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Rapid Sequence Intubation in the ER Using Video Laryngoscopy and Direct Laryngoscopy

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ABSTRACT

Endotracheal intubation, or EI, is a common procedure in the ICU, particularly for critically ill patients who require mechanical ventilation or airway compromise. This patient population presents unique challenges, including anatomic conditions, physiologic factors, logistics, and operator experience. The objective of the systematic was to assess the efficacy of video laryngoscopy compared to direct laryngoscopy in rapid sequence intubation procedures, particularly in intensive care units, intending to evaluate various outcomes such as laryngeal visualization, intubation success rates, time to intubation, and other complications. Systematic review and meta-analysis of nineteen have been conducted according to PRISMA guidelines, sourcing articles from January 2005 to February 2023 across databases like PubMed and Google Scholar. Studies in English comparing video laryngoscopy and direct laryngoscopy for rapid sequence intubation were included. Quality assessment adhered to Cochrane risk of bias guidelines, and the meta-analysis utilized a Mantel-Haenszel random-effect model with a 95% confidence interval for precision. The results concluded that VL exhibited higher first-attempt intubation success rates than DL, but no significant differences were observed in overall success rates. Time to intubation showed a slight reduction with VL compared to DL, while complications such as hypotension and dental trauma were moderately higher with VL. In summary, the utilization of VL in rapid sequencing intubation has been linked to a reduced time to achieve successful intubation compared to DL. However, additional analysis, such as hospital duration of stays, follow-up time, and monitoring of adverse events, has been necessary for a thorough meta-analysis.

INTRODUCTION

Endotracheal intubation, or EI, is a common procedure in the ICU, particularly for critically ill patients who require mechanical ventilation or airway compromise (Hypes *et al.*, 2016). This patient population presents unique challenges, including anatomic conditions, physiologic factors, logistics, and operator experience. The Risk of complications increases with repeated attempts and the inability to abandon intubation attempts. It has become crucial to develop methods to optimize chances for first-attempt success (Baek *et al.*, 2018). EI is associated with a higher rate of complications outside the emergency room than inside. Successful intubation at first attempt is important in emergency settings, as multiple intubation attempts have been associated with several complications (Baek *et al.*, 2018).

Prehospital intubations (PI) may differ from clinical intubations due to impaired patient access and airway access, neck and face Trauma, an oral intake history, or the potential for body fluids in the airway. Monitoring, equipment, limited care providers, and environmental issues can impede EI (Cavus *et al.*, 2018). PI relies on airway devices that are easy to use, quick, and reliable. Over the past few years, Macintosh Laryngoscopy (ML) has performed Direct Laryngoscopy (DL). Due to several drawbacks, recently, Video Laryngoscopy (VL), a device that has been developed, comprises a miniaturized camera at the tip of the blade for an indirect visualization of the glottis.

Direct Laryngoscopy

Direct laryngoscopy (DL) is the most common emergency EI method, introduced over 50 years ago (Goksu *et al.*, 2016). The Macintosh laryngoscope (MCL) was the 'gold standard' device for DL and EI, invented by Foregger in the 1940s (Pournajafian *et al.*, 2014). The technique involves high forward and upward force on the handle to visualize the glottis by aligning oral, pharyngeal, and laryngeal axes (Panwar *et al.*, 2020). DL has been the primary technique for or Tracheal Intubation (TI) in the ICU, but it has been associated with a concerning the rate of challenging intubations and other complications in ICU (Panwar *et al.*, 2020).

Video Laryngoscopy

Over the past decade, various airway equipment, including a VL, has been developed and compared to conventional ML (Dey *et al.*, 2020). VL, a device with a camera attached to the blade tip, might increase the first-attempt intubation success rate (Baek *et al.*, 2018; Hypes *et al.*, 2016). It allows operators to direct the tube without visualization, potentially improving performance. VL requires less airway manipulation, resulting in less hemodynamic stress responses. Studies suggest that, as compared to DL, VL yields a higher success rate for first-attempt intubation (Gao *et al.*, 2018; Goksu *et al.*, 2016)

METHODOLOGY

The present research performed a systematic review and

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meta-analysis following the "Preferred Reporting Items for Systematic Reviews and Meta-analysis" (PRISMA) guidelines.

Data Source and Search Strategy

Articles were retrieved for publication from January 2005 to February 2023 from three databases: "PubMed, Google Scholar, and Cochrane Library". The strategy was based on the population, intervention, control and outcome (PICO) format. The population of interest was critically ill adults admitted for rapid sequence intubations; the intervention was video laryngoscopy; the comparison was direct laryngoscopy, and the outcomes of interest are first attempt intubation success rate, time of intubations, and complication arising from intubation.

The search was performed using the following keywords; "Fiberoptic intubation" OR "C-MAC rapid sequence intubation" "Rapid sequence induction" AND "C-MAC" OR "Direct laryngoscopy" OR "Video-assisted devices" OR "Video laryngoscopy "OR "Crush induction." To retrieve more articles, reference lists were used.

