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Emergency Surgical Treatment of Upper Airway Obstruction in Oncological Patients: Bibliographic Review and Proposal for Management Algorithm

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Abstract

Introduction: Tracheostomy is an emergency procedure; however, 85% of cases are due to malignant neoplasms. For different types of neoplasia, till date there are no algorithms in literatures for the management of airway obstruction.

Objective of the study: To Generate an algorithm for the management of airway obstruction in head and neck cancer patients.

Material and methods: An exhaustive bibliographical search was carried out in PubMed database with the MeSH terms "malignant airway obstruction/surgery", "airway obstruction/etiology", "airway management/standards". Patients with airway obstruction and its management that included cancer were studied, the most outstanding authors in the subject were identified through the Science Citation Index and the exchange of information was carried out with specialists in the subject. A total of 344 articles were found to be reviewed, of which 11 articles addressing obstruction in the cancer patient were selected for review.

Results: A management algorithm is created combining the oncological characteristics of the patient (type of tumor, clinical status, functional status, treatment) anesthetic management as well as surgical treatment. Patients with airway obstruction that can be intubated are preferred cytorreduction with CO₂ and biopsy in case of cancer of the larynx, oropharynx or oral cavity; if the patient cannot be intubated, supraglottic devices or facial mask can be used. In case of failure, cricothyrotomy is performed. Once the airway is controlled, the

tracheostomy is performed; complementary treatment specifications are made in the different types of tumors (larynx, thyroid, oral cavity and oropharynx).

Discussion: Creating a management algorithm is of vital importance since everything is not resolved with "tracheostomy". For decision making, there are no data available in other literature that groups all the oncological head and neck disorders. Therefore, a management algorithm is proposed based on the bibliographic review and the exchange of information with specialists in head and neck cancer.

Conclusion: We propose a management algorithm based on the characteristics of the patients and tumor with the current anesthetic management.

Keywords: Malignant obstruction of the airway; Oncological emergencies; Airway management; Malignant airway obstruction; Oncological urgencies; Airway management

Abbreviations: QT/RT: Chemotherapy/Radiotherapy; SAD: Supraglottic insertion device; NINO: No intubation no oxygen; CO₂: Carbon dioxide.

Introduction

In a recent review, data of 5 years of experience of emergency tracheostomies performed in Third level hospital were collected. Out of which 85% was due to malignant neoplasms and 14% to benign conditions. The most common cause is laryngeal cancer 70-80% is supposed to be the narrowest point of the airway, followed by tumors of the oral cavity, oropharynx and hypopharynx and the third cause is

extrinsic compression of lymphoma and anaplastic thyroid cancer. Benign causes include postsurgical complications such as hematomas, aspiration, obstruction due to voluminous reconstructions in the oral cavity or at the base of the tongue and recurrent laryngeal nerve injury. The most common presentation was stridor and dysphonia in 54%, dyspnea in 38% and a neck lump in 12% [1].

Airway obstruction in head and neck cancer is the leading cause of death and about 70% of patients with locally advanced head and neck cancers require airway control at some point. The degree of stenosis to generate resistance to the passage of air is 50-75%, occurs with a diameter of less than 5 mm.

As it is an urgent situation, few cases have a diagnosis; however it is advisable to have a CT scan of the head and neck with a chest extension. This scan is useful to identify the level of obstruction and the surgical procedure to be performed, which should be performed 2 cm from the obstruction site. If the neoplasia involves the entire neck, it often involves the trans-tumoral placement with risk of bleeding. The emergency tracheostomy is associated with a lower rate of decannulation of only 22% in contrast to 73% in elective procedures. It also increases the rate of complications in general from 8 to 40% and in the immediate post-surgical period from 16% [1,2]. Till date there are no algorithms in literatures for the management of airway obstruction, we conducted a bibliographic review on emergency surgical management in the upper airway obstruction focused on the oncological patient, based on this review we propose a management algorithm that integrates the characteristics of the patients and tumor with the current anesthetic management.

