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ORIGINAL ARTICLE

Medicine Science International Medical Journal

Medicine Science 2024;13(4):921-9

Comparison of video laryngoscope and direct laryngoscope for endotracheal intubation across different body mass index categories: A prospective study

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Received 11 September 2024; Accepted 06 November 2024
Available online 01 December 2024 with doi: 10.5455/medscience.2024.08.103

Abstract

The aim is to compare video laryngoscopy (VL) and Macintosh blade direct laryngoscopy according to the intubation difficulty scale (IDS) in patients with ASA 1 and Mallampati score I (C-MAC-D blade) according to body mass index (BMI). A total of 180 patients aged 18-70 years, scheduled for elective surgery under general anesthesia with ASA 1-2, Mallampati score I, and BMI>18 kg/m² were included. DL and VL were performed in 50% of patients. Patients were randomly assigned to six groups based on BMI and laryngoscopy type. During intubation, data on the number of tubes used, number of anesthetists attempting intubation, number of alternative techniques employed, C-L score (C-L), laryngoscopy suspension power, application of external pressure, and vocal cord imaging were recorded, and IDS was calculated. Notable variations were detected in mouth opening, thyromental distance, and C-L and IDS levels across different laryngoscopy methods. Patients in the VL group exhibited a greater frequency of mouth opening of <3 cm and thyromental distance of 6.5 cm (p=0.029 and p<0.005, respectively). The VL group demonstrated higher rates of C-L=1 and easy IDS, whereas the DL group showed increased C-L=3 and mildly difficult-to-difficult IDS ratios (p=0.049 and p<0.001, respectively). Within the BMI 25-30 kg/m² category, the VL group had a significantly larger number of patients with a thyromental distance <6.5 cm (p=0.008). No substantial differences in mouth-opening measurements were observed between the groups. The intubation duration was extended in the VL group (p=0.019). The VL group displayed a higher frequency of easy IDS, whereas the DL group showed an increased rate of mild IDS (p =0.001). For patients with BMI >30 kg/m², the VL group had considerably more individuals with a thyromental distance <6.5 cm (p<0.001). The DL group exhibited higher proportions of mildly difficult and difficult IDS, C-L=3 ratio, and prolonged intubation times (p<0.001, p=0.026, p=0.028, respectively). In obese patients who undergo endotracheal intubation, better glottic visibility with the use of VL shortens the intubation time and makes the procedure easier.

Keywords: Body mass index, video laryngoscope, macintosh direct laryngoscope, intubation difficulty scale

Introduction

Ensuring a clear airway during general anesthesia is crucial for anesthesiologists as it is directly linked to patient safety. Maintaining an open airway is vital to prevent complications, such as hypoxia and aspiration, which can be life-threatening during surgery. Endotracheal intubation (ETI) is considered the primary method of airway control, offering both controlled ventilation and protection from aspiration. However, successful ETI is not guaranteed in all cases and can be affected by various patient-specific factors, including anatomical differences, existing health conditions, and body mass index (BMI) [1-3].

Managing airways in individuals with a body mass index (BMI) of ≥30 kg/m², which is classified as obesity, poses distinct difficulties. The accumulation of fatty tissue in the neck and chest regions, coupled with decreased chest wall flexibility and the possible occurrence of obstructive sleep apnea, makes it more challenging to obtain and sustain a clear view of the vocal cords during intubation [4,5]. Structural and functional alterations in anatomy and physiology can result in challenging tracheal intubation (DTI), a situation that anesthesiologists dread due to the heightened risk of complications and fatalities during the perioperative period. Research has indicated that while obesity alone is not the most dependable predictor of DTI, it does

CITATION
Esen G, Acikel A. Comparison of video laryngoscope and direct laryngoscope for endotracheal intubation across different body mass index categories: A prospective study. Med Science. 2024;13(4):921-9.

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DOI: 10.5455/medscience.2024.08.103

enhance the intricacy of managing the airway, especially when combined with additional risk elements [1,6,7].

