Anesthesia for Oncological ENT surgeries: Review

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Abstract

Patients with head and neck cancer may present to anaesthesiologist for various diagnostic or definitive procedures. These patients are challenging for an anaesthesiologist not only in view of its inherent problems of the airway due to tumor mass but also the comorbid conditions. The present review discusses various concerns in patients presenting for head and neck cancer surgeries.

INTRODUCTION

Patients with head and neck cancer may require anesthesia for minor procedures like evaluation of extent of tumor, biopsy, laser procedures or for a major surgical therapy like laryngectomy, glossectomy, pharyngectomy, parotidectomy, hemimandibulectomy, maxillectomy, angiofibroma, and associated radical neck dissection. Endoscopic examination often precedes these major procedures and which in turn may be followed by reconstructive surgery, such as the transplantation of a free microvascular muscle flap.

PREOPERATIVE CONSIDERATIONS

Patient with cancer deserves special anesthetic considerations and perioperative management needs to be individualized depending upon the associated comorbidities like chronic obstructive pulmonary disease (COPD), bronchitis, hypertension, coronary artery disease and diabetes mellitus. Incidence of head and neck cancers is highest in the age group of 60 or above, however a study by Kowalski et al failed to identify any increased frequency of postoperative complications or mortality as compared with younger patients[12]. The choice of perioperative management should be based not only on age but also on patient's general condition.

During preoperative check up, the history should include smoking, alcohol abuse history and airway related problems[34]. Airway, respiratory, cardiovascular, renal, neurological and hepatic systems need to be evaluated thoroughly. Anesthesiologists should obtain the pertinent history related to prior surgery and anesthesia as it may effect the perioperative management. Past treatment of cancers (surgery, radiotherapy, chemotherapy) may have an impact on anesthesia management. Chemotherapy is often used to enhance the response of cancer cells to radiation therapy but may have adverse effect depending on the specific agents used, the cumulative dosage, and drug toxicity. Most often pulmonary and cardiac toxicities are the primary concerns. Chemotherapy drugs commonly used include cisplatin, fluorouracil, methotrexate, carboplatin, and paclitaxel. Methotrexate, paclitaxel and docetaxel cause myelosuppression leading to thrombocytopenia and neutropenia[567]. Paclitaxel and carboplatin can produce decrease of more than 20% diffusion capacity of carbon monoxide, which may persist for five months after completion of chemotherapy[8]. Reckzen et al described interstitial pneumonia in patients treated with paclitaxel combined with radiotherapy due to lymphocytopenia[9]. Gastrointestinal toxicity leading to oral mucositis, diarrhea, weight loss and electrolyte imbalance may occur with methotrexate[1011].Cisplatin and docetaxel may produce central nervous system toxicity[710].

Chemotherapeutic agents may cause impaired cardiac contractility, dysrhythmias (antracycline antibiotics), cardiomyopathy (anthracycline), myocardial tissue injury (cyclophophamide), endocardial fibrosis (busulfan), prolongation of QT interval (Doxorubicin). Clinical manifestations include pericarditis, congestive cardiac failure, ischemic chest pain syndromes, and arrhythmias. Radiotherapy causes dose dependent endocardial and myocardial fibrosis that can result in a restrictive cardiomyopathy. The anesthesiologist should be aware that different cancer treatments could cause pathology in patients with normal hearts or exacerbate preexisting cardiac conditions.

Cancer patients may present with treatment induced lung injury which may manifest as noncardiogenic pulmonary edema, chronic pneumonitis and fibrosis and hypersensitivity pneumonitis. Since these patients are immunocompromised, so they are more prone for secondary infection, often affecting lungs. Complete physical examination with appropriate investigations like pulmonary function tests, chest radiograph should be done.

Cancer patients may develop metabolic abnormalities caused by tumor-induced factors or from tumor destruction by antineoplastic therapy. Tumor lysis syndrome is a known complication associated with cancer.

