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The usefulness of the laryngeal mask compared to that of endotracheal tube in anesthesia for mastectomy

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SUMMARY

Objective: We compared the usefulness of the laryngeal mask airway (LMA) vs. the endotracheal tube (ETT) for the management of the upper respiratory tract in patients subjected to mastectomy. **Material and methods:** It was studied a total amount of 207 patients subjected to modified radical mastectomy, with a physical condition ranging from ASA I to III. The patients were divided into two groups: Group I, LMA, 104 patients and Group II, ETT, 103 patients. Both groups were managed through general anesthesia balanced with sevoflurane, fentanyl, and vecuronium. The ventilation was kept by a semi-closed circuit with controlled mechanical ventilation. **Results** from the 104 patients of the Group I (LMA): in 7 patients the placing of the LM was very difficult, and it was impossible in another one, due to escapes in ventilation. Therefore, it was necessary to practice tracheal intubation; the pharyngeal pain was present in the 10% of the patients. In the Group II (ETT), with 103 patients, intubation was found difficult in 17 patients, and it was necessary to use fibrolaryngoscopy in 2 of the patients; pharynx pain was present in the 55% of the patients ($p < 0.05$). In the ETT placing, it was found an increase in cardiac frequency with a significant statistical difference ($p < 0.05$). The medicine (drugs) consumption was lower for the LMA Group with a significant statistical difference for vacuronium ($p < 0.05$). **Conclusion:** The use of LMA in patients subjected to mastectomy is safe and useful. It presents advantages over ETT. We noticed a great usefulness in the use of LMA in this kind of surgeries, where the complication possibility is reduced to a minimum and the patients go home with fewer problems in the upper respiratory tract.

Key words: Laryngeal mask, endotracheal tube, mastectomy.

RESUMEN

Objetivo: *Comparamos la utilidad de la mascarilla laríngea (ML) vs tubo endotraqueal (TE) para el manejo de la vía aérea en pacientes sometidas a mastectomía.* ***Material y métodos:*** *Se estudiaron un total de 207 pacientes sometidas a mastectomía radical modificada, con estado físico del ASA I a III, divididas en dos grupos: el grupo I: ML 104 pacientes y el grupo II: TE 103 pacientes. Ambos grupos fueron manejados con anestesia general balanceada con sevoflurano, fentanyl y vecuronio. La ventilación fue mantenida con circuito semicerrado con ventilación mecánica controlada. Resultados de las 104 pacientes del grupo I (ML): en 7 fue difícil la colocación y en una imposible, por fuga durante la ventilación, por lo que fue necesario la intubación traqueal; el dolor en la faringe se presentó en el 10% de las pacientes. En el grupo II (TE) 103 pacientes, se encontró dificultad para la intubación en 17 pacientes, entre las cuales en 2 fue necesario utilizar fibrolaringoscopía; el dolor en la faringe se*

presentó en el 55% de las pacientes (p < 0.05). En la colocación de TE se encontró aumento de la frecuencia cardíaca con diferencia estadísticamente significativa (p < 0.05). El consumo de medicamentos fue menor en el grupo de ML con significancia estadística para el vecuronio (p < 0.05). ***Conclusión:*** *El uso de la ML en pacientes sometidas a mastectomía es útil y seguro, presenta ventajas sobre el TE, notamos una gran utilidad en el uso de la ML en este tipo de cirugías, en donde la probabilidad de complicación es mínima y las pacientes se van a su domicilio con menos molestias por el manejo de vía aérea.*

Palabras clave: *Mascarilla laríngea, tubo endotraqueal, mastectomía.*

INTRODUCTION

In present times, the laryngeal mask airway (LMA) represents a resource of paramount importance in the everyday work of the anesthesiologist. It was designed by Dr. Archie J. Brain (1981) and was reported for the first time in the medical literature in 1983. In 1988 it was approved in England, Canada and Australia, but it was not until 1992 that it was introduced in the United States. In 1994 appeared the first report of its use in Mexico, Monterrey City. It was used in an outpatient plastic surgery performed by Dr. Enrique Mancha Castaneda, this case was published in a leading article of the *Anestesia en México* Journal by Dr. Acosta Nava and Dr. Ramírez Acosta from the *Instituto Nacional de la Nutrición*[1,2].