Mesh Terms

"("video's"[All Fields] OR "videoed"[All Fields] OR "videotape recording"[MeSH Terms] OR ("videotape"[All Fields] AND "recording"[All Fields]) OR "videotape recording"[All Fields] OR "video"[All Fields] OR "videos"[All Fields] OR "VL"[All Fields] OR (("direct"[All Fields] OR "directed"[All Fields] OR "directing"[All Fields] OR "direction"[All Fields] OR "directional"[All Fields] OR "directions"[All Fields] OR "directivities"[All Fields] OR "directivity"[All Fields] OR "directs"[All Fields]) AND ("laryngoscopy"[MeSH Terms] OR "laryngoscopy"[All Fields] OR "laryngoscopies"[All Fields])) OR "DL"[All Fields]) AND (("rapid"[All Fields] OR "rapidities"[All Fields] OR "rapidity"[All Fields] OR "rapidness"[All Fields]) AND ("base sequence"[MeSH Terms] OR ("base"[All Fields] AND "sequence"[All Fields]) OR "base sequence"[All Fields] OR "sequence"[All Fields] OR "sequences"[All Fields] OR "sequence analysis"[MeSH Terms] OR ("sequence"[All Fields] AND "analysis"[All Fields]) OR "sequence analysis"[All Fields] OR "sequencing"[All Fields] OR "sequence s"[All Fields] OR "sequenceable"[All Fields] OR "sequenced"[All Fields] OR "sequenceing"[All Fields] OR "sequencer"[All Fields] OR "sequencers"[All Fields] OR "sequencies"[All Fields] OR "sequencings"[All Fields]))) OR "RSI"[All Fields] OR ("rapid sequence induction and intubation"[MeSH Terms] OR ("rapid"[All Fields] AND "sequence"[All Fields] AND "induction"[All Fields] AND "intubation"[All Fields]) OR "rapid sequence induction and intubation"[All Fields] OR ("rapid"[All Fields] AND "sequence"[All Fields] AND "intubation"[All Fields]) OR "rapid sequence intubation"[All Fields]) OR ("intubate"[All Fields] OR "intubated"[All Fields] OR "intubates"[All Fields] OR "intubating"[All Fields] OR "intubation"[MeSH Terms] OR "intubation"[All Fields] OR "intubations"[All Fields] OR "intubator"[All Fields] OR "intubator s"[All Fields] OR "intubators"[All Fields])) AND ("clinical trial"[Publication Type] OR "clinical trials as topic"[MeSH Terms] OR "clinical trial"[All Fields])) OR "RCT"[All Fields]) AND (randomizedcontrolledtrial[Filter])."

Eligibility Criteria

The selected studies had to be clinical trials conducted in a medical setting to establish the significance of VL and DL, used for rapid sequence intubations. The eligibility criteria were grouped into inclusion and exclusion criteria.

Inclusion Criteria

The inclusion criteria were applied during the search process and study selection. Articles published in English between 2005 and 2023, as well as clinical studies and randomized trials (control), comparing the efficacy of VL and DL, have been included. The population of interest is Adults admitted for rapid sequence intubation. We include studies that reported the incubation time, first and second attempt intubation, and complications after intubation.

Exclusion Criteria

The articles published before 2005, articles without an abstract or control group, and articles published in another language rather than English have been excluded. Study designs such as case studies, retrospectives, journals, magazines, and meta-analyses were excluded.

Study Selection

The inclusion and exclusion criteria were used in the selection process. After conducting a comprehensive database search, the articles that were obtained underwent filtering and screening by two independent authors to validate and ensure adherence to both the inclusion and exclusion criteria. For the removal of duplicates, all articles were collected in the Endnote library and then exported into an Excel sheet. For screening of essential information, remaining references were also exported to an Excel file. The screening was done in phases: the first was through the title and abstracts, and the second was full-text screening. The quality assessment of the remaining studies was the last phase of screening.

Quality Assessment

Cochrane risk of bias guidelines has been utilized to assess the quality of the remaining articles. To avoid any risk of bias at different time frames, the data was extracted twice by utilizing the similar search words. Low, high, and unclear were utilized as the defined range of Risk of bias. For Systematic Reviews of Interventions, the Cochrane Handbook was followed and focused particularly on the following factors: "random-sequence generation, allocation concealment, blinding, outcome assessment, selective reporting of selected studies, and the percentage of each measure will be accessed through a visualization graph".

Risk of Bias Assessment

Using the Cochrane risk of bias guidelines, The Risk of bias in the included studies was evaluated by two independent reviewers. Each study was assessed for the following domains:

Random Sequence Generation

This domain assessed whether the randomization process was adequately described and conducted to minimize selection bias. Studies were categorized as having low Risk if they described a random sequence generation method such as computer-generated randomization or random number tables.

Allocation Concealment

Allocation concealment evaluates whether the method used to conceal the allocation sequence was adequate to prevent selection bias. Studies were categorized as having low Risk if they described methods such as centralized randomization or sealed opaque envelopes.

Blinding of Participants and Personnel

Blinding assesses whether participants, personnel, and outcome assessors were blinded to the intervention to minimize performance and detection bias. Studies were categorized as having low Risk if they reported blinding of participants and personnel, blinding of outcome assessors, or if blinding was not applicable.

Blinding of Outcome Assessment

This domain assesses whether outcome assessors were blinded to the intervention allocation when measuring outcomes to minimize bias in outcome assessment. For the blinded outcome assessors, studies were categorized as having low Risk, high Risk if outcome assessors were not blinded, and unclear if the blinding status was not reported.

