Review Article

Difficult airway in head and neck tumours - Anaesthetic concerns an overview

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Abstract

The term Head and Neck Cancer encompasses a wide range of tumours that occur in several areas of the head and neck, including the nasal passages, sinus, mouth, throat, larynx, swallowing passages, salivary glands and the thyroid glands. Difficulty in airway management is one of the aspects which concerns anaesthesiologists most and which leads to the greatest repercussions in regard to anaesthetic mortality and morbidity. Successful and safe tracheal intubations with induction of anaesthesia should prevent morbidity and avoid the serious consequences of failure to establish the airway. Various methods employed for airway assessment that do not give 100% prediction of a successful intubation. Therefore, for head and neck tumours, it is better to have definitive and alternate plans for management of both anticipated and unanticipated difficult airway. Apart from having all difficult airway gadgets it is more important that an experienced anaesthesiologist always makes difference in handling such cases.

Keywords: Difficult airway, Tumours, Head and Neck, Iatrogenic, Anaesthetic concerns.

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INTRODUCTION

The first public demonstration of ether anesthesia took place in the Bullfinch Amphitheater of the Massachusetts General Hospital in 1846. Dr. William Morton anesthetized a patient with diethyl ether while Dr. John Warren excised a vascular tumor from the left side of the patients neck and jaw. Anesthesia for head and neck tumor surgery was at the very beginning of surgical anesthesia.[1] Since 1846, much has changed and yet much remains the same. While airway management in general and for head and neck surgery has undergone remarkable transformation and sophistication, it is still the airway which demands special focus. Now, as then, problems concerning the airway lead to some of the most frequent and major morbidity and mortality in head and neck surgery patients. Given the rapid progression and development of airway management it is important to periodically review some of these problems and to suggest some current solutions. Detailed knowledge of tumor types, workup, and subtleties of tumor location may not initially seem important to anesthetic care but insofar as this understanding fosters a better grasp of airway anatomy and an appreciation of several factors such as tumor location, size, vascularity , post chemotherapy/ radiotherapy which may relate directly to airway management, along with most important thing would be to discussion with surgeon about the plan of airway management which in fact is more critical. From an epidemiologic and societal standpoint, head and neck cancer continues to be very prominent, especially in India. Malignant tumors of the larynx, pharynx, and oral cavity rank sixth in overall incidence behind the other cancers. Squamous cell carcinoma composes 90% of head and neck malignancies. Adenocarcinoma, which develops in the major and minor salivary glands, is the next most common type. All other pathologic varieties comprise less than 1%. Patients with head and neck cancer are more prone to develop a second primary malignancy. Thus, the patient cured of cancer must remain under surveillance for the rest of his life--to detect metastases as well as to detect a new malignancy.[2,3,4]

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BASIC FORMS OF THE DIFFICULT AIRWAY IN HEAD AND NECK SURGERY PATIENTS

Airway management remains central to perioperative care. Over the past decade, the American Society of Anesthesiologists has conducted a closed claim study of anesthetic disasters and malpractice awards arising from them. Over one third of these were related to respiratory events, most occurring during the induction of anesthesia with failed intubation. Of these respiratory events, eighty-five percent resulted in death, either whole body or brain death.[5] What is a difficult airway and how frequently is it encountered? According to ASA TASK FORCE 2013 guidelines The difficult adult airway can be attributed to problems with mask ventilation and/or problems with direct vision laryngoscopy and intubation or both.[6] Mask ventilation can range from zero difficulty to infinite difficulty and maneuvers necessary to maintain airway patency can range from simple jaw thrust to oro or nasopharyngeal airway placement and two person jaw thrust. While the frequency of each of these has been estimated , the potentially catastrophic episodes of either unsuccessful intubation (cannot intubate/can ventilate) or failed intubation with inability to ventilate (cannot intubate/cannot ventilate) occur quite infrequently, about 0.05-0.35 and 0.0001-0.02%, respectively.[8,9,10,11] In these situations it is interesting and instructive to note that the incidence of airway complications appears to strongly correlate with the degree of anticipated airway difficulty.[12]

