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Management of difficult non-predictable airway during cholecystectomy, use of laryngeal mask and literature review

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SUMMARY

Objective: To present a case of management of difficult non predictable airway in elective surgery under general anesthesia. In this case, the author, reflects on the surgery evaluation, since it is very frequent to count on a little time to assess it at urgency surgeries. Therefore, when it is present, its management and conservation must be evaluated according to its knowledge and the existing tools. **Clinical case:** Male patient of 34 years old programmed for open cholecystectomy. Obese through Mallampati II evaluation, short neck, Patil Aldreti lower than 6 centimeters. Rest: normal. The patient is monitored and begins with the medication for intubation with direct laringoscopy, being observed a Cormack-Lehane IV. Two failed attempts of intubation are made, after that there are two attempts more with failed McCoy No. 4 sheet. Finally, there is an airway management through a disposable laryngeal mask, beginning a surgical procedure which lasted for 2:30 hours, without complications. **Conclusions:** The present case shows us the importance of knowing predictive factors of a difficult airway. We must be constantly updated about this medical problem, as well as about the available guides and strategies in order to obtain the best possible results. This is not so easy, but it is actually possible if we count on knowledge, ability or skills, techniques and technological resources.

Key words: Airways, difficult airway, failed intubation, laryngeal mask.

RESUMEN

Objetivo: *Presentar un caso de manejo de vía aérea difícil no predecible en cirugía electiva bajo anestesia general. En este caso, el autor reflexiona sobre la valoración de la misma, pues con demasiada frecuencia se cuenta con poco tiempo para efectuarla en cirugía de urgencia, así como en caso de presentarse se debe valorar su manejo y conservación de acuerdo al conocimiento y armamentario existentes.* ***Caso clínico:*** *Paciente masculino de 34 años programado para colecistectomía abierta. Obeso con valoración de Mallampati II, cuello corto, Patil Aldreti menor de 6 cm. Resto normal. Se monitoriza, inicia medicación para intubación con laringoscopía directa, observándose un Cormack-Lehane IV, se realizan 2 intentos de intubación fallidos, posteriormente 2 intentos más con hoja McCoy No. 4 fallidos. Finalmente se maneja vía aérea con mascarilla laríngea desechable, dando inicio a procedimiento quirúrgico con duración de 2.30 horas, sin complicaciones.* ***Conclusiones:*** *El presente caso nos muestra la importancia del conocimiento de factores predictivos de una vía aérea difícil. Debemos mantenernos en actualización constante de la misma, así como de las guías y estrategias disponibles para elaborar un plan y obtener los mejores resultados. Lo anterior no es fácil, pero sí posible si contamos con el conocimiento, habilidad, técnica y recursos tecnológicos.*

Palabras clave: *Vía aérea, vía aérea difícil, intubación fallida, mascarilla laríngea.*

INTRODUCTION

Traditionally, anesthesiologists perform the treatment of airways and preservation of an permeable airway by techniques involving the manipulation of various elements of the upper airways.

They are divided functionally in nose, pharynx and larynx. The lower airway includes the trachea and main bronchi[1].

Assurance and maintenance of a permeable airway is still one of the key responsibilities of the anesthesiologis; in case of loss of airways, they should be restored promptly through implemented manoeuvres or surgical intervention before the subject undergoes irreversible injury.

Although the assessment of the airways is essentially a regional anatomical procedure, the overall assessment of the body constitution, from head to neck in particular, would provide valuable information.

The knowledge of this situation is intended to determine skills required in the airways for the anesthesiologist and they are used to: 1) define the nature of a difficult airway; 2) examine the airways for the difficulties ahead, 3) make a careful plan for the care of the airways using the ASA Difficult Airway Algorithm as a guide[1-3].

The systematic assessment of the airways of patients should include the following stages:

1. Boca; 2. Teeth; 3. Tongue; 4. Oropharyngeal cavity with the structures that compose it (uvula, pillars of the fauces, soft and hard palate) by using the Mallampati classification and their relation to additional risk factors including short and thick neck, retracted upper jaw, decreased mobility of cervical and Atlanto-occipital joints, thyromental distance of 6 cm or less. These methods, regardless of their advantages and disadvantages, should help the clinician to refer the patient to an airway management plan[2,4,5].

Wilson et al. described 5 risk factors that are important to predict a difficult intubation including weight, head and neck movements, movements of the jaw, prominent teeth and mandibular setback. In the study by Zahin Hussain Khan et al. was found that the upper-lip-bite test has a specificity of 88.7% while that the modified Mallampati's test has a specificity of 66.8% and that the combination of mandibular subluxation and the simultaneous presence of prominent teeth was increasing their predictive value and security[6].

Direct laryngoscopy and tracheal intubation are essential in certain surgical anesthetic procedures to maintain ventilation and oxygenation in an adequate and safe manner for all fabrics.

