"CAROL DAVILA" UNIVERSITY OF MEDICINE AND
PHARMACY BUCHAREST
DOCTORAL SCHOOL
FIELD OF MEDICINE

PARTICULAR ASPECTS OF ANAESTHESIA AND INTENSIVE CARE TECHNIQUES IN CERVICAL SURGERY

THESIS SUMMARY

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Introduction

Maintaining airway patency is a fundamental condition of anesthetic practice. By their ability to reduce the airway lumen, cervical pathologies induce an additional difficulty in airway management, including face mask ventilation, orotracheal or nasotracheal intubation, but also patient extubation, and avoidance of post-extubation stridor. Knowledge of airway management techniques and documented anticipation of airway-related difficulty can eliminate the risk of preanesthetic morbidity.

The Ph.D. thesis entitled "Particular aspects of anesthesia and intensive care techniques in cervical surgery" aims to highlight the most relevant aspects of the current state of knowledge of the subject, continuing with the results obtained thanks to the individual research study.

The topic belongs to a frontier field, open to clinical and fundamental research, which allows the identification and analysis of specific situations of anesthesia and intensive care arising from cervical pathology, deeply conditioned by the anatomy of the region, requiring specific anesthetic-surgical techniques.

The theme also aims to gain knowledge on the cervical anthropometric characteristics of patients at potential risk for difficulties in face mask ventilation and/or orotracheal or nasotracheal intubation, to establish parameters to define the notions of thick neck, short neck, and stiff neck, by measuring the distances between different anatomical landmarks and the change of these distances in different positions of the head, compared to the neutral position.

In the **first chapter,** the elements of topographic and descriptive anatomy involved in the anesthetic gesture are outlined, i.e., the description of the trajectory followed by the intubation probe in the case of orotracheal, nasotracheal or tracheal intubation, as well as the anatomical elements involved in the use of supraglottic devices, all of which are carefully analyzed during the routine pre-anesthetic examination.

Detailed knowledge of these elements is important for the anesthesia-intensive care physician to guide him during intubations, anticipated as potentially difficult, to shorten the time needed to perform the maneuvers, to eliminate the risk of accidentally producing any harm to the patient (mucosal injury, bleeding, dental avulsion), but especially, the risk of preanesthetic morbidity or mortality.

Nasotracheal intubation is a procedure involving the insertion of the intubation tube from the nasal vestibule to the trachea after anesthetic induction and is used mainly in

intraoral surgery or any surgical procedure requiring isolation of the tracheal tube from the operating field.

Orotracheal intubation and nasotracheal intubation are potentially risky and difficult medical procedures.

Cervical pathology can create additional difficulties in the management of the patient's airway through the presence of a tumor, infectious, inflammatory, or traumatic cause in the same area of anesthetic and surgical interest, resulting in the narrowing or diversion of the airway.

In the general part of the Ph.D. thesis, the main muscle groups involved in the lifting and lowering movements of the mandible, flexion, and extension movements of the head and neck are highlighted. The occurrence of limitations in these movements can make airway management difficult, both in face mask ventilation and in orotracheal or nasotracheal intubation.

Chapter 2, entitled **"Intubation difficulties**" begins with the definition of difficult intubation, provided by the American Society of Anesthesiologists (ASA): "An experienced anesthesiologist has difficulty with upper airway face mask ventilation, difficulty with tracheal intubation, or both" or "unsuccessful tracheal intubation after no more than 3 attempts define failed tracheal intubation".

The general causes that can anticipate difficult airway management are multiple, but the most common in practice are the following: short neck, micrognathia, retrognathic mandible, ogival palate, macroglossia, protruding upper incisors, anteriorly located larynx, "looped" epiglottis, limited movements in the temporomandibular joint in rheumatoid arthritis (vigilant nasal intubation is required), inadequate neck extension (ankylosing spondylitis), decreased cervical mobility.

In difficult intubation of laryngopharyngeal and cervico-maxillofacial tumors, the respiratory space is narrowed in evolution, by volume, deformation of the area with anatomical asymmetries, bleeding, infected secretions, peritumoral suppuration.

Specific intubation problems can also bring laryngeal neurological pathology - laryngeal dysplasia - bilateral recurrent nerve injury resulting in impaired mobility of the vocal cords which can sometimes remain on the midline during inspiration, leading to acute respiratory failure (Gerhardt syndrome).

Subglottic laryngitis from specific (tuberculosis, scleroma) or non-specific infections stenoses the lumen of the larynx in its narrowest portion.

Difficult intubation may occur in congenital anomalies in complex malformations of the oral cavity (cheilognathopalatoschisis), craniofacial dysostosis, and choanal imperforation in the newborn and in trauma to the larynx and trachea when the patient may be in traumatic and hemorrhagic shock, with dyspnea dominating the symptoms.

Also, fractures of the mandible and upper jaw can cause difficulties with tracheal intubation.

