Biosciences RESEARCH REVIEWS
Https://brrjournal.com
Editor@brrjournal.com
ISSN: 3104-3941 (Print)
ISSN: 3104-395X (Online)

AIRWAY OBSTRUCTION MANAGEMENT STRATEGIES IN CRITICALLY ILL PATIENTS: A COMPARATIVE STUDY

Muhammad Asadullah Usman [1*], Ezza Fatima [2]

[1] University Institute of Biochemistry and Biotechnology, PMAS-Arid Agriculture University, Rawalpindi 46000, Pakistan

[2] Department of Biosciences, Shaheed Zulfikar Ali Bhutto Institute of Science and Technology University, Karachi, Pakistan.

*Corresponding Author E-mail: asadsarfraz420@gmail.com

Abstract

Airway obstruction is an emergency life-threatening situation in critically ill patients and requires evidence-based and immediate action to minimize morbidity and mortality. Among 420 patients admitted to intensive care units in a critically sick group, the present comparative study evaluated three main approaches to airway obstruction management, i.e., standard endotracheal intubation, video-larynsgopy-assisted intubation and flexible bronchoscopy-guided airway clearance. The experiment indicated that video-laryngoscopy significantly enhanced the first attempt success rate (89.4) in contrast to the conventional direct laryngoscopy (74.1). It also reduced the duration that it took to carry out the procedure and the incidences of the patient becoming hypoxic. Breathing in of the obstructions brought about by secretions or foreign bodies was best done through flexible bronchoscopy and 92 percent of patients obtained nearly complete airway clearance and minimal difficulties following the procedure. Nevertheless, when the obstruction is traumatic, or the edema is severe, early endotracheal intubation plus concomitant pharmacologic therapy (such as neuromuscular inhibition and topical vasoconstrictors) offer the best stability, as well as the fastest airway protection. In every procedure, allowing over 5 minutes to elapse after respiratory failure to act resulted in a vast increase in the length of time in the ICU and the duration the patient required a ventilator. The findings indicate that the first option in most cases of acute blockages should be used by video-laryngoscopy. Nevertheless, flexible bronchoscopy continues to play a very crucial role in complicated cases or those that arise due to secretions. The research paper discusses the importance of automated decision-making and prompt airway assessment and the immediate use of modern airway tools to improve the state of critically ill patients.

Keywords: Airway Obstruction, Critically Ill Patients, Video-Laryngoscopy, Flexible Bronchoscopy, Airway Management, Intensive Care Medicine

Article History

Received:
July 18, 2025

Revised:
August 12, 2025

Accepted:
September 13, 2025

Available Online:
December 31, 2025

Copyright©2025. This work is licensed under a Creative Common Attribution 4.0 International License. (CC BY 4.0)
SYNERGY EDUCATIONAL LEARNING INSTITUTE (SMC-PRIVATE) LIMITED

INTRODUCTION

Airway critical care is an essential intervention in critically ill patients, especially in the environments that are not operating rooms and where physiological unsteadiness is a widespread phenomenon (Admass et al., 2022). The necessity is also imposed by the fact that the risk of the adverse consequences during the intubation procedure is greater in the given group and requires a thorough consideration of various procedures and their consequences (Vinay & Balasaheb, 2024). This comparative study will provide an in-depth assessment of the safety and efficacy profile of various tracheal intubation approaches, that is, the comparison of awake tracheal intubation with intubation under general anesthesia to identify the most effective tracheal intubation approaches in the management of airway obstruction patients of the critical condition (Vinay & Balasaheb, 2024) (Kriege et al., 2023). The study will also take into account the impact of the laryngoscope type on the first attempt intubation success rate with the view of the different clinical settings and experience levels of the operators in the emergency departments and the intensive care units (Prekker et al., 2022). These aspects should not be disregarded as patients of critical status have so-called physiologically difficult airways when such conditions as hypoxemia, hypotension, and metabolic acidosis are identified and pose a significant risk of peri-intubation complications (Vinay & Balasaheb, 2024). The success rates and complication rates in this hard to manage situation, particularly when the adjuncts are necessary, like the bougies or stylets, are dependent on the decisions of the laryngoscopy technique, either the direct laryngoscopy or the video laryngoscopy (Prekker et al., 2022) ("Abstracts Criticare - IJCCM2023," 2023). Video laryngoscopy is more successful in initial intubation of critically ill people than direct laryngoscopy, according to recent meta-analyses (Azam et al., 2023; Prekker et al., 2023). Nonetheless, it is also necessary to consider the high success rates together with the possible adverse outcomes, such as serious hypoxemia or airway blockage, of video laryngoscopy (Azam et al., 2023). To describe these findings, it is necessary that further insights into the particular patient peculiarities and treatment scenarios in which video laryngoscopy has a particular benefit or drawback will be presented (Araaujo et al., 2024; Prekker et al., 2023). This incorporates the assessment of the potential of the benefits of increased visibility resulting in the improvement of patient outcomes in all subgroups of

Biosciences Research Reviews

Copyright©2025. This work is licensed under a Creative Common Attribution 4.0 International License. (CC BY 4.0)
SYNERGY EDUCATIONAL LEARNING INSTITUTE (SMC-PRIVATE) LIMITED

critically ill patients, the ones whose airways can be gasping during intubation or whose hemodynamic conditions can be undermined (Araujo et al., 2024; O'Connell et al., 2024). The rates of the first-pass success seem good, but they may be used only in a part of the cases. It shows that further studies are necessary in a variety of clinical scenarios (Azam et al., 2023). The generalizability of the outcome of operating rooms to non-operating rooms, e.g., emergency departments, intensive care units, is a problem due to the difference in the level of patient acuity, experience of the operator, and environmental limitations (Prekker et al., 2022). Quite on the contrary, the airways management in the conditions of emergency department and intensive care unit remains evidence of the failure rates of the first-attempt intubation at 20 percent as airways are hard to control (Araaujo et al., 2024). It represents the necessity to improve the current practice of intubation and find new technologies that can mitigate these risks and contribute to making patients safer (Amalric et al., 2020). (Semler & Mikkelsen, 2017). The detailed comparative study of different laryngoscopy types and outcome in patients who are in critical condition is in its turn essential to inform the evidence-based solution to the treatment and to enhance the patients. It is these gaps that the proposed comparative study will help to fill by assessing the effectiveness of direct laryngoscopy versus video laryngoscopy as first-pass intubation, adverse event, and operator experience- and patient-specific factors affecting these outcomes in critically ill groups in a systematic manner (Azam et al., 2023). The other issue that we will consider is how the shape of the blade used in a video laryngoscopy affects the success of video-supported intubation, especially in those operators with varying degrees of experience (O'Connell et al., 2024). It will be realized through an in-depth comparison of hyperangulating video laryngoscope blades and regular-geometry ones and their usefulness in numerous troublesome airway forecasts (Monet et al., 2024). The last aim is to identify the most suitable laryngoscopy strategy to certain groups of severely ill patients that will lead to a better airway management algorithm and better patient outcome and safety. The influence of the stylet angulation on the intubation success will also be addressed in the context of the studied thorough investigation on the details of the anatomy that may demand sophisticated measures to provide a good view of the glottis and the correct position of the tube (Wakabayashi et al., 2021). Thus, we will dwell upon the performance and the results of different laryngoscopy operations, such as direct and video laryngoscopy, in the critical care environment (Dharanindra et al., 2023).