Incomplete Outcome Data

This domain evaluates whether there were missing outcome data and whether handling missing data was appropriate to minimize attrition bias. Studies were categorized as having low Risk if they reported low rates of missing data or if appropriate methods, such as intention-to-treat analysis, were used to handle missing data.

Selective Reporting

Selective reporting assesses whether all predefined outcomes were reported to minimize reporting bias. Studies were categorized as having low Risk if they reported all prespecified outcomes or if the study protocol was available and followed.

Other Biases

This domain assesses other sources of bias that could affect the study's results, such as conflicts of interest or funding sources. Studies were categorized based on the presence or absence of potential sources of bias.

Data Extraction and Synthesis

In a predefined Excel sheet, the following variables were extracted: Author's first name, study design, country of publication, number of participants, reason for intubation, medical setting (Emergency or ICU), techniques used (VL, DL), age of patients in the intervention group (mean, SD), gender (Number and percentage of Male only), number and percentage of patients underwent Rapid sequence intubation, age and gender of patients in the control group. For the meta-analysis, the number of patients randomized into intervention and control groups, the time of intubation, and the number of first attempt intubation success rates were extracted.

The meta-analysis was performed using RevMan Version 5.4 Cochrane review software. An effect model called Mantel-Haenszel random, was chosen due to patient allocation techniques across all trials. The heterogeneity was measured using (I2). The authors opted to estimate the analysis results within the confidence interval of 95%, which indicated that, on either side of the distribution, only a 2.5% error was allowed. The level of precision also indicated that the p-value of less than 0.05 indicates the significance of the results. Additionally, the index of the effect size and the homogeneity in each sample, has been chosen by a unique precision of each study.

RESULTS

Study Selection

Two thousand eight hundred articles were retrieved from all databases and 13 through manual search. After removing 601 duplicates, the remaining articles were screened by two independent authors. The first phase of screening was going through the title and abstracts. After the first phase, 113 articles were remained for screening. The authors screened the full text of the articles, and 94 articles were excluded due to different scopes of the studies, poor methodology, lack of control groups, and absence of data analysis in a few articles. The remaining 19 articles were included in the meta-analysis and synthesis of results. The PRISMA flowchart shows the process of study selection (Figure 1).

Characteristics of Included Studies

From nineteen randomized control trials, 14 studies reported Rapid Sequence Intubation (RSI) in the Emergency medical service (EMS) setting, while 5 studies performed RSI at the intensive care unit (ICU). The participants comprise adults with average ages ranging from 37 years to 73 years (Ducharme *et al.*, 2017; Sanguanwit *et al.*, 2021). The average and total number of patients across all 19 studies were 267.85 and 5357, respectively. The reasons for intubation reported by the patients are Respiratory Failure (RF), Airway Protection, EI, multiple Trauma, Congestive Heart Failure, and Emergency Intubation. The experiments were conducted in 12 countries (USA, Canada, Switzerland, Korea, UK, India, Poland, China, France, Thailand, Palatine and Australia).

Quality Assessment of the Included Studies

The Risk of bias tools for randomized control trials were used to assess the quality of the included studies. Under the domain of Random Sequence Generation, Allocation Concealment, Blinding of Participants and Personnel, Blinding of Outcome Assessment, and other biases, 96% of all studies reported a low Risk of bias and 4% high risk of bias. Under the incomplete outcome data and selective reporting, all the included studies reported a 100% low risk of bias, as shown in Figure 2. The summary of the quality assessment graph is presented in (Figure 2).

Outcome Measures in the Included Studies

The first outcome measures were the success rate of the first and second TI attempts. The patients were randomized to VL and DL groups in 19 trials. The number of participants randomized to receive VL and DL were recorded and analyzed. The complications from TI bastion and time of intubation in both groups were also recorded and analyzed.