Chapter 3 presents the usefulness of ultrasonography in predicting the difficult airway.

The technique of airway ultrasonography is safe, simple, painless, non-irradiative, non-invasive, and repeatable.

Airways are shallow, air-filled structures (high acoustic impedance). This is not conducive to the transmission of the ultrasonic signal, resulting in a poor ultrasonic image.

Ultrasound allows a new approach to the airway in anesthesia and intensive care, with the ability to visualize the entire airway from the mouth to the lungs or stomach. Pre-operative ultrasound assessment defining criteria for difficult intubation can thus be performed non-invasively, quickly, non-irradiative, and safely for the patient.

After intubation, ultrasound confirms the correct position of the intubation tube in the trachea and accurate visualization of pleural movements during the ventilatory cycle.

Ultrasound exploration of the airway may require the presence of several types of ultrasound probes: 5-14 MHz, below 5 MHz, and a cardiac probe.

According to the literature and published studies, the criteria for suspecting difficult intubation are:

- tongue thickness greater than 60 mm;
- hyomandibular distance less than 52 ± 6 mm (65 ± 4 mm for easy intubation);
- chin guard ratio less than 1.1;
- mandibular condyle translation less than 10 mm;
- soft tissue thickness at the level of the hyoid bone greater than 16.9 mm (11.9 - 21.9) or soft tissue thickness at the level of the thyroid membrane greater than 34.7 mm (28.8 - 40.7).

Ultrasound can guide the airway and guide in performing percutaneous dilated tracheostomy, and cricothyrotomy, but also predict laryngoscopy and the risk of difficult post-extubation stridor.

Chapter 4 presents the non-invasive and invasive airway approach techniques, focusing on tracheostomy of necessity for general anesthesia in difficult-to-intubate orotracheal patients.

Alternative non-invasive techniques to address a difficult or presumed difficult airway include the use of another laryngoscope blade and/or tracheal tube, laryngeal mask or other supraglottic devices, intubation assisted by fibroscopy, tracheal tube guides or retrograde intubation.

Non-invasive emergency techniques include an esophageal-tracheal combi tube, trans-tracheal jet ventilator, and jet ventilation catheter.

Invasive techniques include cricothyrotomy, tracheostomy, and percutaneous dilation tracheostomy.

In the case of a stable patient in whom intubation is presumed to be impossible due to severe airway obstruction, the first-line indication for open/percutaneous tracheostomy may be required.

In case of complete or imminent obstruction, cricothyrotomy is indicated to quickly restore an airway.

Indications for invasive airway approach are:

1. Indication of first intention established preoperatively in the team (anesthesiologist - ENT surgeon) in cases of severe obstruction with compromised airway, anticipating failure of all non-invasive techniques (e.g. tumor, inflammatory pathology).
2. Failure of classical intubation and alternative techniques with the inability to delay surgery (non-urgent route);
3. Failure of intubation and face mask/laryngeal ventilation ± failure/absence of non-invasive emergency techniques (urgent pathway);
4. Prolonged orotracheal intubation.

In general, post-induction intubation is indicated in low-to-moderate degrees of airway difficulty, and vigilant intubation in moderate-to-severe degrees, considering patient compliance.

The Special part of the Ph.D. thesis begins with the research (**Chapter 5**).

The research aims to identify the most effective airway management strategies based on the anthropometric and clinical characteristics of patients.

A more detailed analysis of the elements involved in the anesthetic gesture was performed to better predict the difficulty that may arise in airway management and to eliminate any risk of morbidity or mortality.

It also aimed to identify the types of lesions that increase the anesthesiologic risk in cervical surgery.

The statistical analysis conducted was observational, non-randomized, and descriptive of the variables in the study.

The research aimed to identify variables that correlate with difficult intubation and difficult ventilation on a face mask and to develop logistic regression models that can predict the odds of a patient with certain characteristics experiencing difficult intubation and difficult ventilation on a face mask. We also aimed to identify differences, demographically, anthropometrically, and clinically between patients diagnosed with cervical malignancies and patients diagnosed with cervical benign tumors.

To carry out this research, the following hypotheses were put forward, which the results of the study were intended to confirm or refute, as appropriate:

1. Increased values of intercondylar distance measured submandibular, occurring in the presence of a bulky tumor formation in this trajectory, may lead to a prediction of difficult mask ventilation and/or difficult intubation;
2. There is a positive correlation between increased distance between the mastoid processes measured submandibular and the presence of a difficult VMF or OTI/NTI;
3. Chin angle and Mallampati score are predictors of difficult VMF or OTI, although taken individually they cannot predict with certainty the level of difficulty of VMF or OTI;
4. The existence of left/right asymmetries in the anatomical landmarks: gonion, hyoid, thyroid, or cricoid or the inability to identify landmarks induced by cervical pathology may indicate a possible difficulty of OTI or VMF;
5. The existence of left/right asymmetries in the length of the SCM muscle or the inability to identify landmarks induced by cervical pathology may indicate a difficulty with OTI or VMF;
6. The existence of left/right asymmetries of the neck at the chin level or the inability to identify landmarks induced by cervical pathology may indicate a difficulty of OTI or VMF;