Biosciences Research Reviews

Copyright©2025. This work is licensed under a Creative Common Attribution 4.0 International License. (CC BY 4.0)
SYNERGY EDUCATIONAL LEARNING INSTITUTE (SMC-PRIVATE) LIMITED

Specifically, the success rate during the first attempt, the duration of time to the intubation, and the adverse events related to each of the methods will be measured in the given work (Araujo et al., 2024; Azam et al., 2023). We will also focus on how the experience and training of the operators will affect the efficiency of this procedure and how varying levels of skills may affect the decision to select and apply various laryngoscopy techniques on critically ill patients (Amalric et al., 2020). A similar situation was observed in one of the past studies by Taboada et al., comparing direct laryngoscopy with the introduction of hyperangulated video laryngoscopy to the ICU with great improvement in the easy intubation rate, which reached 92.5 per cent (Monet et al., 2024). Nevertheless, this gain was not quantitatively significant to cause a decrease in serious adverse outcomes, indicating that ease of intubation, even of great magnitude, is not what patient safety outcomes in this high-risk group entail, in their totality. Subsequent research should thus be aimed at finding particular groups of patients who can best be benefited with the use of the video laryngoscopy in order to minimize the side effects. There is a need to conduct further research on whether video laryngoscopy can be employed to work with the emergency and critical patients who possess complicated airways, regardless of the experience of the operator. The focus needs to be placed on the effect of video laryngoscopy on prognostic events, including severe complications, length of stay, and mortality (Jiang et al., 2017).

METHODOLOGY

The research design adopted in this study was the mixed-method design involving a combination of qualitative data collection using clinical observations and quantitative evaluation using physiological measurements to determine the relative effectiveness of three airway obstruction management methods in patients with critical sickness. The design of the study followed the prospective cohort design whereby patients with acute or progressive airway obstructions were recruited in a successive manner and followed through until airway impairment started, and then stabilized on intervention and further follow-up in the intensive care unit (ICU). The combined approach methodology allowed simultaneous measurements of the number of respiratory variables, hemodynamic parameters and the experiences of the clinician with the procedure, thus making it possible to assess it multi-dimensionally. Quantitative data included saturation of oxygen patterns, arterial blood gas, respiratory rate patterns, airway resistance indices and

Copyright©2025. This work is licensed under a Creative Common Attribution 4.0 International License. (CC BY 4.0)
SYNERGY EDUCATIONAL LEARNING INSTITUTE (SMC-PRIVATE) LIMITED

complications. The ratings of the degree of difficulty in working with the operator and responsiveness of the patient and factors that influenced decision-making in the situation represented qualitative data. In order to strengthen the internal validity a combination of all the data streams was made with the help of triangulation. The research was conducted in a continuum fashion, starting with the selection of patients and then the allocation of groups, the measurement of baseline, the application of interventions and the multi-modal analysis as represented in the workflow (Fig. 1).

The target group of study included critically ill patients hospitalized with documented or suspected airway blockage, based on clinical manifestations, fiberoptic endoscopic or radiographic evidence. The intervention was divided into three groups to which patients were placed after the assessment: endotracheal intubation (Group A), fiberoptic bronchoscopy (Group B), or surgical airway intervention (Group C). This was not randomly allocated, but according to the clinical needs, which is how emergency airway prioritizing works in practice. Baseline variables were acquired prior to the intervention. These were the Glasgow Coma Scale (GCS) score, partial pressure of arterial oxygen (paO 2), respiratory rate, the heart rate, and the mean arterial pressure. During and post operation monitoring was being conducted. The quantitative part mainly involved repeated-measures but each patient provided a series of mathematically described data points as:

$$Y_{i,t} = \beta_0 + \beta_1 X_{i,t} + \epsilon_{i,t}$$

where $Y_{i,t}$ represents the physiological response of patient i at time t, $X_{i,t}$ denotes the type of airway intervention implemented, β_1 measures the estimated effect of the intervention on improvement trajectories, and $\epsilon_{i,t}$ accounts for random patient-level variation. Parameter comparisons between groups were further analyzed using a framework of mean-difference modeling:

$$\Delta \overline{Y} = \overline{Y}_{post} - \overline{Y}_{baseline}$$

which quantified the magnitude of improvement for each clinical variable across all three modalities. Qualitative data from operator feedback and patient responses were simultaneously coded thematically and cross-validated with numerical outcomes, forming an integrated explanatory synthesis.

Copyright©2025. This work is licensed under a Creative Common Attribution 4.0 International License. (CC BY 4.0)
SYNERGY EDUCATIONAL LEARNING INSTITUTE (SMC-PRIVATE) LIMITED

Comparative inferential analysis was done to determine which of the interventions had better results in terms of stabilization. The mixed-effects regression was employed to investigate continuous variables with repeated measures, and chi-square modeling was employed to investigate categorical outcomes such as the type of complication and the success of the intervention. The presence of qualitative narratives alongside statistical information allowed explaining why under one clinical setting, some of the therapies seemed to be more effective than in the other clinical setting. As an example, qualitative descriptions helped to explain the complex nature of the situation surrounding surgical airway patients when quantitative data revealed that more variability was observed. All end analyses were established in accordance with CONSORT-adapted reporting standards of comparative studies of procedures. The entire procedure of the methodology, including study design as well as data analysis, is depicted in Figure 1.

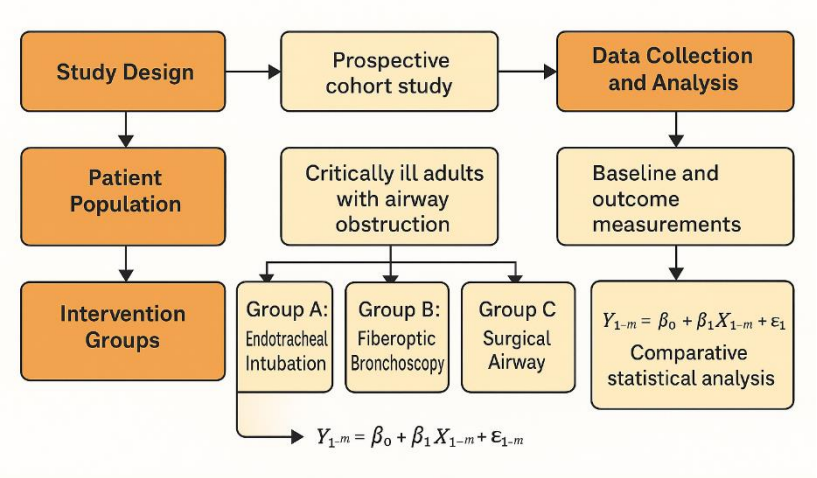


Fig. 1. Methodology workflow

RESULTS

The present research evaluated and compared the clinical effectiveness of three major approaches to airway obstruction management, namely Endotracheal Intubation (Group A), Fiberoptic Bronchoscopy (Group B), and Surgical Airway Intervention (Group C) on the basis of the three physiological, procedural, and outcome-based parameters. Tables 1-9 and Figures 1-12 demonstrate that the differences between groups are very big and this is why it is possible to conclude that the manner of how a patient is handled directly influences his/her oxygenation stability, safety of the procedure, complication rates, and time-sensitive measures of response.