Prisma Flow Chart

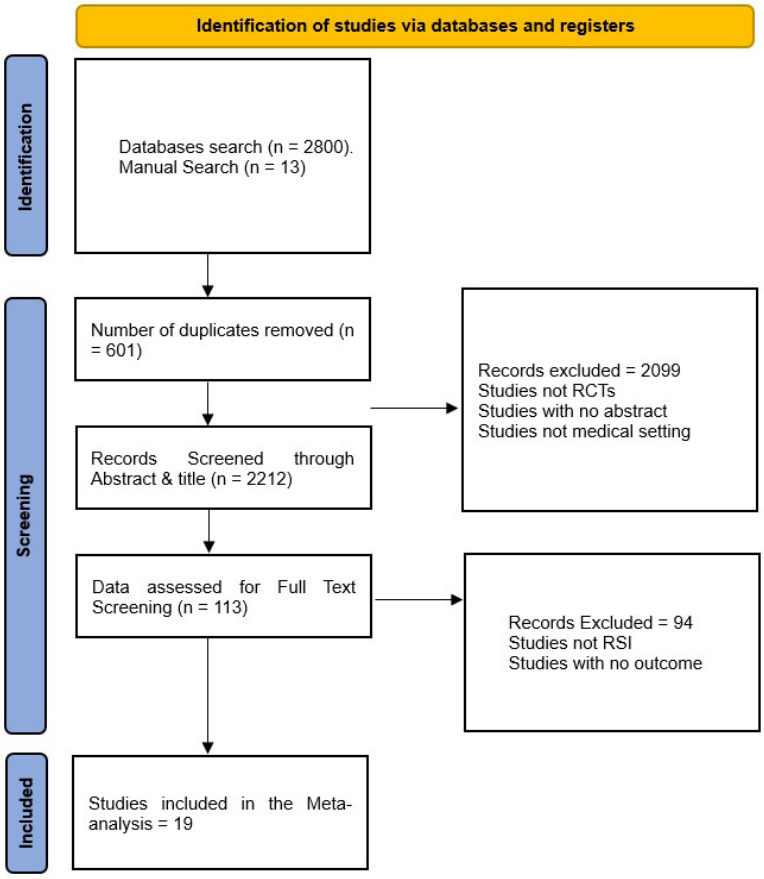

Figure 1: The PRISMA diagram of the study selection process

Table 1:

Author Information				Participants			Intervention			Control Group		
S. No	Author	Design	Country	n	Reason for RSI	Setting	Technique used	Age/Male	RSI	Technique used	Age/Male	RSI
1.	(Donald *et al.*, 2012)	RCT`	Canada	40	Respiratory failure	ICU	VL	68 (16)/15 (75)	NR	DL	61 (16)/13 (65)	NR
2.	(Mosier *et al.*, 2013)	PB-RCT	USA	317	Respiratory Failure, Airway Protection	EMS	VDL	59.5 (IQR 23 to 90)/56.0% (131)	76.5% (179)	DL	61.8 (IQR 40 to 82)/50.0% (28)	86.0% (48)

14.	13.	12.	11.	10.	9.	8.	7.	6.	5.	4.	3.
(Kreutziger *et al.*, 2019)	(Gao *et al.*, 2018)	(Cavus *et al.*, 2018)	(Baek *et al.*, 2018)	(Lascarrou *et al.*, 2017)	(Ducharme *et al.*, 2017)	(Kim *et al.*, 2016)	(Janz *et al.*, 2016)	(Hypes *et al.*, 2016)	(Goksu *et al.*, 2016)	(Sulser *et al.*, 2016)	(Silverberg *et al.*, 2015)
RCT	RCT	RCT	Retrospective study	RCT	RCT	RCT	RCT	RCT	RCT	RCT	RCT
Australia	China	Canada	Korea	France	USA	Korea	USA	USA	Turkey	Switzerland	UK
514	163	168	958	371	82	140	150	809	150	150	117
surgical airway access	Acute respiratory Failure, Trauma	prehospital	Airway Protection	Orotracheal	Endotracheal intubation	Arrest	Hypoxic or Hypercarbic Respiratory Failure	Respiratory Failure, Airway protection	Head Trauma, Cardiac arrest	Multiple Trauma	Congestive heart failure
EMS	EMS	EMS	EMS	ICU	EMS	EMS	ICU	ICU	EMS	EMS	EMS
McG VL	VDL	AP Advance, C-MAC PM System	VDL	VDL	KVL	VDL	VDL	VDL	VDL	VDL	VDL
65 (18–95)/179 (67.1)	68.72±16.88/ 58 (71.6)	66 (19–90)/41	61 [51, 71]/303 (61.5)	62.7 (15.3)/122 (65.6)	37 (17.5)/28 (70%)	61.3 61.3 (18.5)/ 45 (63.4)	59 (49 - 68)/47 (63.5%)	59 (IQR 49–69)/44%	39 ± 19	53(21)/68	65.4/27 (45)
14 (4.8)	3 (3.7)	NR	NR	NR	NR	3 (4.3)	68 (52 - 69)	2.1% (14)	0	147	0(0.0)
DL	DL	King Vision DL	DL	Conventional DL	DL	DL	DL	DL	DL	DL	DL
64 (18–95)/176 (71.3)	69.86±15.55/ 56 (68.3)	67 (26–91)/27	66 [56, 74]/318 (68.4)	62.8 (16.3)/113 (61.1)	14 (33.3)/33 (78.6)	60.5 (18.7) /49 (71)	60 (51 - 67)/44 (57.9%)	60 (IQR 53–73)/42%	35 ± 15.5	54(17)/55	69.6/34 (57)
9 (3.2)	6 (7.3)	NR	NR	NR	NR	0(0.0)	47 (35 - 58)	6.6% (9)	7 (9.3%)	147	4 (7)

15.	(Dey *et al.*, 2020)	RCT	India	218	elective endotracheal	ICU	C-MAC VL	48.3 (16.8) /63/45	NR	Macintosh DL	45.8 (16.2) /67(43)	NR
16.	(Panwar *et al.*, 2020)	RCT	India	100	emergency intubation	EMS	VL	18-60 years	NR	DL (Macintosh)	18-60 years	NR
17.	(Sanguanwit *et al.*, 2021)	RCT	Thailand	158	Acute respiratory Failure	EMS	VDL	73±12.9, 44(57%)	49(62.8%)	DL	65±17.2	48(60%)
18.	(Kriege *et al.*, 2021)	RCT	Palatine	500	Orotracheal	EMS	McG VL	NR	NR	DL	NR	NR
19.	(Gadek *et al.*, 2021)	RCT	Poland	54	Cardiac arrest	EMS	McG VL	53 years (IQR: 33–71)/69%	NR	MAC DL	31%	NR