RECOGNITION OF THE DIFFICULT AIRWAY

Central to our management of the difficult airway is being able to recognize it. It has been estimated that 90% of difficult intubations can be anticipated13 yet as many as 50% of these are not, even with thorough preoperative evaluation.[14] This disparity is probably the most frequent cause of catastrophe related to the airway.[8,13,15,16] One of the first airway management goals in the head and neck tumor surgery patient is to detect obstructive symptoms. This is critical because if patients with subtle obstructive lesions become apneic, clinically obvious airway obstruction can be unmasked, mask ventilation can be difficult or impossible, and hypoxemia can rapidly ensue. It is for this reason that the detection of obstructive symptoms by history is especially important. Is the patient hoarse or stridorous? Hoarseness can be an early manifestation of glottic carcinoma but is often delayed with supraglottic or subglottic tumors. Stridor during forced exhalation frequently indicates upper airway pathology and inspiratory stridor may suggest very dramatic airway stenosis. In general, inspiratory stridor is indicative of a subglottic lesion, expiratory stridor a supraglottic lesion, and biphasic stridor a glottic lesion. Further, is there a history of sleep apnea, dyspnea, dysphagia, or odynophagia? Dyspnea from upper airway obstruction must be distinguished from chronic obstructive pulmonary disease, for which these patients are also at high risk. Flow volume loops may be useful in differentiating the two. Specifically, a decrement in the inspiratory portion of the flow-volume loop can indicate an extrathoracic lesion and a decrement in the expiratory portion indicates an intrathoracic one.[17,18] Flow volume loops can be especially useful in evaluation of the pediatric airway and specifically in the determination of a fixed stenosis versus a dynamic stenosis. Many methods to recognize the difficult adult airway and to predict difficult tracheal intubation have been suggested. These include radiographic assessment[19] as well as assessment of oropharyngeal structure[20] or external anatomic airway structure.[21] None is flawless as a predictor of significant intubation difficulty. On the physical exam, there are four questions that must be considered in every patient coming to the operating room-especially in the head and neck tumor surgery patient who has pathology in or near the airway.[6] None is fail-safe alone but together they are powerful predictors of the difficult airway.[10]

1. How well can the patient open his mouth? Normal mouth opening is about 5-6 cm. Patients must usually be able to open at the mouth maximally at least 3 cm for successful laryngoscopy.
2. Can the soft palate, uvula, and faucial pillars be visualized? The ability to do so embodies the so-called "Mallampati test"7 and has been correlated with ease of laryngoscopy.20, 22 23 The Mallampati classes are as follows:
   Class I: soft palate, uvula, faucial pillars visualized.
   Class II: soft palate, faucial pillars visualized, uvula masked by base of tongue.
   Class III: only soft palate visualized.
   Class IV: only hard palate visualized.
   While this examination alone does provide valuable information as to tongue size in relation to the size of the oral cavity and is a useful predictor of intubation difficulty, it has been associated with both false positive 24 and false negative 25 results and should not, by itself, be considered fail-safe.
3. What is the size of the mandibular space? This is the area from the inside of the submentum to the hyoid bone. If this distance is greater than 6 cm and the horizontal length of the mandible greater

than 9 cm, the line of vision to the glottic opening will likely be relatively straight (with sufficient room for the tongue to move into the mandibular space during laryngoscopy) and direct laryngoscopy probably easy.[23] If the mandibular space is small, the larynx is usually anterior, the curve to it therefore greater, and intubation more difficult. In general,[2] fingerbreaths or more correlates well for successful intubation.