Common sites of head and neck cancer metastasis are liver, lung and bone. They may cause a site-specific symptoms and thus systemic examination must include these sites as well. Nutritional status and pre-operative nutrition is another concern. Several authors reported malnutrition in head and neck cancer patients or with compromised airway[12,13,14].

Another important aspect is the profound effect the diagnosis of the cancer can have on a patient's psychological and emotional state. Preoperatively, patients may have heightened level of anxiety and nervousness and premedication should be advised accordingly. Excessive sedative premedication is to be avoided in compromised elderly patients with head and neck cancers.

A comprehensive pre-anesthetic evaluation is very important. Precise assessment of physical status and appropriate anesthetic plan for the cancer patient is a great challenge to the anesthesiologist. Common problems that we encounter in such patient are compromised airway, a shared operative field and the appropriate timing for extubation.

Airway management in such patients often present to the operating room with conditions that make mask ventilation and tracheal intubation potentially or obviously difficult. There are certain pre-operative indicators which helps to predict a potential difficult airway like change in voice, history of dyspnoea, dysphagia, exercise intolerance, radiation to head and neck region and previous head and neck surgery, peri-anesthesia difficult airway and tumors and edema of pharynx and hypopharynx[15,16]. Similarly specific history may indicate location of tumor. History of troubled breathing in supine position but not in lateral or prone position may indicate a pharyngeal, neck or anterior mediastinal mass[17]. Anaesthetizing such a patient in the supine position without securing the airway first may lead to severe airway obstruction. Individuals with stridor need to undergo a laryngoscopy and bronchoscopic evaluation of the airway. A coarse, scratchy voice suggests a glottic tumor; a muffled voice suggests a supraglottic tumor. History of snoring and sleep apnea are important as it may indicate the presence of tumor mass. Information must be gathered about the duration, likely cause, and the positions that make the stridor better or worse. The presence of wheezing, cyanosis, chest retraction, and nasal flaring should also be noted. Radiation therapy often leads to limited jaw motion, rigid immobile cervical spine secondary to radiation fibrosis. In addition larynx and trachea may become resistant to manipulations with external digital pressure during tracheal intubation. Thus tracheal intubation may be difficult. Careful physical examination of tissues particularly between the sub mental region and hyoid bone can provide clues to potential difficult airway. The submandibular space in such patients may be noncompliant by post radiation fibrosis. In certain patients, the larynx will appear to be anterior, despite a normal mental hyoid distance, due to fibrosed submandibular space. Prior radiation therapy can also obliterate lymphatics, resulting in increased postoperative edema[18]. Patients may present with acute side effects of radiotherapy in the form of inflammatory reaction leading to epidermitis and oral mucositis and are susceptible to infection and bleeding during airway manipulation. Head and neck surgeries may create a difficult airway. Patients airway must be evaluated each and every time they come for surgery. In patient who have undergone surgical resection of tumor may have an easy airway earlier but the same patient when comes for another surgery later may have difficult airway due to distortion of anatomy of the airway because of previous surgery or other therapy[4,19].

Cancer patient receiving opioids for prolonged duration usually express variety of cognitive dysfunction ranging from delirium, sedation to unconsciousness[20].

INVESTIGATIONS

For proper planning of peri-operative management of the patient, appropriate preoperative investigations are done depending on the clinical condition of the patient and associated illness[21]. Head and neck malignancies may be associated with hypercalcaemia[22]. Liver function test is warranted in these patients irrespective of age as these patients may have received chemotherapy especially serum albumin as it may effect metabolism and duration of anesthetic drugs[23]. Laboratory studies of patients with history of prior chemotherapy or alcohol intake must include

complete blood count, serum electrolytes, liver function tests and a coagulation profile. A chest radiograph and electrocardiograph are needed.