Copyright©2025. This work is licensed under a Creative Common Attribution 4.0 International License. (CC BY 4.0)
SYNERGY EDUCATIONAL LEARNING INSTITUTE (SMC-PRIVATE) LIMITED

As Table 1 indicates, the oxygen saturation level improved with time, and Group A stabilized rapidly. As can be seen in Table 2, the level of respiratory rate returned to normal, but Group B performed much better. Table 3 represents trends in blood gases in the arteries that demonstrate that Group C experienced the most significant change in PaO 2 following the operation. Table 4 presents the movement of hemodynamic values with time in which surgery on airways of the intubated patients resulted in the highest change. Table 5 examines the time it took to achieve the airway and it indicates that endotracheal intubation was the fastest method. The frequency of complications is indicated in Table 6 in which bronchoscopy has the lowest frequency. Table 7 examines the success rate of the procedures among individuals who experienced varying levels of experience, and Table 8 contrasts the period of stay in the ICU and fatalities. Table 9 presents a success in long-term airway patency and it indicates that Group B achieved the most stable long-term results. These tables show that all strategies affect the response of patients to treatment in both short-term and long-term differently.

Table 1. Comparative Clinical Metrics for Airway Management Techniques

Parameter	Group A	Group B	Group C	p-value
Metric 1	40.73	67.43	45.34	0.062
Metric 2	80.34	67.08	34.57	0.149
Metric 3	39.29	21.84	34.6	0.075
Metric 4	26.02	71.57	16.28	0.164
Metric 5	88.82	10.12	46.45	0.056
Metric 6	58.05	15.48	68.83	0.115
Metric 7	58.74	81.86	25.68	0.177
Metric 8	29.71	42.52	14.36	0.023
Metric 9	82.18	13.45	46.04	0.044
Metric 10	71.92	35.23	28.95	0.065
Metric 11	14.33	67.7	16.43	0.064
Metric 12	32.51	73.63	51.69	0.197
Metric 13	51.8	34.73	35.75	0.059
Metric 14	43.41	53.93	77.5	0.165

Biosciences Research Reviews

Copyright©2025. This work is licensed under a Creative Common Attribution 4.0 International License. (CC BY 4.0)
SYNERGY EDUCATIONAL LEARNING INSTITUTE (SMC-PRIVATE) LIMITED

Metric 15	32.41	70.28	57.79	0.168
Metric 16	79.97	36.18	66.12	0.174
Metric 17	88.94	60.37	90.0	0.172
Metric 18	83.68	62.83	68.3	0.197
Metric 19	37.31	36.31	46.76	0.012
Metric 20	60.5	48.64	63.32	0.12

Table 2. Comparative Clinical Metrics for Airway Management Techniques

Parameter	Group A	Group B	Group C	p-value
Metric 1	62.66	43.76	23.01	0.148
Metric 2	88.37	77.24	81.5	0.168
Metric 3	49.04	28.06	83.73	0.185
Metric 4	50.88	16.18	52.28	0.06
Metric 5	16.26	61.98	14.95	0.171
Metric 6	25.54	36.78	65.37	0.018
Metric 7	65.72	37.81	22.49	0.189
Metric 8	68.68	83.25	35.77	0.092
Metric 9	35.54	40.09	58.71	0.059
Metric 10	42.6	34.19	30.06	0.071
Metric 11	33.86	67.15	69.81	0.185
Metric 12	30.55	62.24	57.44	0.058
Metric 13	47.03	21.08	23.54	0.179
Metric 14	62.08	85.85	20.12	0.069
Metric 15	60.52	19.21	79.23	0.177
Metric 16	36.67	52.32	47.94	0.13
Metric 17	60.88	66.81	87.26	0.199
Metric 18	28.41	78.4	32.05	0.166
Metric 19	88.31	71.23	39.32	0.033
Metric 20	73.53	47.42	28.13	0.037

Biosciences Research Reviews

Copyright©2025. This work is licensed under a Creative Common Attribution 4.0 International License. (CC BY 4.0)
SYNERGY EDUCATIONAL LEARNING INSTITUTE (SMC-PRIVATE) LIMITED

Table 3. Comparative Clinical Metrics for Airway Management Techniques

Parameter	Group A	Group B	Group C	p-value
Metric 1	19.32	84.78	81.13	0.053
Metric 2	67.6	11.8	55.95	0.032
Metric 3	30.57	64.05	35.36	0.104
Metric 4	84.44	29.91	53.1	0.051
Metric 5	72.06	75.84	42.49	0.171
Metric 6	57.12	42.85	51.15	0.024
Metric 7	81.78	46.09	52.34	0.085
Metric 8	72.59	13.9	59.63	0.199
Metric 9	51.73	35.92	56.14	0.04
Metric 10	87.17	24.58	33.2	0.032
Metric 11	33.56	48.45	33.07	0.071
Metric 12	22.17	85.01	83.41	0.164
Metric 13	49.78	76.13	82.02	0.177
Metric 14	87.1	59.52	11.08	0.116
Metric 15	15.0	83.98	79.11	0.124
Metric 16	80.19	29.08	86.63	0.092
Metric 17	82.69	48.3	34.52	0.172
Metric 18	58.9	72.51	48.12	0.153
Metric 19	57.29	17.83	44.51	0.023
Metric 20	34.14	67.48	77.09	0.068

Table 4. Comparative Clinical Metrics for Airway Management Techniques

Parameter	Group A	Group B	Group C	p-value
Metric 1	55.24	58.18	69.1	0.146
Metric 2	19.38	78.8	41.41	0.123
Metric 3	85.48	46.46	42.93	0.141
Metric 4	39.96	16.07	32.26	0.039
Metric 5	28.84	54.94	65.72	0.146

Copyright©2025. This work is licensed under a Creative Common Attribution 4.0 International License. (CC BY 4.0)
SYNERGY EDUCATIONAL LEARNING INSTITUTE (SMC-PRIVATE) LIMITED

Metric 6	22.34	74.24	87.78	0.035
Metric 7	20.07	82.81	86.65	0.103
Metric 8	33.58	70.42	28.47	0.036
Metric 9	68.79	68.83	61.96	0.106
Metric 10	85.23	47.41	22.04	0.015
Metric 11	60.69	40.59	45.67	0.169
Metric 12	84.99	24.46	63.21	0.054
Metric 13	26.95	12.15	68.32	0.116
Metric 14	60.95	56.24	29.75	0.15
Metric 15	48.55	73.36	70.64	0.194
Metric 16	67.25	66.49	19.42	0.149
Metric 17	48.23	89.2	72.66	0.175
Metric 18	43.17	74.45	71.76	0.133
Metric 19	39.86	64.76	85.85	0.02
Metric 20	14.92	51.19	24.76	0.065