Identifying patients who are at risk of difficult tracheal intubation has always been an area of interest to the anesthesiologist. A difficult airway is defined as a clinical situation in which a trained anesthesiologist experiences difficulty with face-mask ventilation of the upper airway, difficulty in tracheal intubation, or both[4,7,8].

The American Society of Anesthesiologists has defined a difficult intubation such as that of the direct insertion of the orotracheal cannula, practiced by a well trained anesthesiologist using conventional direct laryngoscopy, requires more than 3 attempts or more than 10 minutes. However, this definition is not universally accepted[7,9,10].

The difficulty in airway represents a complex situation between patient factors such as: 1. Face-mask ventilation difficulty; 2. Laryngoscopy difficulty: It is not possible to visualize a portion of the vocal cords after multiple attempts with conventional laryngoscopy; 3. Tracheal intubation difficulty, tracheal intubation requires multiple attempts in the presence or absence of tracheal pathology; and 4. Failed intubation, orotracheal tube placement failed after multiple attempts[3,11].

The key factor is the prediction and anticipation of patient's characteristics and physical findings that strongly suggest a difficult mask ventilation, intubation problems, or both for most of these cases of treatment of the airways. As a result, Cormack and Lehane published a classic study classifying the image obtained from a laryngoscopy. The American Society of Anesthesiologists has defined a difficult intubation as those in which the direct insertion of the orotracheal cannula is practiced by a well trained anesthesiologist and as a direct insertion in four grades. Their work concluded that it is possible to anticipate a difficult intubation with laryngoscopical grades 3 and 4[1,11].

Thus, by reviewing a little history, until the beginning of the twentieth century all the techniques of intubation was performed blindly guided by palpation of the fingers. In 1805 Professor Manuel Garcia invented the direct laryngoscope. After other anesthesiologists, including Ivan W. Magill, systematized tracheal intubation by designing tubes, laryngoscopes and all kinds of accessories and connections such as the Magill forceps.

In 1941, Sir Robert MacIntosh made its curved blade in place until today and in 1946 Miller described his straight blade laryngoscope.

In 1950, the manufacture of inert PVC pipes began and in 1967 Murphy performed the first intubation using a fibrolaryngoscopy, which is used primarily in the difficult airway management[12,13].

Other authors continued creating innovations in the laryngoscope leaves such as the one of Bowen-Jackson Huffman in 1968 which added a prism to the leave, the one of Siker, the one of Choi Bullard in 1990 and most recently the one of McCoy in 1993.

Subsequently, the laryngeal mask is one of the latest innovations in the approach to airway; it was first used clinically in 1983. The difficulty in the visualization of the lar-

ynx, which is often the cause of the difficulty in intubation, is irrelevant at the time of placing the laryngeal mask. Therefore, it is associated with a high risk/benefit relationship in a situation where there is a significant incidence of morbidity and mortality. Another recent contribution is the combitube in 1986[13,14].

The laryngeal mask is a device used for difficult airway management as airway control device and auxiliary method in tracheal intubation. It is one of three non-surgical techniques that is currently recommended by American Society of Anaesthesiologists for anesthetized patient who can not be intubated or ventilated using facial mask[15,16].

The advantages and limitations of the laryngeal mask versus the facial and/or the endotracheal tube have led to a meta-analysis of randomized and prospective clinical studies presented at the World Congress in Sydney 1996. The cardiovascular response to insertion of the laryngeal mask has been specifically studied; minimal cardiovascular and hemodynamic changes have been demonstrated compared with endotracheal intubation manoeuvres.

With the mask it is possible to use any mode of ventilation such as manual ventilation, controlled assisted ventilation and the use of mechanical ventilator with positive pressure up to 20 cmH_2O without air leakage by competent sealing.

The use of an orogastric probe is applicable in certain cases to keep safely an empty stomach[17].

ADVANTAGES AND DISADVANTAGES

The main disadvantage of the laryngeal mask compared with the facial mask is that the esophageal reflex is more likely, but this assertion is still disputed and controversial. Its advantages are: Direct access to the glottis, better control of the airway, better oxygenation index, the anesthesiologist has his/her hands free, and it is not affected by anatomical facial factors, etc.

It its disadvantages compared with the tracheal tube are the greater possibility of leaks or leakage and gastric insufflation.

Its advantages over the tracheal tube are: Avoid the use of the laryngoscope, it causes less trauma to the vocal cords, lower invasion of respiratory tract, eliminates the risk of endobronchial or esophageal intubation; the patient tolerated it with a light level of anesthesia, etc.[10].

Therefore and according to the presence of a risk expressed as *"I can not intubate my patient" and "I see nothing during the laryngoscopy"* arose in me the concern of expressing this type of situation occurred during my daily workday at my work center as well as emphasizing the importance and need for have and implement in our work centers a "*red car for difficult airway management*".

