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Airtraq® is superior to the Macintosh laryngoscope for tracheal intubation: Systematic review with trial sequential analysis

The Airtraq® laryngoscope (Prodol Ltd., Vizcaya, Spain) is a one-time-use video-guided laryngoscope for tracheal intubation of patients with either normal or difficult airways [1]. Compared with the conventional laryngoscope, the efficacy of the Airtraq for tracheal intubation has been reported to be inconsistent in adults [2,3]. Here, we performed a systematic review and meta-analysis of several RCTs to compare the usefulness of the Airtraq versus the Macintosh laryngoscope for tracheal intubation in an adult population.

We conducted this meta-analysis according to the recommendations of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement [4]. We only included a study in the analysis if it was a prospective randomized trial or it compared the Airtraq and the Macintosh laryngoscope in adults. A comprehensive literature search was performed using PubMed, Cochrane Central Register of Controlled Trials, EMBASE, and Scopus (Table 1).

Data extracted from the eligible studies included the success rate (success on the first attempt), the intubation time, and the assessment of glottic visualization using the Cormack-Lehane classification (2 versus ≥3). We also conducted trial sequential analysis (TSA) [5]. In subgroup analysis, we separated these parameters to assess the influence of the airway condition (normal versus difficult) and laryngoscopist skill (novice versus experienced). We performed all statistical analyses with Review Manager (ver. 5.2, Nordic Cochrane Centre, The Cochrane Collaboration, Copenhagen, Denmark). We combined all data from the individual trials and used DerSimonian and Laird random effects models for our calculations. Pooled effect estimates for the binary variables of success rate and glottic visualization are shown as RR with the 95% CI. Pooled differences in intubation time between the two devices are expressed as the weighted mean difference (WMD) with 95% CI. To determine the percentage of variability due to heterogeneity rather than that due to sampling error, we used the Cochran Q and I^2 statistics to test for homogeneity of the effect size across all trials [6].

Twenty-nine articles describing 31 trials met the inclusion criteria. The Airtraq was used to intubate 1211 patients and the Macintosh laryngoscope was used to intubated 1203 patients. The rate of successful tracheal intubation with the Airtraq in the present meta-analysis of these 31 trials was significantly higher than that with the Macintosh laryngoscope (RR = 1.07, 95% CI, 1.03–1.11, P = 0.001, Cochrane's Q = 108.6, I^2 = 72%). TSA corrected the 95% CI to 1.02–1.11. The Z curve met the TSA monitoring boundary for benefit, and the accrued sample size (n = 2414) satisfied the previously estimated RIS (n = 1298). Intubation time with the Airtraq was significantly shorter than that with the Macintosh laryngoscope (WMD = −9.66, 95% CI 1–13.7 to −5.26, P < 0.0001, Cochrane's Q = 1070.1, I^2 = 97%). TSA resulted in correction of the 95% CI to −14.9 to −4.45. The Z curve crossed over the boundary of futility, and TSA further showed the accrued information size (n = 2192) to be 72.9% of the previously estimated RIS (n = 3003). Assessment of glottic visualization in 17 of the 31 trials examined showed that the Airtraq provided better glottic visualization than the Macintosh

Table 1
Characteristics of included studies

No.	Author	Year	Number of patients (ATQ/Mac)	ASA status	Status of airway	Laryngoscopists
1	Maharaj CH	2006	60 (30/30)	I–III	Normal	Novice
2	Maharaj CH	2007	40 (20/20)	I–III	MILS	Experienced
3	Maharaj CH	2008	40 (20/20)	I–III	Predict difficult airway	Experienced
4	Ndoko SK	2008	106 (53/53)	I–III	Morbidly obese patients	Experienced
5	Hirabayashi Y	2009	200 (100/100)	N/A	Normal	Novice
6	Hirabayashi Y	2009	20 (10/10)	N/A	Normal	Novice
7	Wang WH	2009	40 (20/20)	I–II	Normal	Experienced
8	Gaszynski T	2009	68 (36/32)	N/A	Mobidly obese patients	Experienced
9	Dhonneur G	2009	212 (106/106)	III	Mobidly obese patients	Experienced
10	Chalkeidis O	2010	63 (35/28)	I–III	Normal	Experienced
11	Park SJ	2010	74 (37/37)	I–II	Normal	Novice
12	Koh JC	2010	50 (25/25)	I–II	MILS	Experienced
13	di Marco PD	2011	108 (54/54)	I–III	Normal	Novice
14	de Oliveira GS	2011	30 (15/15)	I–II	Normal	Novice
15	McElwain J	2011	60 (29/31)	I–III	MILS	Experienced
16	Ferrando C	2011	120 (60/60)	I–III	Normal	Novice
17	Nishiyama T	2011	38 (18/20)	I–II	Normal	Experienced
18	Puchner W	2011	40 (20/20)	I–II	Normal	Experienced
19	Mont Gst	2012	100 (50/50)	N/A	Normal or predict difficult airway	Experienced
20	Amor M	2013	120 (60/60)	I	MILS	Experienced
21	Bhandari G	2013	80 (40/40)	I	Normal	Experienced
22	Bensghir M	2013	70 (35/35)	I–II	Difficult, thyroid surgery	Experienced
23	Zhao H	2014	149 (74/75)	I–II	Normal	Novice
24	Saracoglu KT	2014	62 (31/31)	I–II	Normal	Experienced
25	Ranieri Jr. D	2014	132 (68/64)	III	Mobidly obese patients	Experienced
26	Colak A	2015	100 (50/50)	I–III	Normal	Experienced
27	Vijayakumar V	2016	90 (45/45)	I–II	MILS	Experienced
28	Al-Ghamdi AA	2016	43 (21/22)	I–II	Normal	Experienced
29	Castillo-Monzon CG	2017	46 (23/23)	III	Morbidly obese patients	Experienced

