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SCIENTIFIC ARTICLE

Preanesthetic assessment data do not influence the time for tracheal intubation with Airtraq™ video laryngoscope in obese patients[☆]

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KEYWORDS

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Abstract

Purpose: this study investigated the influence of anatomical predictors on difficult laryngoscopy and orotracheal intubation in obese patients by comparing Macintosh and Airtraq™ laryngoscopes.

Methods: from 132 bariatric surgery patients (body mass index $\geq 35 \text{ kg m}^{-2}$), cervical perimeter, sternomental distance, interincisor distance, and Mallampati score were recorded. The patients were randomized into two groups according to whether a Macintosh ($n = 64$) or an Airtraq™ ($n = 68$) laryngoscope was used for tracheal intubation. Time required for intubation was the first outcome. Cormack–Lehane score, number of intubation attempts, the Macintosh blade used, any need for external tracheal compression or the use of gum elastic bougie were recorded. Intubation failure and strategies adopted were also registered.

Results: intubation failed in two patients in the Macintosh laryngoscope group, and these patients were included as worst cases scenario. The intubation times were $36.9 \pm 22.8 \text{ s}$ and $13.7 \pm 3.1 \text{ s}$ for the Macintosh and Airtraq™ laryngoscope groups ($p < 0.01$), respectively. Cormack–Lehane scores were also lower for the Airtraq™ group. One patient in the Macintosh group with intubation failure was quickly intubated with the Airtraq™. Cervical circumference ($p < 0.01$) and interincisor distance ($p < 0.05$) influenced the time required for intubation in the Macintosh group but not in the Airtraq™ group.

Conclusion: in obese patients despite increased neck circumference and limited mouth opening, the Airtraq™ laryngoscope affords faster tracheal intubation than the Macintosh laryngoscope, and it may serve as an alternative when conventional laryngoscopy fails.

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Introduction

Difficulties in airway management are a concern in obese patients.^{1,2} Anatomical characteristics such as cervical and occipital fat accumulation, tongue size, airway narrowing, limited neck extension, and limited mouth opening are factors that make tracheal intubation more difficult in obese patients than in those with a lower body mass index.^{3,4} These factors have been designed to predict difficult laryngoscopy and intubation.

Several devices can be used to facilitate intubation in patients with conditions such as obesity. Airtraq™ (Prodol Medic; Biscay, Spain) is a disposable video laryngoscope designed to provide vocal cord visualization without the need to align the mouth and pharynx with the tracheal axis, and has been in clinical use since 2006.⁵ In several studies, Airtraq™ has proven to be better than conventional laryngoscopes for patients with certain conditions, including obesity.^{6–8}

The difficult airway anatomical predictors are useful when the Macintosh laryngoscope is used; however, when video laryngoscopy is employed these predictors are uncertain. Thus, the aim of this study was to investigate the influence of demographic data and anatomical characteristics of obese patients in airway management by comparing the Macintosh laryngoscope and Airtraq™ video laryngoscope.

Materials and methods

After receiving approval from the Institutional Research Ethics Committee, and registering at Australian and New Zealand Clinical Trials (ANZCT, 12610000136000), candidates aged 18–60 years were invited to participate in this study. All patients provided informed consent and the participants were ASA I–III (American Society of Anesthesiologists) and had a body mass index (BMI) ≥ 35 kg/m². Patients with a history of untreated gastro-oesophageal reflux, succinylcholine intolerance, or previous difficult or unfeasible intubation were excluded. At preanesthetic assessment, Mallampati score,⁹ interincisor distance, sternomental distance, and neck circumference at the level of the thyroid cartilage were recorded.

The patients were given ranitidine 50 mg and metoclopramide 10 mg intravenously 1 h before surgery. In the operating room after monitoring and prior to anesthesia induction, the patients were randomly assigned (with sealed opaque envelopes) to one of the two groups, according to the device to be used for tracheal intubation: Macintosh or Airtraq™ laryngoscope. Patient monitoring included continuous electrocardiography (EKG), pulse oximetry (SpO₂) and non-invasive blood pressure.

The patients were placed in the ramped position, which began at the lumbar region and progressed to the subscapular and suboccipital areas, to keep the auditory meatus above the sternal manubrium and the shoulders according to the description by Collins and colleagues.¹⁰ After a 3-min pre-oxygenation, anesthesia was induced with 2.0 μ g/kg fentanyl and 2.0 mg/kg propofol. After the corneal–palpebral reflex was lost, the patients were given succinylcholine 1.0 mg/kg. The propofol dose was adjusted

according to corrected weight (22 height \times height).¹¹ Intubation was performed at complete cessation of visible muscle twitching and was confirmed by capnography curve. Then 0.1 mg/kg vecuronium was injected, and anesthesia was maintained by the administration of sevoflurane (2%–3%) in a mixture of oxygen and air (FiO₂ = 0.4).