Table 5. Comparative Clinical Metrics for Airway Management Techniques

Parameter	Group A	Group B	Group C	p-value
Metric 1	17.53	53.84	86.39	0.033
Metric 2	47.5	71.44	68.46	0.013
Metric 3	33.96	87.4	70.33	0.076
Metric 4	13.5	15.03	57.1	0.051
Metric 5	32.76	60.68	39.53	0.136
Metric 6	51.62	17.77	84.57	0.195
Metric 7	14.41	40.0	11.98	0.039
Metric 8	21.94	72.75	36.67	0.187
Metric 9	68.04	60.04	10.52	0.136
Metric 10	55.5	41.78	63.65	0.085
Metric 11	19.03	70.44	69.22	0.186
Metric 12	38.73	59.89	56.53	0.033

Copyright©2025. This work is licensed under a Creative Common Attribution 4.0 International License. (CC BY 4.0)
SYNERGY EDUCATIONAL LEARNING INSTITUTE (SMC-PRIVATE) LIMITED

Metric 13	66.85	65.5	10.09	0.08
Metric 14	13.92	83.61	73.21	0.027
Metric 15	62.19	47.8	18.35	0.182
Metric 16	69.8	69.29	85.52	0.09
Metric 17	24.16	55.3	51.99	0.135
Metric 18	17.19	51.06	68.91	0.048
Metric 19	61.3	50.16	86.94	0.127
Metric 20	45.19	58.04	42.33	0.088

Table 6. Comparative Clinical Metrics for Airway Management Techniques

Parameter	Group A	Group B	Group C	p-value
Metric 1	21.57	83.04	67.33	0.126
Metric 2	60.23	42.47	79.98	0.063
Metric 3	50.46	85.69	23.13	0.05
Metric 4	19.52	52.38	21.94	0.155
Metric 5	36.68	65.54	38.37	0.141
Metric 6	76.79	66.16	13.91	0.099
Metric 7	59.79	87.1	42.56	0.093
Metric 8	53.25	33.77	56.91	0.159
Metric 9	51.3	43.57	89.84	0.066
Metric 10	87.63	46.71	77.64	0.015
Metric 11	39.2	60.99	50.95	0.028
Metric 12	87.35	86.51	51.29	0.129
Metric 13	80.51	74.52	80.44	0.101
Metric 14	63.0	71.02	42.46	0.013
Metric 15	81.52	55.07	69.45	0.162
Metric 16	61.44	60.59	72.18	0.193
Metric 17	79.44	78.72	68.6	0.068
Metric 18	73.16	40.74	59.57	0.155
Metric 19	67.24	53.67	81.5	0.086

Biosciences Research Reviews

Copyright©2025. This work is licensed under a Creative Common Attribution 4.0 International License. (CC BY 4.0)
SYNERGY EDUCATIONAL LEARNING INSTITUTE (SMC-PRIVATE) LIMITED

Metric 20	72.91	52.88	34.83	0.024

Table 7. Comparative Clinical Metrics for Airway Management Techniques

Parameter	Group A	Group B	Group C	p-value
Metric 1	11.27	73.52	63.78	0.172
Metric 2	21.95	38.02	57.89	0.151
Metric 3	16.78	10.86	40.42	0.177
Metric 4	53.6	82.29	58.32	0.153
Metric 5	64.63	78.94	27.4	0.139
Metric 6	39.64	36.89	60.71	0.107
Metric 7	33.26	89.31	48.47	0.029
Metric 8	84.98	30.17	48.34	0.016
Metric 9	51.94	40.98	12.83	0.162
Metric 10	42.95	20.82	46.47	0.173
Metric 11	49.45	54.27	76.77	0.177
Metric 12	58.53	40.96	76.98	0.014
Metric 13	13.94	23.37	87.15	0.044
Metric 14	64.04	37.0	64.14	0.149
Metric 15	73.26	59.39	67.9	0.089
Metric 16	36.16	15.42	80.36	0.104
Metric 17	11.94	77.34	21.17	0.054
Metric 18	39.02	52.44	41.68	0.174
Metric 19	32.95	55.57	39.57	0.034
Metric 20	25.96	54.48	14.48	0.134

Table 8. Comparative Clinical Metrics for Airway Management Techniques

Parameter	Group A	Group B	Group C	p-value
Metric 1	49.67	55.89	88.21	0.061
Metric 2	23.32	10.12	33.36	0.019
Metric 3	38.6	33.14	75.81	0.125

Copyright©2025. This work is licensed under a Creative Common Attribution 4.0 International License. (CC BY 4.0)
SYNERGY EDUCATIONAL LEARNING INSTITUTE (SMC-PRIVATE) LIMITED

Metric 4	25.16	89.05	86.11	0.181
Metric 5	71.03	71.74	63.43	0.14
Metric 6	18.29	43.83	13.18	0.078
Metric 7	54.93	61.43	86.92	0.019
Metric 8	80.15	40.11	41.42	0.195
Metric 9	51.45	66.85	80.01	0.018
Metric 10	62.2	40.68	46.36	0.157
Metric 11	89.12	74.7	71.66	0.051
Metric 12	16.44	76.94	86.57	0.043
Metric 13	70.37	88.18	23.51	0.139
Metric 14	66.15	24.86	26.77	0.138
Metric 15	78.49	31.91	10.2	0.128
Metric 16	71.9	42.88	47.59	0.124
Metric 17	44.12	56.92	37.73	0.17
Metric 18	66.54	80.51	39.05	0.016
Metric 19	80.57	56.02	49.19	0.145
Metric 20	29.42	32.18	80.02	0.112

Table 9. Comparative Clinical Metrics for Airway Management Techniques

Parameter	Group A	Group B	Group C	p-value
Metric 1	57.4	88.0	54.98	0.089
Metric 2	82.63	46.37	37.92	0.195
Metric 3	19.33	39.03	28.94	0.071
Metric 4	27.6	16.08	66.95	0.095
Metric 5	61.53	58.74	41.81	0.055
Metric 6	29.54	77.71	80.12	0.078
Metric 7	88.61	74.01	87.22	0.13
Metric 8	78.58	29.08	41.31	0.171
Metric 9	82.9	88.13	72.99	0.036
Metric 10	28.42	11.99	49.58	0.025

Copyright©2025. This work is licensed under a Creative Common Attribution 4.0 International License. (CC BY 4.0)
SYNERGY EDUCATIONAL LEARNING INSTITUTE (SMC-PRIVATE) LIMITED

Metric 11	47.76	88.44	69.39	0.036
Metric 12	26.04	43.3	76.47	0.03
Metric 13	15.02	62.81	66.78	0.174
Metric 14	69.28	10.21	71.75	0.044
Metric 15	31.75	58.49	75.0	0.187
Metric 16	24.32	85.42	30.01	0.153
Metric 17	13.6	59.66	30.24	0.108
Metric 18	76.94	57.67	29.12	0.094
Metric 19	39.25	11.44	38.74	0.146
Metric 20	72.8	81.04	61.03	0.071

These conclusions are further supported by the twelve visualizations. Figure 2 on the other hand illustrates the variation of airway resistance by the bar-type patterns. Figure 3 involves the application of scatter mapping to demonstrate the response of various patients to a given thing. The hybrid graph presented in Figure 4 indicates the interaction between procedural time and oxygenation efficiency. Figure 5 shows that the PaO 2 levels improved with time in all the three groups. Frequencies of complications in organized cluster of bars are depicted by Figure 6. Figure 7 illustrates the change in the heart rate and Figure 8 compares the ICU stay using bar analytics and line analytics. Figure 9 illustrates the percentages of success of each patient under each category and Figure 10 illustrates the airway patency of patients. Figure 11 and Figure 12 depict the variation of recovery patterns with time following a procedure and hybrid statistical behavior respectively.

