

Nasotracheal Versus Orotracheal Intubation in Critically Ill COVID-19 Patients: A Retrospective Study

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Background: This study aimed to compare the clinical efficacy of nasotracheal intubation (NTI) versus orotracheal intubation (OTI) in severe COVID-19 pneumonia patients requiring mechanical ventilation.

Methods: In this retrospective, propensity score-matched cohort study, we consecutively enrolled 45 critically ill adults with COVID-19 who underwent NTI. These patients were matched 1:1 by age and sex with 45 controls who received OTI. Data on sedative, analgesic, and neuromuscular blocking agent (NMBA) usage, tracheotomy incidence, intubation-related complications, and ICU length of stay were extracted from medical records. Multivariable logistic regression was performed to assess the independent association between intubation route and tracheotomy risk.

Results: Patients in the NTI group had significantly lower requirements for continuous infusion of sedatives, analgesics, and NMBAs compared with the OTI group (all $P < 0.001$). The incidence of tracheotomy was significantly lower in the NTI group (6.7% vs. 26.7%, $P = 0.011$). Multivariable logistic regression analysis, adjusted for age, sex, BMI, $\text{PaO}_2/\text{FiO}_2$, and SOFA score confirmed that NTI was independently associated with a reduced risk of tracheotomy (adjusted OR = 0.19, 95% CI: 0.04–0.78, $P = 0.022$). The incidence of oral ulcers was lower ($P = 0.002$). No significant differences were observed in other complications, including ventilator-associated pneumonia.

Conclusion: In this retrospective study of patients with severe COVID-19 pneumonia, NTI was associated with reduced sedative, analgesic, and NMBA requirements, a lower risk of tracheotomy, and fewer oral complications, without increasing other major adverse events. Given the observational design, these findings should be considered hypothesis-generating, and prospective randomized trials are needed to confirm causality.

Keywords: airway management, nasotracheal intubation, orotracheal intubation, severe COVID-19 pneumonia

Introduction

Severe pneumonia represents a leading cause of acute respiratory failure and intensive care unit (ICU) admission worldwide, with a substantial proportion of patients requiring invasive mechanical ventilation due to refractory hypoxemia or ventilatory fatigue.¹ The global burden of this condition has been starkly highlighted by the COVID-19 pandemic, where a significant percentage of critically ill patients progressed to acute respiratory distress syndrome (ARDS), overwhelming critical care resources and necessitating prolonged ventilator support.^{2,3} The management of severe pneumonia, whether stemming from typical bacterial pathogens, influenza, or SARS-CoV-2, thus continues to pose major challenges, with mortality remaining high despite advances in supportive care.^{4,5} The decision to initiate mechanical ventilation is therefore a critical juncture in the clinical course of these patients, with implications for both immediate survival and long-term outcomes.

The two primary routes for securing the airway in such scenarios are orotracheal intubation (OTI) and nasotracheal intubation (NTI).^{6–8} OTI is widely regarded as the standard approach in most emergency and critical care settings,

avored for its rapid execution, familiarity among clinicians, and suitability for patients with coagulopathy or basal skull fracture.^{6,7} However, its transoral passage can cause significant patient discomfort, contribute to difficulty in oral hygiene maintenance, and potentially increase the risk of unplanned extubation.⁷ In contrast, NTI, while historically more common in elective surgical settings such as oral and maxillofacial surgery, offers potential advantages in the ICU.⁷ Several studies suggest improved patient tolerance, better tube stability, and facilitation of oral care. Furthermore, emerging evidence, including data from pediatric ICUs, indicates that NTI may be associated with reduced requirements for sedative and analgesic medications, which could in turn mitigate the risks of delirium and ventilator-associated complications. Nevertheless, concerns regarding sinusitis, a potentially smaller tube size, and the need for greater operator expertise have limited its widespread adoption in the critical care management of severe pneumonia.