The intubation was performed by four participating senior anesthesiologists with more than 4 years of clinical experience with conventional laryngoscopy and Airtraq™. The maximum time permitted for intubation was 120 s. Anesthesiologists using the Macintosh laryngoscope were free to choose the blade size (3, 4, or 5) and in the case of failure, a new intubation attempt was performed with a different blade size. The regular Airtraq™ (size 3) was used in all cases in this group.

Optimizing maneuver for the laryngoscopy was the *Backward, Upward, Rightward Pressure* (BURP) maneuver.¹² Intubation failures were recorded, and the alternative device could be used. Thus, patients who could not be intubated with the Macintosh laryngoscope could be then intubated with the Airtraq™, and vice versa. For cases where intubation could not be performed with either device, or for cases where facemask ventilation posed difficulty, a laryngeal mask airway (Fastrack™) or a flexible bronchoscope could be used. Alternatively, the patient could be awakened and the surgery rescheduled. For women, 7.5-diameter lubricated tracheal tubes were used, and 8.5-diameter was used for men.

Time in seconds from the moment the anesthesiologist picked up the device (Macintosh laryngoscope or Airtraq™) until cuff inflation was our primary outcome. Other secondary outcomes were the Cormack–Lehane scores¹³ as reported by the anesthesiologist; the number of intubation attempts; the number of the Macintosh blade used; any need for external tracheal compression by means of a BURP performed by an assistant, or the use of a gum elastic bougie; and intubation failure and the strategies adopted.

The number of participants in this study was calculated considering a minimum time difference for intubation of 21 s with a standard deviation of 27 s, in a series of 20 obese patients intubated with Macintosh laryngoscope or Airtraq™, derived from the experience of members of our group in a pilot study. A total of 126 patients were required to produce a significant difference with a power of 0.9 and $\alpha = 0.05$. Student's *t*-tests were used for comparing continuous variable with a Bonferroni correction as appropriate. The Mann–Whitney *U* test was applied to the Cormack–Lehane score. Chi-squared tests were applied to categorical variables. Demographic and anatomical variables were analyzed to verify their influence on the time required for intubation. For this purpose, the multiple linear regression method with dummy variables was used, and correlation coefficient (*r*) for each group and variable is shown. Values of $p < 0.05$ were defined as statistically significant. The STATISTICA version 6, 2001 (StatSoft, Inc. Tulsa, OK), was used.

Results

From 158 initially selected patients, 26 were excluded. Nineteen declined to sign the informed consent form, and 7

Table 1 Demographic data and airway anatomical measurements. Values are expressed as the means (standard deviation) or counts (gender, physical status, and Mallampati score).

	Macintosh laryngoscope group <i>n</i> = 64	Airtraq™ group <i>n</i> = 68
Gender (male/female)	15/47	15/53
Age (years)	34.9 (9.4)	35.4 (8.8)
Body mass index (kg m ⁻¹)	42.7 (4.4)	43.5 (6.3)
Physical status ASA (I/II/III)	26/13/13	28/32/8
Sternomental distance (cm)	12.6 (1.5)	12.5 (1.5)
Interincisor distance (cm)	3.8 (1.5)	3.7 (1.5)
Neck circumference (cm)	44.6 (4.2)	45.5 (4.4)
Mallampati score: 1/2/3/4	6/32/20/4	9/33/22/4

required sedatives before entering the operating room. The Airtraq™ group consisted of 68 patients, each of whom was successfully intubated within the established maximum time of 120 s. The Macintosh laryngoscope group consisted of 64 patients, but 2 were treated considering the worst-case scenario due to failed tracheal intubation (intention to treat analysis) (Fig. 1).

The groups were homogeneous with respect to demographic and airway anatomical variables (Table 1).