Dyspnoea from upper airway obstruction due to tumor must be distinguished from that of chronic obstructive pulmonary disease and flow volume (FV) loops may be useful in differentiating them[242526]. Involvement of recurrent laryngeal nerve may jeopardize an already compromised airway by causing additional narrowing at the glottic opening[24] Routine preoperative indirect laryngoscopy to evaluate glottic apparatus of all the patients presenting for laryngeal surgery is important.

Radiographic studies for airway evaluation of patient with head and neck cancer should be reviewed as some large tumor may be relatively asymptomatic but may make intubation extremely difficult[27]. CT scan can also give an idea of tracheal compression, if any, by large neck tumor[182428].

Clear communication between the surgeon and anesthesiologist is important in proper perioperative management of the patient. It should always be kept in mind that cancer surgery is an urgent surgery. For this reason, it is imperative to avoid unwarranted delay in surgery because of specialty consultations that may not have significant effect on the anesthetic plan and perioperative management[529].

AIRWAY MANAGEMENT

Airway management may be one of the major challenges in patients with head and neck cancer[30]. Establishing, maintaining and protecting an airway in the face of abnormal anatomy due tumor and simultaneous surgical intervention can be challenging.

The surgical team usually requires complete and easy access to the operative site, which is either the airway itself or an area near it. The anesthesiologists may not be able to position himself near the patient's head, yet the surgical team expects a quiet operative field free of the bulky equipment, and the patient's smooth emergence from anesthesia at the end of the operation.

Surgical resection of tumor may distort the normal airway anatomy. Moreover subsequently fibrosis develops, limiting mobility of the entire airway. A patient undergoing stage reconstructive procedures may have tracheostomy during his initial resection. If the patient did not receive a tracheostomy during an initial resection, then the patient should undergo awake fiberoptic bronchoscopy for a staged reconstruction. The forces exerted during direct laryngoscopy may damage previous reconstructive efforts.

With cancers of the head and neck, it is better to proceed with awake fiberoptic intubation in the sedate, well-topicalized patient along with a sialogogue agent.Indirect laryngoscopy prior to surgery can provide the anesthesiologist many useful information like anatomy of the airway, location of tumor. Injuries of the 9, 10, 12 cranial nerves from the tumor invasion or due to surgical resection can predispose the patient to aspiration or obstruction. An oropharyngeal pack is often placed to minimize the amount of blood and other debris reaching the larynx, trachea and stomach. The presence or suspicion of airway difficulty mandates awake direct or fiberoptic laryngoscopy. In inhalational induction, maintaining spontaneous ventilation rather than intravenous induction or use of muscle relaxant is a safe option. Nasal intubation with a preformed tube is usually preferred for oral surgery. Various airway management techniques like fiberoptic bronchoscopy guided intubation, transtracheal jet ventilation, retrograde tracheal intubation, tracheostomy should be well known to the anesthesiologists handling cancer patients.

POSITIONING

Patient is placed in head up position to improve venous drainage, reduce the blood loss and clear surgical field[31]. In view of prolonged surgery the positioning should be done carefully with soft padding of the pressure points. In such type of surgeries, arms are usually tucked to the side of the patient and care should be taken to prevent compression of neurovascular structures.

MONITORING

Besides the routine monitoring, invasive monitoring like arterial blood pressure and central venous pressure monitoring may be required major surgery with anticipated blood loss or because of the to associated co morbid disease. Arterial cannulas should not be placed in the same arm if a radial forearm flap is planned. Two large bore cannulas must be secured for major surgeries. Urinary catheterization and temperature monitoring is essential.