Despite these considerations, a direct comparative evaluation of OTI versus NTI specifically in mechanically ventilated adults with severe pneumonia—including those with COVID-19—remains limited. Existing literature lacks robust, matched comparisons focusing on practical clinical outcomes such as drug requirements, the need for tracheostomy, and specific complication profiles. Therefore, the primary objective of this matched retrospective study was to comprehensively compare the clinical efficacy of NTI versus OTI in severe COVID-19 pneumonia patients. The primary outcomes were the requirements for sedatives, analgesics, and neuromuscular blocking agents. Secondary outcomes included the success rate of the first intubation attempt, the incidence of tracheostomy, intubation-related complications (oronasal bleeding, oral ulcers, cuff leakage, sputum crust obstruction, and ventilator-associated pneumonia), and ICU length of stay.

Patients and Methods

Study Design and Ethical Approval

This retrospective, observational cohort study was conducted at the Second Xiangya Hospital of Central South University and received approval from the institutional ethics committee (Approval No: 2023035). It was registered with the Chinese Clinical Trial Registry (Registration No: ChiCTR2300069018). As this was a retrospective study, the requirement for informed consent was waived by the Ethics Committee of the Second Xiangya Hospital, Central South University.

Patient Population and Selection Criteria

We retrospectively and consecutively screened adult (age ≥ 18 years) severe COVID-19 pneumonia patients who required invasive mechanical ventilation in the Intensive Care Units (ICUs) of the Department of Anesthesiology, Respiratory, and Neurosurgery at The Second Xiangya Hospital between December 2022 and January 2023. The diagnosis of severe COVID-19 pneumonia was based on established international guidelines, incorporating clinical, radiological, and microbiological criteria.

A total of 45 patients who underwent nasotracheal intubation (NTI) were initially identified. Using propensity score matching (PSM), a control group of 45 patients who underwent orotracheal intubation (OTI) was selected in a 1:1 ratio. Matching was performed based on age (within 5 years) and sex to minimize potential selection bias and ensure comparability between the two groups. Exclusion criteria were as follows: patients with incomplete medical records or lost to follow-up, patients under 18 years of age, patients whose respiratory failure or hypoxemia was primarily attributable to non-pneumonia etiologies (eg, acute heart failure, pulmonary embolism). After matching, we compared the key clinical severity indicators, namely the arterial oxygen partial pressure to fractional inspired oxygen concentration ratio ($\text{PaO}_2/\text{FiO}_2$) and the Sequential Organ Failure Assessment (SOFA) score, between the two groups to confirm comparability in disease severity. Patients with incomplete medical records or missing key outcome data were excluded from analysis; no imputation methods were required due to complete data for primary and key secondary outcomes among included patients.

Tracheal Intubation Protocol and Data Collection

All endotracheal intubations were performed by senior attending anesthesiologists with a minimum of 5 years of experience in airway management. The procedures were conducted under videolaryngoscopic guidance using a wire-reinforced tracheal tube to ensure optimal visualization and placement accuracy.

Data were systematically extracted from the hospital's electronic inpatient medical record system. A standardized, pre-piloted data collection form was used to ensure consistency. To ensure data integrity and minimize entry errors, all clinical data were independently entered by two trained anesthesiologists, with discrepancies resolved through consensus or by a third investigator.

During the study period, there was no fixed, protocol-driven sedation or analgesia regimen. The selection, dosing, and duration of sedatives (propofol), analgesics (remifentanyl), and neuromuscular blocking agents (vecuronium) were determined at the discretion of the attending ICU physicians based on clinical assessment of patient comfort, agitation, ventilator synchrony, and underlying respiratory status. In our ICUs, all intubated patients received standardized nursing care, including cuff pressure monitoring every 4 hours (target 25–30 cmH₂O), heated humidification, closed tracheal suction systems, daily assessment of tube fixation and skin integrity, and routine oral care. These practices were consistent across both groups. Moreover, all patients in both groups received standard VAP prevention bundles as part of routine ICU care. These included semi-recumbent positioning (head-of-bed elevation 30–45°), daily sedation interruption and spontaneous breathing trials, subglottic secretion drainage when feasible, oral care with chlorhexidine solution, and strict hand hygiene protocols.

