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Awake fiberoptic intubation in patients with stenosis of the upper airways: Utility of the laryngeal nerve block

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Abstract

Awake fiberoptic intubation (AFOI) is mandatory to manage difficult airways. Superior laryngeal nerve block (SLNB) could reduce risks and improve patient comfort. The aim of this study is to assess the procedural comfort of SLNB during AFOI in a population of patients undergoing upper airway oncological surgery. Forty patients were randomized into two groups and were treated with continuous infusion of remifentanil, topic anesthesia and intercricoid block. In the study group (=20), SLNB was performed with lidocaine (L-SLNB); in the control group (n=20) SLNB was performed using saline (S-SLNB). AFOI was more comfortable in the L-SLNB group compared to S-SLNB patients [FOICS ≤ 1 in 18 patients (90%) L-SLNB; 2 (10%) S-SLNB (P<0.001)]. Intubation was faster in L-SLNB (47.45 ±15.38 sec) than S-SLNB (80.15 ±37.91 sec) (p<0.001). The SLNB procedure during AFOI is a safe and comfortable procedure in a population of patients undergoing upper airways surgery. Time to intubation was shorter in L-SLNB than in S-SLNB. ***Clin Ter 2020; 171 (4):e??-??. doi: 10.7417/CT.2020.????***

Key words: *Difficult airway management; awake fiberoptic intubation; superior laryngeal nerve block; severe airways obstruction; head and neck cancer*

Introduction

Squamous cell carcinoma of the head and neck is one of the most common malignancy worldwide, accounting for nearly 6% of all cancer cases and with an increased incidence rate in middle-aged and elderly males worldwide (1-4). Several treatment approaches have been proposed for head and neck cancer, based on clinical stage and patient's conditions. They include surgery, chemoradiotherapy and, for selected cases, electrochemotherapy (4-11). Surgery is usually considered the first approach; however, upper airway stenosis caused by neoplastic diseases, such as tumors of the larynx, pharynx and base of the tongue, is associated with difficult perioperative airway management and a higher level of discomfort (12, 13). In these patients, mechanical obstruction can complicate the ventilation and intubation due to tumor mass compression (14, 15), loss of pharyngeal muscles tone and the collapse of the upper airway after neuromuscular blocking drugs injection potentially leading to "Can't Intubate Can't Oxygenate" (16). As in other subsets of patients, when difficult intubation is anticipated the use of awake fiberoptic intubation (AFOI) is the safest option, despite available algorithms for difficult airway management do not provide specific guidelines for the management of patients with neoplastic upper airway obstruction (17-19).

The association of superior laryngeal nerve block (SLNB) to systemic sedation has been proposed for AFOI; however, there are no evidences of benefits for this association in patients undergoing upper airways oncological surgery (20-24).

Aim of this prospective randomized study is to evaluate in patients undergoing upper airway oncological surgery the safety and efficacy of the association of systemic sedation with SLNB for AFOI. Recorded variables include occurrence of complication, patients' comfort and the time necessary to intubate.

Methods

Patients and Study Design

A non-selected series of 40 consecutive patients, aged >18 years, undergoing elective AFOI for upper airway neoplastic obstruction were prospectively enrolled. Exclusion criteria were any of the following: patients with respiratory tirage and cornage; Arnè multifactorial scale < 11 (25). The study was approved by Ethical Committee of our University Hospital (406/17). All study participants gave informed written consent and the research was conducted in accordance with the Helsinki Declaration.