Outcome Measures of Risk of Bias Assessment

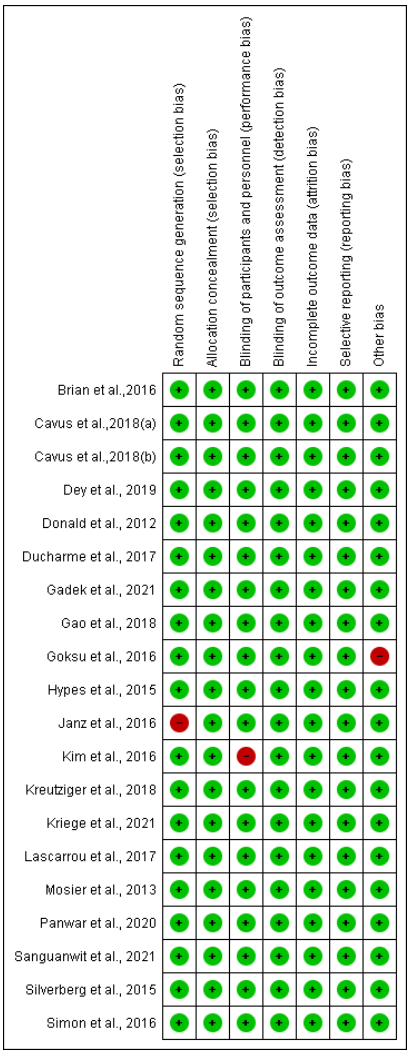

Figure 2: Results of the quality assessment using the Risk of bias tool

Results of Meta-Analysis

Comparison of the Efficacy of Rapid Sequence Intubation by DL and VL

To investigate if VL or DL for EI provides better laryngeal visualization, nineteen trials were included in the meta-analysis. The Mantel-Haenszel random effect meta-analysis showed no significant differences between VL and DL "(OR = 1.38, 95% Confidence interval 0.81 to 2.35, p = 0.23)". The studies had significant heterogeneity "(I2 = 97%, p-value = 0.00001)", as shown in Figure 3. Publication bias was assessed using visual inspection. The funnel plot showed no evidence of publication bias while rather than publication bias, two outliers indicated true heterogeneity, as shown in Figure 4.

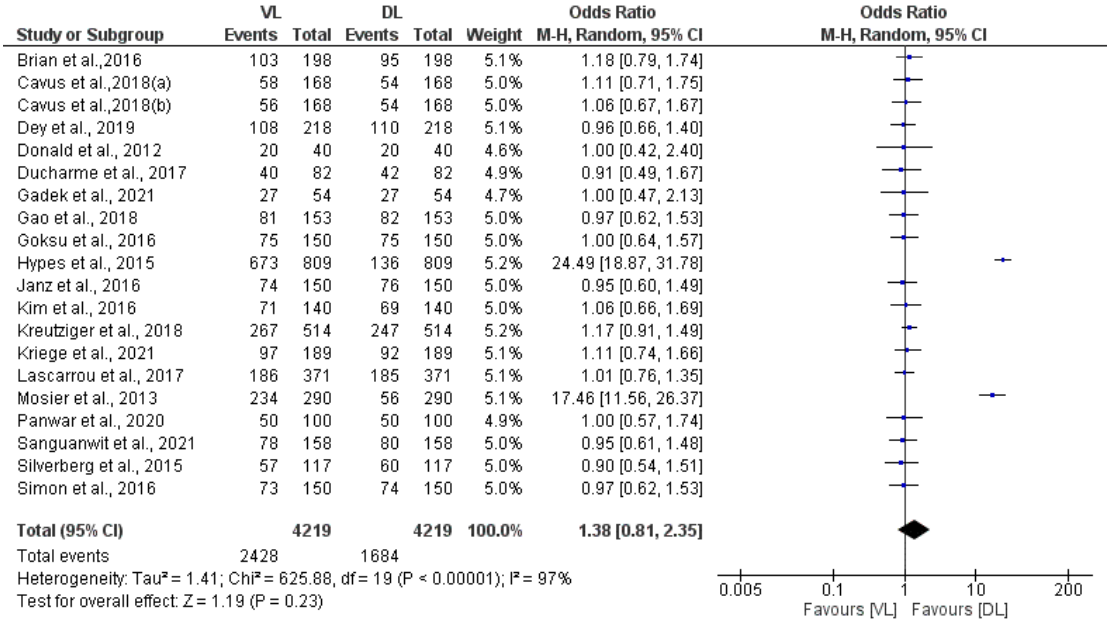

Figure 3: Forest plot: reported odds ratio of Efficacy of Rapid Sequence Intubation in two groups

