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Original contribution

Comparison of the Macintosh and Airtraq laryngoscopes in morbidly obese patients: a randomized and prospective study☆,☆☆

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ABSTRACT

Study objective: Morbid obesity is associated with a difficult management of the airway. There is no agreement on these patients being difficult to intubate, but if they are difficult to ventilate with facial mask, then the fast control of their airway becomes a priority. This study compares the quickness and success in tracheal intubation, glottic view, hemodynamic response, and complications from the use of the Macintosh and Airtraq laryngoscopes in morbidly obese patients for scheduled surgery.
Design: Prospective, observational, and randomized study.
Setting: Operating room.
Patients: Forty-six American Society of Anesthesiologists III patients.
Interventions: Patients were randomly assigned to undergo tracheal intubation using a Macintosh (n = 23) or an Airtraq laryngoscope (n = 23).
Measurements: The following were compared: intubation time, laryngeal vision, the necessity of additional maneuvers to carry out the tracheal intubation, the success of the maneuvers, complications, and hemodynamic response.
Main results: The preoperative conditions of the studied patients were similar in both groups. The average time of the intubation was 17.27 ± 16.1 seconds and 22.11 ± 13.62 seconds in the Airtraq and Macintosh groups, respectively ($P = .279$). With the Airtraq device, 95.65% of patients presented a glottic view 1 and 2a ($P = .006$) and less optimizing maneuvers were needed to perform the tracheal intubation ($P = .001$). There were no cases of difficult intubation, failed intubation, or difficult ventilation. A statistically significant increase in the heart rate was detected with the use of the Macintosh laryngoscope. A patient with redundant epiglottis could not be intubated with the Airtraq laryngoscope.
Conclusion: Both devices allow quick and safe management of the airway. The Airtraq laryngoscope improved the glottic view by the modified Cormack-Lehane classification, reduced the need for additional maneuvers for tracheal intubation, and also reduced the degree of sympathetic stimulus detected by a minor increase in heart rate after tracheal intubation.

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1. Introduction

Currently, there is no consensus that the morbidly obese patient may be difficult to intubate [1–7]; these patients are usually associated with difficult airway management, with a majority of researchers agreeing that there is an increased risk of difficult ventilation with a facial mask [8,9]. This feature leads to a fast and safe control of the airway, which becomes a priority in the anesthetic management of these patients.

In the available literature, a standard definition of difficult airway, difficult laryngoscopy, difficult tracheal intubation, difficult ventilation,

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or failed intubation cannot be identified, so the lack of consistency on these concepts leads to a discrepancy in the results of different studies. *Difficult intubation* has been defined as one that needs more than 3 attempts in the presence or absence of a tracheal pathology [10,11]. Among other criteria, it has been defined by the Cormack-Lehane classification [12,13], the intubation difficulty scale of Adnet (IDS) [1,2], and the time required for the procedure. In this way, Cook [14] defines time as an objective parameter to evaluate the difficulty in intubation and claims that intubation is easy when it is performed in less than 30 seconds and difficult when it is longer than 4 minutes.

Since its publication, the Cormack-Lehane classification became the criterion standard to describe laryngeal view by direct laryngoscopy. Later, it was modified by Yentis and Lee [15] and subsequently by Cook [14]. There is no a validated classification to evaluate laryngeal view with indirect laryngoscopy.

The airway management is determined by the interaction of 4 variables: the patient's characteristics, the anesthetist skills, the time of the surgical procedure, and the available devices [16]. The Macintosh laryngoscope is the most used in the airway management, and the optical devices have demonstrated their usefulness in a previously known or unknown difficult airway [11,17,18].

This study was carried out to compare the quickness in tracheal intubation of the Macintosh vs Airtraq laryngoscope (Prodol Meditec SA, Vizcaya, Spain) in morbidly obese patients for scheduled surgery. The secondary objectives were to compare the success in intubation expressed by the number of attempts of intubation, additional maneuvers for the intubation, laryngeal view, hemodynamic response, and complications derived from the use of both laryngoscopes.

2. Materials and methods

After obtaining the patients' written informed consent approved by the Research and Ethics Committee, a prospective, observational, longitudinal, analytical, and randomized study was performed.

The target population was those morbidly obese patients scheduled for surgery requiring endotracheal intubation consecutively and attended by the main investigator. Forty-six patients were randomly allocated to 2 groups using a random number generator. Inclusion criteria were body mass index (BMI) ≥40 kg/m^2, 18 years or older, and American Society of Anesthesiologists III physical status. Patients with a background of difficult intubation, except morbid obesity as the only factor, gastroesophageal symptomatic reflux, gastric bands, urgent surgery, rigid cervical spine, mouth opening less than 2.5 cm, and allergy to any of the drugs used during the procedure, were excluded.