Awake fiberoptic intubation procedure and endpoint evaluation

After the first measurement of vital parameters (T0) for AFOI, all patients received a continuous infusion of remifentanil at a rate ranged between 0.05 and 0.15 mcg/

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kg/min, reaching by titration of a conscious sedation plane corresponding to the 0/-1 stage of the Richmond Agitation-Sedation Scale (RASS). In all patients of both groups, topical anesthesia of the oropharynx mucosa was performed through 10 puffs of 10% lidocaine spray at the back of the tongue and at the base of the palatopharyngeal and palatoglossal arch; in addition, an intercricoid block was performed by translaryngeal puncture and 4 ml of lidocaine 1.5%. Patients were randomized into two groups: patients undergoing SNLB with 4 ml of 1.5% lidocaine (study group, L-SNLB) and patients that received SNLB with saline (control group, S-SNLB). After regional anesthesia, the patient was placed on the operating table with the head in a neutral position. The vital parameters and the level of sedation reached (T1) were registered. If SpO_2 was less than 96%, the patient was pre-oxygenated with FiO_2 100%. The AFOI procedure was performed using a 4 mm Olympus LF-2 bronchoscope and spiral tracheal tubes (internal diameter of between 5-6 mm) were used. Discomfort during AFOI was evaluated through the Fiber Optic Intubation Comfort Score (Table 1).

During the AFOI procedure, unstructured airway maneuvers (neck's hyperextension, jaw subluxation, and pulling the tongue manually) were evaluated. Hypoxemia, aspiration of secretions and time to perform intubation were reported. After intubation, a new evaluation of the vital parameters was performed (T2) and patients underwent to a total intravenous general anesthesia in accordance with the current international protocols. The primary endpoint was to evaluate the capability of SLNB to reduce the degree of discomfort of the AFOI procedure measured with the relative risk of Fiber Optic Intubation Comfort Score > 1. Secondary endpoints were incidence of hypoxemia, time required to intubate, intraprocedural hemodynamic stability, airway obstruction score, need to aspirate secretions during AFOI, Tracheal Tube Tolerance Score.

Table 1. Fiber Optic Intubation Comfort Score

1- No reactions, collaborating patient
2- Slight facial movements
3- Vigorous facial movements
4- Verbal op position
5- Movements of head and arms

Fiber Optic Intubation Comfort Score used to evaluate discomfort during the procedure

Statistical analysis

The primary endpoint was analyzed using the Chi-square test. Secondary endpoints were evaluated using survival analysis techniques (Kaplan-Meier estimator, Cox model), logistic models and multiple regression models possibly after the Box-Cox transformation of the outcome. For the analysis of the time to intubation, the quantile regression was used. All tests were two-tailed. The primary endpoint was the comparison of the Fiber Optic Intubation Comfort Score > 1 between the two groups. Based on case studies in the literature and our personal experience, we assumed that in the absence of the SLNB there is about 80% of Fiber Optic Intubation Comfort Score (FOICS) > 1, while this percentage drops to 50% with the laryngeal block. Therefore, against a chi-square test level of 5%, 39 subjects guarantee a power of 90%.

Results

Forty patients (20 for each group) were recruited and completed the study. Demographic characteristics (age, gender, weight, ASA-PS and Arnè scale) were comparable between 2 groups (Table 2).

In all patients, the level of systemic sedation was adequate (RASS < 1) during AFOI [L-SNBP 18 (90%) and S-SNBP 19 (95%) (P = 0.51)]. Cough score differed between patients assigned to the two treatment groups (20/20 in L-SNBP achieved cough score ≤2 and 14/20 in S-SNBP: p=0.007). Patients assigned to L-SNBP reported a higher comfort and better tolerance to endotracheal tube: fiberoptic intubation score was 1 in 18 (90%) patients in the L-SNBP group and in 2 (10%) patients of S-SNBP group (p<0.001); tracheal

Table 2. Demographic characteristics of the group population

		L-SLNB	S-SLNB	p-value
Gender	Male	11 (55%)	12 (60%)	1
	Female	9 (45%)	8 (40%)	
Age	mean (SD)	64.95 (±12.05)	59.65 (±16.3)	0.25
	Me (Q1,Q3)	67.5 (59.5,75.5)	60.5 (47.7,75.2)	
Height	mean (SD)	166.5	169.0	0.914
	Me (Q1,Q3)	(162.2,173.5)	(163.7,174.2)	
Weight	mean (SD)	69.75 (±10.24)	72.25 (±11.88)	0.481
	Me (Q1,Q3)	67.5 (62.5,78.2)	69.0 (66.0,77.0)	
RASS	-1	6 (30%)	3 (15%)	0.511
	0	12 (60%)	16 (80%)	
	1	2 (10%)	1 (5%)	