7. The greater the distance between the plane of the arytenoid cartilages and the skin, the thicker the neck (obesity), and the association of a thick neck with a tumor formation and reduced head mobility makes prediction of VMF or OTI difficult;
8. If the distance between the arytenoid cartilages is >1.30 cm it can be considered a thick neck and may increase OTI time and VMF difficulty;
9. The greater the angle formed by the posterior edges of the SCM, the thicker or shorter the neck;
10. The greater the angle formed by the leading edges of the SCM, the thicker or shorter the neck.

The total research sample was 50 patients, selected from people who underwent cervical surgery under general anesthesia, requiring face mask ventilation and endotracheal intubation.

The research method used was observation. Data were collected with the consent of the patients, after receiving permission from the health institution.

The study determined the degree of difficulty of intubation by the time required to perform it correctly, defining the time required for intubation as the time elapsed between the insertion of the laryngoscope blade between the dental arches and the removal of the blade after insertion of the endotracheal tube.

The inclusion criteria of the patients in the analyzed group were:

1. diagnosis of hospitalization with cervical localization;
2. patients requiring surgery in the cervical region;
3. over 18 years of age;
4. patients who, following the pre-anesthetic consultation, consented to participate in the study by an agreement signed in the general clinical observation sheet in the institution with teaching and research activity;
5. patients who required general anesthesia with orotracheal or nasotracheal intubation and who consented by signature to the proposed and explained anesthetic and surgical act.

The exclusion criteria for patients in the analyzed group were:

1. dyspnea patients in orthostatic or clinostatic position, regardless of the cause/types of dyspnea;
2. patients who have experienced spontaneous pain or pain to the touch in the cervical region;

3. patients who have had skin lesions, bleeding, or fistulous abscesses in the cervical region;
4. patients admitted as surgical emergencies and who required immediate surgical action;
5. under 18 years of age;
6. absence of written informed consent.

Regarding the results of the study, patients with difficult mask ventilation or difficult intubation were mainly from the category of those with high and medium values of intercondylar distance (measured submandibular), from those with medium or high distances between mastoid apophyses (measured submandibular) "from patients with Mallampati scores 3 or 4, from among those with Cormack-Lehane glottis visibility grades III or IV, from among those with a cervical tumor located in the airway, or from among those with a thick neck.

Table 1. Distribution of patients according to measured submandibular intercondylar distance

Central tendency indicators	*Value*
Minimum	22.0
Maximum	50.0
Medium	27.252
Median	26.000
Mode	26.0[a]
Standard deviation	4.2971
Asymmetry	3.179
Standard error of asymmetry	. 337
Kurtosis	15.501
Standard error of kurtosis	.662

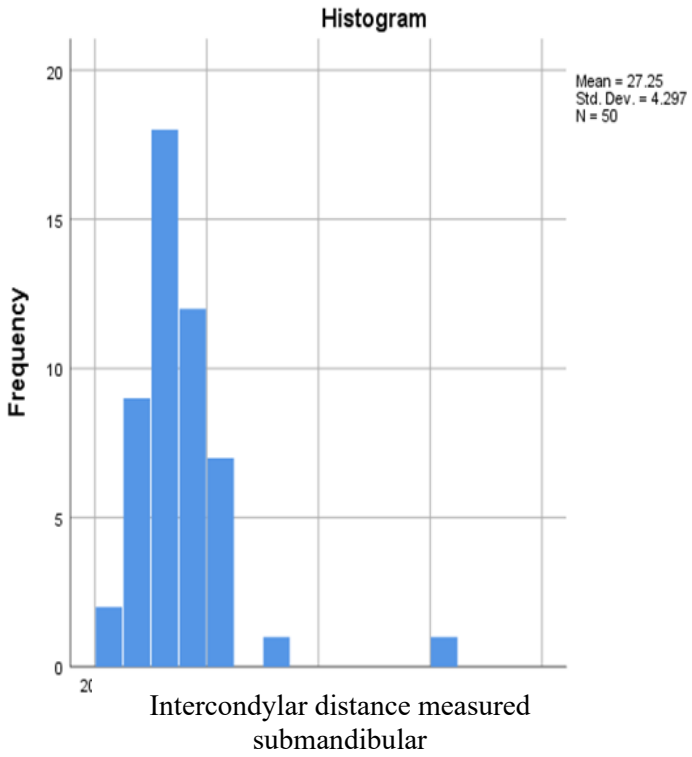
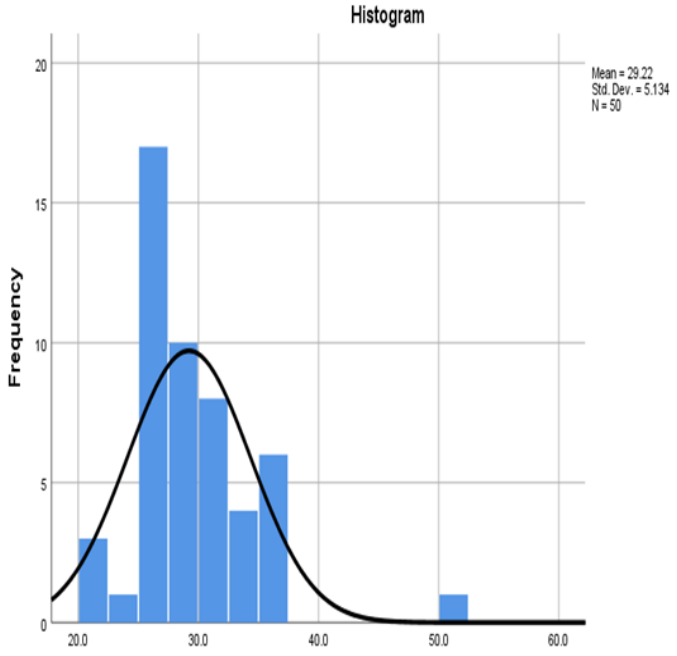