The first data about the anatomy and physiology of the airways were thoroughly discussed by Aristotle, who recognized in animal corpses the structure and function of the epiglottis, the vocal cords and the trachea. For the year 1037, Arabic physician Avicena described the intubation in his work "Liber Canonis" whose translation reads as follows: "Whenever necessary, a cannula made of gold, silver or any other metal should be introduced in the throat to support breathing"; this description closely resembles the orotracheal intubation. Marsalios in 1542, Vesalius in 1543, and Hooke in 1667 described the animal airways researched surgically in pigs, sheeps and dogs, which underwent resection of ribs and diaphragm, as positive pressure ventilation was applied to avoid the secondary lung collapse[3]. In 1743 L. Heister advised to open the trachea of drowned people by inserting a tube and insufflating air through it. The Amsterdam Society for Recovery of drowned people was founded in 1773, this society issued various recommendations including the use of tracheostomy. P.J. Desault (1744-1795) was the precursor of the use of intubation to resolve laryngeal obstruction-related conditions. O'Dwyer (1841-1898), from Cleveland, crafted from 1880 to 1885 a laryngeal intubation device thus contributing to treat diphtheria-induced laryngeal obstruction[3].

In 1852, John Snow began the principles of the inhalation anesthesia by performing tracheal intubation in animals to administer anesthetic vapours; in 1871, Trendelemburg used the same method in humans for oral procedures by means of a inflatable cuff to occlude fully the trachea. In 1880, William MacEwen published in the British Medical Journal his technique for inserting tracheal tubes without the need for tracheostomy or laryngotomy, which he had been performing through the mouth as a tactile procedure in awake patients since 1878, displaying masterful skill. In oral procedures he would administer anesthetic chloroform through the tube and would make use of a sponge to cover the larynx in order to prevent bronchoaspiration[4].

Up until the beginning of XX century, all of the intubation techniques were performed blindly guided by palpation of the fingers. Manuel García (a Spanish singing professor , 1805-1906), who taught at the Paris Conservatory, invented the laryngeal mirror or indirect vision laryngoscope, which earned him recognition as the father of laryngoscopy. In spite of its originality and usefulness, this laryngoscope did not match the needs of anesthetic procedures. In 1899, Chevalier Jackson (an otorhinolaryngologist) developed in Philadelphia the first direct vision laryngoscope, which represented a milestone in the history of Anesthesiology[4].

Anesthesiologists Harold Gillies, Edgar S. Rowbotham (1890-1979) and specially Ivan W. Magill (1880-1986) systematized tracheal intubation by designing tubes, laryngoscopes and a wide variety of accessories and connections such as currently used Magill forceps. For the year 1942, in Montreal, Canada, Harold Griffith and Enid Johnson used curare for the first time in anesthesia to promote muscular relaxation during surgery. A common complication to all this progress continued being the bronchoaspiration, and although some recommendations were using such as the application of anesthesia to sitting patients, was until 1961 when Sellick described the manoeuvre now bears his name[4]. In 1941, Sir Robert McIntosh brought his curved blade in place until today, and in 1946, Miller presented his straight blade laryngoscope. In 1950, the manufacture of inert tubes of PVC with different shapes was began, and high-pressure cuffs were changed by low-pressure cuffs. The problem at that time was the nitrous oxide applied on the low-pressure

cuff, because its spread was transforming this cuff into a high-pressure cuff; forcing developing a gas-tight cuff, it was developed by Fujiwara. In 1967, Murphy, using a fibre-optic endoscope, performed the first intubation, this starts with the era of fiberoptic bronchoscopy[5].

