Which nostril should be used for nasotracheal intubation with Airtraq NT®: the right or left? A randomized clinical trial

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Received: 21.03.2018 • Accepted/Published Online: 08.12.2018 • Final Version: 11.02.2019

Background/aim: Nasotracheal Airtraq is specifically designed to improve the glottis view and ease the nasotracheal intubation process in normal and difficult cases.

Materials and methods: After Ethics committee approval, we decided to enroll 40 patients with an ASA physical status of I or II, between 18 and 70 years of age undergoing elective maxillofascial, oral, and double chin surgery to determine which nostril is more suitable for nasotracheal intubation with nasotracheal Airtraq. Patients were randomized into the right and left nostril groups.

Results: Demographic and airway characteristics were similar among the groups. Nasotracheal intubation through the right nostril was shorter than that of the left nostril during nasotracheal intubation with the Airtraq NT (P < 0.001). 90° counterclockwise rotation of the tip of the tube was needed for directing the tube into the vocal cords in both right and left nostril groups (72% vs 88%). External laryngeal pressure and head flexion maneuvers can ease the intubation from the left nostril (P < 0.001 vs P = 0.03). Cuff inflation maneuver also can be helpful in some cases. We did not need any operator change or Magill forceps for any of the patients.

Conclusion: Nasotracheal intubation via the right nostril can be safely and quickly performed with the Airtraq NT without the need of Magill forceps. We recommend the use of the 90° counterclockwise rotation, external laryngeal pressure, and head flexion maneuvers to direct the tube into the vocal cords first. On the other hand, cuff inflation maneuver must also be kept in mind.

Key words: Airtraq, nasotracheal, right nostril, 90° degree counterclockwise, cricoid pressure, head flexion
Figure 1. Nasotracheal Airtraq with and attachable high resolution Wi-Fi camera.

Figure 2. Baseline glottic view of Airtraq NT from the right nostril. The tube is extremely at the right bottom.

Figure 3. 90° counterclockwise rotation of the tube helps us to view the tip of the tube and direct it into the center of glottis inlet.

Figure 4. External laryngeal pressure maneuver to direct the tube into the vocal cords.

Figure 5. Cuff inflation maneuver to direct the tube into the vocal cords.

Figure 6. Head flexion maneuver to direct the tube into the vocal cords.
Oxygen flush, and impossible (11). Then, 0.6 mg kg\(^{-1}\) of iv ventilations were recorded as easy, airway, two-handed, time, and Cormack–Lehane grades of the patients. We recorded the insertion time, tube through the nostril, we started to intubate the patient in random order. Following the insertion of the spiral changed the tube with a small one to the selected nostril resistance was felt, we tried the other nostril and then of 7.5 mm for men and 7.0 mm for women. Then, if any tube (Mallinckdrodt Medical, Athlone, Ireland) lubricated we inserted the cuffed spiral lateral beveled endotracheal rocuronium was administered for muscle relaxation. First, 0.03 mg kg\(^{-1}\) intravenously (iv) at preoperative care unit this study. The patients were premedicated with midazolam experience with orotracheal intubation with the Airtraq and who had at least 20 successful intubations with the Macintosh laryngoscope and Magill forceps. All intubations were performed by individuals with at least 4 years of anesthesia experience, experience with orotracheal intubation with the Airtraq and who had at least 20 successful intubations with the Airtraq NT. SpO\(_2\) < 92 was recorded as hypoxemia. Insertion time is the time elapsing from the device entering the oral cavity until the optimal glottis visualization occurred. Reinserting and handling force maneuver included in this time period. Nasotracheal intubation time is the time elapsing from the device entering the oral cavity until the visualization of the tube entering through the vocal cords. When a resistance was felt during the tube adjustment, the maneuvers included 90° counterclockwise rotation maneuver (6,12), external laryngeal pressure (3,13), cuff inflation (14,15), head flexion, changing the operator, use of Magill forceps were applied (10) in random order. Total nasotracheal intubation time is the time elapsing from the device entering the oral cavity until the confirmation of intubation from the capnograph.

Systolic blood pressure, diastolic blood pressure, mean arterial pressure, heart rate, and pulse oximetry were recorded baseline (preoperatively), after anesthesia induction, and 1 min intervals after intubation for 3 min by an independent unbiased observer. Occurrence of epistaxis was also recorded. In the case where the patient could not be intubated after three attempts or after 120 s, then she/he was intubated with the Macintosh laryngoscope and Magill forceps. All intubations were performed by individuals with at least 4 years of anesthesia experience, experience with orotracheal intubation with the Airtraq and who had at least 20 successful intubations with the Airtraq NT. SpO\(_2\) < 92 was recorded as hypoxemia.