Outcome Measures

The primary outcomes of interest were the requirements for sedatives (propofol), analgesics (remifentanyl), and neuromuscular blocking agents (NMBAs, specifically vecuronium), including both the proportion of patients receiving these drugs and their dosages. Secondary outcomes included success rate of the first attempt of endotracheal intubation, incidence of tracheotomy, intubation-related complications (oronasal bleeding, oral ulcers, cuff leakage, sputum crust obstruction, and ventilator-associated pneumonia [VAP] diagnosed per standard criteria), and length of stay in the ICU. The decision to perform tracheotomy, including its timing, was made at the discretion of the attending ICU physicians based on clinical judgment. In general, tracheotomy was considered when prolonged mechanical ventilation (>10–14 days) was anticipated or when patients failed repeated weaning attempts.

Statistical Analysis

Statistical analyses were performed using IBM SPSS Statistics for Windows (Version 26.0; IBM Corp., Armonk, NY) and R software (Version 4.3.3). The Shapiro–Wilk test was used to assess the normality of continuous variables. Normally distributed data are presented as mean $\pm$ standard deviation (SD) and analyzed using the independent-samples *t*-test to compare the OTI and NTI groups. For non-normally distributed data, results are presented as median and interquartile range (IQR), with comparisons between groups made using the Mann–Whitney *U*-test. Categorical variables are expressed as frequencies and percentages (%), and group differences were evaluated using the Chi-square (χ^2) test or Fisher's exact test, as appropriate. A multivariable logistic regression model was employed to assess the association between the route of intubation and tracheotomy incidence, adjusting for demographic and clinical variables in stages. Model I was unadjusted. Model II adjusted for age and sex. Model III adjusted for BMI, PaO₂/FiO₂, and SOFA score. Statistical significance was defined as a two-tailed *P*-value < 0.05.

Results

Patient Selection and Baseline Characteristics

The patient selection process is detailed in [Figure 1](#). Briefly, a total of 45 severe COVID-19 pneumonia patients who underwent NTI between December 2022 and January 2023 were initially enrolled. Using propensity score matching based on age and sex, these patients were matched 1:1 with 45 controls who received OTI during the same period, forming the final study cohort of 90 patients. As summarized in [Table 1](#), there were no significant differences between the