Currently, and considering the vast amount of literature on the subject, , it is known that many researchers have suggested that the LMA offers enormous advantages over the ETT, specially in short to middle duration procedures[6]. The objective of this study was to determine the efficacy and usefulness of the laryngeal mask airway (LMA) as an method alternative to the use of endotracheal intubation (EI) in anesthetic and surgical procedures for mastectomy, and to determine the difficulty of positioning each one of these devices, as well as to study the changes in oxygen saturation, capnography, airway pressure, hearth rate and blood pressure during ventilation with LMA and EI. Other objective was to describe the benefits and pitfalls of the placement of both devices, to see if there was any advantage between the use of one or another for the protection of the airway in patients undergoing general anesthesia, to assess pain in the larynx and to see if there is difference in regard to the occurrence of nausea and vomiting in the postoperative period in patients undergoing mastectomy at the *Hospital de Oncología del CMN Siglo XXI* from *IMSS*.

MATERIAL AND METHODS

A study was conducted by three anesthesiologists with minimum 5 years experience in anesthesiology, with the authorization of the protocol by the Research Ethics Committee of the hospital, over in the period January 2003 to April 2005, in which 215 patients were studied. They were divided into two groups: Group 1, laryngeal mask airway (LMA); and Group 2, endotracheal tube (ETT). Classic non-disposable sizes 3, 4, 5 LMA according to the needs and No. 7.0, 7.5, 8.0 and 8.5 tubes according to each patient were used. It is a prospective longitudinal study. Inclusion criteria were: 1) patients with ASA physical status I-III; 2) patients of any age and gender who will undergo an elective mastectomy; and 3) patients who have agreed to enter the studio. The exclusion criteria were: 1) patients with deformities of the oral cavity or pharynx; 2) patients with a full stomach; 3) morbidly obese patients; and 4) patients who have not agreed to enter the studio. The elimination criteria were: 1) all patients who have to be reintubated or relocated the laryngeal mask in the postoperative period for any reason. All patients were monitored through ECG, pulse oximeter, capnograph, non-invasive blood pressure, inhaled and exhaled gas analyzer. Medication previous to induction with 0.02 to 0.03 mg/kg midazolam. Induction with 1.5 to 2 mg/kg propofol, 0.003 to 0.005 mg/kg fentanyl, 0.05 to 0.1 mg/kg vecuronium. Maintenance on mechanical ventilation, with 5-7 mL/kg CV and Risk Factor (RF) 10x ‘, with 100% oxygen and sevoflurane in volumes percent according to needs of each patient and bolus fentanyl, 8 mg ondansetron and NSAIDs as an analgesics for postoperative period. It took into account the ease of placement of LMA or ETT, how many attempts were made if there was need to change the technique, at the first try was considered easy, at the second attempt was considered more difficult and at third attempt was considered impossible. BP and HR were taken every minute during induction and were taken every 5 min after placement of LMA or ETT. The difficulty and complications of ventilation, pulse oximetry and capnography in transanesthesic period, the emergence of anesthesia were registered, and finally postoperative nausea and vomiting and laryngeal pain were analyzed, comparing both groups.

RESULTS

Of the 215 patients underwent mastectomy who entered the study, 8 patients were removed because they again underwent surgery by hematoma in the immediate postoperative period. There were 104 female patients in Group 1 (LMA), with an average age of 54.6 ± 16.3 years and an average weight of 64.8 ± 8.8 kg. ASA physical status grade I: 23 patients; grade II: 74 patients; grade III: 7 patients. There were 103 patients in Group 2 (ETT), 102 woman and 1 man. With an average age of 53.4 ± 15.9 years and an average weight of 65.3 ± 8.3 kg (Table I). ASA physical status grade I: 19 patients; grade II: 76 patients; grade III: 8 patients. No statistically significant difference was found in both groups (Table II). Of the 104 patients in Group 1 (LMA), placement was very easy in 96 patients, it was difficult in 7 patients, and LMA can not be placed properly in 1 patients, there

Table I. Demographic variables in each group.

	Group 1 LMA	Group 2 ETT	p
Age (years)	54.6 ± 16.3	53.4 ± 15.9	0.810
Weight (kg)	64.8 ± 8.0	65.3 ± 8.3	0.721

Table II. ASA physical status in each group.