Table 2. Distribution of patients according to distance between mastoid apophyses

Central tendency indicators	*Value*
Minimum	20.0
Maximum	52.0
Medium	29.218
Median	29.000
Mode	29.0
Standard deviation	5.1338
Asymmetry	1.693
Standard error of asymmetry	.337
Kurtosis	6.766
Standard error of kurtosis	.662



Distance between the mastoid apophyses measured submandibular

Table 3. Association between Mallampati score and difficult ventilation on a face mask

Mallampati score		*Difficult ventilation on a face mask*			*Significance test*
		no	**from**	**Total**	
Mallampati 1 or 2	Number	22	3	25	χ^2 (2) = 19.010, p= 0.000
	%	88.0%	12.0%	100.0%	Cramer's V =0.617
	Adjusted residues	3.5	-3.5		**moderate positive association**
Mallampati 3	Number	9	6	15	
	%	60.0%	40.0%	100.0%	
	Adjusted residues	-.4	.4		
Mallampati 4	Number	1	9	10	
	%	10.0%	90.0%	100.0%	
	Adjusted residues	-4.0	4.0		
Total	Number	32	18	50	
	%	64.0%	36.0%	100.0%	

Table 4. Association between the presence of a cervical tumor and difficult ventilation on a face mask

Tumour etiology - cervical tumor		*Difficult ventilation on a face mask*			*Significance test*
		no	**from**	**Total**	
outside the airway	Number	25	2	27	χ^2 (1) = 20.827, p = 0.000 φ (Phi) = 0, 645 **moderate positive association**
	%	78.1%	11.1%	54.0%	
	Adjusted residues	4.6	-4.6		
by air	Number	7	16	23	
	%	21.9%	88.9%	46.0%	
	Adjusted residues	-4.6	4.6		
Total	Number	32	18	50	
	%	100.0 %	100.0%	100.0 %	

Several statistical correlations were found between difficult mask ventilation or difficult intubation and other variables included in the study.

Thus, difficult ventilation on a difficult face mask correlated with Mallampati score, body mass index, the distance between mastoid apophyses measured submandibular, presence of a cervical tumor in the airway, asymmetry on the left at the hyoid (for right-handed).

Difficult orotracheal intubation correlated with left or right cricoid asymmetry, Mallampati score, the distance between mastoid apophyses measured submandibular, the distance between arytenoid cartilages, the distance between the plane of arytenoid cartilages and skin, presence of cervical airway tumor.

Regarding the study design, the 50 included patients were divided into two distinct groups: Group A - 23 patients diagnosed with cervical tumors; and Group B - 27 patients diagnosed with non-tumor pathology in the cervical region.

The main objective of the study was to investigate whether patients with oncological conditions present greater challenges with orotracheal intubation (OTI) compared to non-oncological patients.

Among the specific objectives were: to determine the existence, between these two categories of patients, of anatomical and anthropometric differences in the cervical region, and to determine some predictors of difficult intubation (measured by OTI duration) in patients with ENT problems requiring cervical surgery.

Simple univariate linear regression identified 32 predictors of difficult OTI (influencing OTI duration).

To build the prediction model based on the multilinear regression, the best subset of predictors that had statistically significant effects in the simple univariate linear regression was selected using a forward selection algorithm. It should be noted that the model was built on only 40 observations, as in some patients not all anthropometric variables could be measured and were analyzed separately.

Seven of the 32 predictors from the simple regression that had statistically significant effects were used.