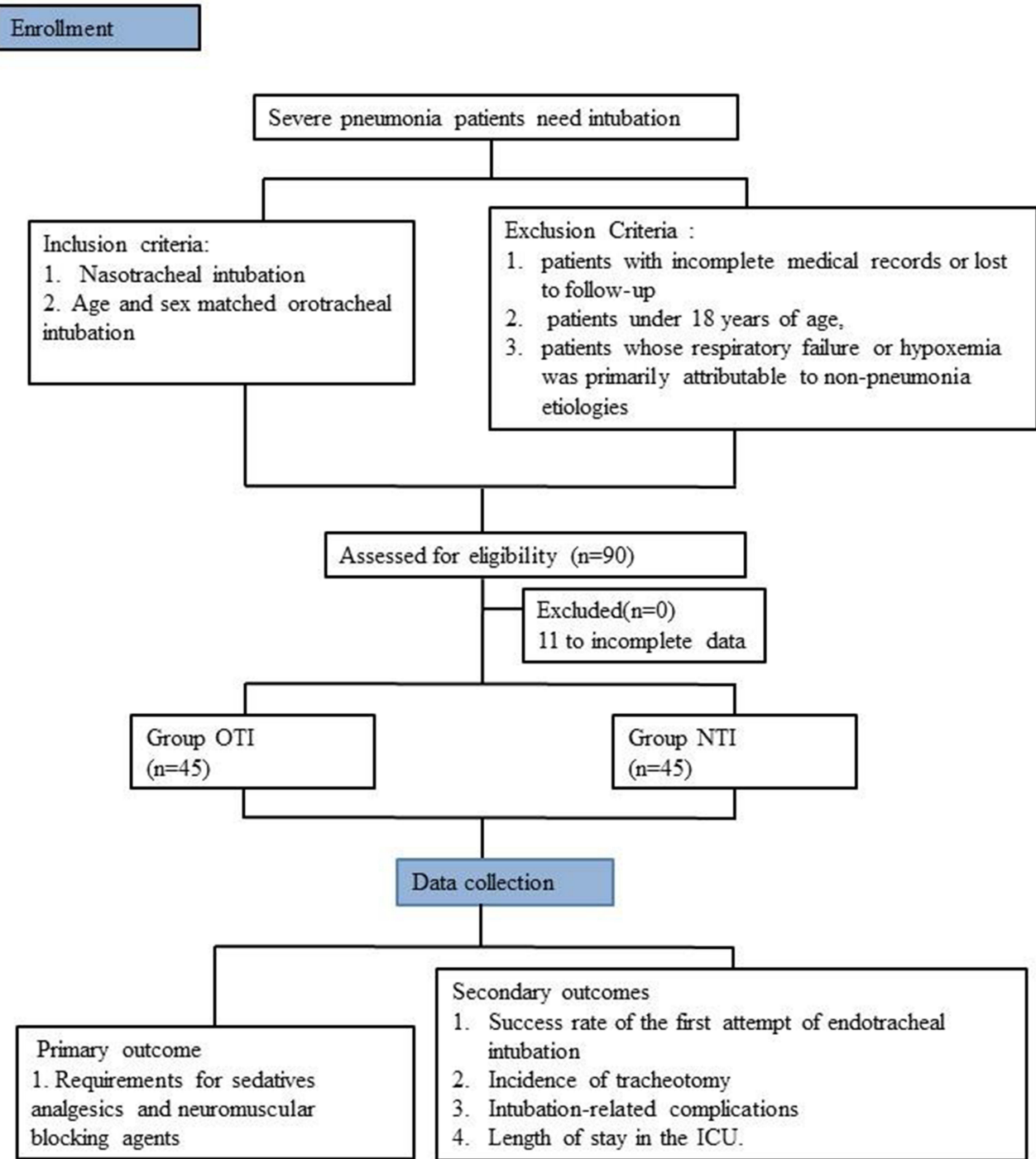


Figure 1 Patient Selection and Matching Flowchart.

two groups in terms of age, sex, height, weight, or prevalence of comorbidities such as hypertension, diabetes, coronary artery disease, and history of renal transplantation (all $P > 0.05$), indicating successful matching and well-balanced baseline characteristics. Importantly, the two groups did not differ significantly in disease severity, as reflected by $\text{PaO}_2/\text{FiO}_2$ ratio (NTI: 171.4 ± 40.1 vs. OTI: 173.3 ± 43.5 , $P = 0.827$) and SOFA score (NTI: 4 [3–6] vs. OTI: 4 [3–6], $P = 0.77$).

Table 1 Baseline Characteristics of the Study Cohort After Propensity Score Matching

	OTI (n = 45)	NTI (n = 45)	P-value
Age (years), mean $\pm$ SD	75.3 $\pm$ 11.5	76.3 $\pm$ 10.6	0.654
Sex (F), n (%)	10 (22.2)	10 (22.2)	1
Height (cm), mean $\pm$ SD	166.7 $\pm$ 6.8	162.3 $\pm$ 7.4	0.287
Weight (kg), mean $\pm$ SD	60.2 $\pm$ 7.2	65.0 $\pm$ 11.2	0.150
Hypertension, n (%)	28 (62.2)	29 (64.4)	0.827
Diabetes, n (%)	16 (35.6)	20 (44.4)	0.259
Coronary artery disease, n (%)	23 (51.1)	18 (40.0)	0.199
Patients kidney transplants, n (%)	0 (0.0)	1 (2.2)	0.315
PaO ₂ /FiO ₂ (mmHg), mean $\pm$ SD	171.4 $\pm$ 40.1	173.3 $\pm$ 43.5	0.827
SOFA score, Median (IQR)	4 (3,6)	4 (3,6)	0.77

