

Abstract.

Airway-Protective 60-second step-limit Tracheal Intubation Algorithm decreases Throat Pain and Complications.

Background.

Figure 1. Laryngoscope blades used in the study: the single-use plastic blade (Heine XP, HEINE Optotechnik GmbH & Co. KG, Herrsching, Germany) (up), and reusable metal blade (HEINE Classic+® F.O. Macintosh, HEINE Optotechnik GmbH & Co. KG, Gilching, Germany) (down).

Direct laryngoscopy with a blade laryngoscope remains the first option for routine tracheal intubation despite video-assisted laryngoscopes. Reusable metal blade induces complications like throat pain in 30% of patients.(1-2) We observed 40% of throat pain in our setting with plastic blade. We aimed to evaluate a potentially airway-protective 60-second step-limit tracheal intubation algorithm to reduce these incidences.

Methods.

This trial was multicenter, prospective, randomized, single-blind controlled study. We included 693 adult patients without predictive criteria for difficult tracheal intubation. A potentially airway-protective 60-second step-limit tracheal intubation algorithm was used when performing tracheal intubation using a single-use plastic or reusable metal blade. The operator had 60 seconds to evaluate the difficulty, choose the appropriate technique to intubate the

trachea and promptly change it if the difficulty persisted thus avoiding oxygen desaturation and pharyngolaryngeal injury by reducing both intubation duration and struggling with the blade to improve the laryngeal view. When the first laryngeal view, with a reasonable force of mandibular traction, was poor, leading to unexpectedly difficult tracheal intubation, alternative techniques had to be widely and quickly used.