	Group 1 LMA patients	Group 2 ETT patients	p
ASA I	23	19	0.876
ASA II	74	76	0.932
ASA III	07	08	0.915

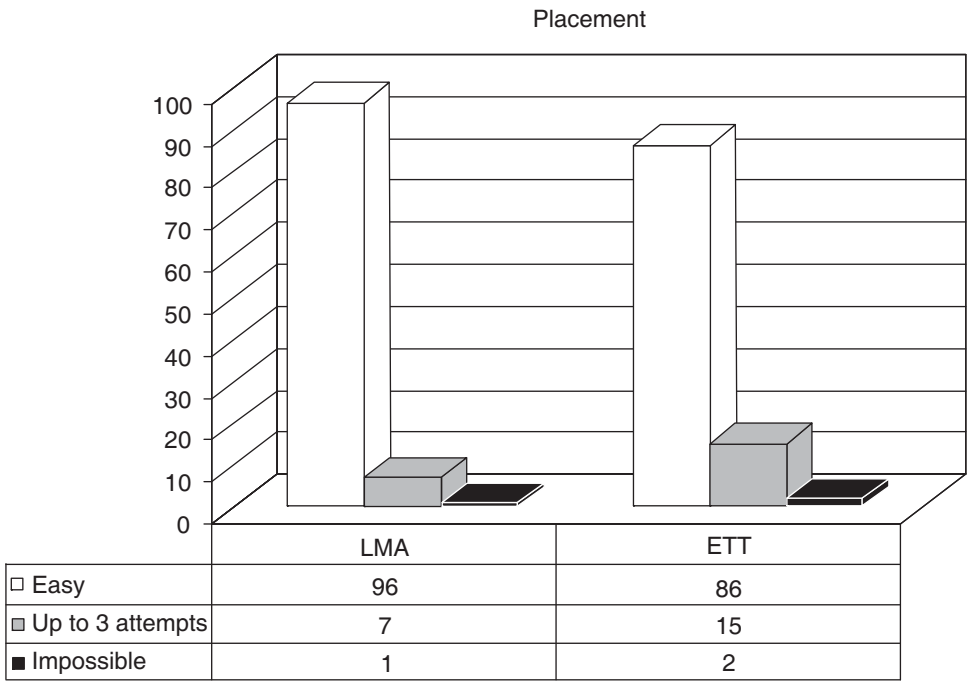

Figure 1. During the placement of the LMA, from a total of 104 patients, in 96 was easy, in 7 there was some difficulty and in one case, although it was placed, could not be maintained a suitable ventilation. For the endotracheal tube, from a total of 103 patients, intubation was easy in 86 patients, in 15 represented greater difficulty and it was impossible by direct laryngoscopy in two cases, so it was used fiberscope. In spite of the result was not found significant statistical difference.

was air leakage during ventilation, so this patient had to be intubated (Figure 1). No. 3 LMA was used more frequently (Table III). There was no difficulty in handling of the ventilation, graph was normal in the capnography, expiratory CO_2 (29 ± 3 mmHg) was handled properly, pulse oximetry was always above 98%. Of 103 patients in Group 2 (ETT), intubation was easy in 86 patients, it was difficult in 15 patients, and it was impossible by traditional laryngoscopy in 2 patients, so it was done using fiberscope with no complications. The No. 7.5 endotracheal tube was the one most used (Table IV). During mechanical ventilation, in the capnography, in handling of expiratory CO2 (28 ± 4 mmHg) and pulse oximetry was above 98% in all patients.

With regards to the use of drugs, in the LMA group this use was lower, 1.7 mg/kg propofol were administrated in LMA group as compared to 2.2 mg/kg fentanyl in ETT group. Moreover, total consumption was lower in the LMA group, 1.8 mg/kg sevoflurane were administrated in LMA group as compared to 2.6 mg/kg in ETT group, 1.0 MAC was administrated in LMA group and 1.1 MAC in ETT group; there was no statistic significance in these parameters. Average dose of vecuronium bromide was 0.04 mg/kg in LMA group and 0.08 mg/kg in ETT group as single dose during induction in both groups with p <0.05 statistically significant (Figure V).