The performance of the model was tested as follows: the group of patients was divided into two equal parts, one part being the training group and the other the test group.

The model was applied to the training group, based on which predictions were made for the dependent variable (duration of the OTI maneuver) and these predictions were compared with the value of the dependent variable in the test group.

The variation in the duration of intubation maneuver per patient group was 88% explained by the predictor values in the model.

A prediction model was used to examine how different factors may influence the variable entitled “difficult ventilation on the face mask” conducted in three stages:

- identifying an initial model;
- model fitting according to the relationships between variables;
- pattern checking.

Considering difficult ventilation the dependent variable and independent variables: Mallampati score, body mass index, the distance between mastoid apophyses measured submandibular, the distance between arytenoid cartilages - measured ultrasonographically, the distance between arytenoid cartilage plane and skin - measured ultrasonographically, the presence of cervical tumor, the gonion distance and the left posterior SCM margin, right posterior hyoid-SCM distance, left posterior hyoid-SCM distance, right posterior thyroid-SCM distance, left anterior thyroid-SCM distance, an echographically visible thyroid membrane, the most significant predictors were identified.

Predictors were selected according to their predictive power: the best predictor was selected first after necessary adjustments were made, then the best predictor was chosen from the remaining predictors, and so on.

Thus, the following predictors were chosen: Mallampati score, body mass index, the distance between mastoid apophyses measured submandibular, the distance between arytenoid cartilages, the distance between arytenoid cartilage planes and skin passing through the anterior commissure of the vocal cords, presence of a cervical tumor, visibility of the hypothyroid membrane, asymmetry through change in thickness of the left part of the neck at the level of the hyoid bone and the level of the cricoid cartilage (for right-handers).

The regression model equation was:

$$y = a+b1* q1+b2* q2 +b3* q3+ b4* q4+b5* q5+ b6* q6 +b7* q7+ b8*q8+b9* q9$$

$$P=\frac{e^y}{1+e^y}$$

Where P = probability of event 1 occurring; e symbolizes the exponent, and y takes different values depending on the type of logistic equation.

$$\frac{p}{1-p}$$

$$\text{logit}(p)=\ln\frac{p}{1-p}$$

The ratio p/(1-p) is called chance, and the transformation logit(p)=ln p/(1-p) is the logarithm of chance.

Thus, for a patient with the following characteristics:

- Mallampati score - 3 (grade 3);
- Body index - 2 (overweight);
- Distance between mastoid apophyses measured submandibular - 3 (large);
- Distance between arytenoid cartilages - 2 (thick neck);
- Distance between the plane of the arytenoid cartilages and the skin - 2 (increased);
- Presence of a cervical tumor - 1 (airborne);
- THM visible ultrasonographically - 1 (yes);
- Asymmetry on the left hyoid - 2 (abnormal);
- Asymmetry on the left at the cricoid level - 2 (abnormal).

we have y= 0.804.

This gives exp (y) = 2.234461 and p = 0.690829469.

Since a critical classification value of 0.5 was chosen and 0.69 was obtained, it can be said that, in this case, there was a higher probability of stating that a patient who showed the above-mentioned characteristics might have had difficulties with ventilation on the face mask (p = 0.69) than the opposite (probability of belonging to the other category, i.e. q = 1-p = 0.31).

It resulted that the odds ratio of a patient having difficulty with face mask ventilation was 2.23, which could be interpreted as follows: the risk of a patient with the characteristics considered above having difficult face mask ventilation was 2.23 times higher than not having difficulty with face mask ventilation.

It was found that the model predicted the dependent variable (patient had difficulty with face mask ventilation) 91.7% of the time and that most errors (2) were found when a patient was predicted to have difficulty with face mask ventilation when in fact they did not. The prediction accuracy for a critical classification value of 0.5 was 93% correct, and the model was able to provide better prediction of cases of subjects who did not have difficult ventilation on the face mask.

For a critical classification value of 0.3, the sensitivity decreased to 90.3%, but the specificity increased - from 91.7% to 100%.

Table 1. Comparison of the 2 predictive models according to the critical classification value

Critical classification value (cut value)	***Observed results*** - Difficult ventilation on the face mask	***Estimated results (predictions)*** **Difficult ventilation on the face mask**		
		no	yes	% correct
0,50	no	29	2	93.5
	yes	1	11	91.7
	% Total			93.0
0,30	no	28	3	90.3
	yes	0	12	100.0
	% Total			93.0

In terms of results and discussion, it was found that of the 50 patients included in the study, 11 had at least one unmeasurable/unpalpable landmark, which placed them early in the category of patients with a high likelihood of experiencing difficult face mask ventilation or difficult orotracheal intubation.

A 1 cm increase in intercondylar distance was associated with an average increase in OTI maneuver duration of 0.33 s.

A non-intuitive effect (opposite that of the simple regression) was observed for right posterior hyoid-SCM distance, with a 1 cm increase in this being associated with an average 0.72 s decrease in OTI maneuver duration - another sign of multiple correlations between predictors.