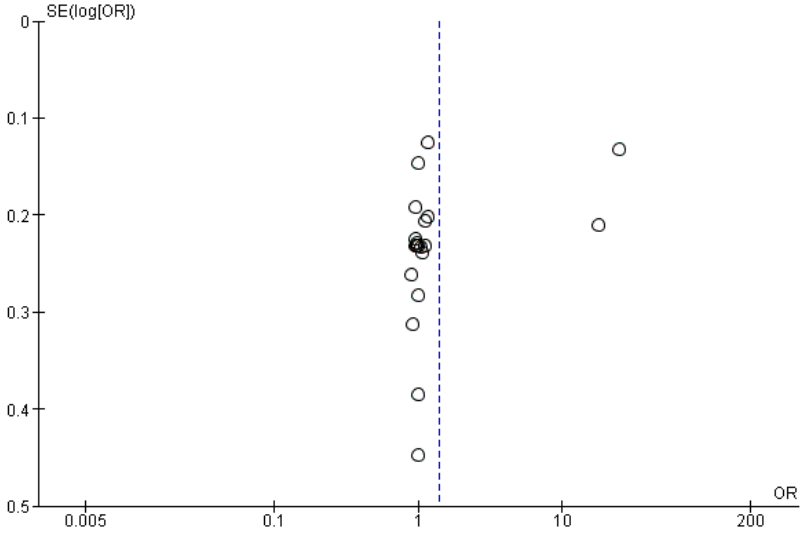

Figure 4: Funnel Plot: no evidence of publication bias

First, Second, and Overall Attempt Tracheal Intubation Success Rate between VL and DL

Eighteen studies have reported the intubation success rate between VL and DL in the first attempt. The meta-analysis results identified no significant differences "(OR = 2.52, 95% Confidence interval 0.83 to 7.67, p–value = 0.04)", as shown in Figure 5. This implied that, in the VL group, the odds of patients with a first attempt of successful intubation, were higher than that of the DL group. Moderately high significant heterogeneity was found "(I2 = 95%, p-value = 0.00001)". However, the result of the success rate in the second attempt and the overall success rate showed no significant difference between VL and DL "(2nd Attempt; OR = 0.66, 95% CI; 0.39, 1.11, p-value = 0.12)" and "(Overall attempt; OR = 2.33, 95% CI; 0.68, 7.95, p–value = 0.18)" respectively. The funnel plot showed a symmetric visualization, which indicated no evidence of publication bias, as shown in Figure 6.

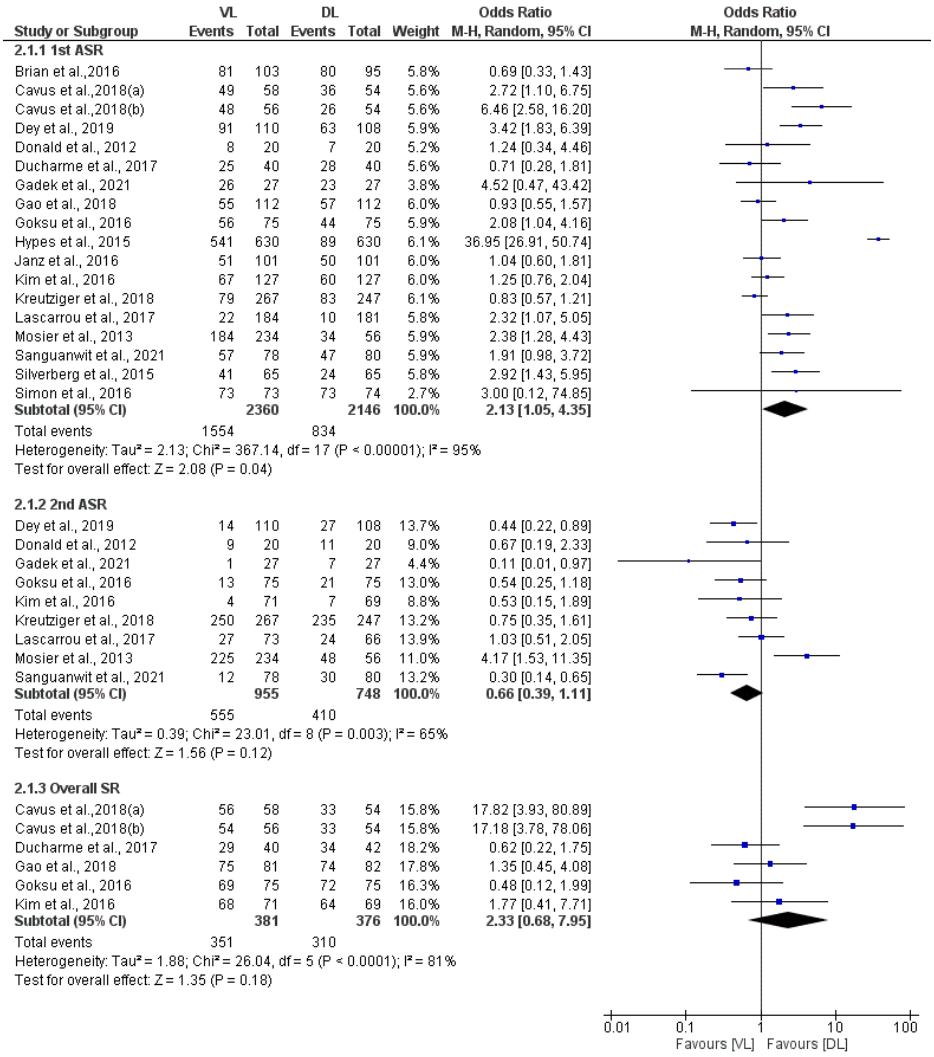

Figure 5: Forest plot: reported an odds ratio of first attempt (2.1.1), Second attempt (2.1.2), and overall attempt (2.1.3) intubation success rate in two groups