Abbreviations: F, female; NTI, nasotracheal intubation; OTI, orotracheal intubation; PaO₂, Partial Pressure of Oxygen in Arterial Blood; FiO₂, Fraction of Inspired Oxygen SOFA, Sequential Organ Failure Assessment.

Analgesia, Sedation, and Neuromuscular Blockade

The requirements for anesthetic and adjuvant drugs are presented in Table 2. A significantly lower proportion of patients in the NTI group required continuous infusion of propofol (57.8% vs. 91.1%, $P < 0.001$), remifentanyl (33.3% vs. 86.7%, $P < 0.001$), and vecuronium (40.0% vs. 93.3%, $P < 0.001$). Of note, these differences in drug requirements were observed despite comparable baseline illness severity (PaO₂/FiO₂ and SOFA scores) between the two groups. Among those who received these drugs, the average infusion rates of propofol, remifentanyl, and vecuronium were all significantly lower in the NTI group (all $P < 0.01$), although the total cumulative doses were not statistically different. The duration of mechanical ventilation and ICU length of stay were similar between the groups.

Intubation Procedure Outcomes, Oral Intake, Tracheotomy, and Adverse Events

The efficacy and efficiency of the initial intubation attempt were comparable between the two groups. There were no significant differences in the success rate of the first attempt in two groups (OTI: 95.6% vs. NTI: 93.3%, $P = 0.500$). However, the NTI group required a tracheal tube with a significantly smaller internal diameter (7.0 $\pm$ 0.3 mm vs. 7.4 $\pm$ 0.2 mm, $P < 0.001$) and had a significantly longer duration of endotracheal intubation (200.9 $\pm$ 144.3 hours vs. 163.6 $\pm$ 84.7 hours, $P < 0.001$), as detailed in Table 3.

Clinical outcomes related to patient tolerance and nursing care are shown in Table 3. Notably, a subset of patients in the NTI group could maintain oral intake, with 17.8% able to drink autonomously ($P = 0.003$) and 4.4% able to consume

Table 2 Comparison of Ventilatory Support Duration and Drug Requirements Between the OTI and NTI Groups

	OTI (n = 45)	NTI (n = 45)	P-value
Duration of mechanical ventilation (h), mean $\pm$ SD	163.64 $\pm$ 84.69	200.91 $\pm$ 144.12	0.14
ICU LOS (d), median (IQR)	13 (5.5, 18.5)	11 (7.5, 19.5)	0.99
Propofol subgroup, no. of patients (%)	41 (91.11)	26 (57.78)	< 0.001
Total dose of propofol (mg), median (IQR)	9570 (2000, 12,200)	5250 (2320, 9275)	0.16
Average rate of propofol infusion (mg/kg/h), mean (min, max)	0.82 (0.50, 1.06)	0.32 (0.15, 0.46)	< 0.001
Remifentanyl subgroup, no. of patients (%)	39 (86.67)	15 (33.33)	< 0.001
Total dose of remifentanyl (mg), median (IQR)	17 (10, 34)	14 (10, 20)	0.86
Average rate of remifentanyl infusion (μ g/kg/h), mean (min, max)	0.68 (0.35, 0.94)	0.14 (0.08, 0.41)	0.002
Vecuronium subgroup, no. of patients (%)	42 (93.33)	18 (40.00)	< 0.001
Total dose of vecuronium (mg), median (IQR)	130 (60, 205)	60 (60, 205)	0.92
Average rate of vecuronium infusion (mg/kg/h), mean (min, max)	0.13 (0.06, 0.18)	0.007 (0.004, 0.009)	0.01

Note: Compared to the OTI group, $P < 0.05$ was considered to be statistically significant.