TRACHEOSTOMY

Elective preoperative tracheostomy is usually not preferred by surgeons as it can interfere with delineating the tumorous growth, extent of tumor and resection intraoperatively. Rather, intraoperative tracheostomy is often a part of head

and neck cancer surgery. During changeover of endotracheal tube to tracheostomy tube intraoperatively, ventilationshould be with 100% oxygen, the endotracheal tube and hypopharynx should be thoroughly suctioned to avoid the risk of aspiration of blood and secretions. After dissection down to the trachea, the endotracheal cuff is deflated to avoid perforation with the scalpel. When the tracheal wall is transected, the endotracheal tube should be withdrawn so that its tip is just cephalad to the incision. Ventilation during this period is difficult because of the large leak through the trachea. A sterile wire reinforced tracheal tube or J shaped laryngectomy tube (mortando's tube) is placed in the trachea, connected to a sterile breathing circuit and sutured to the chest wall. As soon as correct positioning is confirmed by capnography and chest auscultation, the old endotracheal tube may be removed. An increase in the peak inspiratory pressure immediately after tracheostomy usually signals a malpositioned tube or debris in the trachea.

INTRAOPERATIVE AIRWAY MANAGEMENT

The proximity of the airway to the surgical field increases the possibility of intraoperative airway problems such as tracheal tube kinking, disconnection or perforation by a surgical instrument. Airway monitoring should include capnography, peak inspiratory pressures, and esophageal stethoscope breath sounds.

Endotracheal tube and connectors must be nonkinking and properly secured. Whenever possible the breathing circuit attached to the endotracheal tube should be secured to the patient's head to enable the surgeon to reposition the head, if necessary without causing an accidental extubation. Constant vigilance is needed to prevent the breathing circuit from pulling downward on the tube's adapter.

MAINTENANCE OF ANESTHESIA

Maintaining the body temperature intraoperatively is important. Intraoperative hypothermia and consequent vasoconstriction can be particularly detrimental for perfusion of a microvascular flap. To maintain body temperature, various methods like warm and humidified inspiratory gases, forced air warming blanket, warm intravenous fluids should be used.

Neuromuscular blockade may sometime need to be reversed intraoperatively to test the integrity and also to identify the nerves (spinal accessory, facial nerve) by direct stimulation and thus to preserve them during the dissection. Cerebral perfusion pressure may be severely compromised, when the tumor involves the carotid artery (decreased cerebral arterial pressure) or jugular vein (increased cerebral venous pressure). Furthermore, a head up tilt may increase the chances of venous air embolism. Following reanastomosis of a microvascular free flap, blood pressure should be maintained at the patients baseline level. Vasoconstrictive agents should be avoided because even though the systemic blood pressure increases, flap perfusion decreases due to vasoconstriction of graft vessels. Likewise, vasodilators should be avoided due to decreased perfusion pressures.

At the end of surgery, the oropharyngeal pack must be removed and the pharynx suctioned. Although it is unusual for there to be some bloody debris during initial suctioning, repeat efforts should be less productive. If there are chances of postoperative edema involving structures that can potentially obstruct the airway, the patient should be carefully observed and perhaps should be left intubated. Extubation can be attempted once the patient is fully awake and there are no signs of continued bleeding.

EXTUBATION OF TRACHEA

In any head and neck operation in which tracheostomy is not established, the timing of extubation is crucial. It will depend on various factors like the degree of edema and upper airway distortion produced by the surgery[32]. In patient undergoing a lengthy procedure, including free flap reconstruction, the trachea may remain intubated and patient sedated overnight in the intensive care unit. Other patients can be extubated in the operating room or post-anesthesia care unit when they are fully awake. Equipment for securing the airway at the beginning of anesthesia must be readily available at the time of extubation also. Airway edema and surgical changes in the patient's anatomy may prevent adequate mask ventilation should acute airway obstruction develop following extubation.

INTRAOPERATIVE AND POSTOPERATIVE COMPLICATIONS

Venous air embolism, though not very common but is of concern in radical neck surgery[33]. An end tidal carbon-di-oxide monitor indicates a sudden decrease, and a precordial Doppler probe picks up the murmur of venous air embolism. Treatment mainly includes supportive and includes increasing venous pressure through the use of IPPV or jugular venous compression, discontinuation of nitrous oxide, 100% oxygen, flooding the surgical field with saline, Trendelenburg and left lateral position, aspiration of air from central venous catheter.