4. Can the patient assume the sniffing position, which is moderate flexion of the neck on the chest and extension of the neck about the atlantoaxial junction? Ability to assume the sniffing position is predictive of a relatively straight axis to the glottis.[26,27]

In addition, other physical evaluations and tests are warranted in the head and neck tumor surgery patient. These physical examinations are crucial because a high percentage of head and neck malignancies can be seen or palpated by a careful head and neck evaluation. They include indirect mirror nasopharyngoscopic (IDL) and/or flexible nasopharyngoscopic examination of the laryngeal cartilage, tongue base, and cervical soft tissue.[28] Depending upon the findings, fine needle aspiration of cervical lymph nodes, angiography, chest X-ray, CT scan, and magnetic resonance imaging may be necessary. Complete tumor mapping requires Direct laryngoscopy(D L SCOPY), esophagoscopy and bronchoscopy under general anesthesia.[29] Radiographic study has played an increasingly greater role in the airway evaluation of the head and neck tumor surgery patient.[30] CT scanning is especially valuable in evaluating the size and extent of lesions and in detecting any erosion of the bony or cartilaginous structure. Axial plane images of a patient in a supine position can be difficult for the anesthesiologist to interpret, but improvements in CT software promise reconstruction in the sagittal plane. In addition, three dimensional reconstruction with projection on a two dimensional screen has been developed and will only further improve the ability to more fully evaluate head and neck tumors. C-arm fluorography may also offer great promise in both airway and head and neck tumor evaluation by revealing dynamic changes in the airway with inspiration, swallowing, and jaw and neck movement.[30] The MRI offers multiplanar views of cartilage and soft tissue and may be useful in evaluating tumor extension but it is expensive.[32] Laryngography and plain film tomography are modalities that have largely been supplanted by CT and MRI technology. The difficult airway in head and neck tumor surgery patients occurs in five general situations: the recognized difficult airway in both emergent and nonemergent settings, the unrecognized difficult airway in both of these settings, and the iatrogenic difficult airway. We have encountered case examples of all of these in head and neck cancer surgery patients during the past four years. A review of some of these provides a useful vehicle for discussion.

TUMOURS OF HEAD AND NECK

Can be classified based on the structure from where the tumour is arising,

1. Supraglottic tumours
   a. Tumours of lip
   b. Tumours of tongue
   c. Tumours of palate
   d. Tumours of buccal mucosa
   e. Pharyngeal tumours
2. Subglottic tumours
   a. laryngeal tumours
   b. piriform fossa
3. External tumours compressing airway
   a. Thyroid tumours (benign and malignant)
   b. Secondaries in neck(lymphoma)
   c. Tumours of salivary glands
4. Iatrogenic
   a. Surgery
   b. Radiotherapy
   c. Chemotherapy

Now going individually to each of classifications.

Supraglottic Tumours

Airway Pathology: The pharynx is divided into three regions: oropharynx, nasopharynx, and hypopharynx. The anterior border of the nasopharynx is the nasal choanae. The posterior border extends from the hard and soft palates to the skull base. The oropharynx extends from the plane of the hard palate superiorly to the plane of the hyoid bone inferiorly. Laterally it encompasses the tonsils, tonsillar fossa, and faucial pillars. The hypopharynx extends from the plane of the hyoid bone above to the plane of the cricoid cartilage below and consists of three parts: pharyngo-esophageal junction (postcricoid area), pyriform sinus, and posterior pharyngeal wall. Approximately 90% of cancers of the oral cavity and pharynx are squamous cell carcinomas. While they represent about nearly one-half of all cancers in some Asian countries.[29] The hypopharynx extends from the piriform sinuses to the posterior cricoid region. Lesions arising in the hypopharynx are most frequently located in the piriform sinus and can commonly grow to a size sufficient to cause airway obstruction. Delayed onset of symptoms coupled with a high rate of metastases contribute to the poor rate of longterm survival.28 Presentation is most often characterized by a history of progressive dysphagia and odynophagia with the development of hoarseness usually being a late symptom.

These lesions are not usually hypervascular and the central core can be avascular and necrotic. Lateral base of tongue tumors are not usually obstructive but also fixed, especially on the left side, do not usually significantly impede oral laryngoscopy. However, if one underestimates the size of these potentially friable tumors and/or their midline extension the airway can be compromised.