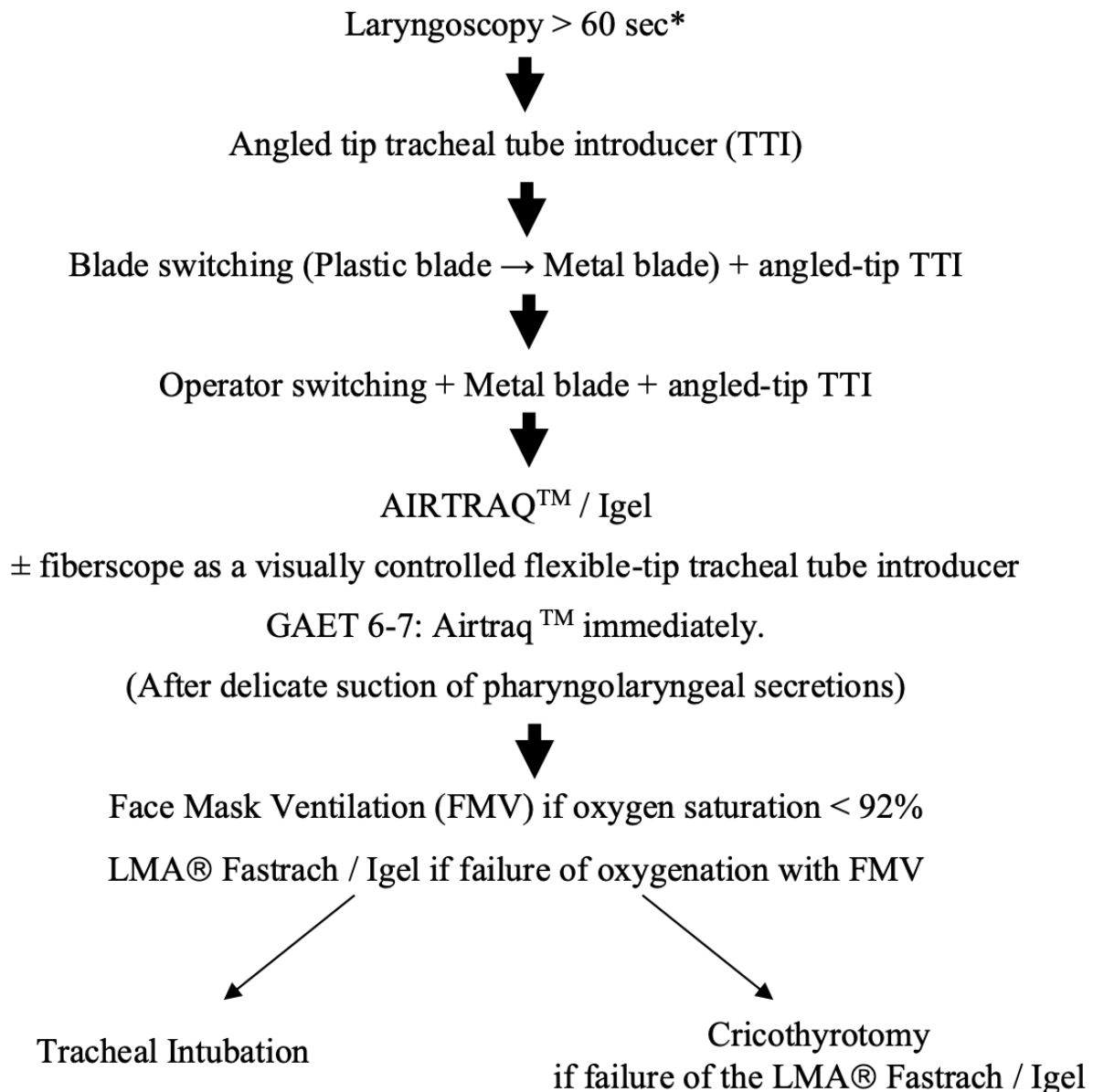


Figure 2: Sixty-second step-limit tracheal intubation algorithm. * The operator could skip steps as necessary to avoid injury and maximize efficiency. Arrow (➡), beyond 60 s, use of an alternative technique.

The primary endpoint was the frequency of throat pain, without swallowing, 24 hours after tracheal intubation. The first secondary endpoint was the incidence of unexpectedly difficult tracheal intubation (Intubation Difficulty Score ≥ 1). Chi-squared test was used for comparison of frequencies and Student's t-test for comparison of means.

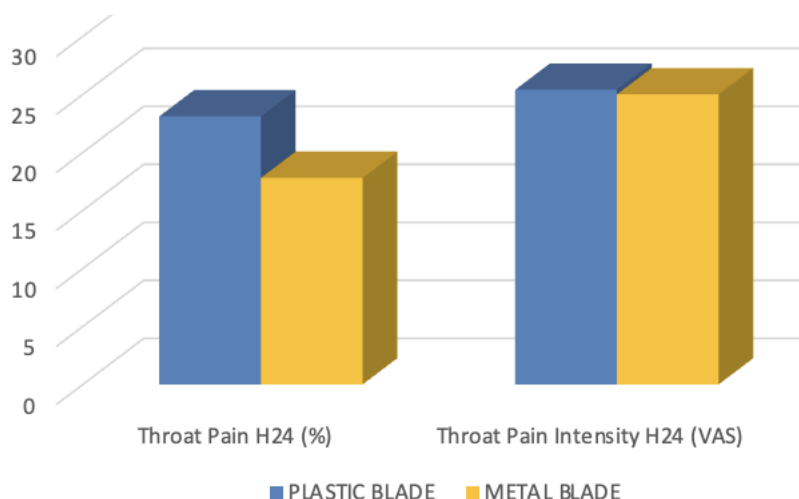


Figure 3: Throat pain incidence and mean intensity at 24 hours following tracheal intubation using either single use plastic blade or reusable metal blade based on a potentially protective 60-second step-limit tracheal intubation algorithm. No significant difference. VAS, visual analogue scale.

Results.

Patient characteristics were comparable between the two groups (Table 1).

At 24 hours, the throat pain incidence was reduced and quite low in the two groups without a significant difference: 81 (23.1%) vs. 61 (17.8%); difference, 5.3%; 95% Confidence Interval, $[-0.8 - 11.2]$; $P = 0.087$ (Figure 1). The unexpectedly difficult tracheal intubation incidence was significantly higher in the plastic group: 194 (55.3%) vs. 146 (42.7%); difference, 12.6%; 95% Confidence Interval, $[12.3 - 12.8]$; $P = 0.0009$ (Table 2).