Manipulation of the carotid sinus and stellate ganglion during radical neck dissection has been associated with wide swings in the blood pressure, arrhythmias, sinus arrest and prolonged QT intervals. Pressure on the carotid sinus can elicit a vagal reflex resulting in bradycardia and hypotension. Ablation of the right sympathetic stellate ganglion increases the QT interval of the electrocardiography and may lower the threshold for ventricular fibrillation. Infiltration of the carotid sheath with local anesthetic will usually ameliorate these problems. Bilateral neck dissection may result in postoperative hypertension and loss of hypoxic drive because of denervation of the carotid sinuses and bodies. Patients with carotid atherosclerosis (examine for bruit in the preanesthetic checkup) are at increased risk of stroke during neck surgery, and it has been suggested that some patients need to have prophylactic endartectomy.

Postoperative considerations consist of care of the tracheostomy, use of humidified oxygen and institution of chest physiotherapy. Chest X-ray are important to see the position of the tracheostomy tube, for pneumothorax, subcutaneous emphysema and hematoma.

Changing the tracheostomy tube after a fresh tracheostomy can be dangerous but may be required because of a cuff leak or obstruction of the tube from secretions as tube may enter the false passage as tissue support is lacking in the fresh tracheostomy.

Following neck surgeries, hematomas may form which can compress the trachea and lead to airway compromise. Management depends on the clinical scenario including immediate intubation should the respiratory embarrassment occur. Intubation may be difficult if hematoma formation distorts the airway anatomy, e.g. by causing deviation and compression of the trachea. Reopening of the surgical site with manual evacuation of the hematoma may help to reduce respiratory embarrassment and facilitate intubation.

In the postoperative acute period respiratory distress syndrome may develop in the patients with cancer due to direct toxins, free radicals, charged particles, and cytokines working on specific components of the alveolar capillary cells result in altered permeability. Supportive therapy remains the mainstay of management.

CANCER PAIN MANAGEMENT

Pain can be directly associated with advancement of the cancer or with the therapy for treatment of the cancer. When a patient with cancer related pain presents to the operating room the anesthesiologists should know what type of pain the patient is experiencing and, how much and what type of medication the patient is taking. Patients with moderate to severe pain syndromes, controlled with oral opioids may have a high tolerance for narcotics and benzodiazepines.

Patients with severe cancer related pain who require parental narcotics with or without adjuvant therapy are very difficult to treat in the operation room. It is imperative that these patients remain on their chronic infusions of narcotics and all analgesic should be continued. The patient may have narcotic withdrawal during the operative procedure (hypertension, tachycardia, diaphoresis). Additional narcotic are to be administered as necessary intraoperatively.

DIRECT LARYNGOSCOPY, MICROLARYNGEAL SURGERY, LASER

The general anesthetic goals for these procedures include: dry immobile field, maintenance of airway, oxygenation, ventilation, hemodynamic stability and fast and complete anesthetic recovery with return of protective reflexes mandating use of shorter acting anesthetic agents. Because direct laryngoscopy can be extremely stimulating and can cause abrupt rises in blood pressure and heart rate, the chosen anesthetic technique should attenuate these responses. In patient whose airway is compromised, laryngoscopy is performed using topical anesthesia with the patient awake and spontaneously breathing may be an safe alternative to general anesthesia. Antisialogogue agent like glycopyrrolate should be administered prior to the procedure. Consideration of the patient's underlying medical situation, the duration of procedure, and possibility of the airway compromise at the end of the procedure will lead to a rational plan of induction, maintenance and emergence. Muscle relaxation should continue for the duration of the procedure to ensure a quiet surgical field. Other agents such as narcotics, beta-blockers, or an easily titrable antihypertensive may be added to attenuate hemodynamic responses.