We based our sample size on our preliminary study. We enrolled 4 patients for each group, 8 patients in total for this calculation. We found total intubation times as 29.5 (2.38) for the right nostril and 44.3 (3.95) for the left nostril. Based on this data, a = 0.05 and b = 0.2, we needed 15 patients for each group. We decided to enroll 20 patients per group considering possible exclusions. Continuous data were examined for normal distribution with the Kolmogorov–Smirnov test. For normally distributed data, we used the Student's t-test, and Mann–Withney U test for not normally distributed data. Normally distributed data were given as mean ± standard deviation (SD) and nonnormally distributed data as median [25–75 percentiles]. Categorical data was calculated with Chi-square test. P < 0.05 was considered statistically significant.

## 3. Results

We enrolled 40 patients; however, 2 patients denied participation in this study and 3 patients lost-to-follow-up. Therefore, we analyzed 35 patients (18 patients in the right nostril group, 17 patients in the left nostril group) (Figure 7).

Demographic and airway variables of the nostril groups were similar. Types of surgery and airway management parameters were similar between the groups (Table 1). Mallampati, mandibular protrusions, interincisor distance...
of patients with mandibular fractures could not be evaluated, so the values were not presented in Table 1.

All the patients were intubated at the first attempt successfully in the right nostril group and all except one patient in the left nostril group. The reinserting maneuver was used with more than half of the patients in both groups for optimization of the glottis view of the Airtraq NT. There was no need to apply the handling force maneuver for optimization of the glottic view. Cormack–Lehane grades were similar between the groups (Table 1).

The insertion times were comparable between the groups. Nasotracheal intubation and total nasotracheal intubation times were shorter in the right nostril group compared to the left nostril group (P < 0.001)(Table 2). No hypoxemia occurred during the entirety of the procedure. Especially the 90° counterclockwise rotation of the tip of the tube was needed to direct the tube into the vocal cords for both nasotracheal intubations of the right and left nostril groups (72% vs 88%)(Table 2). When this maneuver was felt, secondly, we applied external laryngeal manipulation (Sellick maneuver) to direct the tube into the vocal cords during nasotracheal intubation through the left nostril (P < 0.001) (Table 2). Head flexion maneuver was statistically significantly helpful while intubating through

**Table 1.** Demographic and airway characteristics of patients; values were given as numbers (n), mean (SD), or IQR [25–75 percentiles].

| ASA I /II (n) | Right nostril (n = 18) | Left nostril (n = 17) | P  |
|---------------|------------------------|-----------------------|----|
| Sex F/M (n)   | 8 /10                  | 6 / 11                | 0.836 |
| Height (cm)   | 172.3 (9.9)            | 170.1 (8.7)           | 0.474 |
| Weight (kg)   | 72 (16.7)              | 70.4 (14.7)           | 0.759 |
| Age (years)   | 25.5 [20.8-37]         | 30 [23-52]            | 0.869 |
| Sternomental distance (cm) | 14 [14-16.3] | 15 [14-16] | 0.909 |
| Tyromental distance (cm) | 8 [7-9]         | 9 [7-9]              | 0.130 |
| Interincisor distance (cm) | 4 [4-5]          | 4.5 [4-5]            | 0.610 |
| Mandibular protrusion A/B (n) | 13 /1            | 11 /0                | 0.366 |
| Teeth morphology Full/lack/absent (n) | 15 / 2 / 1  | 14 / 1 / 2 | 0.714 |
| Mallampati I / II / III / IV (n) | 5 / 5 / 3 / 1 | 5 / 5 / 1 / 0 | 0.800 |
the left nostril (P = 0.03) (Table 2). Inflating the tube cuff was helpful in some cases (Table 2). We did not need any operator change, any use of Magill forceps. Hemodynamic variables were similar among the groups.

4. Discussion
The main result of this study was that nasotracheal intubation could be performed in a shorter time through the right nostril than through the left nostril. In addition, 90° counterclockwise rotation maneuver of the endotracheal tube is useful for nasotracheal intubation for both right and left nostrils with the Airtraq NT. External laryngeal pressure and head flexion maneuvers eased the nasotracheal intubation from the left nostril. Cuff inflation could also be performed for nasotracheal intubation with the Airtraq NT instead of using Magill forceps.

There are possible reasons for shorter intubation time when nasotracheal intubation was performed through the right nostril. First, the tube is often displaced to the right pharyngeal wall and it makes it easier to view the tip of the tube and manipulate it with the tube adjustment maneuvers or with the Magill forceps (16,17). Second, the multiplanar imaging studies showed that the ease was due to the association between the right nostril and the posterior nasopharyngeal anatomy (5).

Consistent with our results, there was a recently published awake nasotracheal intubation case with an oral cancer with Mallampati IV using the Airtraq NT through the right nostril at the first attempt without the need of any maneuvers or Magill forceps (18).

Gomez et al. (19) reported that anesthesia residents needed the external laryngeal pressure maneuver in 32% of difficult nasotracheal intubation of a manikin with the Airtraq NT. In addition, they had to use Magill forceps, stylet, or operator change in some difficult cases. Inexperienced users needed help with the maneuvers more often, the use of Magill forceps or operator change during the nasotracheal intubation process. Even in inexperienced hands, Airtraq NT had the fastest intubation, better Cormack–Lehane grades, and required less force than McGarth MAC and Macintosh in this study. The necessity of maneuvers (head flexion, external laryngeal pressure) to advance the endotracheal tube through the vocal cords was also taken into consideration.