The time required for intubation was significantly longer with the Macintosh laryngoscope (36.9 ± 22.8 s) than with the Airtraq™ (13.7 ± 3.1 s), ($p < 0.01$). In the Macintosh group, 13, 39, and 10 patients were subjected to intubation with blades of size 3, 4, and 5, respectively. In eight patients, the first attempt to intubate was unsuccessful and the blade was replaced with a larger one; for four of these, blade 4 was changed to blade 5, and in the remaining 4, blade 3 was changed to blade 4. Considering these eight patients, a BURP maneuver was required for 6, and of these, a gum elastic bougie was also needed for 1 patient. For 2 patients in the Macintosh group, intubation could not be accomplished within 120 s. One patient required three attempts with blades 4 and 5, and this patient had a Cormack–Lehane score IV. After facemask

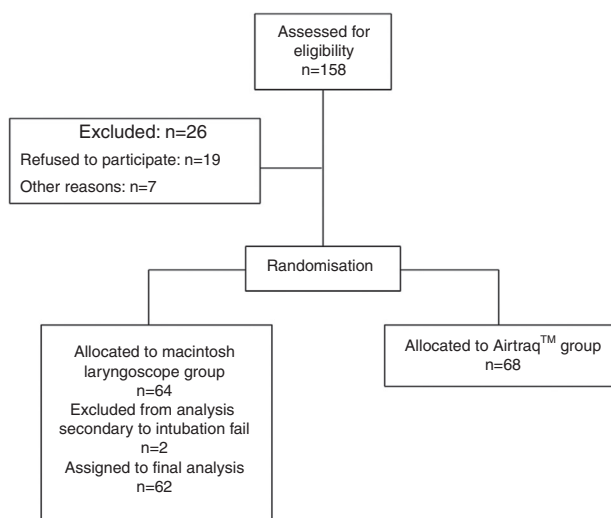
ventilation, this patient was intubated within 30 s using the Airtraq™, resulting in a Cormack–Lehane score I. Another patient exhibited bronchospasm, received facemask ventilation until spontaneous respiration recovered, and the procedure was postponed. The data on airway management are presented in Table 2.

The following factors did not have a significant influence on the time required for intubation: age ($p = 0.39$), sex ($p = 0.07$), BMI ($p = 0.91$), and sternomental distance ($p = 0.17$). Neck circumference ($p < 0.01$) (Fig. 2) and interincisor distance ($p < 0.05$) (Fig. 3) did have a significant influence on the time required for intubation with the Macintosh laryngoscope, but not for the Airtraq™.

Discussion

In this study, increased cervical circumference significantly influenced the time for intubation with the Macintosh laryngoscope but not for the Airtraq™.

The minimum interincisor distance recommended for Airtraq™ oral introduction is 2 cm.^{7,14} The interincisor distance only influenced the time required for intubation with the Macintosh laryngoscope, thus revealing that the Airtraq™ can be used for patients with a limited mouth opening.

**Figure 1** Patients flowchart.**Table 2** Time for intubation expressed as the mean and standard deviation. Number of laryngoscopies attempted, need to perform the BURP maneuver (back up right position) and Cormack–Lehane scores reported by the anesthesiologist expressed as total numbers of patients.

	Macintosh laryngoscope group <i>n</i> = 64	Airtraq™ group <i>n</i> = 68
Time for intubation (seconds)*	36.9 (22.8)*	13.7 (3.1)*
Laryngoscopy attempts: 1/2/3	54/6/2	68/0/0
BURP maneuver	6	0
Cormack–Lehane score: I/II/III/IV	37/20/4/1	65/3/0/0

* $p < 0.01$.

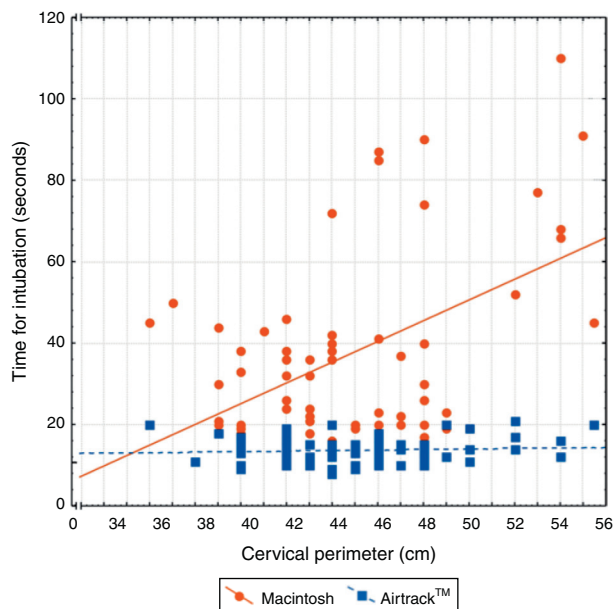


Figure 2 Adjusted correlations for the relationship between cervical perimeter and intubation time, according to intubation method for the Macintosh laryngoscope versus the Airtraq™ ($p < 0.01$).