- "Airway Obstruction/etiology"[MeSH Terms] AND ((hasabstract[text] AND "loattrfull text"[sb]) AND ("1983/01/01"[PDAT] : "2018/12/31"[PDAT]) AND "humans"[MeSH Terms] AND English[lang] AND cancer[sb] AND "adult"[MeSH Terms])
- "airway management/standards"[All Fields] AND ("loattrfree full text"[sb] AND ("1983/01/01"[PDAT] : "2018/08/00"[PDAT]) AND English[lang])

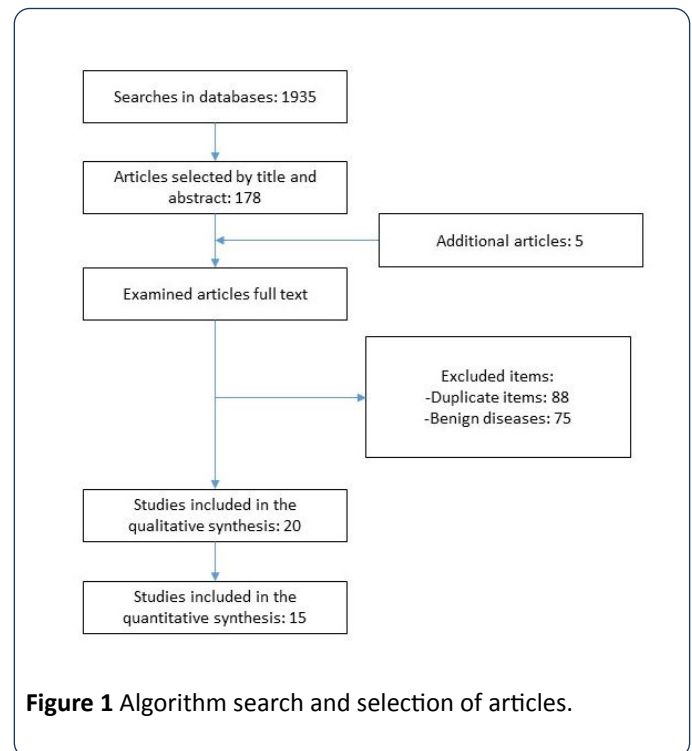


Figure 1 Algorithm search and selection of articles.

Materials and methods

An exhaustive bibliographical search was carried out, close to the total of the literature published in relation to “Emergency Surgical Treatment of Upper Airway Obstruction in Oncological Patients”. The automated path was defined as the search engine, the descriptors, the years of search and the languages. The review was conducted in the PubMed database with the MeSH terms “malignant airway obstruction/surgery”, “airway obstruction/etiology”, “airway management/standards”. Free full text articles of core clinical journals from 1983 to August 2018 in English language were reviewed. Patients with airway obstruction and its management that included cancer were studied, the most outstanding authors in the subject were identified through the Science Citation Index and the exchange of information was carried out with specialists in the subject. A total of 1,935 articles were found, out of which 344 were of interest, of which 10 articles addressing obstruction in the cancer patient were selected for review and 5 more articles out of the review made were cited to emphasize certain points in the work (Figure 1).

PubMed Search details:

- "airway obstruction/surgery"[All Fields] AND ("1983/01/01"[PDAT] : "2018/08/00"[PDAT]) AND "humans"[MeSH Terms] AND "adult"[MeSH Terms]

Analysis of documents

The information was classified in a preliminary way, classifying the documents on the basis of their content and organizational criteria (first evaluation), later the selection and extraction of the most relevant information was carried out in order to eliminate all that was not necessary. Finally, the concepts or data were verified in individual extracts (second evaluation). The inclusion criteria were patients with cancer of the head and neck area treated surgically due to obstruction of the upper airway and exclusion criteria were: all other causes of obstruction of the airway that were not secondary to malignant etiology; the previous ones were determined with the purpose of generating a set of articles that would keep relevance by discarding those with notable methodological deficiencies and that represented a bias in the information that would discredit the validity of the information that they contained and consequently, that of the present review.