In the hemodynamic parameters during the placement of both devices, the heart rate was 80 ± 7 beats per minute with a baseline of 72 ± 5 beats per minute in LMA group and it was 98 ± 8 beats per minute in ETT group with a baseline of 69 ± 6 beats per minute, p <0.05 statistically significant (Figure 2). The average systolic blood pressure was 135 ± 15 mmHg in LMA group with a baseline of 130 ± 20 mmHg and it was 145 ± 25 mmHg in ETT group with a baseline of

Table III. Size of laryngeal mask used.

Laryngeal mask	No. 3	No. 4	No. 5
Total of patients	87	17	0

Table IV. Internal diameter of endotracheal tube.

Endotracheal tube	No. 7.0	No.7.5	8.0	8.5
Total of patients	21	43	29	10

Table V. Average consumption of medicines. Differences are found for fentanyl and vecuronium, was statistically significant for vecuronium, with p < 0.05.

	LMA	ETT	p
Fentanyl mg/kg	0.0018	0.0026	0.09
Vecuronium mg/kg	0.04	0.08	0.04
Sevoflurane CAM	1.0	1.1	0.95

130 ± 12. The diastolic arterial pressure was 88 ± 7 mmHg in LMA group with a basal of 83 ± 16 mmHg and it was 95 ± 13 in LMA group with a baseline of 80 ± 15 mmHg, although there were notable changes, there was no statistical significance (Figure 3). During the perioperative period, average heart rate was 68 ± 7 beats per minute in LMA group and it was 67 ± 7 beats per minute in LMA group; the average systolic pressure was 110 ± 7 mmHg in LMA group and it was 112 ± 5 mmHg in ETT group; the diastolic pressure was 62 ± 6 mmHg in LMA group and it was 58 ± 10 mmHg in ETT group without statistical significance (Figure 4). On the other hand, 21 patients of Group 1 had nausea and vom-

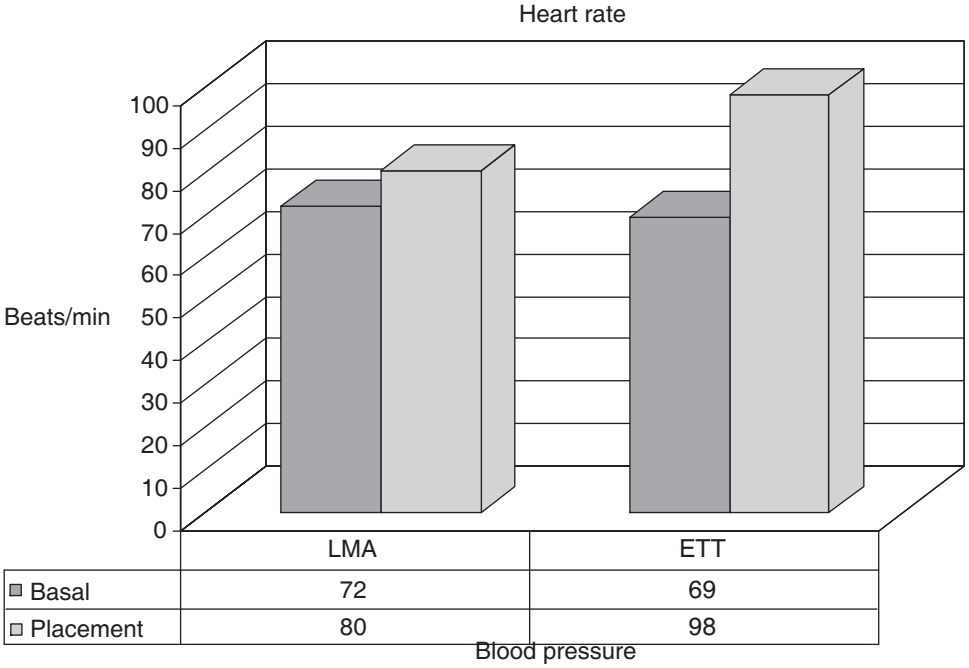

Figure 2. Heart rate in beats per minute, basal and during placemet of the LMA and intubation with ETT, with basal average of 72 for LMA and 69 for ETT, in the placement the average for LMA 80 and to ETT of 98. It was found significant statistically differences with $p < 0.05$.