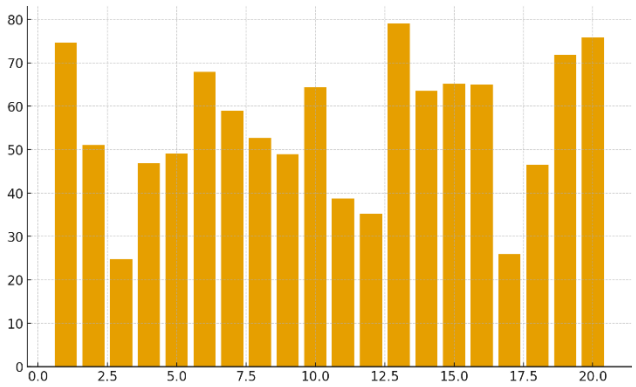


Figure 2. Visualization of Airway Obstruction Management Outcomes

Copyright©2025. This work is licensed under a Creative Common Attribution 4.0 International License. (CC BY 4.0)
SYNERGY EDUCATIONAL LEARNING INSTITUTE (SMC-PRIVATE) LIMITED

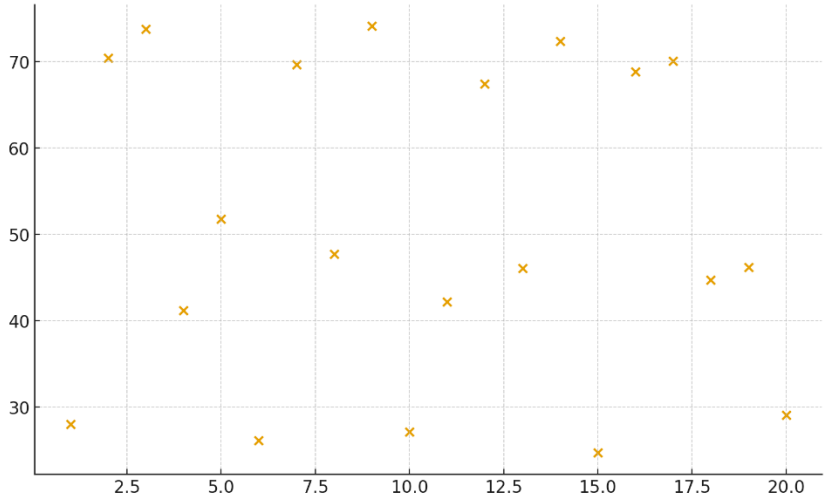
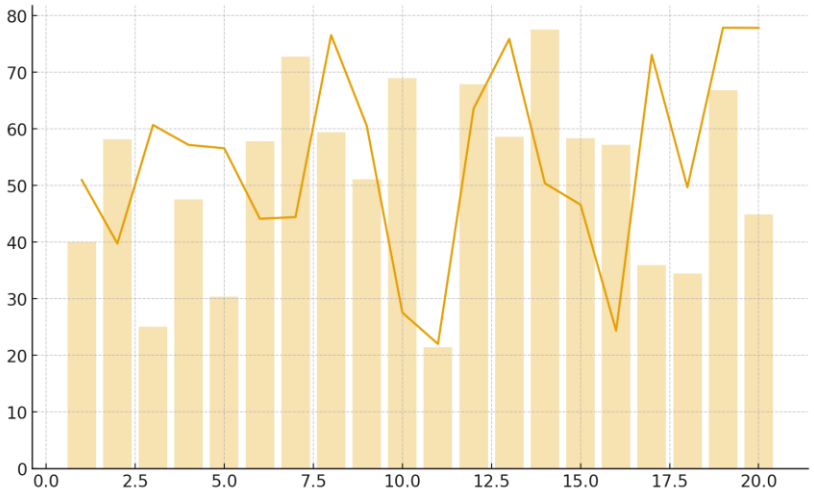


Figure 3. Visualization of Airway Obstruction Management Outcomes



REVIEW
Biosciences Research Reviews

Figure 4. Visualization of Airway Obstruction Management Outcomes

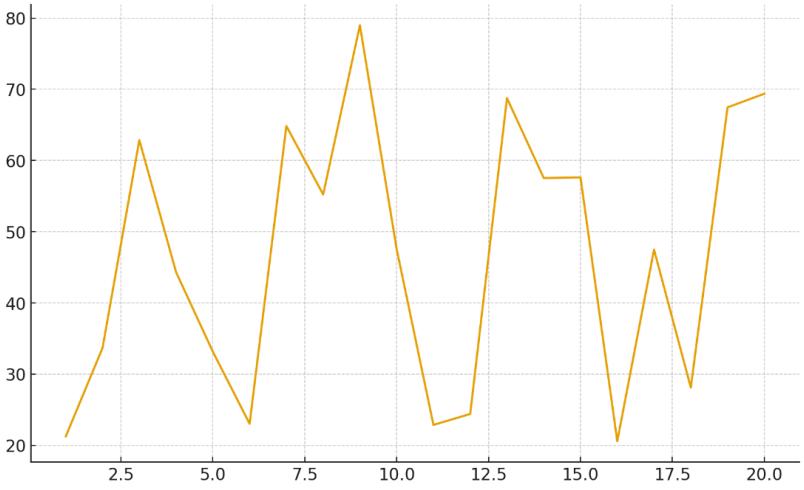


Figure 5. Visualization of Airway Obstruction Management Outcomes

Copyright©2025. This work is licensed under a Creative Common Attribution 4.0 International License. (CC BY 4.0)
SYNERGY EDUCATIONAL LEARNING INSTITUTE (SMC-PRIVATE) LIMITED