Synthesis of the information

Abstract and summary of the articles from all the available sources was analyzed and information was collected. Subsequently, a new structure was generated with an interpretative and evaluative point of view. Thus giving place to order and combination of information extracted within each

epigraph or sub epigraph (objectives) proposed in the design of the study. Subsequently, the comparative evaluation of the different extracts or data was carried out in order to resolve the conflicts that arise between the different summaries.

In order to evaluate the validity of the primary studies, the design and execution of the research collected in the selected articles was analyzed, to do this; values were assigned relative to the data, using a standardized assessment. Finally, the references were compared with the others of the review articles. The final synthesis of the information, the result of the correct combination of the results of the studies analyzed through the systematic and selective integration of these. Items considered irrelevant, based on standardized assessment, were discarded.

Results

Larynx cancer

Laryngeal cancer presents with a tumor in the vocal cords, with dysphonia as its main symptom and early detection. However, 5% to 15% present with obstruction of the airway (stridor and dyspnea). 81% of these patients disease is classified as T4 and 82% as stage IV [3].

Patients with airway obstruction that can be intubated prefer cytorreduction with CO₂ and biopsy; therefore, newer techniques include intubation and performing a CO₂ laser cytorreduction of the tumor to resolve the airway obstruction with a success rate of 91%. Once the urgency results come out, the patient can be referred to either Chemotherapy/Radiotherapy, induction chemotherapy or to a total laryngectomy within the following 4 weeks. This technique without increasing the risk of postoperative complications as well as recurrences gives same oncological results compared to patients who present without obstruction of the airway. Nowadays the standard treatment performed is intubation with a tube of asbestos preferably with a caliber of no.6 [3].

If the patient cannot be intubated, supraglottic devices or facial mask can be used, in case of failure, cricothyrotomy is performed, once the airway is controlled, the tracheostomy is done preferably at the level of the first tracheal ring to ensure that in definitive surgery an adequate tracheal margin is assured, and a biopsy to corroborate the diagnosis. The tracheostomy is the main risk factor for stoma recurrence as well as infection, it is estimated that stoma recurrence occurs in a range of 5-15% of all patients, and is associated with an overall survival of 15% to 2 years [4]. For this reason, many authors prefer to perform an early laryngectomy (within 24 hrs. of admission) in patients presenting with airway obstruction. However, this approach has a morbidity rate of 36% in this clinical situation [3].

Thyroid cancers

Of all thyroid cancer patients, 35% have some evidence of airway involvement and may be classified as compression,

displacement with compression, displacement without compression, airway infiltration with or without displacement or compression and neurogenic airway dysfunction. The treatment of choice is thyroidectomy (previous CT scan for its staging), to relieve compression or displacement. In case of invasion trachea or cricoid invasion and if the segment is less than 35%, partial resection and tracheoplasty may be performed. If the invasion is 2.5 cm to 4 cm, circumferential resection and tracheoplasty are performed. In case of major invasions, laryngectomy or total pharyngolaryngectomy should be considered [5].

Anaplastic carcinomas, which account for 2-3% of all thyroid cancers with an average survival of 6 months without treatment, are suspected in patients with a history of differentiated thyroid cancer as well as large, fast-growing tumors [6]. The treatment must be individualized with the CT scan of the neck; if it is resectable, thyroidectomy will be performed. If it is unresectable it is divided into bulky & non-bulky tumors, most of it presents with bulky tumors that complicate the surgical technique, so in this situation cricothyrotomy is preferred, and in non-bulky tumors the treatment of choice is the tracheostomy. In patients with poor functional status and bulky tumors, it is suggested to talk to the patient and family members about the prognosis and to assess the possibility of offering better medical support [6,7]. It must also be considered that tracheostomy can be indicated prophylactically before initiating chemotherapy/radiotherapy, as well as to prevent obstruction in patients who present asymptomatic has been reported minor survivals when taken to tracheostomy [8].

Chemotherapy/Radiotherapy

Management before treatment with chemotherapy or radiotherapy in head and neck tumors is necessary. During treatment the tumor can produce edema and difficulty in the management of secretions. Most of the patients are diagnosed with tumors T3 and T4 of base of the tongue, larynx or hypopharynx and 39% present symptoms of airway obstruction and obstruction data in nasofibrolaryngoscopy, in these patients the area should be managed before starting the treatment; both tracheostomy and laser cytorreduction with CO₂ have been shown to be effective without increasing the rate of pulmonary metastases, and patients undergoing CO₂ cytorreduction should be monitored closely, CO₂ laser resection treatment avoids tracheostomy in up to 82% of patients [9].