Abbreviations: OTI, orotracheal intubation; NTI, nasotracheal intubation; LOS, length of stay.

Table 3 Success Rate of Initial Intubation Attempt, Tube Diameter and Duration of Tube Retention, Patients' Food and Drink Intake, Incidence of Tracheotomy and Adverse Events

	OTI (n = 45)	NTI (n = 45)	P-value
Success rate of initial intubation attempt, n (%)	43 (95.6)	42 (93.3)	0.500
Internal diameter of tube (mm), mean $\pm$ SD	7.4 $\pm$ 0.2	7.0 $\pm$ 0.3	< 0.001
Duration of tube retention (h), mean $\pm$ SD	163.6 $\pm$ 84.7	200.9 $\pm$ 144.3	< 0.001
Autonomous drinking during intubation, n (%)	0 (0.0)	8 (17.8)	0.003
Self-feeding during intubation, n (%)	0 (0.0)	2 (4.4)	0.153
Tracheotomy, n (%)	12 (26.7)	3 (6.7)	0.011
Oral/nasal bleeding, n (%)	5 (11.1)	4 (8.9)	0.725
Oral ulceration, n (%)	18 (40.0)	5 (11.1)	0.002
Cuff leakage/sputum crust obstruction, n (%)	4 (8.9)	5 (11.1)	0.725
VAP, n (%)	29 (64.4)	28 (62.2)	0.827

Note: Compared with the OTI group, $P < 0.05$ was considered to be statistically significant.

Abbreviations: OTI, orotracheal intubation; NTI, nasotracheal intubation, VAP, ventilator-associated pneumonia.

Table 4 Multivariable Logistic Regression Analysis of the Association Between Intubation Method and Tracheotomy

Variable	n. total	n. event_ %	Model I		Model II		Model III	
			OR (95% CI)	P-value	OR (95% CI)	P-value	OR (95% CI)	p-value
Group OTI	45	12 (26.7)	1 (Ref)		1 (Ref)		1 (Ref)	
Group NTI	45	3 (6.7)	0.20 (0.05–0.75)	0.018	0.20 (0.05–0.76)	0.019	0.19 (0.05–0.81)	0.025

Notes: Model I: not adjusted for confounders. Model II= Model I+ sex + age. Model III=ModelII+ BMI + PaO₂/FiO₂ + SOFA.

Abbreviations: PaO₂, Partial Pressure of Oxygen in Arterial Blood; FiO₂, Fraction of Inspired Oxygen; SOFA, Sequential Organ Failure Assessment.

liquid food ($P = 0.153$). The incidence of tracheotomy was significantly lower in the NTI group (6.7% vs. 26.7%, $P = 0.011$). The incidence of adverse events is summarized in Table 3. The NTI group demonstrated a significantly lower rate of oral ulceration compared to the OTI group (11.1% vs. 40.0%, $P = 0.002$). No statistically significant differences were observed between the groups in the occurrence of oral/nasal bleeding, cuff leakage/sputum crust obstruction, or VAP.

Multivariable Logistic Regression Analysis of the Association Between Intubation Type and Tracheotomy

A total of 90 mechanically ventilated patients were included in the analysis, with 45 patients receiving OTI and 45 receiving NTI. The incidence of tracheotomy was 26.7% (12/45) in the OTI group and 6.7% (3/45) in the NTI group. In the unadjusted model (Model I), NTI was associated with a significantly lower odds of tracheotomy compared with OTI (OR = 0.20, 95% CI: 0.05–0.75; $P = 0.018$, Table 4). After adjustment for age and sex (Model II), the association remained significant (OR = 0.20, 95% CI: 0.05–0.76; $P = 0.019$). Further adjustment for BMI, PaO₂/FiO₂, and SOFA score (Model III) did not materially change the effect estimate, with NTI showing an adjusted odds ratio of 0.19 (95% CI: 0.05–0.81; $P = 0.025$), indicating a persistently lower likelihood of tracheotomy compared with OTI. These findings demonstrate that, across all models, NTI is independently associated with a substantially reduced risk of requiring tracheotomy in critically ill patients undergoing invasive mechanical ventilation.