At the preanesthetic assessment, demographic and control variables were registered, among them Mallampati score modified by Samsoon and Young, thyromental distance, interincisors distance, neck circumference, and difficulty to ventilate according to the Han scale [19].

The modified Mallampati score was determined with the patient seated and the tongue maximally protruded, and scored 1 to 4. The thyromental distance was determined with the forced extension of the head from the chin symphysis to the prominence of the thyroid cartilage, being classified as easy when ≥6 cm and difficult when <6 cm. Interincisors distance was measured with the patient's maximum mouth opening, from the rim of the median upper incisors to the inferior ones. An easy one was ≥4 cm and difficult was <4 cm. Neck circumference was measured with the head in a neutral position, at the level of the thyroid cartilage, and it was considered as easy when it was <45 cm and difficult when ≥45 cm.

The *time of the tracheal intubation* was defined as the time taken from the insertion of the blade between the teeth until the tracheal tube was placed through the vocal cords, evidenced by the direct visual confirmation of the anesthetist and confirmed by the presence of carbon dioxide in the exhaled flow. An independent observer registered the time with a chronometer. The tracheal intubation was classified by time lapse, being considered easy intubation time (EIT) when it was completed in less than 30 seconds, moderately difficult intubation time (MDIT) when it was between 31 and 239 seconds, and difficult intubation time (DIT) when it took longer than 240 seconds. More than 5 attempts were regarded as a failure of intubation.

The success of the intubation was expressed by the number of intubation attempts, being established that if the intubation failed at the first attempt, an additional attempt could be made with the same laryngoscope, and after a second attempt, it would be changed to another type of laryngoscope. If the degree of visualization was equal or more than 3b, the laryngoscope should be changed. If none of the laryngoscopes achieved the tracheal intubation, the nonpredicted difficult airway algorithm of the Difficult Airway Society should be applied [20]. Additional maneuvers were registered: the laryngeal external maneuver and/or the use of the stylet and the change of the device for intubation.

The laryngeal view was assessed by the Cormack-Lehane classification for the scoring of IDS and the modified Cormack-Lehane classification for the direct and indirect laryngoscopy. The laryngeal view was considered easy when it was 1 or 2a, limited when a glottal visualization was 2b or 3a, and difficult when it was 3b or 4.

The hemodynamic response was assessed by the measurement of the arterial blood pressure and the heart rate; both were recorded just before the induction and 1, 3, and 5 minutes after intubation.

Throughout the procedure, the oxygen saturation monitoring by pulse oximetry was registered; hypoxemia was considered if the value was less than 92% [21]. Complications were also recorded.

2.1. Study procedure

After the patients were admitted to premedication area, a peripheral 18G venous access was placed in upper limb, and 4 mL/kg Ringer's lactate solution was infused (ideal weight). As a part of the procedure, all patients were premedicated with ranitidine 1 mg/kg, metoclopramide 10 mg, and midazolam 1 or 2 mg depending on their needs.

The standard monitoring included the following: II-lead electrocardiography, noninvasive blood pressure, pulse oximetry, end-tidal carbon dioxide, and bispectral index. Patients were preoxygenated with 100% oxygen with a tight facemask using continuous positive airway pressure of 8-10 cm H_20 for 5 minutes.

Anesthesia was induced with fentanyl 1 μg/kg (real weight) and target controlled infusion (TCI) of propofol on the Marsh model: 4-6 μg/mL, weight was corrected according to Servin et al [22]:

$$\text{Corrected body weight} = \text{ideal body weight} + [0.4 \times (\text{total body weight} - \text{ideal body weight})].$$

Before the induction, all patients were placed in a ramped position; the external auditory meatus and the sternal notch were horizontally aligned. With the patient asleep, before administering the neuromuscular blocking agent (NMBA), the ventilation was assessed under the Han score [19]. According to the results of the randomized table previously established, the patient was allotted to the Macintosh or the Airtraq group. The anesthetist did not know up to this moment which device she was going to use (double-blind masked technique). If the patient was included in the Airtraq group, it was changed to the sniffing position, whereas those in the Macintosh group were maintained in ramped position. Then rocuronium 0.9 mg/kg (real weight) was administered. The minute after administration of NMBA, laryngoscopy was performed and then we proceeded to tracheal intubation. Maintenance of the anesthesia was made with remifentanyl on TCI perfusion and propofol on TCI perfusion until 5 minutes after intubation.

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