Gonion-origin clavicular SCM distance on the right, head in the left lateral position, a 1 cm increase in distance on the left was associated, on average, with an increase in OTI duration of 0.19 s. Arytenoid cartilage distance and a 1 mm increase were associated with an average increase in OTI duration of 5.4 s.

Patients who had high Mallampati Score values were 6.761 times more likely to have difficult ventilation on the face mask (holding other variables constant).

Patients with cervical tumor pathology were 27.959 times more likely to be in the category of those who would have difficulty with face mask ventilation (holding other variables constant).

Also, a patient who had a large distance between the mastoid (submandibular) apophyses was 2.077 times more likely to belong to the category of those who had difficulty with face mask ventilation (holding all other variables constant).

Patients who had a cervical airway tumor were 5.504 times more likely to have difficulty with orotracheal intubation (holding other variables constant).

A patient who had a large distance between the submandibular mastoid apophyses was 3.007 times more likely to belong to the category of those who had difficulty with orotracheal intubation (holding other variables constant).

Patients with left-sided asymmetry in the cricoid were 1.379 times more likely to have difficulty with orotracheal intubation (holding other variables constant).

The challenges of airway management in cervical surgery, the analysis of each clinical case, the need for an extremely short time to safely approach the patient, and the results of this study, have led to the idea of a possible new device useful in performing patient intubation in anesthesia and intensive care in cervical surgery, called the **Arytenoscope.**