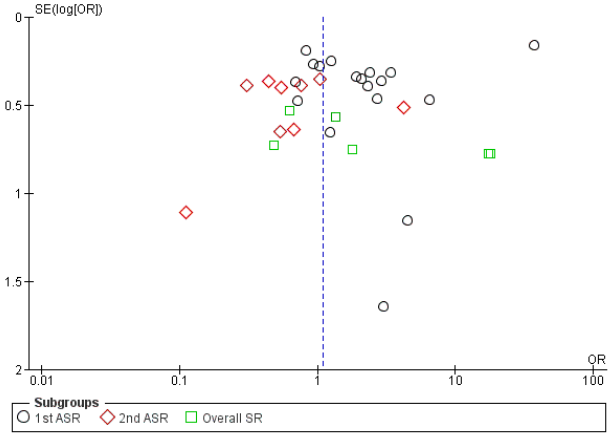

Figure 6: Funnel plot: no publication bias in the studies included in the success rate of first-attempt intubation

Time of Tracheal Intubation in Seconds between VL and DL

Five trials were included in the meta-analysis of intubation time. The results were insignificant with VL "(SMD = -0.03s (95% Confidence Interval -0.22s to 0.42s), p–value = 0.75)" compared with DL. However, despite insignificant results, there was a reduction in incubation time in the VL group compared to the DL group. High heterogeneity was found among the studies "(I2 = 95%, p-value < 0.000)" as shown in Figure 7. The funnel plot showed a symmetric shape with no evidence of publication bias, as shown in Figure 8.

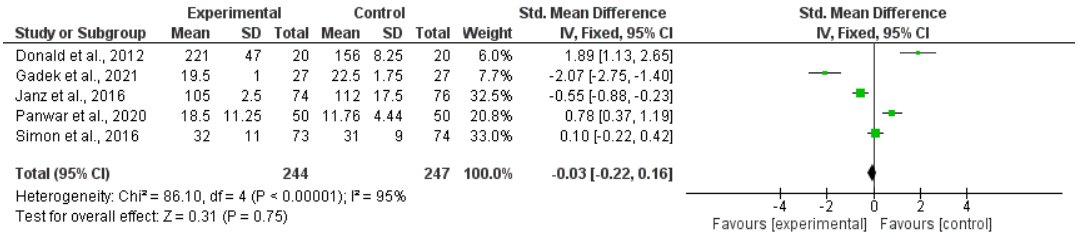

Figure 7: Forest plot: reported odds ratio of time to intubation in seconds

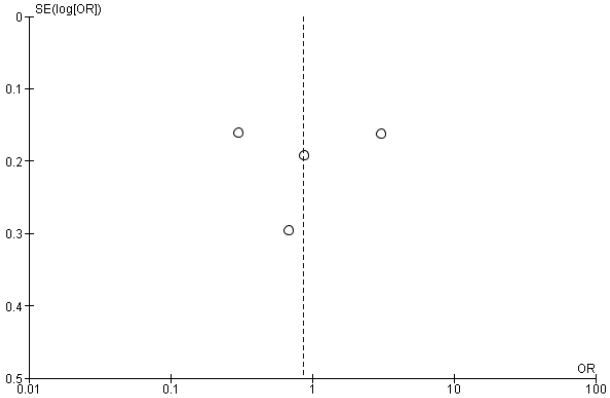

Figure 8: Funnel plot of included studies in the intubation time

Subgroup Complications of Intubation

Subgroup analyses for the complications in intubation showed that the odds of Hypotension, Dental Trauma (DT), Severe Desaturation (SD), and RF after RSI was higher in the DL group as compared to VL "(OR = 3.20, 95% CI; 0.48; 21.10, p–value = 0.23), (Trauma; OR = 1.02, 95% Confidence interval 0.62 to 1.68, p–value = 0.93, I2 = 21%), (Severe Desaturation; OR = 0.69, 95% Confidence Interval 0.47 to 1.03,p–value = 0.07) and (Respiratory Failure; OR = 0.69, 95% Confidence interval 0.43 to 1.09, p–value = 0.11)" as shown in Figure 9.