Use of metal stents

The use of metal stents as palliative treatment in patients with inoperable tumors has been evaluated. Especially in cases of esophageal and thyroid cancer with immediate resolution of symptoms in 100% of patients with improvement in FEV1 by 10% compared to preoperative value, no intraoperative complications or death were reported, with good tumor within the stent and stent migration in 8.3% [10]. The effect on patients receiving radiotherapy is not well studied, however in porcine models the radiation dose to the airway and adjacent tissues is not affected [11].

Anesthetic management

The preoperative assessment of the airway by the anesthesiologist needs to be done by gathering all relevant information from the medical history, physical examination, anesthetic and surgical history, the current surgical plan, laboratory and cabinet studies. This together will establish the anesthetic requirements of the patient and will require special attention on the assessment of the airway and intubation with the awoken patient [12].

The patient with cancer may have difficulty in the airway due to various causes such as limited mobility of the head or neck; limitation of the mouth opening (Trismus) in head and neck cancer, usually an oral cavity and locally advanced Oropharyngeal cancer; limited airway space at any level due to edema, tumor or previous surgery; anatomical alteration by the tumor or previous operations; Fixation of the tissues of the head and neck, mouth, pharynx or larynx by the tumor, surgery or post-operative radiotherapy tolerance reported as the most frequent complication. The intubation with the awoken patient is indicated in patients with known or predicted difficult airway. Within the predictors of difficulty of ventilation with facial mask we can mention:

- a) Body mass index of 30 kg, presence of beard,
- b) Mallampati class III or IV,
- c) Age of 57 years or more,
- d) History of Snoring,
- e) Protrusion of the limited jaw [12].

The appropriate repair of the patient allows it to be carried out with a variety of techniques, although the gold standard continues to be fibroscopic intubation. The indications and contraindications are summarized in **Tables 1 and 2** [13,14].

Once we have detected the possibility of a difficult airway, it will be very important to discuss these findings with the patient, his family and the surgeon responsible for the surgical intervention, so that the technique of induction to the anesthesia and intubation is scheduled together; emphasizing the existing risks for the patient's medical situations, intubation in case of patients with maxillary antrum tumors will be carried out preferably through the nostril contralateral to the procedure.

Table 1 Indicators that predict a difficult intubation.

S no.	Indicators
1.	Previous history of difficult intubation.
2.	via difficult area planned by physical examination
3.	Trauma on the face, upper airway or cervical spine
4.	Early difficulty to ventilate with face mask
5.	Severe aspiration risk
6.	Severe respiratory insufficiency

7.	Severe hemodynamic instability
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Table 2 Contraindications of intubation in awoken patients.

S no.	Contraindications
1.	Negative of the patient
2.	Patient who does not cooperate: pediatric, mentally retarded, intoxicated or combative
3.	Patient with documented allergy to local anesthetics

Once the patient has been assessed and risk factors for a difficult airway have been identified (**Table 1**) [14], the main objective is to maintain oxygenation, begins with plan A ("It consists of positioning the patient, using the video laryngoscope or flexible fiberscope and attempting tracheal intubation"). If plan A is not successful or if three failed attempts are presented, initiate plan B with maintaining oxygenation and the insertion of a supraglottic airway device (DSG).

If the intubation is successful we have several clinical scenarios:

- 1) Wake up the patient if the surgery is not urgent and reverse neuromuscular blockage,
- 2) Intubation via tube (DSG) if anesthesiologist is trained,
- 3) Proceed to surgery using the SDA,
- 4) Tracheostomy or cricothyrotomy.

If there is failure of ventilation with (DSG) after three attempts start plan C consisting of ventilation with face mask, if successful the patient should wake up, if it is not possible to ensure oxygenation declare (No intubation, no oxygen) (NINO), initiate plan D consisting of the emergency cervical approach (cricothyrotomy) [15].