In our study, all nasotracheal intubations were performed with experienced users of both orotracheal Airtraq® and the Airtraq NT; we did not need any use of Magill forceps or operator change in this study.

Some authors recommended the cuff inflation method to direct the tip of the tube to the vocal cords if the tube was felt excessively posterior or lateral to the glottis opening without using Magill forceps or bougie (13,15,20,21). We used the cuff inflation maneuver and it helped us to direct the tip of the tube through the vocal cords easily in some cases.

When nonanesthesiologist physicians (novice laryngoscopy professionals) performed nasotracheal intubation, they could intubate easily and faster with the Airtraq NT (65 s) than with the Macintosh and Magill forceps combination (22,23).

Mont et al. (24) compared the Airtraq NT and the Macintosh laryngoscopes in both easy and difficult

| Table 2. Nasotracheal intubation variables of patients, values were given as numbers (n), mean (SD), or IQR [25–75 percentiles]. |
|---------------------------------------------------------------|
| **Right nostril (n = 18)** | **Left nostril (n = 17)** | **P** |
| **Mask ventilation** | Easy/airway/two-handed | 11 / 5 / 2 | 11 / 2 / 4 | 0.447 |
| **Number of intubation attempts (n)** | 18 / 0 | 16 / 1 | 0.486 |
| **Reinserting maneuver** | Yes / No | 6 / 12 | 8 / 9 | 0.629 |
| **Insertion time (s)** | Yes / No | 5.8 (1.9) | 6.5 (1.8) | 0.293 |
| **Nasotracheal intubation time (s)** | 16.7 (5.7) | 33.1 (15.4) | <0.001* |
| **Total nasotracheal intubation time (s)** | 30 [28-31.3] | 50 [33.5-62] | <0.001* |
| **SpO2 (%)** | Yes / No (n) | 99.5 [98.8-100] | 99 [99-100] | 0.732 |
| **90° counterclockwise rotation** | Yes / No (n) | 13 / 5 | 15 / 2 | 0.237 |
| **OELM Y es /No** | Yes / No (n) | 72% / 28% | 88% / 12% | 0.001* |
| **Head flexion Yes / No** | Yes / No (n) | 0 / 18 | 9 / 8 | 0.03* |
| **Tube cuff inflation** | Yes / No (n) | 1 / 17 | 5 / 12 | 0.06 |
| **Epistaxis Yes / No** | Yes / No (n) | 3 / 15 | 4 / 13 | 0.612 |

* P < 0.05 and * P < 0.001
nasotracheal intubations in 200 patients. In the expected difficult nasotracheal intubation group; the Cormack–Lehane grades were better, intubation times were shorter and the number of optimization maneuvers were lower in the Airtraq NT group. There was no data about the nostril side in this manuscript. 30% of the expected easy nasotracheal intubation patients in the Airtraq NT group needed manipulations such as external laryngeal pressure, guidance of the Eschmann stylet, changes in the head position, and the use of Magill’s forceps. However, they did not perform these four maneuvers in a strict order. In the expected difficulty groups, the need for these maneuvers increased significantly. They allowed the anesthetists to change the order. However, we did them in order in our study.

In a published prospective randomized study that compared the Airtraq NT and the Macintosh laryngoscope in routine nasotracheal intubation of 62 patients, it was reported that laryngoscopy, tube insertion, and intubation times were similar in both groups. However, intubation difficulty scales were significantly reduced in the Airtraq NT group compared to the Macintosh laryngoscope group. In the Airtraq NT group, external manipulation was done to direct the tube through the vocal cords. There was no data about the nostril selection in this trial either (25).

There are few studies and even case reports published in difficult nasotracheal intubation situations. When we read them, we saw that all successful intubations were performed from the right nostril with the Airtraq NT and McGrath MAC and with help of the 90° counterclockwise rotation maneuver (7,18,26).

The limitation of our study is as follows; the operators were not blind to the selected nostrils and our patients were not expected to be difficult intubation patients. Further investigations are needed in nasotracheal intubation patients with different videolaryngoscopes, different maneuvers that would be helpful advancing the tube into the vocal cords, different shaped tips of endotracheal tubes, in different difficult intubation conditions. Maybe, a left channeled Airtraq NT will be produced in the future to ease through the left nasotracheal intubation processes (6,9,27).

In conclusion, we recommend the use of the right nostril with the help of the 90° counterclockwise rotation, external laryngeal pressure, and head flexion maneuvers to shorten the nasotracheal intubation process without the need of Magill forceps while using the Airtraq NT.

Acknowledgement
We thank Prodol for providing Nasotracheal Airtraq for this trial.

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