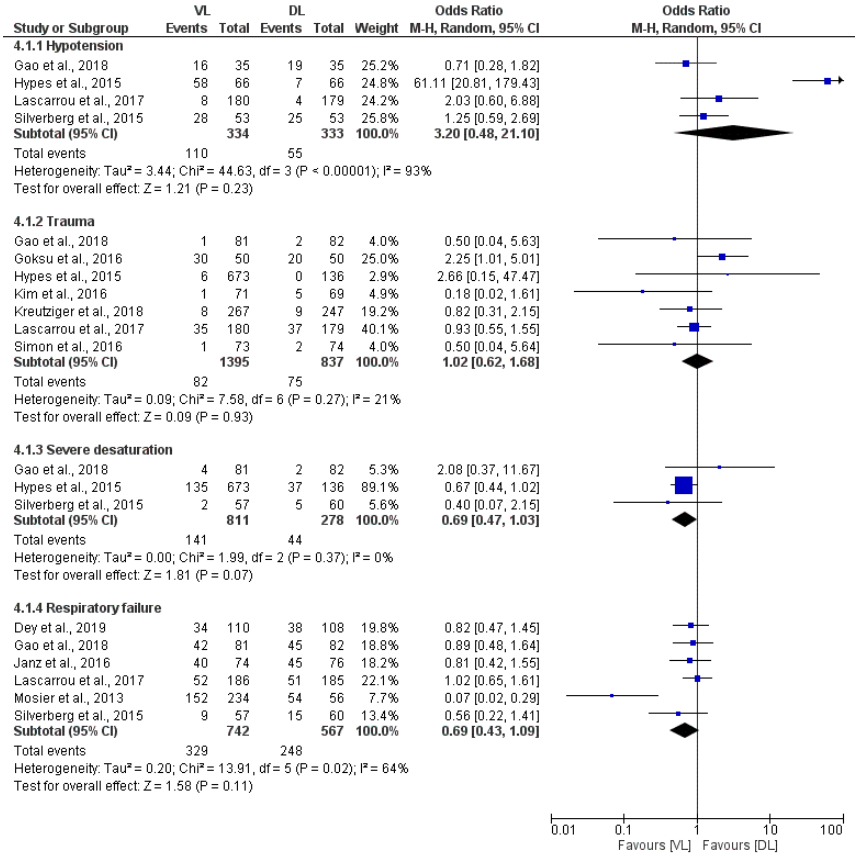

Figure 9: Forest plot of cases with complications in intubations with Hypertension, Dental Trauma, Severe Desaturation and Respiratory Failure

DISCUSSION

This systematic review and meta-analysis have analyzed the efficacy of VL and DL in RSI in ICU. The first meta-analysis, a comparison of VL over DL for RSI, was conducted, as shown in Figure 4. The results revealed no significant difference between the VL and DL techniques, implying that the DL technique was better in RSI than VL. In the last decade, DL was first introduced in RSI for providing control on rapid airway that served as a prevention for patients suffering from a full stomach or other risks of pulmonary aspiration. However, the introduction of VL was found to be more efficient than DL due to the attachment of a camera at the tip of the blade that could improve the visualization of the glottis by assisting airway management in critically ill patients (Arulkumaran *et al.*, 2018; Griesdale *et al.*, 2012; Silverberg *et al.*, 2015). In contrast, no significant difference between the two techniques has been found. Hence, a further and detailed meta-analysis with more clinical trials on the best techniques for RSI in the emergency setting has been required.

In the meta-analysis, a comparison of the success rates in RSI attempts was conducted within the EU using VL and DL. The comparison showed that only the success rate of the first attempt was significant and higher in the VL group with an Odds ratio of 2.13 and 95% Confidence interval; 1.05 – 4.35 favoring DL with high heterogeneity I2 = 95%, as shown in Figure 3 and Figure 4. Hence, VL had a success rate in the first attempt compared to DL, but no significant difference was found in the second and overall attempts (Ba, 2022).

The high heterogeneity was due to differences in laboratory settings or follow-up periods. The non-superiority of VL over DL might be due to limited experience of the physicians handling airway management in VL. Additionally, VL offers visual aids, its image quality may not always match the clarity of DL, potentially leading to misinterpretations (Olatunji *et al.*, 2024). Anatomical variations and technical limitations of VL systems further contribute to its comparable efficacy with DL (Kim *et al.*, 2016).

In the systematic review, the time to achieve success in EI using VL compared to DL found a reduction in time to achieve success in VL compared to DL in the EU (SMD = -0.03s, 95% CI -0.22 – 0.16). The results implied that the average time to achieve a successful EI was lower in VL than in DL. The results were consistent with a clinical trial of EI. In a study, despite a significant improvement in Cormack-Lehane grade of glottis view, DL took a prolonged period to achieve success compared to VL (Janz *et al.*, 2016). Conversely, another study found that the time to intubation was similar between the two groups (Sulser *et al.*, 2016).

The systematic review also compared several complications arising from utilizing VL and DL. The results found that hypotension, DT, RF, and SD were moderately high in VL compared with DL. The results aligned with the previously published meta-analysis in which the complications were significantly increased in DL compared with VL (Ba, 2022). No evidence of publication bias has been found in the funnel plot of the included studies which indicated that, VL has not been a preferable method for RSI in the EU (Merola *et al.*, 2024).

LIMITATIONS

In acknowledging the scope of meta-analysis, it is imperative to address certain limitations that might have influenced the systematic review's findings. First, Selection Bias and High Heterogeneity were inevitably introduced when observational studies were included. Second, during the database search process, studies that were published in English only were included. As a result, pertinent, relevant controlled trials demonstrating advancements in VL may have been published in other languages, potentially enhancing the findings of the systematic review and meta-analysis if considered.

CONCLUSION

In summary, the utilization of VL in RSI has been linked to a reduced time to achieve successful intubation compared to DL. However, the effectiveness of VL over DL remains modest. Therefore, further analysis, such as hospital duration of stays, follow-up time, and monitoring of adverse events, has been necessary for a thorough meta-analysis.

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