ATQ: Airtraq, Mac: Macintosh laryngoscope, MILS: manual in-line neck stabilization, ASA: American Society of Anesthesiologist, N/A: not available.

Table 2
Compared the Airtraq with the Macintosh laryngoscope at tracheal intubation in subgroup analysis

		Number of trials	RR or WMD (95% CI)	*P*-value	Cochrane's Q	I² statistic, %
The success rate	Total	31	1.07 (1.03 to 1.11)	0.001*	108.6	72
	Normal airway	18	1.02 (0.98, 1.07)	0.34	45.8	63
	Difficult airway	13	1.15 (1.07 to 1.23)	0.0002*	59.4	80
	Novice	9	1.14 (1.03 to 1.27)	0.01*	32.1	75
	Experience	22	1.05 (1.01 to 1.10)	0.03*	76.3	72
The intubation time	Total	28	−9.66 (−13.7 to −5.62)	<0.0001*	1070.1	97
	Normal airway	16	−2.87 (−8.00 to 2.27)	0.27	433.2	97
	Difficult airway	12	−19.6 (−26.6 to −12.6)	<0.0001*	451.1	98
	Novice	6	−17.3 (−28.7 to −5.99)	0.003*	54.2	91
	Experience	22	−7.96 (−12.4 to −3.50)	0.0005*	9998.9	98
The glottis visualization	Total	17	1.23 (1.13 to 1.33)	<0.00001*	79.7	80
	Normal airway	8	1.07 (1.01 to 1.15)	0.03*	16.8	58
	Difficult airway	9	1.43 (1.25 to 1.63)	<0.00001*	31.7	75
	Novice	4	1.15 (1.01 to 1.30)	0.03*	13.8	78
	Experience	13	1.26 (1.14 to 1.40)	<0.0001*	61.8	81

RR: relative risk, WMD: weight mean difference, CI: confidence intervals, N/A: not applicable.

* Significant difference.

laryngoscope (RR = 1.23, 95% CI, 1.01–1.30, *P* < 0.00001, Cochrane's Q = 79.7, I² = 80%). The 95% CI was corrected to 1.12–1.34 by TSA, which also showed the accrued information size (*n* = 1510) to be 91.6% of the previously estimated RIS (*n* = 1648). In subgroup analysis, the Airtraq is more effective in terms of successful tracheal intubation, intubation time, and better visualization of the glottis in difficult airway conditions and when used by novice or experienced laryngoscopists. However, the success rate and intubation time of tracheal intubation with the Airtraq were not significantly different from those with the Macintosh in normal airway settings (Table 2).

When using the Macintosh laryngoscope to intubate the trachea, the laryngoscopist must align the oral, pharyngeal, and laryngeal axes extending from the incisors to the larynx. However, the lens located in the tip of the Airtraq blade displays a high-resolution image of the glottis on the separate liquid-crystal display of the device [1]. For several reasons, such as tongue edema and limited neck movement, it can be difficult to align these axes in a difficult airway when using the Macintosh laryngoscope. This could worsen glottic visualization and lead to a failure to intubate with the Macintosh laryngoscope. However, when the glottis is visualized on the Airtraq monitor, it is possible to intubate the trachea, even in difficult airways, under indirect visual guidance. This increases the success of tracheal intubation and permits excellent glottic visualization.

In conclusion, the Airtraq is superior to the Macintosh laryngoscope in terms of success rate, intubation time, and glottic visualization during tracheal intubation.

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Multiplex polymerase chain reaction test to diagnose infectious diarrhea in the emergency department

Acute diarrheal illnesses are common presentations in US Emergency Departments (ED) with over 500,000 visits in 2014 [1]. In presumed infectious diarrhea, culture-based diagnosis is the standard means of identifying a causative agent and directing management [2,3]. Results of