. As of today chemoradiotherapy should be considered the standard of care for small volume stage III/IV laryngeal and hypopharyngeal cancer. This has resulted in preservation of organ that otherwise would have required total laryngectomy without compromising survival. A decreased incidence of distant metastasis was seen in the organ preservation group compared with the surgery group (25% vs 36%). The 5 year estimate of other retaining the functional larynx for chemoradiation was 35%. Similar data has been reported by the institutions,²²,²³ More recently, concurrent chemoradiotherapy, the simultaneous use of chemotherapy and radiotherapy has been used to take advantage of radiation enhancer. Concurrent treatment with chemotherapy potentially treats distant disease and locoregional disease and may improve survival rates. Although organ preservation is possible, but preserved organ is not always functional. Acute side effects, particularly mucositis are more severe with the concurrent than neoadjuvant treatment. Significant laryngeal and pharyngeal dysfunction has been reported following chemoradiation. Pretreatment vocal cord fixation seems to be the strongest predictor of poor functional outcome, with more than 50% requiring a feeding tube or tracheotomy 6 months after the completion of therapy compared with the patients without vocal cord fixation.
The goal of the surgical resection is en bloc removal of the tumor with margins clear of neoplastic cells. Total maxillectomy is the standard procedure for maxillary sinus cancer. Numerous modifications like medial maxillectomy, infrastructure maxillectomy, subtotal maxillectomy and radical maxillectomy may be used depending on the tumor extent. Neoplasm involving ethmoids frontal and sphenoid sinuses will need craniofacial resection because of the skull base involvement. Surgical resection therefore remains the initial treatment of choice for nearly all sinonasal tumors except those which are felt to be categorically unresectable. Surgical treatment alone is considered appropriate for nearly early staged malignant tumors amenable to a curative surgical resection. Criteria of unresectibility are:

- Gross infiltration of infratemporal fossa.
- Pterygoplatine fissure involvement.
- Involvement of dura and intracerebral extension of squamous carcinoma.
- Cavernous sinus involvement.
- Involvement of sphenoid.
- Extensive soft tissue and skin infiltration.
- Bilateral orbital involvement.

On the other hand, unresectable tumors are currently treated by a simultaneous treatment program of systemic chemotherapy and hyper fractionated radiotherapy with promising early results.

Although the use of endoscope has many advantages like lack of skin incision and lower morbidity as compared to open approach. The endonasal approach should be limited to tumors without extensive involvement of sinuses, orbit or cranial base.

**Treatment of Neck**

N0 neck both clinically and radio logically should be observed. Appropriate neck dissection and postoperative radiotherapy to both necks should be done for depending on nodal status. Microvascular free tissue transfer for extensive skin and soft tissue defect, orbital exentration, skull base reconstruction and if more than half of the palate needs to be resected.

**REFERENCES**