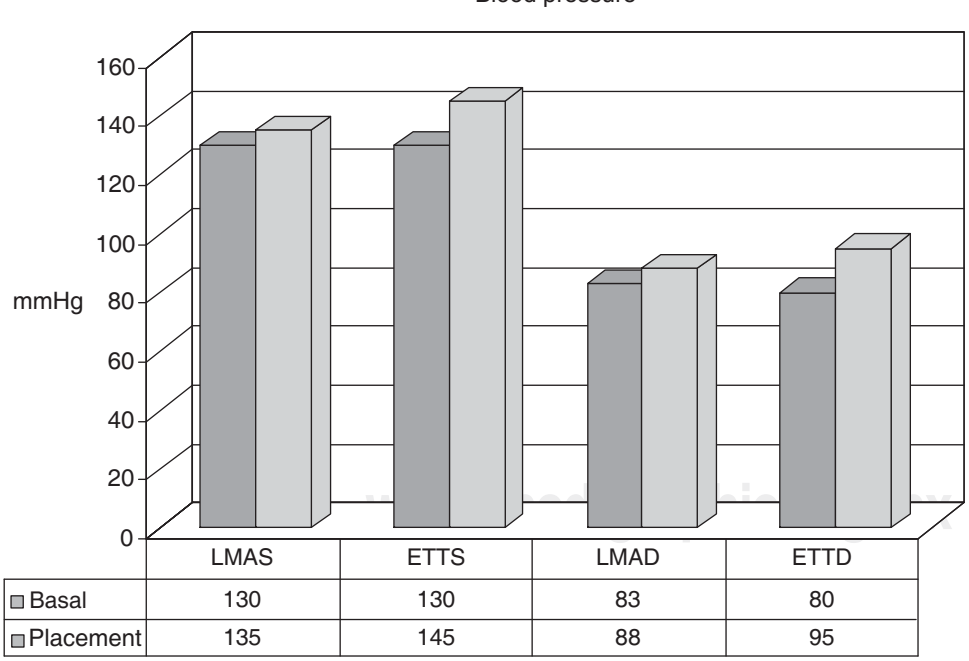

Figure 3. Systolic and diastolic blood pressure in mmHg during placement of the LMA or intubation with ETT. Although there are fewer changes, in systolic blood pressure for LMA, basal 130 mmHg and placement 135 mmHg, for the ETT, basal 130 mmHg and placement 145 mmHg and diastolic, basal for LMA 83 mmHg, in the placement 88 minHg, for the ETT basal 80 mmHg and the placement 95 mmHg. It was not found significant statistically differences.

iting in postoperative period, representing 21.8%; 19 patients of group 2 had these symptoms, representing 19.5%. No statistically significant difference was found in these events. Moreover, 10 patients (10.4%) had pain of the larynx during postoperative period and within 24 h 6 (6.2%) patients had this symptom in LMA group; in ETT group, 54 patients (55.6%) had pain of the larynx during postoperative period and within 24 h 17 (17.5%) patients had this