There was not a significant difference between the two groups concerning frequency of adverse events (Table 3).

Discussion and Conclusion.

	Plastic Blade n = 351	Metal Blade n = 342
Age (years)	48.0 (13.6)	48.8 (13.2)
Sex (male), n (%)	103 (29.3)	113 (33.0)
Weight (kg)	74.6 (16.5)	74.2 (15.8)
Height (cm)	166.2 (8.6)	167 (9.7)
Surgery duration (min)	109.3 (60.2)	109.5 (57.0)

Table 1. Baseline characteristics of patients scheduled for surgery with tracheal intubation performed using the Heine® single-use plastic blade or the Heine® reusable metal blade. Values are mean (SD) or number (proportion).

Using a 60-second step-limit tracheal intubation algorithm may explain the observed low incidence of throat pain in the two groups despite significantly more unexpectedly difficult tracheal intubations using the plastic blade. Otherwise, wide and early use of angled-tip tracheal tube introducers should implicate routinely accepting relatively poor views and avoiding pharyngolaryngeal injuries and oxygen desaturation.(3) Finally, the generalizability of this concept and the implementation of such an airway-protective algorithm in other institutions and clinical settings is worth considering.

Incidence of throat pain following tracheal intubation using single-use plastic or reusable metal blade based on a potentially airway-protective tracheal intubation algorithm was reduced at a quite low level in the two groups without a significant difference. However, further studies are necessary to confirm the potentially airway-protective effect of this 60-second step-limit tracheal intubation algorithm especially in the context of video-assisted laryngoscopes. Additionally, it has been previously shown that Airtraq did not induce any throat pain in obese patients.(4)

Characteristics of Tracheal intubation	Plastic Blade n = 351	Metal Blade n = 342	<i>P</i>
IDS = 0, n (%)	155 (44.4)	195 (57.2)	0.0007
IDS 1–5	181 (51.6)	139 (40.6)	0.0039
IDS > 5	13 (3.7)	7 (2.0)	0.192
POGO score (mean (SD))	70.8 (32.3)	79.4 (28.3)	0.0002
Cormack – Lehane score (mean (SD))	1.2 (0.6)	1.1 (0.4)	0.0089
GAET score (mean (SD))	2.0 (1.3)	1.7 (1.1)	0.0002
GAET 7, n (%)	3 (0.0)	0 (0.0)	0.086
Airtraq. n (%)	1 (0.0)	0 (0.0)	1.00
Switching of plastic to reusable metal blade, n (%)	12 (3.5)	-	-
Increased Traction Strength. n (%)	116 (33.4)	74 (21.8)	0.0006
Tracheal intubation duration (s) (mean (SD))	40.1 (52.6)	29.3 (33.1)	0.0014
Angled-tip tracheal tube introducer, n (%)	34 (9.7)	21 (6.2)	0.0842

IDS, Intubation Difficulty Score; POGO, Percentage Of Glottic Opening; GAET, Glottis – Arytenoid – Epiglottis – Tongue.

Table 2. Characteristics of routine and scheduled tracheal intubation performed using the Heine® single-use plastic blade or the Heine® reusable metal blade in patients without predictive criteria for difficult tracheal intubation. IDS = 0, easy, IDS = 1–5, slightly difficult, IDS > 5, moderate to very difficult. Values are mean (SD) or number, n (proportion, %).

Tracheal intubation morbidity	Single-use Plastic blade n = 351	Reusable Metal blade n = 342	<i>P</i>
Oxygen desaturation	13 (3.7)	9 (2.6)	0.42
Bronchospasm	2 (0.5)	0 (0)	0.25
Inhalation	0 (0)	0 (0)	0.99
Blood stains on the blades	11 (3.1)	6 (1.7)	0.24
Dental trauma	0 (0)	0 (0)	0.99
Lip wound	1 (0.3)	2 (0.6)	0.65

Table 3. Adverse events expressing morbidity 24 hours after tracheal intubation using single-use plastic or reusable metal blade based on a potentially airway-protective 60-second step-limit tracheal intubation algorithm. VAS, visual analogue scale.

References

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