CASE REPORT

Male patient 34 years of age with diagnosis of chronic lithiasic cholecystitis and scheduled for open cholecystectomy.

He has the following background:

Surgery on his right hand index finger, no additional information was obtained.

The physical examination of patient 85 kg, height 1.70 m, good general condition, obese, rubicund, normal hydration, isocoric eyes, permeable nostrils, no secretions. Oropharynx with own teeth, not prominent, no prosthesis, Mallampati II, short neck, Patil Aldreti less than 6 cm, normal oral opening, normal swallowing, normal neck mobility, no prominences neck. Cardiopulmonary had rhythmic noises, FC 62, no blows or exudates. There were apparently not changes in the remaining parameters.

LABORATORY

Hemoglobin 14 mg. Hematocrit 38%. Group and Rh is ignored. Prothrombin time 11.9 seconds. Partial thromboplastin time 25.8 seconds, glucose 85 mg.

ASA EIB

Plan of balanced general anesthesia

He entered the operating room, Hartmann solution (1.000 mL) was administrated by peripheral venous route.

Non-invasive monitoring was initiated with blood pressure 100/70, heart rate 60 per minute, partial oxygen saturation of 97%, and precordial stethoscope and cardioscope at DII lead were installed.

Occipital pad in sniffing position and facial mask with oxygen 5 liters per minute were placed.

Medication was started with 800 µg atropine, 2 mg midazolam, 250 µg fentanyl, neuromuscular relaxation with 8 mg vecuronium and induction with 160 mg propofol. Oxygenation by face mask was continued.

Under direct laryngoscopy with curved leave No. 4, 2 attempts for intubation were performed, any laryngeal structure was not observed, and a Cormack-Lehane classification of class IV was given. He was oxygenated again through facial mask, at this moment were observed the following parameters: blood pressure 120/80, heart rate 90 per minute and arterial oxygen saturation 96%.

A new intubation using conventional laryngoscope and McCoy No. 4 leave was intended, there were 2 failed attempts with oral mucosal lesion. Secretions were aspirated and it was applied ventilation by face-mask with oxygen (5 liters per min). Without cardiopulmonary compromise with partial oxygen saturation of 96% and CO2 capnography of 36 mmHg, no arrhythmias.

Finally disposable No. 4 laryngeal mask was placed in proper position; first attempt, it was insufflated with 20 mL air, without leakage, ventilation was confirmed in both lung fields with a partial oxygen saturation of 97%, CO_2 capnography of 38 mmHg, blood pressure 120/90 mmHg, and heart rate of 92 per minute.

In total, 10 mg metoclopramide, 50 mg ranitidine and 1 g hydrocortisone were administered.

Maintenance with 3 L oxygen per minute was started through a laryngeal mask, a 200 mg bolus of fentanyl, 2% sevofluorane with controlled manual ventilation.

Surgical procedure was initiated.

Patient was remained hemodynamically stable transanaesthetic showing a blood pressure of 120/80, heart rate 80', partial oxygen saturation of 98-99%, CO_2 36-38 mmHg, 2% sevofluorane, 3 L oxygen per minute under controlled manual ventilation 12 breaths per minutes, and additional bolus of 50 µg fentanyl for a total of 500 µg was administrated.

Egresses and ingresses were estimated of 3,500 mL and 3,000 mL, respectively, with a negative water balance of 500 mL.

Surgery was ended with a period of approximately 2:30 h. Dial was closed, and secretions were aspirated by lysis, spontaneous ventilation. He obeyed verbal commands, had spontaneous eye opening, there was swallowing, laryngeal mask was removed without complications.

Diclofenac, 75 mg of solution for intravenous injection was administrated. Additionally, 4 mg of Ondansetron were administrated. Patient had recovery in conscious state showing a blood pressure 130/90, heart rate 100', respiratory rate 20' and partial oxygen saturation 96% with spontaneous ventilation, oxygen 3 L per minute via nasal catheter was administrated. There was presence of droopy eyelids and malar edema ++ Aldrete 9. No incidents.

Patient remained in the Post-Anesthetic Care Unit for 4 h, then he was discharged from it and was remained hospitalized for 48 h. Remission of face edema was observed, the patient was asymptomatic from the cardiovascular, respiratory, and neurological point of view.

Patient was discharged from hospital without incident and open appointment to the Service.

DISCUSSION

The failure of the anesthesiologists to maintain a permeable airway after induction of general anesthesia is one of the more frequent reasons of morbidity and mortality related to the anesthesia.

The incidence of difficult intubation is variable. Deller et al. found from 1.2 to 3.1% in a number of 8384 patients. Williamson et al. found 4% in 2,000 patients and Rose et al. found 0.3%. It is clear from these figures that the incidence is low, but 600 patients die annually because of difficulty in intubation[4,6,7,13].