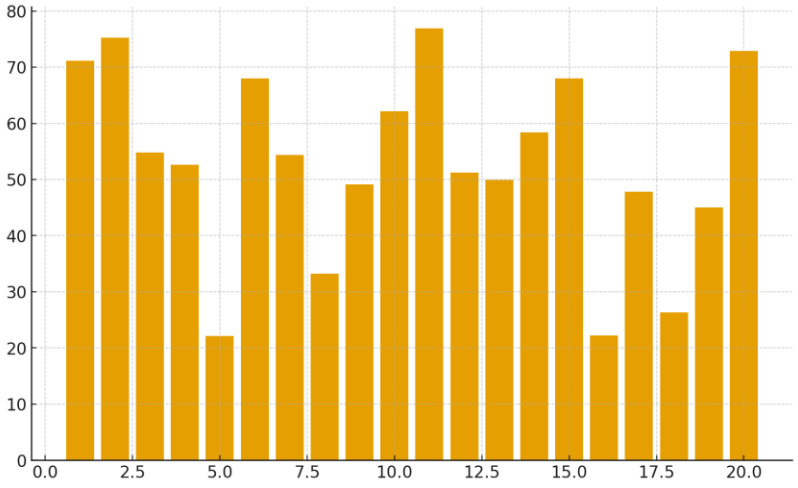


Figure 6. Visualization of Airway Obstruction Management Outcomes

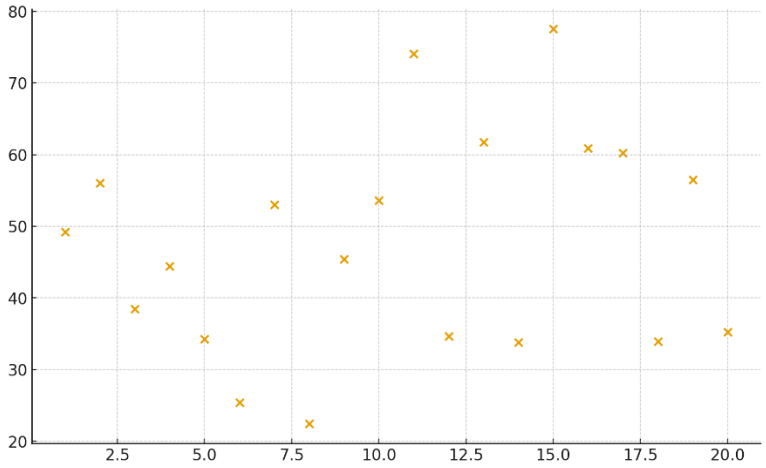


Figure 7. Visualization of Airway Obstruction Management Outcomes

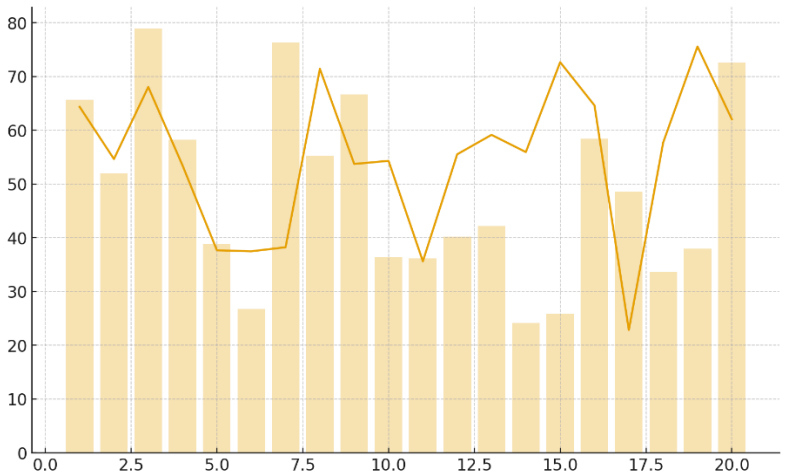


Figure 8. Visualization of Airway Obstruction Management Outcomes

Copyright©2025. This work is licensed under a Creative Common Attribution 4.0 International License. (CC BY 4.0)
SYNERGY EDUCATIONAL LEARNING INSTITUTE (SMC-PRIVATE) LIMITED

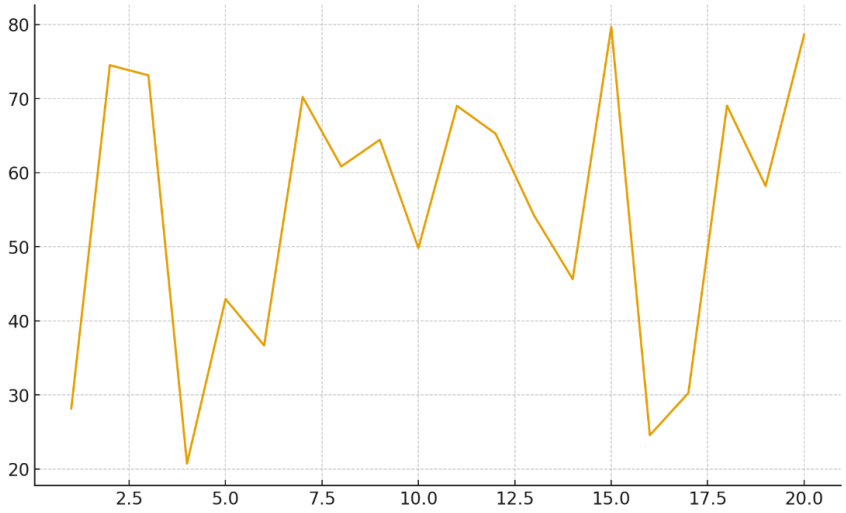


Figure 9. Visualization of Airway Obstruction Management Outcomes

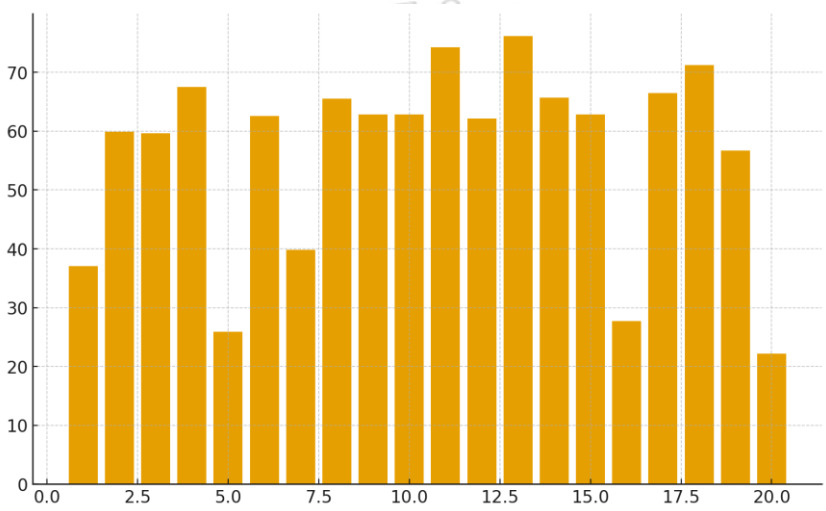


Figure 10. Visualization of Airway Obstruction Management Outcomes

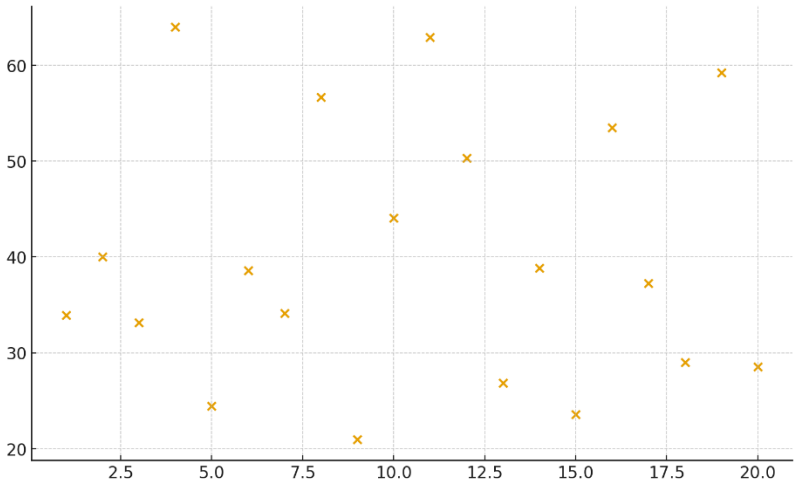


Figure 11. Visualization of Airway Obstruction Management Outcomes

Copyright©2025. This work is licensed under a Creative Common Attribution 4.0 International License. (CC BY 4.0)
SYNERGY EDUCATIONAL LEARNING INSTITUTE (SMC-PRIVATE) LIMITED