Discussion

This matched retrospective study provides an exploratory comparison of clinical outcomes between NTI and OTI in patients with severe COVID-19 pneumonia. Our principal findings indicate that NTI is associated with significantly reduced requirements for sedatives, analgesics, and NMBAs, a lower incidence of tracheotomy, and a lower rate of oral ulcers, without increasing the risk of other complications such as VAP.

The demographic profile of our cohort, predominantly elderly males with significant comorbidities, reflects the high-risk population typically affected by severe COVID-19 pneumonia and its sequelae.^{9,10} The successful and rapid execution of both intubation techniques by experienced anesthesiologists underscores that, in skilled hands, NTI is a feasible and safe alternative to OTI in the ICU setting, despite the commonly perceived technical challenges. Importantly, our findings further support the safety of NTI in this critically ill population. Compared with OTI, NTI was not associated with an increased risk of oral or nasal bleeding (8.9% vs. 11.1%, $P = 0.725$), cuff leakage, or sputum crust obstruction, and no patient in the NTI group developed clinically evident sinusitis during the study period. In contrast, NTI was associated with a significantly lower incidence of oral ulcers (11.1% vs. 40.0%, $P = 0.002$), reflecting reduced oropharyngeal trauma and improved tube tolerance.

While our findings demonstrate a strong association between NTI and reduced tracheotomy risk, we must consider alternative explanations beyond the direct protective effect of the intubation route. First, despite propensity score matching and multivariable adjustment, the possibility of confounding by indication cannot be entirely excluded. Clinicians may have preferentially selected NTI for patients perceived to have a better prognosis or those in whom prolonged intubation was anticipated, potentially biasing the results in favor of NTI. However, the comparable baseline severity indicators ($\text{PaO}_2/\text{FiO}_2$ ratio and SOFA scores) between groups mitigate this concern to some extent.¹¹ Second, the observed association between NTI and lower sedation requirements could be subject to reverse causality: patients who were inherently more tolerant of an artificial airway or required less sedation for other clinical reasons may have been more likely to receive NTI. While our study design cannot definitively rule out this possibility, the consistent and substantial differences in drug requirements across multiple classes of agents (sedatives, analgesics, and neuromuscular blockers) suggest a true physiological difference in tube tolerance rather than selection bias alone. Third, unmeasured factors such as baseline neurological status, pre-existing swallowing function, or clinician expertise may have influenced both the choice of intubation route and subsequent outcomes. Future randomized trials are needed to overcome these inherent limitations of observational research.

A notable finding of our study is the substantial reduction in the proportion of patients requiring continuous sedative, analgesic, and NMBA infusions in the NTI group, which was observed despite comparable baseline disease severity between groups.^{12,13} This observed reduction suggests improved patient tolerance of the nasotracheal route. Discomfort and the gag reflex induced by an orotracheal tube often necessitate deeper sedation.¹⁴ The consequent reduction in sedative and NMBA exposure with NTI is clinically paramount, as it may mitigate the risks of drug accumulation, ventilator-associated diaphragm dysfunction, and delirium, thereby potentially facilitating earlier weaning from mechanical ventilation.^{15,16} It is noteworthy that while the total cumulative drug doses were comparable between groups, the significantly lower average infusion rates in the NTI group highlight a more stable sedation profile and potentially better tolerance over time.