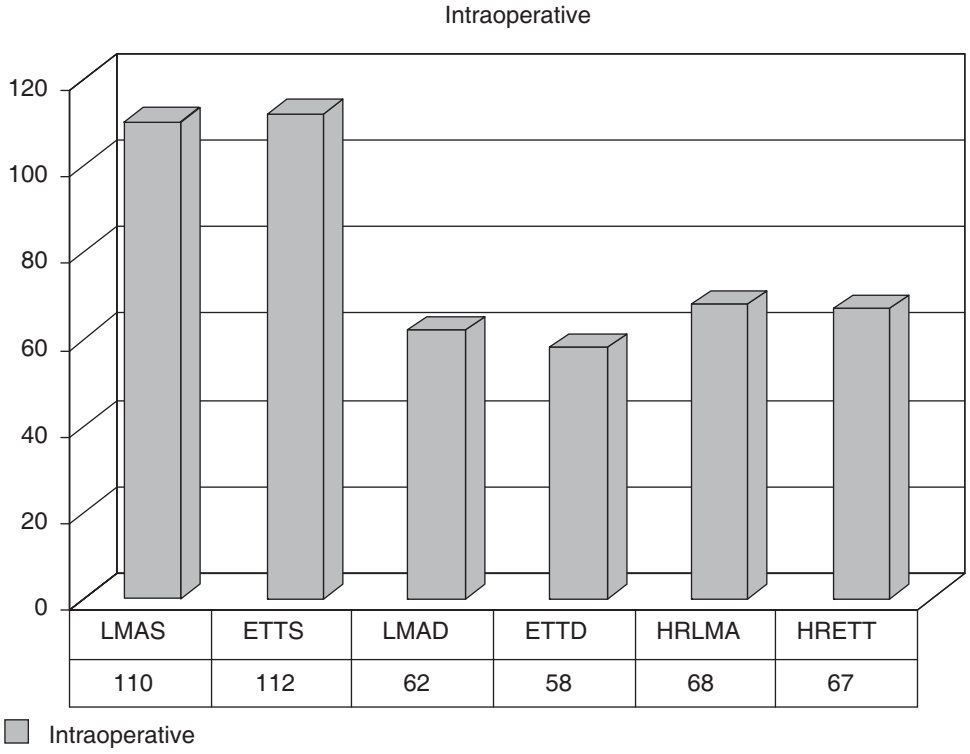

Figure 4. Systolic and dyastolic heart rate during intraoperative period. There were no differences in both groups, they both behaved in similar form without finding difficulties in the handling of these parameters. There were no significant statistical differences. LMA (laryngeal mask airway), ETT (endotracheal tube), S (systolic), D (dyastolic), HR (heart rate).

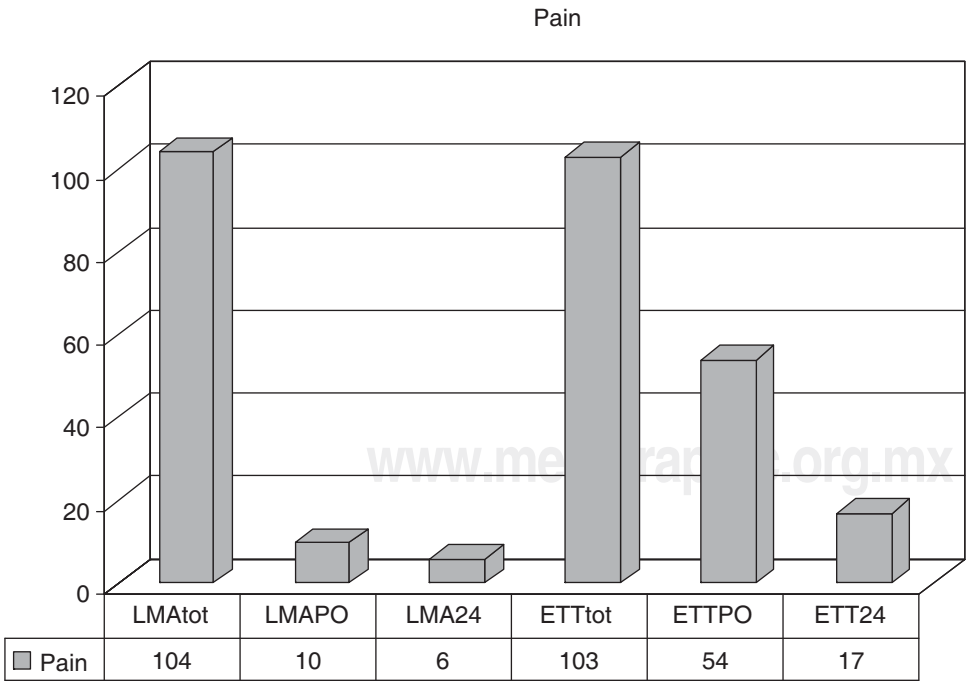

Figure 5. LMA was placed to 104 patients. In immediate postoperative (PO) presented pain 10 patients and 24 hours PO presented pain 6 patients. ETT of a total of 103 patients in the immediate PO 54 presented pain and 24 hours PO, 17 still had pain. Were found statistically significant differences, $p < 0.05$.