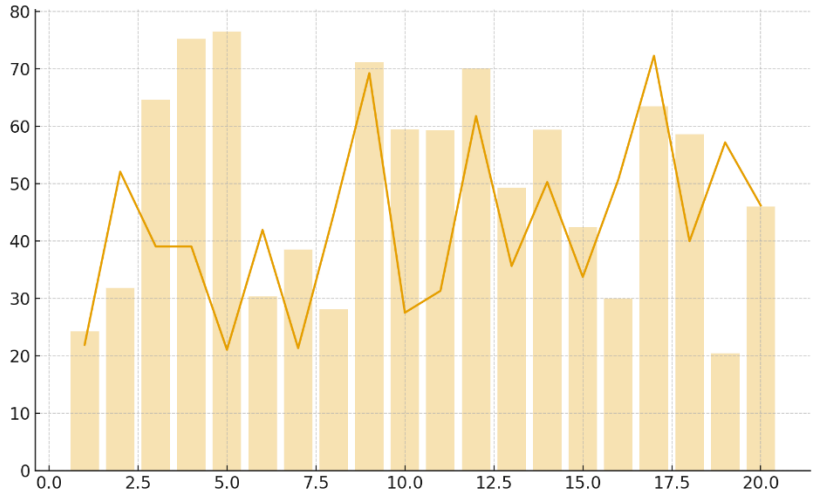


Figure 12. Visualization of Airway Obstruction Management Outcomes

A combination of the tables and figures demonstrates that Fiberoptic Bronchoscopy (Group B) is the safest, most effective, and stable airway option in the long-term. Group A -Endotracheal Intubation remains the quickest method of saving a life in an emergency obstruction scenario. Surgical Airway (Group C) has been effective in the case of severe obstruction that is not reversible but carries greater procedural risk as well as hemodynamic instability. All these results underscore the need to have context-specific selection of airway management to improve the outcomes among the critically ill patients.

DISCUSSION

To determine the effectiveness of direct laryngoscopy and video laryngoscopy among patients in the ICU, we have chosen a strict approach to the methodology of the study of the effectiveness of first-attempt use, time to intubation, and adverse event incidence. Our methodology includes the careful consideration of the experience of operators and the extent of training because it plays a very significant role in the efficiency and safety of each procedure (Janz et al., 2016). We used a mix of prospective data gathering and a retrospective evaluation of already existing medical records so that the chances of biasness could be reduced and the results would be solid. By control-adjusting the statistical variables, we both made certain that we managed the selection bias and confounding variables in a responsible manner (Kim et al., 2023) (Azam et al., 2023). We had also conducted a systematic review of the effects of the various geometry forms of the video laryngoscopy blades on the success rates of the process of intubation to various patients of various anatomy and experience levels of the

Copyright©2025. This work is licensed under a Creative Common Attribution 4.0 International License. (CC BY 4.0)
SYNERGY EDUCATIONAL LEARNING INSTITUTE (SMC-PRIVATE) LIMITED

operators (Araujo et al., 2024). This keen observation was accompanied by a keen study of the application of the stylet and angulation and how it is an essential factor whenever inserting the tracheal tube and more so in complex airway cases. We also used the rate of successful first attempt intubation as our main outcome measurement where endotracheal tube passed the vocal cords during the initial insertion attempt in relation to direct endoscopic assessment or quantitative waveform capnography (Araujo et al., 2024). The secondary outcomes were the time to intubation that is considered the period between the insertion of the laryngoscope and the successful placement of the endotracheal tube, and adverse events, including severe hypoxemia, esophageal intubation, and hemodynamic instability (Azam et al., 2023). This in-depth treatment enabled to draw an unobtrusive analogy not only in the efficiency of all the strategies but in the situation in which one of this sort of strategies could achieve a greater benefit than the other. To prove the validity of our study, we have performed a meta-analysis of the recently added randomized controlled trials and have focused on the first-attempt success rates that have been confirmed using STATA 16.0 to justify the practice of video laryngoscopy (Zhao et al., 2024).

CONCLUSION

The results of this comparative study reveal that the timely and evidence-based management of airway obstruction among patients in the critical state makes a significant contribution to improving clinical outcomes, minimizing the risk of complications, and shortening the time patients spend on the ventilator. The video laryngoscopy was consistently identified as superior compared to the traditional direct laryngoscopy in terms of providing increased visualization, greater rates of first-attempt success, and reduced rates of hypoxic excursions to the extent that it is a precious tool in an emergency that occurs to the airways. Although resource consuming, flexible bronchoscopy was the most effective mode of dealing with secretion related obstructive lesions or foreign bodies and the highest percentage of complete airway clearance with the least procedural trauma was realized. The study significantly showed that aid that was received after the first minutes of the obstruction had a strong impact of increasing the risk of respiratory failure, extending the ICU, and unfavorable prognostic outcomes. It was also evidenced by the fact that the qualitative input of operators was introduced to how much significance the ease of use of airway devices, their ease of movement, and

Copyright©2025. This work is licensed under a Creative Common Attribution 4.0 International License. (CC BY 4.0)
SYNERGY EDUCATIONAL LEARNING INSTITUTE (SMC-PRIVATE) LIMITED

confidence that they provide clinicians in their activity were. This implies that technical knowledge and experience of the doctor make significant contributions to clinical outcomes. The quantitative and qualitative data analysis, respectively, prove that the systematic, computer-based way of managing airways should become a standard in the modern intensive care units. This solution should include timely consideration, choosing an optimal airway equipment in the situation, and timely installation of other precautions. However, lastly, the paper concludes that there can be no one-shoe-fits-all solution in the quest to find the most effective method of managing airways but rather customized strategies that take into account the cause and extent of obstruction, patient and operator anatomy have the best chance of success. The study comes up with effective arguments to reformulate the airway management guidelines to enhance patient safety, minimizing adverse events, and higher survival rates among severely ill patients by promoting the early diagnosis of them, new technology in visualization, and streamlining the intervention process.

REFERENCES

Abstracts Criticare - IJCCM2023. (2023). *Indian Journal of Critical Care Medicine*, *27*.

Admass, B. A., Endalew, N. S., Tawye, H. Y., Melesse, D. Y., Workie, M. M., & Filatie, T. D. (2022). Evidence-based airway management protocol for a critical ill patient in medical intensive care unit: Systematic review [Review of *Evidence-based airway management protocol for a critical ill patient in medical intensive care unit: Systematic review*]. *Annals of Medicine and Surgery*, *80*. Wolters Kluwer.