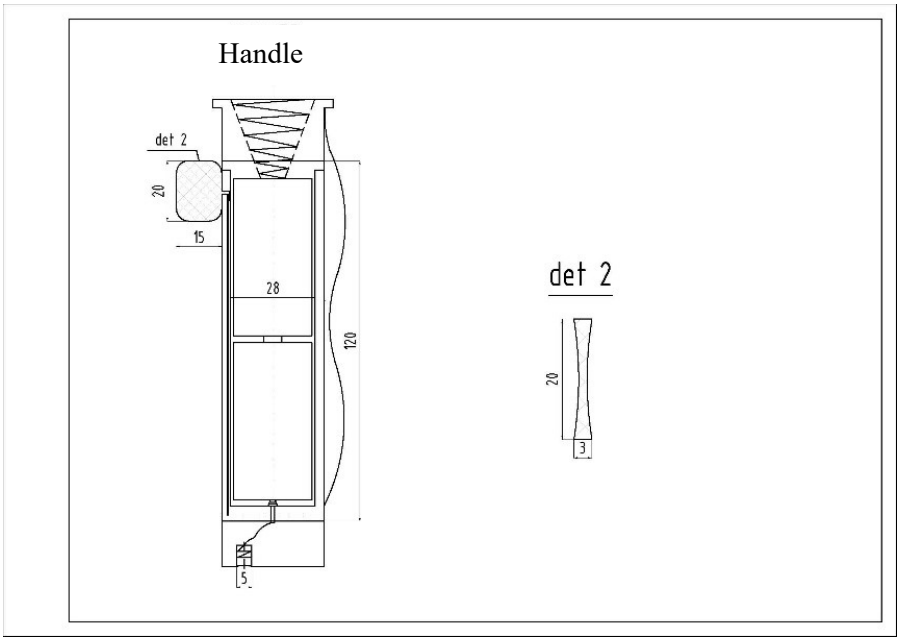


Fig. 66 Handle side view

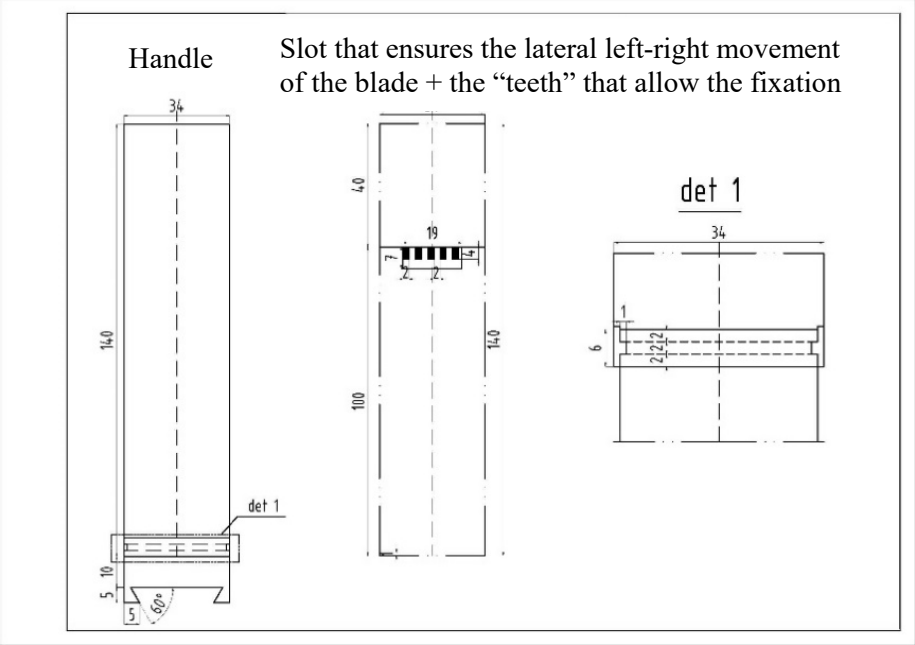


Fig. 67 Handle rear view

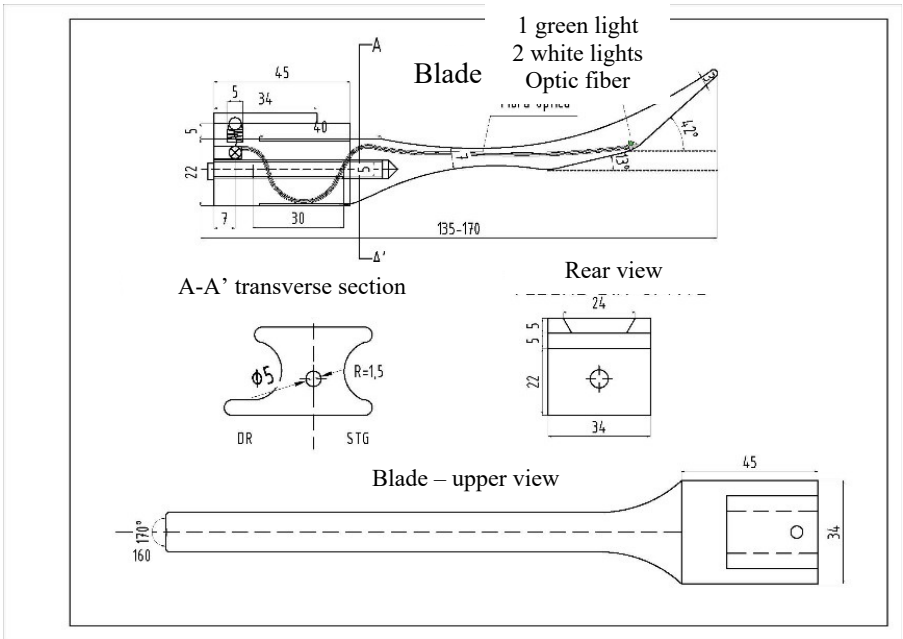


Fig. 68 Endotracheal-mouth piece

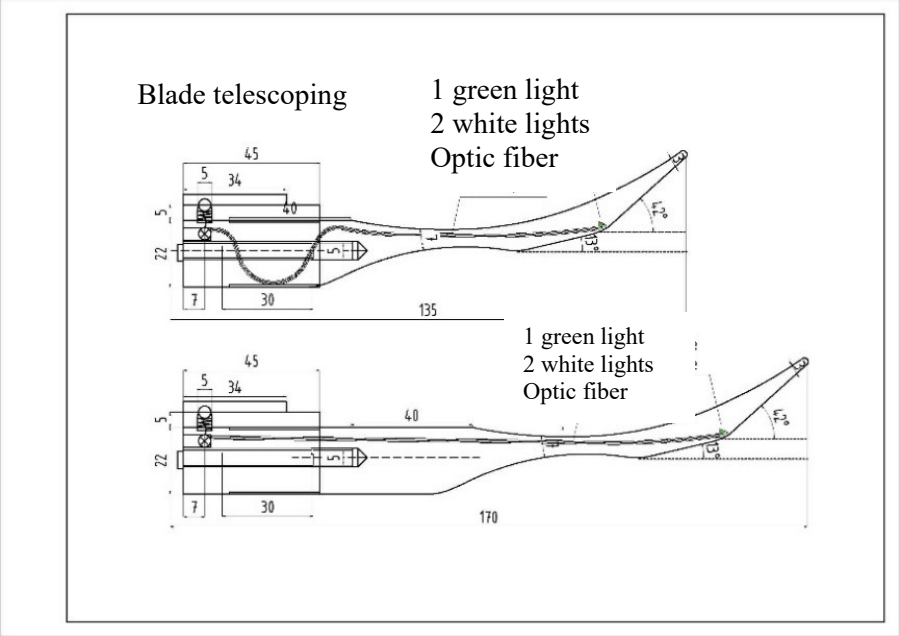


Fig. 69 Telescoping

The main functions of the device are:

1. the possibility of moving the mouthpiece horizontally at an angle of at least 30˚ and, by driving the movement in the desired direction and angle, using a blade arranged on the handle of the arytenoscope. The arytenoscope is grasped in the left hand so that insertion of the intubation probe is performed with the dominant hand;

2. telescoping the mouthpiece in real time, adapted to the dimensions of each patient using a screw-type structure which allows, using its operation, also from the handle of the arytenoscope, the mouthpiece to be extended or retracted until the region of interest is visible;
3. the presence of three optic fibers is arranged as follows, two white for the plane of the arytenoid cartilages and one green above the first, which illuminates the glottis. The optical fibers, housed in the piece of the apparatus, are adjustable in length, they follow the faithful change in size of the mouthpiece.