Anesthetic Concerns

During laryngoscopy in such cases orientation to the distorted anatomy is the first line to judge the airway and to decide the plan of management. Eg; small size tube, use of bougie, nasal or oral intubation, fiberoptic bronchoscope/tracheostomy.Airway obstruction with a tumor of this size and in this location is an obvious risk, especially with apnea. While these exophytic tumors like that of lip and tongue are almost always friable which leads to bleeding and make intubation difficult along with chances of aspiration. Sometimes can be fractured and dislodged distally with instrumentation. Tumours of palate (soft or hard) occupy the oral cavity which makes difficulty in mask ventilation, introducing laryngoscope blade and endotracheal tube. Nevertheless, whenever the larynx or pharynx are instrumented one must be aware of the possibility for significant bleeding and making access of airway further messy and scary. Its always important for the anaesthesiologist to discuss with surgeon prior to surgery regarding the plan of airway management and in case be ready for emergency tracheostomy. Preoperative X-rays of neck, CT scan and MRI will help in assessing the extent and nature of obstruction.

Subglottic Tumours

Airway Pathology: Tumours of vocal cords and subglottis, thyroid tumours infiltrating trachea are common. laryngeal papillomatosis is most often viral. Recurrence occurs because surgical treatment is not curative. Symptoms range from mild hoarseness to marked stridor and severe respiratory distress.

Anesthetic Concerns

1. Airway obstruction with apnea with induction of anaesthesia. Sometimes chances of losing airway with bleeding and inability to negotiate endotracheal tube or tracheostomy tube, collapse of airway due compression from tumour itself can be a problem.
2. Risks to patient and OR personnel, especially corneal injury, with carbon dioxide laser use.

There are four common approaches to the airway in a case of this type:

1. Nasopharyngeal insufflation with spontaneous respiration.
2. Endotracheal intubation with a special laser tube or a red rubber tube wrapped in aluminum foil.
3. Jet ventilation with a cannula applied to a suspension laryngoscope.[36]
4. Apneic technique whereby a patient is intermittently intubated and ventilated and then extubated momentarily while the surgeon operates.
5. Intermittant ventilation via a mask.

Laryngeal hemangiomas are congenital malformations of vascular tissue which most frequently occur in the subglottis. They appear in both infants and adults. Infants typically have stridor or "pseudocroup" within the first six months of life. A lateral radiograph of the neck reveals soft tissue swelling. Other symptoms include a barking cough, hoarseness, and failure to thrive. Unrecognized or untreated cases have a relatively high mortality from complete airway obstruction. Many therapies have been tried but expectant treatment, steroid therapy, or laser excision is favored.[37,38] Anesthetic Concerns: 1) Ensuring the adequacy of oxygenation and ventilation while providing the surgeon with a clear view and an immobile field.[39]

Thyroid and other malignancies

Airway Pathology: Large goiters or cancers of the thyroid can be threatening to the airway by external airway compression, deviation, or distortion. Parathyroid adenomas present airway concerns that are frequently more theoretical than real. In contrast, a number of cancers of the thyroid can threaten the airway. These are primarily papillary and follicular cancers but occasionally are medullary, anaplastic, or lymphomatous. Such lesions can cause upper airway obstruction by local invasion of the trachea, softening of the trachea (tracheomalacia), mass effect causing distortion of the trachea, and through involvement of the recurrent laryngeal nerve. Involvement of this nerve may jeopardize an already compromised airway by causing additional narrowing at the glottic opening. Concern about the status of the recurrent laryngeal nerve indicates for routine preoperative indirect laryngoscopy to evaluate the vocal cords of all patients presenting for thyroid surgery and may be important for both medical and medicolegal reasons. Medically it is important to detect nerve palsy which may not be manifest by voice changes because of compensation by the nerve on the other side. This would emphasize the importance of special caution in terms of preservation of the contralateral nerve. Medicolegally, such evaluation demonstrates the presence or absence of nerve involvement preoperatively, a fact which is of importance in the evaluation of voice disturbance postoperatively. Anesthetic Concerns: 1) Potential difficulty with standard laryngoscopy based upon the preoperative airway assessment 2) The risk of complete airway obstruction by extrinsic compression of the goiter

3) Difficult mask ventilation 4) difficult intubation 5) Difficult or impossible surgical airway access. 6) sometimes need for tracheostomy or tracheal resection.7) extubation of such patients is equally as same concerns that of securing airway due postoperative laryngomalacia, tracheomalacia or nerve injuries.