Discussion

The oncological patient who presents airway obstruction is a special group in which management will depend on their clinical stage, as well as the type of tumor, histology and treatment previously received. So with the systemic review we performed, we created an airway management algorithm in the oncological patient grouping all factors mentioned in result section (**Figures 2 and 3**).

Patients with obstruction of the airway that can be intubated are preferred cytoreduction with CO₂ and biopsy in case of cancer of the larynx; oropharynx or oral cavity; if the patient cannot be intubated, supraglottic devices or facial mask can be used. In case of failure, cricothyrotomy is performed, once the airway is controlled, the tracheostomy is performed, complementary treatment specifications are made in the different types of tumors.

In laryngeal cancer the tracheostomy is done preferably at the level of the first tracheal ring to ensure that in definitive surgery an adequate tracheal margin is assured and a biopsy to

corroborate the diagnosis. If differentiated thyroid cancer is suspected, thyroidectomy should be evaluated (previous CT scan for its staging), requires tracheoplasty in case of invasion of less than 4 cm or less than 35% of the circumference, otherwise the performance of a laryngectomy or pharyngolaryngectomy will be evaluated. In anaplastic thyroid cancer the volume of tumor and previous CT scan will be assessed to assess its resectability, if it is not bulky and it is unresectable tracheostomy and incisional biopsy of the tumor will be considered, if the tumor is bulky and unresectable stent will be assessed metal or better medical support according to the functional status of the patient. In case of cancer of the oral cavity or oropharynx, a conventional tracheostomy will be performed and the biopsy will be evaluated.

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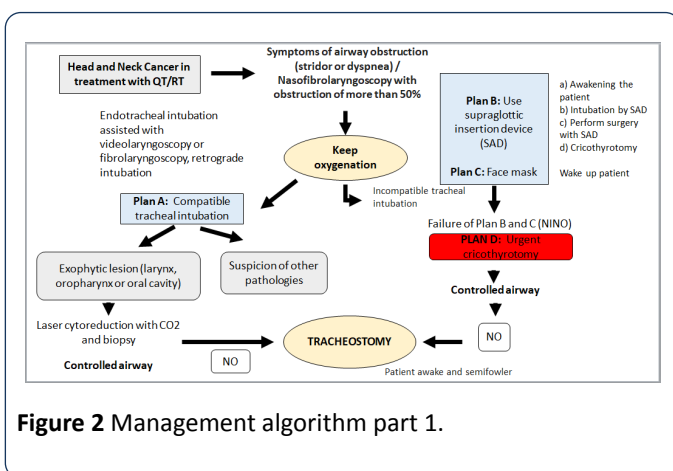


Figure 2 Management algorithm part 1.

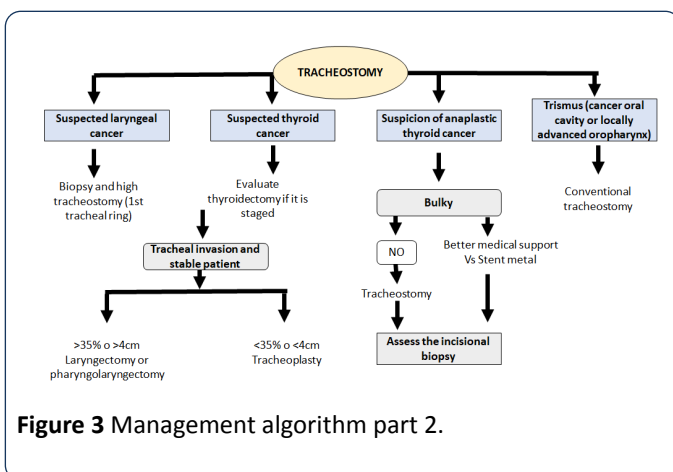


Figure 3 Management algorithm part 2.

Conclusion

The oncological patient presenting the obstruction of the airway should be properly protocolized with an algorithm that combines the characteristics of the patient, the tumor, as well as the anesthetic management; all this is necessary to decide the management and standardize it and obtain the better oncological and functional results.