Results are showed as mean and median (Me) [Quartiles]. RASS (Richmond Agitation-Sedation Scale)

tube tolerance score was 1 in 14 (70%) patients of L-SNBP group and 5 (25%) of S-SNBP group (p=0.003). Patients in the L-SNBP group required a shorter time for intubation compared to patients in the S-SNBP group [47.45 sec vs 80.15 (p<0.01)] (Table 3).

No complications were recorded in studied patients; all patients maintained SpO2 ≥ 95% during the procedure, none required additional O2 therapy and jaw thrust maneuver.

Baseline arterial blood pressure, HR and SpO2 were comparable throughout the procedures in the two study groups. No significant changes were reported in hemodynamic variables during and after the procedure at T0 to T2 (Table 4).

Table 4. Hemodynamic parameters

	SAP T0	SAP T1	SAP T2
L-SLNB	152.8 (±12.53)	146.7 (±14.7)	151.1 (±14.02)
S-SLNB	165.3 (±22.58)	158.2 (±25.34)	163.9 (±26.42)
	DAP T0	DAP T1	DAP T2
L-SLNB	77.95 (±5.69)	73.75 (±10.04)	77.25 (±9.93)
S-SLNB	83.3 (±13.79)	76.9 (±13)	80.45 (±12.04)
	MAP T0	MAP T1	MAP T2
L-SLNB	102.65 (±6.25)	97.75 (±9.55)	101.65 (±9.57)
S-SLNB	110.45 (±15.03)	103.65 (±14.82)	108 (±15.72)
	HR T0	HR T1	HR T2
L-SLNB	77.5 (±11.21)	75.1 (±12.38)	82.4 (±10.35)
S-SLNB	76.25 (±9.74)	74.2 (±10.8)	86.2 (±14.24)
	SpO_2 T0	SpO_2 T1	SpO_2 T2
L-SLNB	97 (±1.55)	95.1 (±3.11)	96.7 ± (1.94)
S-SLNB	97.65 (±1.42)	95.55 (±1.87)	97.6 (±1.84)

L-SLNB Lidocaine- Superior Laryngeal Nerve Block; S-SLNB Saline- Superior Laryngeal Nerve Block. SAP Sistolyc Arterial Pressure; MAP: Mean Arterial Pressure; DAP: Diastolic Arterial Pressure; HR: heart rate

Discussion

In this prospective randomized controlled study, we originally tested the safety and efficacy of L-SLNB in association with systemic sedation for AFOI in patients undergoing oncological upper airway surgery and recorded a better comfort status and a shorter time to intubation in patients that received L-SLNB. These results are consistent with

Table 3. Outcomes of anesthesiology procedure

Fiberoptic Intubation Confort scale	1	18 (90%)	2 (10%)	<0.001
	2	2 (10%)	12 (60%)	
	3	0 (0%)	5 (25%)	
	4	0 (0%)	1 (5%)	
Obstruction score	1	17 (75%)	2 (10%)	0,007
	2	3 (15%)	12 (60%)	
	3	0 (0%)	5 (25%)	
	4	0 (0%)	1 (5%)	
Cough	1	17 (75%)	12 (60%)	0,035
	2	3 (15%)	7 (30%)	
	3	0 (0%)	2 (10%)	
Need for suction	Yes	4 (20%)	7 (35%)	0,479
	No	16 (80%)	13 (65%)	
Tracheal tube tollerance score	1	14 (70%)	5 (25%)	0,003
	2	6 (30%)	12 (60%)	
	3	0 (0%)	3 (15%)	
Duration of the procedure (sec)	mean (SD)	47.45 (±15.38)	80.15 (±37.91)	<0.001
	Me (Q1,Q3)	45.0 (39.5,58.2)	79.0 (61.0,90.0)	