Tumours of salivary glands

Airway Pathology: The major salivary glands are the parotid, submandibular, and sublingual glands. Tumors of the salivary gland account for only 3% of all malignant and benign tumors.[33] As in this case, these tumors can be large and the associated swelling painless. Anesthetic Concerns:1) Unappreciated tumor extension, perhaps to the base of the tongue causing tongue fixation and difficulty with laryngoscopy and intubation 2) Tooth loss with laryngoscopy and panendoscopy, given very poor dentition.

Glomus tumors

were first reported and named by Guild in 194.140 They are a benign, highly vascular collection of epithelioid cells in or near the temporal bone in association with the adventia of the jugular bulb. About 80% occur in women.[41] Symptoms include unilateral pulsatile tinnitus, hearing loss, aural fullness, pain, vertigo, facial nerve palsy or palsies of cranial nerves V, VII, IX, X, XI, and XII.37 Palsies of cranial nerves IX and X may predispose to patient difficulty in clearing secretions and increased susceptibility to upper airway obstruction. These tumors may secrete catecholamines and cause symptoms similar to those of a pheochromocytoma.[42]

Anesthetic Concerns

1. Increased intracranial pressure secondary to tumor mass.
2. Preoperative and postoperative aspiration and/or airway obstruction secondary to cranial nerve palsy from tumor compression or nerve injury from surgery.
3. High blood catecholamine levels producing symptoms and risks similar to a pheochromocytoma as well as elevated cholecystokin levels which may impair gastric motility postoperatively.
4. Intraoperative blood loss from resection of these highly vascular lesions, which can be rapid and massive.
5. Venous air embolism, especially if the procedure is performed in the sitting position.
6. Patient temperature and specifically hypothermia during 8-15 hours of surgery.[42]

Preoperative management must focus upon the possible presence of high serum catecholamine levels. Suspicions are raised and formal serum levels drawn if the patient has suggestive symptoms. These closely mirror those seen with a pheochromocytoma and the preoperative preparation should reflect similar principles and constraints.[43]

Iatrogenic difficult airway

Treatment of such head and neck tumours preoperatively or postoperatively by chemotherapy/radiotherapy or resection and reconstruction surgeries can itself be great problem in airway management due to altered anatomy. With the surgeon and anesthesiologist sharing the airway, there is usually greater airway manipulation and probably a greater risk of subsequent airway compromise. When this occurs, with compression, distortion, deviation, and edema of the airway dynamic rather than static processes, a patent airway one moment can be obstructed the next. Therefore, the iatrogenic difficult airway in head and neck tumor surgery patients is often an emergency, sometimes a life threatening one. Such emergencies can be sudden and unexpected. For example, the most serious danger during any laser surgery is an endotracheal fire, the incidence of which is about 1.5% in patients undergoing laryngeal surgery with the CO2 laser.[34] Jet ventilation has been thought to represent one solution to the problem of airway fires, since there is no combustible endotracheal tube in the airway. Unfortunately, as this case shows, endotracheal tube fires but not necessarily airway fires can be avoided by the use of jet ventilation.[35] Unexpectedly severe airway swelling, especially after a long case with substantial fluid administration in a patient with deformed airway architecture from previous surgery, is a real threat. This can occur even when the airway is not involved either with tumor or surgical manipulation. Patients undergoing radiotherapy for tumor size reduction or debulking, can pose difficulty when coming for curative or palliative surgery. Due to fibrosis of soft tissues, patients can severe restriction of mouth opening (trismus), head extension and neck flexion.

CONCLUSION

Patients with head and neck tumors present airway management problems as difficult as any we confront. Our knowledge, skills, and judgment are routinely and rigorously tested in our care of these patients. The history and physical examinations are crucial in determining the presence of the difficult airway and need for an awake intubation. Specifically, obstructive symptoms, a constellation of findings on physical exam, and use of the CT scan enable us to evaluate head and neck tumors and alert us to the potential for airway management difficulty. Current knowledge of available airway management alternatives allows us to fully explore various options and deliver more safe and expeditious airway care.

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