Laser may be required for ablating smaller lesions. Major hazards include environmental contamination and misdirection of energy. So operating room personnel should wear masks and protective glasses. Patient eyes should also be adequately padded. The possibility of fire due to laser is a possibility and care should be taken during the procedure like use of low inspired oxygen fraction should be used and air/oxygen mixture is preferable.

Techniques other than the endotracheal intubation may be used. Ventilation can be achieved in several ways: supraglottic jet ventilation, subglottic jet ventilation, and transtracheal jet ventilation. With all forms of jet ventilation using venturi techniques, intravenous anesthetics should be used because inhaled anesthetics will contaminate operating room environment and also concentration of inhaled volatile agent is impossible to monitor because of entrainment of atmospheric air. Patient should be monitored of any barotrauma and risk of developing pneumothorax, pneumomediastinum, submucosal emphysema and gastric distension and precaution should be taken accordingly. Apneas ventilation may also be considered in very short procedures. In severely airway compromised patient, placement o f tracheostomy in awake patient is an safe option. Monitored anesthesia care is an alternative to general anesthesia for direct laryngoscopy in selected patients.

MAXILLOFACIAL RECONSTRUCTION

Maxillofacial reconstruction is often required to correct defects due to radical cancer surgery after maxillectomy or mandibulectomy. Various flaps like skin grafting, local flaps, pedicled fasciocutaneous, musculocutaneous and osteocutaneous flap are chosen on the basis of the defect.

Blood loss can be rapid and substantial. Strategies to minimize blood loss include a slight head up position (reversed trendelenberg position), controlled hypotension, and local infiltration with epinephrine solutions. Rheological factors make a relatively low hematocrit (27-30%) desirable when microvascular free flaps are performed. Diuresis should be avoided during microvascular free flap surgery to allow adequate graft perfusion in the postoperative period. Cannulas and monitoring devices should be avoided on the site of donor flaps. Haemodynamics has to be maintained as hypertension may lead to flap edema and bleeding and hypotension may lead to inadequate perfusion of the flap. In case of hypotension, vasoconstrictors drugs should be avoided and blood pressure may be managed with decreasing the volatile agents and administering the fluids. In case of inadequate control, inotropic agents may be used.

LARYNGEAL CANCER

The diagnosis of the laryngeal cancer is made through thorough history, examination and operative laryngoscopy with biopsy. Staging requires investigation like CT, MRI, panendoscopy, and direct laryngoscopy[34]. The most common site is vocal cords (73%). The surgical management of the laryngeal cancers varies according to the site and extent of tumor ranging from conservative laryngeal procedures to total laryngectomy.

Early glottic carcinoma can be managed with endoscopic excision, thyrotomy with cordectomy and hemilaryngectomy. Both radiotherapy and transoral laser excision can offer high cure rates, satisfactory post treatment voice quality, and acceptable short and long term morbidities for an early glottic cancers.[35]

The standard surgical treatment consists of induction chemotherapy followed by conservation surgery and postoperative radiotherapy.

Laryngectomy along with radical neck dissection is the surgical modality. Neck dissection may be required for removal of lymph node and surrounding fatty tissues from various compartments of the neck. The extent of dissection and levels of lymph node removal depends on the site and extent of tumor growth and varies from radical neck dissection to modified and selective neck dissection.

The surgical procedure like laryngectomy and radical neck dissection may require invasive monitoring and perianaesthetic problems relating to airway has been mentioned earlier.

CONCLUSIONS

The cancer patient who requires surgery needs special anaesthetic consideration. The anesthesiologist must understand the pathophysiology of the cancer and attendant therapies. Cancer therapies are effective at treating neoplasm, but affects the patients cardiovascular, pulmonary and renal systems. Airway evaluation forms the major component of the pre-anesthetic evaluation in these patients. Medical history and careful physical examination are the most important steps to detect difficult mask ventilation and difficult tracheal intubation. The preoperative evaluation of the surgical oncology patient should be a comprehensive, systemic assessment by the anesthesiologist to reduce the potential for perioperative morbidity and provide the best outcome possible.

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