Results are showed as mean and median (Me) [Quartiles]. RASS (Richmond Agitation-Sedation Scale)

previous evidence in other subset of patients (21, 26-29). In an observational study of 50 patients, undergoing AFOI, the association of the SLNB to the laryngeal cricothyroid block improved the visualization of the airway, limited the appearance of coughing and vomiting, and reduced the time of the intubation compared to the local anesthesia of the airway (26). In 48 patients with difficult airway undergoing to nasotracheal awake intubation, but without obstructive lesion of the upper airway, Kundra et al reported that the SLNB added to the translaryngeal block improved the patient's comfort. The SLNB limited hemodynamic instability compared to the group of patients managed with topical airway anesthesia (4% lidocaine nebulization) (28). In a previous study, Reasoner et al divided 40 neurosurgical patients with cervical spine instability into two groups: the first group treated with nebulization of 4% lidocaine, the second group with bilateral block of glossopharyngeal and SLNB; in all patients a 4% lidocaine solution was administered via the transcricoid route. In contrast to previous studies, the authors found no differences in the two groups regarding discomfort and hemodynamic alterations; however, the first group required an average double dose of lidocaine. None of the subjects enrolled was a carrier of obstructive lesion of the upper airway (29).

The SLNB could reduce both the risk of oversedation and the dose of local anesthetics (21). Systemic sedation can reduce the muscle tone of the upper airway, decreases the caliber and promotes obstruction at the supraglottic level; oversedation causes respiratory depression, apnea and in patients with obstruction of the airway exacerbates the pre-existing obstruction up to the complete occlusion of the airway (30). In oncological upper airway patients, if local anesthesia is inadequate and insufficient, mechanical stimulation of the mucosa by the fiberscope promotes edema and laryngospasm, compromising the visualization of laryngeal activity and success of the procedure. Furthermore, the application of local anesthetic in subjects with obstruction of the airway worsens the obstruction until the complete closure of the airway with dramatic outcomes (31).

In our study, we have decided to select FOICS: a simplified score of the Observers' Assessment of Alertness/Sedation (OAA/S) and Comfort Scale, to evaluate patient's discomfort during the introduction of the fiberscope (32). A low dose of remifentanil maintained in all patients a slight sedation (RASS < 1), so patients were able to collaborate. They were treated with local anesthesia and intercricoid block; furthermore, in patients in the L-SNLB group intubation resulted a significantly more comfortable procedure compared to patients in the S-SNLB group (90% of patients in the L-SNLB group had a FOICS ≤ 1, compared to 10% in the S-SNLB group). In these patients, the reactivity of the intrinsic laryngeal musculature is often elicited by the presence of edema and inflammation of the mucosa, which on the one hand limit the effectiveness of the topic anesthetic and on the other accentuate the intensity of the protective reflexes of the airway.

In our study, the SLNB also improved patient's tolerance to the presence of the endotracheal tube measured through the Tracheal Tube Tolerance Score scale. This result shows how anesthesia of the territory of this nerve can help limiting the reactivity of the upper airways. Cough score ≤ 2 was another parameter favoring intubation. The control of laryngeal reactivity also favors the patency of the upper airway during the introduction of the fiberscope and could explain the lesser use of unblocking airway maneuvers during intubation procedure in patients undergoing SLNB.

The control of laryngeal reflexivity, anesthesia in the area of distribution of the upper airways and the reduction of discomfort favored patient's collaboration, improving the time to intubation of patients undergoing SLNB. The mean time taken for AFOI was significantly less in the L-SLNB respect to the S-SLNB.

None of the patients reported desaturation or other adverse events during the intubation procedure. This data highlights the block's safety in the AFOI scenario. One limit of this study is that we performed SLNB with landmark technique despite it is demonstrated that ultrasound improves quality of airway anesthesia and patient tolerance.

Conclusions

Our study showed that the association of L-SLNB to systemic sedation in patients undergoing oncological upper airway surgery can be considered safe and effective and induces a higher comfort status for AFOI.

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