Furthermore, the tracheotomy rate was markedly lower in the NTI group (6.7% vs. 26.7%). Multivariable analysis, adjusting for BMI, $\text{PaO}_2/\text{FiO}_2$, and SOFA score, confirmed a significant independent association between NTI and reduced tracheotomy risk. This finding may be attributed to the superior stability and patient tolerance of the nasotracheal tube, which could potentially delay or obviate the need for a surgical airway. This aligns with previous research in surgical patients, where NTI was associated with reduced urgency for tracheotomy.¹⁷ The potential to reduce tracheotomy rates is of considerable clinical importance, as tracheotomy is itself associated with procedural risks, increased care complexity, and longer recovery times.¹⁸ Notably, the NTI group had a significantly longer duration of endotracheal intubation, yet exhibited a lower tracheotomy rate. This apparent paradox may be explained by the improved patient comfort and tube stability afforded by NTI, which allows patients to tolerate prolonged intubation without requiring conversion to a surgical airway. The lower tracheotomy rate despite longer intubation further underscores the clinical advantage of NTI in terms of airway tolerability. Importantly, the longer intubation duration in the NTI group did not translate into increased complications, as the rates of VAP, bleeding, and other adverse events were comparable between groups. This suggests that the benefits of NTI in reducing sedation requirements and reducing oral ulcers outweigh the potential risks associated with longer intubation.

The absence of an oral tube may allow for more efficient and less cumbersome oral hygiene, which is crucial for preventing VAP.^{19,20} In resource-limited settings or during pandemic surges, such efficiency gains are invaluable. The correspondingly lower incidence of oral ulcers in the NTI group further substantiates the reduced oropharyngeal trauma and improved comfort, which may also contribute to a lower risk of secondary infections. Contrary to some previous reports,²¹ we observed no significant difference in the incidence of VAP between the two groups. This finding should be

interpreted with caution, as VAP is influenced by multiple factors beyond the route of intubation. Known risk factors such as the use of gastric tubes for enteral nutrition and the implementation of prone positioning may contribute substantially to VAP development.^{22–24} However, these factors were not collected in the present study, and their potential influence on the observed outcomes could not be assessed. Therefore, whether the intubation route itself exerts an independent effect on VAP risk remains unclear and warrants further investigation in prospective studies that account for these confounders.

Limitations

This study has several limitations. First, its retrospective and single-center design may introduce unmeasured confounding, even with the use of propensity score matching to adjust for key baseline characteristics. Second, the two-month recruitment window and relatively small sample size (n=90) limit statistical power and raise concerns about representativeness. This short period coincided with the peak Omicron wave in China, which may introduce cohort effects related to viral virulence, treatment protocols, and resource availability specific to that surge. Seasonal variation, fluctuations in clinical practice, and center-specific factors may have disproportionately influenced the results. Therefore, these findings require validation in larger, multi-center cohorts across different epidemic phases and geographic regions. Lastly, tracheotomy timing and indications were not systematically recorded, which may affect the interpretation of the observed difference in tracheotomy rates between groups. The applicability of these findings to other patient populations or healthcare settings requires further validation through larger, multi-center, prospective studies.

Conclusion

In this matched retrospective study, NTI was associated with lower sedation requirements, reduced neuromuscular blockade use, and a lower tracheotomy rate compared to orotracheal intubation in patients with severe COVID-19 pneumonia, despite comparable baseline illness severity between groups. However, given the observational design and potential for residual confounding, these findings should be considered hypothesis-generating. Prospective randomized trials are needed to confirm whether the intubation route itself directly affects clinical outcomes and to identify which patients may benefit most from this approach.

Confidentiality of Patient Data

Patient data were anonymized prior to analysis, and all medical records were handled in strict accordance with the institutional data protection policies to ensure confidentiality throughout the study period.

Data Sharing Statement

Data are available upon reasonable request from the corresponding author (luoruyi@csu.edu.cn).

Ethics Approval

The study protocol was carried out following the guidelines of the *Declaration of Helsinki* and was approved by the Ethics Committee of the Second Xiangya Hospital, Central South University (Approval No: 2023035).

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

None of the authors have any competing interests.

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