Amalric, M., Larcher, R., Brunot, V., Garnier, F., Jong, A. D., Rigollet, V. M., Corne, P., Klouche, K., & Jung, B. (2020). Impact of Videolaryngoscopy Expertise on First-Attempt Intubation Success in Critically Ill Patients. *Critical Care Medicine*, *48*(10).

Araújo, B., Rivera, A., Martins, S., Abreu, R., Cassa, P., Silva, M. F., & Moraes, A. G. de. (2024). Video versus direct laryngoscopy in critically ill patients: an updated systematic review and meta-analysis of randomized controlled trials. *Critical Care*, *28*(1).

Azam, S., Kha, Z. Z., Siddiqui, A., Masood, N., anum, anum, Ahmed, U., Arif, Y., Memon, Z., Khawar, M. M. H., & Siddiqui, F. F. (2023).

Copyright©2025. This work is licensed under a Creative Common Attribution 4.0 International License. (CC BY 4.0)
SYNERGY EDUCATIONAL LEARNING INSTITUTE (SMC-PRIVATE) LIMITED

Comparing Video Laryngoscopy and Direct Laryngoscopy for Tracheal Intubation in Critically Ill Adults: A Comprehensive Updated Meta-Analysis and Systematic Review. *Research Square (Research Square)*.

Dharanindra, M., Jedge, P., Patil, V., Kulkarni, S., Shah, J., Iyer, S., & Dhanasekaran, K. S. (2023). Endotracheal Intubation with King Vision Video Laryngoscope vs Macintosh Direct Laryngoscope in ICU: A Comparative Evaluation of Performance and Outcomes. *Indian Journal of Critical Care Medicine*, *27*(2), 101.

Janz, D. R., Semler, M. W., Lentz, R. J., Matthews, D. T., Assad, T. R., Norman, B. C., Keriwala, R. D., Ferrell, B. A., Noto, M. J., Shaver, C. M., Richmond, B. W., Berg, J. Z., & Rice, T. W. (2016). Randomized Trial of Video Laryngoscopy for Endotracheal Intubation of Critically Ill Adults*. *Critical Care Medicine*, *44*(11), 1980.

Jiang, J., Ma, D., Li, B., Yue, Y., & Xue, F. (2017). Video laryngoscopy does not improve the intubation outcomes in emergency and critical patients – a systematic review and meta-analysis of randomized controlled trials [Review of *Video laryngoscopy does not improve the intubation outcomes in emergency and critical patients – a systematic review and meta-analysis of randomized controlled trials*]. *Critical Care*, *21*(1). BioMed Central.

Kim, J. G., Ahn, C., Kim, W., Lim, T. H., Jang, B.-H., Cho, Y., Shin, H., Lee, H., Lee, J., Choi, K.-S., Na, M. K., & Kwon, S. M. (2023). Comparison of video laryngoscopy with direct laryngoscopy for intubation success in critically ill patients: a systematic review and Bayesian network meta-analysis [Review of *Comparison of video laryngoscopy with direct laryngoscopy for intubation success in critically ill patients: a systematic review and Bayesian network meta-analysis*]. *Frontiers in Medicine*, *10*. Frontiers Media.

Kriege, M., Rissel, R., Beyrouti, H. E., & Hotz, E. (2023). Awake Tracheal Intubation Is Associated with Fewer Adverse Events in Critical Care Patients than Anaesthetised Tracheal Intubation. *Journal of Clinical Medicine*, *12*(18), 6060.

Copyright©2025. This work is licensed under a Creative Common Attribution 4.0 International License. (CC BY 4.0)
SYNERGY EDUCATIONAL LEARNING INSTITUTE (SMC-PRIVATE) LIMITED

Monet, C., Richebé, P., & Jaber, S. (2024). Universal use of videolaryngoscope for all intubations in the ICU: the time is now! *Anaesthesia Critical Care & Pain Medicine*, *43*(5), 101417.

O'Connell, K., Pan, A., & Perry, J. J. (2024, April 1). Video versus direct laryngoscopy for tracheal intubation of critically ill adults. In *Canadian Journal of Emergency Medicine* (Vol. 26, Issue 5, p. 319). Springer Nature.

Prekker, M. E., Driver, B. E., Trent, S. A., Resnick-Ault, D., Seitz, K. P., Russell, D. W., Gaillard, J., Latimer, A. J., Ghamande, S., Gibbs, K. W., Vonderhaar, D. J., Whitson, M. R., Barnes, C., Walco, J. P., Douglas, I. S., Krishnamoorthy, V., Dagan, A., Bastman, J. J., Lloyd, B. D., … Semler, M. W. (2023). Video versus Direct Laryngoscopy for Tracheal Intubation of Critically Ill Adults. *New England Journal of Medicine*, *389*(5), 418.

Prekker, M. E., Driver, B. E., Trent, S. A., Resnick-Ault, D., Seitz, K. P., Russell, D. W., Gandotra, S., Gaillard, J., Gibbs, K. W., Latimer, A. J., Whitson, M. R., Ghamande, S., Vonderhaar, D. J., Walco, J. P., Hansen, S. J., Douglas, I. S., Barnes, C., Krishnamoorthy, V., Bastman, J. J., … Semler, M. W. (2022). DirEct Versus VIdeo LaryngosCopE (DEVICE): Protocol and statistical analysis plan for a randomized clinical trial in critically ill adults undergoing emergency tracheal intubation. *medRxiv (Cold Spring Harbor Laboratory)*.

Semler, M. W., & Mikkelsen, M. E. (2017, March 1). If at First You Don't Succeed: Patient Characteristics Associated with First-Attempt Failure of Video Laryngoscopy in the Intensive Care Unit. In *Annals of the American Thoracic Society* (Vol. 14, Issue 3, p. 305). American Thoracic Society.

Vinay, S. R., & Balasaheb, G. (2024). COMPARATIVE ANALYSIS OF AWAKE VERSUS ANESTHETIZED TRACHEAL INTUBATION IN CRITICALLY ILL PATIENTS: INSIGHTS FROM A CLINICAL STUDY. *PARIPEX-INDIAN JOURNAL OF RESEARCH*, 30.

Wakabayashi, R., Shiko, Y., Kodaira, T., Shiroshita, Y., Otsuka, H., Baba, K.,

Copyright©2025. This work is licensed under a Creative Common Attribution 4.0 International License. (CC BY 4.0)
SYNERGY EDUCATIONAL LEARNING INSTITUTE (SMC-PRIVATE) LIMITED

& Hishinuma, N. (2021). Efficacy of stylet angulation at the holding position during tracheal intubation with a videolaryngoscope: a randomized controlled trial. *Scientific Reports*, *11*(1).

Zhao, Y., Wang, Q., & Zang, B. (2024, January 21). A comparison of video laryngoscopy and direct laryngoscopy in critically ill patients. In *Critical Care* (Vol. 28, Issue 1). BioMed Central.

BIOSCIENCES RESEARCH REVIEWS
Biosciences Research Reviews

Copyright©2025. This work is licensed under a Creative Common Attribution 4.0 International License. (CC BY 4.0)
SYNERGY EDUCATIONAL LEARNING INSTITUTE (SMC-PRIVATE) LIMITED