Studies that have analyzed intubation in obese patients have compared video laryngoscopes with a single Macintosh laryngoscope blade size.^{6–8,14} In our study, the anesthesiologists selected the Macintosh blade sizes based on their experience and clinical judgment, and they also had the option to change the blade as needed. Blade changing occurred due to the inability to insert it properly into the vallecula; as many obese individuals are also tall, blade 3

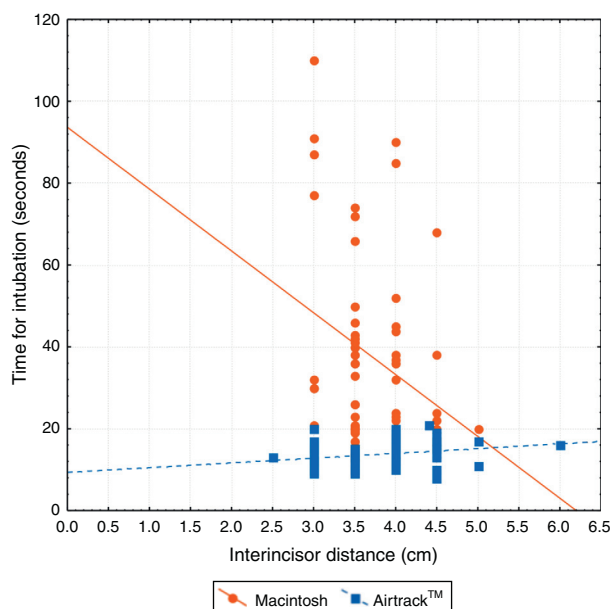


Figure 3 Adjusted correlations for the relationship between interincisor distance and intubation time, according to intubation method for the Macintosh laryngoscope versus the Airtraq™ ($p < 0.05$).

(and even blade 4) may not provide adequate vocal cord visualization.

One novel finding from our study is that the increased neck circumference and limited mouth opening made the Macintosh laryngoscope less efficient than the Airtraq™ for obese patients. Increased cervical circumference has been associated with intubation difficulty using the Macintosh laryngoscope.^{4,15}

Randomized trials with obese patients observed that the time required for intubation was significantly longer with the Macintosh when compared with video laryngoscopes. The time required for tracheal intubation using the Pentax-AWS was significantly longer than that for the Macintosh laryngoscope (38 vs 26 s on average),¹⁶ and the intubation lasted significantly longer with the GlideScope than Macintosh laryngoscope (48 vs 32 s).¹⁷ Otherwise laryngoscopic Cormack–Lehane views were significantly better with video laryngoscopes. In two patients direct laryngoscopy failed and they were subsequently intubated with GlideScope without problems.

In these studies time to intubate was defined as the time elapsing between the insertion of the laryngoscope into the oral cavity and registration of expired CO₂. In our study duration of intubation was defined as the time from gripping the device and tracheal tube cuff inflation. This may explain the very short intubation time with the Airtraq™ in the present report. Recorded start and end times for intubation are not consistent among several studies, so absolute comparisons are difficult.

The common tests designed to predict difficult laryngoscopy are of uncertain relevance when video laryngoscopy is employed and the new devices will probably be safer.^{18,19}

We would stress that the Cormack & Lehane grade was described when Macintosh laryngoscope were used, and the importance to find a specific laryngeal view graduation for the video laryngoscopes.^{20,21} These devices have particularities in their designs and procedures for intubation

Video laryngoscopes may be advantageous compared to the Macintosh laryngoscope because they can be used under awake conditions with adequate topical airway anesthesia, or when the patient is lightly sedated.²² Thus the Airtraq™ is less expensive and easier to store and handle than bronchoscopes. As video laryngoscopes are rigid, they can push away excess tissue, secretions or blood, thereby allowing a better view of the vocal cords.²³

This study has several limitations. We did not use Intubation Difficulty Scale-IDS,²⁴ which is mentioned quite often in the literature. We chose to use the Cormack–Lehane score and the time required for intubation, which are strongly related to clinical practice evaluation. We monitored only clinically the intubation conditions with no nerve stimulator technique for neuromuscular blockade. Although the study was randomized, it was impossible to blind the operator to the airway device being used.

We conclude that in obese patients, some anatomical characteristics, such as cervical circumference and interincisor distance, do not influence the time required for intubation with the Airtraq™, but these factors must be taken into account when using the Macintosh laryngoscope. The use of the Airtraq™ would be considered when the Macintosh laryngoscope intubation is unsuccessful for obese patients in the ramped position.

Conflicts of interest

The authors declare no conflicts of interest.

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