In the last two decades of this century, it has aroused a great interest in issues related to difficult intubation of the trachea. Several reasons have contributed for this such as, firstly the ability to easily predict the cases of difficult tracheal intubation; in this sense the Samsoon's scale, subsequently amended by Mallampati, has an indisputable historical value[13].

Cormack and Lehane also passed into history for their classification of laryngeal view that objectifies the difficulty of intubation. With all of the above, this is how the American Society of Anaesthesiologists in 1993 published guidelines for the difficult airway management and its amendment in 1996 for the introduction of the laryngeal mask[18].

It is must be familiar with the use of the laryngeal mask airway in a first normal before use in patients with difficult airway. Although the laryngeal mask does not guarantee protection against aspiration is probably safer than the facial mask.

It is necessary to be acquainted with the use of the laryngeal mask firstly in a normal airway before using it in patients with difficult airway. Though the laryngeal mask does not guarantee protection against the aspiration, it is probably surer than the facial mask.

On the other hand, if the patient is relaxed and has a low risk of aspiration, the laryngeal mask can be inserted and used as an aid to tracheal intubation. When it comes to deciding when laryngeal mask (LM) could be used in the failed intubation, 2 essential points should be considered:

1. While LM provides no protection against regurgitation, it may be less likely if hypoxemia and obstruction of the upper airway are resolved quickly.
2. The hypoxic damage due to repeated and unsuccessful attempts of intubation in a cyanotic patient is the main problem in case of failed intubation; it is a much larger problem than the pulmonary aspiration of gastric contents.

Something fundamental in the risk of aspiration is the role of cricoid pressure and its relation to the placement of the LM. Seem reasonable to start the first attempt of insertion with the implementation of cricoid pressure. The risk of aspiration appears to be less than 10% without the cricoid pressure. Vaner has suggested removing the cricoid pressure under direct vision and then inserting the LM using laryngoscope[19-22].

In 1995, Brimacombe and Berry published a meta-analysis on the incidence of aspiration associated with the use of LM, which reveals that the risk of suffering from pulmonary bronchoaspiration is 2 per 10,000 users. This relationship is not statistically different from the incidence of pulmonary aspiration using the endotracheal tube (1.7 per 10,000).

Another controversy is about the procedures which required major surgical time, today the LM is recommended for procedures which last from 2 to 4 hours approximately[12].

CONCLUSIONS

Among the multiple roles played by the anesthesiologist is to safeguard the airway, i.e., preserve and protect them from the induction, maintenance and recovery of the anesthetic state.

Therefore, I believe that a first strategy would be to conduct a thorough and objective assessment of the airways in clinical practice, which perhaps in this case was not given due importance as a summation of probable risks of difficult intubation (short neck, obesity, Mallampati II, Patil Aldreti less than 6 cm, giving an overall assessment of the degree of difficulty in airway management.

The purpose of conducting a kind of a clinical history of airway is intended to predict a difficulty in the airway management. There is no single indicator determining the difficulty to ventilate or perform a laryngoscopy and intubation, but all the same has shown a greater sensitivity.

In this case, when the event of difficulty in laryngoscopy and intubation occurs and with the patient being under general anaesthesia, it should consider the following options: 1. Awaken the patient at the end of pharmacological effect. 2. Defer surgical procedure. 3. The risk of poor oxygenation with subsequent after-effects. 4. The risk of bronchoaspiration. 5. The use of accessories and attachments for difficult airway management available at this time. 6. The use of non-invasive techniques (laryngeal mask, combitube, laryngeal tube, etc.). 7. Ask for help, etc.

In such situations, it is recommended the use of auxiliary ventilation such as the laryngeal mask, an accessory that should be within the material and equipment of all anesthesiologists, but in everyday life, not all have it. Public health institutions should consider this situation in order to ensure the supply and existence of this auxiliary ventilation. By evaluating the advantages and disadvantages, its use becomes necessary, representing to some extent savings and economic benefit, since it can be used several times with adequate cleaning and sterilization.

Likewise, the training must be promoted in the difficult airway management, algorithms and accessories to achieve the familiarization of anesthesiologist in its employment.

Establish formal groups with personnel trained and skilled in the difficult airway management, including the practice in simulation centers, courses, undergraduate programmes, etc.

The laryngeal mask becomes indispensable in the difficult airway management into ASA algorithms thanks to its great potential for providing adequate access to the airway.

Finally, it is important to keep vigilant at all the factors above, by watching the patient in a holistic manner, also it is necessary to predict the risk factors to determine whether the patient has a difficult airway or not, as well as the skills and accessories available to address this problem . Where it is possible to predict or in case of doubt, it is better to secure the airway with the patient awake.

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