symptom, there was statistically significant with p <0.05 (Figure 5). The surgical anesthetic time was 174 ± 16 minutes in group 1 (LMA) and it was 168 ± 20 minutes in group 2 (ETT).

STATISTICS

We obtained average values and standard deviations with a confidence interval of 95%. The observed differences were tested using the Friedman test and Wilcox paired test. Significance was assumed as P <0.05.

DISCUSSION

The use of LMA in breast surgery demonstrates the usefulness and safety with which it can be used in this type of surgery.

After carefully analyze this method and doing the procedure on a daily basis, we can establish that the LMA is a highly useful, secure and effective resource in managing airway and controlled mechanical ventilation[7-9]. The ease of application was apparent in our patients, virtually in all cases like it has been reported by other great authors such as Verghese, who reported difficulties in only 0.24% in 11,910 patients[10]. However, it is worth noting that in many cases differences between authors depend on familiarity with the use of LMA, as well as the choice of the size of it.

In our study, the observed criterion on the application form was as following: LMA with partial balloon inflation and good lubrication was placed in all patients, no difficulties were found in implementation as it has been reported above[11,12]. It is worth mentioning that, in our protocol, the muscle relaxant was used in minimal doses, further facilitating ventilation and placement of the LMA, contrasting with the most of the publications reported. However, we believe that can do without muscle relaxants for the placement of the LMA[12].

Mechanical ventilation was established in all cases and no air leak was noted with positive pressure (20 cm of water or less).

Regarding the possibility of gastric aspiration, we always used LMA in patients with short time and we had no evidence of regurgitation in any patient. In large analyses as that of Brimacombe and Berry, the incidence of pulmonary aspiration of gastric contents with a frequency of 2/10, 000 is indicated[13].

Although there have been no reported cases of laryngospasm, we never have seen, although we do not use atropine routinely.

Capnography was normal in all patients and CO_2 could be handled adequately at the end of expiration; the oxygen saturation in all patients remained above 98%[14].

It is worth considering that the mask's cuff was never fully deflated, making insertion and removal without complications. The only side effects encountered and eventually reported in the literature were: mild pain of the larynx (10% of cases) and occasionally blood streaked mask, which is unrelated to pain.

It is particularly worth considering that irrespective of the fields where the laryngeal mask can be used, there are indications virtually absolute such as very difficult laryngoscopy, both for patient characteristics and aggregate pathology. In this sense, the traumatic cervical injury occupies a prominent place as many accidents have occurred on maneuvers in the laryngoscopy and intubation, being able to cause more damage than already exists at the spinal level[17,18]. It is now recognized as an irreplaceable resource in the emergency management of the airway in the areas of Emergency, Intensive Care Units and cardiac arrest units[19,20].

CONCLUSIONS

We believe it should be used virtually daily in breast surgery scheduled, with which the anesthesiologist will obtain the skills required for overcoming a real difficulty in the airway approach, thus obtaining an atraumatic handling of this situation. At the same time, the LMA is useful, safe and reliable to maintain adequate mechanical ventilation.

One of the major advantages that we found with the implementation of the LMA is that there is no sympathetic-adrenergic stimulation as in the case of the ETT, a significant event in patients with limited cardiac reserve, vital signs remained unchanged at onset and during the procedure.

Laryngeal pain is minimal after the emplacement of the LMA, so the patients go to their homes more comfortable and with minimal discomfort by the management of the airway. So we consider that the LMA should be used as the first choice for patients with breast cancer who will undergo an elective mastectomy and have no contraindication to the use of it.

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