By its characteristics, the arytenoscope is a tool designed to decrease the risk and time required to perform endotracheal intubation in cervical surgery whenever two or more predictors of difficulty in airway management are identified.

The first conclusion of the study is that in the pathology of the ENT, anesthesia has specific technical peculiarities in the context that the surgical and anesthetic acts share the same anatomical region.

Predicting the difficult airway is essential at the pre-anesthesia consultation to determine the strategy to follow in these patients.

Several important anatomical landmarks need to be carefully analyzed in the pre-anesthetic assessment that can predict intubation difficulties.

Cervical soft tissue ultrasound complements the clinical and imaging evaluation and provides the anesthesiologist with important guidelines for the management of the difficult airway.

Multiple variables were statistically analyzed in the PhD study. Among these, the Mallampati score, the distance between the arytenoid cartilages, the distance between the mastoid apophyses, the mandibular excursions, etc. should be mentioned.

The presence of a tumor in the airway or extrinsic compression with endoluminal narrowing were other variables analyzed and discussed in the context of this PhD paper.

The results obtained represent a good medical practice guideline in ENT anesthesia, considering the significantly increased risk of orotracheal intubation failure in cervical tumor pathology.

Tracheostomy is a useful and safe alternative, but it is difficult for the patient to accept. With the risks of intubation failure explained, tracheostomy placement is salutary for minimizing risks and ensuring safe intubation and optimal ventilatory support during surgery.

The study demonstrated the existence of varying criteria and parameters that can be analyzed for the prediction of a difficult airway, identified the effectiveness of using ultrasonography whenever possible in pre-anesthetic airway assessment, and quantified the risk of difficult airway approach based on anthropometric data, particularly through the presence of cervical or facial asymmetry.

A well-structured airways management strategy is essential, regardless of advances in science and technology.

The present Ph.D. study aimed to extend research in a frontier field, open to clinical and fundamental research that allows the identification and analysis of specific situations arising from cervicofacial pathology, deeply conditioned by the anatomy of the region, requiring specific anesthetic-surgical techniques.

The multiple pre-anesthesia possibilities for early identification of airway approach difficulties in cervical surgery, individualization of each patient's approach based on anthropometric and ultrasonographic airway criteria, determinations made 24-48 hours before operative time, followed by perioperative airway ultrasonography to confirm endotracheal intubation, intubation tube position, and correct pulmonary ventilation were reviewed.

Various anthropometric parameters not previously used in studies dedicated to anticipating difficulties in anesthetic approach to the airway in cervical region pathology, such as documented identification of right/left side of the neck asymmetries, distances between landmarks on the midline of the anterior cervical region, and the sternocleidomastoid muscle, degree of change in dimensions between landmarks set in neutral, flexion, extension, lateral head tilt positions were analyzed.

Patients whose anatomical landmarks could not be identified visually or by palpation because they were covered by tumor masses of variable size were also included in the study.

A new criterion for analyzing the difficulty of airway management in cervical surgery has also been introduced, namely, the time required to perform endotracheal intubation, with a target of 10 seconds, calculated from the time the laryngoscope blade enters the dental arches until it exits the dental arches after orotracheal intubation.

In addition, a perceived need for a new oro-laryngopharyngeal device with horizontal and anteroposterior movement facilities, with a bi-color illumination system dedicated to the posterior plane and glottis to facilitate intubation maneuvers in patients proposed for general anesthesia with orotracheal intubation in cervical surgery was identified in a binary yes/no system.

This study and the need felt over years of experience in dealing with difficult airways led to the creation of a new device that we called the Arytenoscope. We thus aimed at an easier visualization of the posterior plane of the glottis, of the plane of the arytenoid cartilages, through additional and complex movements of the oropharyngeal piece with identification of the glottis in conditions of limitation of the maneuver time, in conditions of obstruction and/or deviation of the airway axis, all to transform the difficult intubation maneuver, anticipated or unanticipated, into a rapid gesture, as close as possible to the 10-second target, protective for the patient's vocal cords, atraumatic, easy to insert due to its small size and movement properties, to eliminate any complication linked to this anesthetic time with many medico-legal implications.

The device entitled Arytenoscope has been registered by i-DEPOT Evidence Certificate No. 142640/ 18-07-2023 and recognized by WIPO (World Intellectual Property Organization) in 176 Member States.

The subject remains open to research and innovation in anticipating and safely addressing the difficult airway in cervical surgery and beyond in this medical specialty.