Technological advancements have introduced alternative intubation techniques in response to the challenges posed by difficult airways, especially in obese patients. Video laryngoscopy (VL) has emerged as a promising tool, with advantages over traditional direct laryngoscopy (DL) [8]. In contrast to DL, which necessitates a direct view of the vocal cords, VL employs a camera to provide indirect visualization, potentially enhancing the glottic view and improving intubation success rates, especially in patients with challenging anatomical features. Numerous studies have explored the advantages of VL in various clinical contexts, including its use in obese patients. Research has demonstrated that VL can reduce the frequency of unsuccessful intubation attempts and lower the risk of airway injury, making it an appealing alternative in situations where DL is expected to be challenging [9]. Nevertheless, the degree to which VL enhances outcomes across various BMI categories remains an area of ongoing investigation [10]. While VL has been praised for its potential to enhance glottic view and facilitate intubation, especially in obese individuals, further studies directly comparing it with DL are necessary to establish its true effectiveness in relation to BMI-specific results [6,11-13].

The objective of this study was to fill a knowledge gap by performing an extensive comparison between videolaryngoscopy (VL) and direct laryngoscopy (DL) for endotracheal intubation across various body mass index (BMI) categories. Our aim was to determine whether VL significantly enhanced intubation success rates, decreased intubation difficulty as assessed by the Intubation Difficulty Scale (IDS), and reduced complications in comparison to DL, especially in patients with higher BMIs. We anticipate that the results of this investigation will offer crucial insights into the selection of appropriate intubation techniques based on BMI, ultimately informing clinical practice and improving patient safety during anesthesia procedures. Considering the increasing global prevalence of obesity and its associated airway management challenges, the outcomes of this study could have substantial implications for anesthesiologists in optimizing airway management strategies, particularly in populations with high rates of obesity. Through the analysis of a large patient cohort across different BMI categories, this study aimed to provide evidence supporting the use of VL in challenging airway scenarios, potentially influencing the clinical guidelines and practice standards for airway management in obese individuals. We focused on patients with a Mallampati I score to create a uniform study population and minimize variability in airway difficulty due to anatomical differences.

Material and Methods

Study Design and Ethical Considerations

This prospective study was conducted following the approval from the Ethics Committee of Manisa Celal Bayar University Faculty of Medicine, granted on January 20, 2020 (Approval Number: 20.478.486). The study was conducted between February 1, 2020, and June 15, 2022. A total of 180 patients, aged 18–70 years, who underwent elective surgery under general anesthesia across various surgical departments, were included in the study. All participants were classified as American Society of Anesthesiologists (ASA) physical status I-II and had a Modified Mallampati Score of I.

Patient Selection and Grouping

The study's eligibility requirements were as follows: participants between 18 and 70 years old, scheduled for elective surgery requiring general anesthesia with endotracheal intubation, categorized as ASA I-II, and having a BMI exceeding 18 kg/m². The study excluded pregnant individuals, emergency cases, those with ASA physical status III-IV, patients with prior neck surgery, and those with a modified Mallampati score of II-IV.

The participants were divided into six groups based on their BMI and laryngoscopy type.

Group 1: 30 individuals with BMI 18-24.9 kg/m², intubated using a Macintosh laryngoscope.

Group 2: 30 individuals with BMI 25-29.9 kg/m², intubated using a Macintosh laryngoscope.

Group 3: 30 individuals with BMI≥30 kg/m², intubated using a Macintosh laryngoscope.

Group 4: 30 individuals with BMI 18-24.9 kg/m², intubated using a C-MAC D-Blade video laryngoscope (Karl Storz 8403XD, Tuttlingen, Germany).

Group 5: 30 individuals with BMI 25-29.9 kg/m², intubated using a C-MAC D-blade video laryngoscope.

Group 6: 30 individuals with BMI≥30 kg/m², intubated using a C-MAC D-Blade video laryngoscope.

The type of laryngoscopy (VL or DL) was randomly assigned using a computer-generated randomization process to ensure equal distribution and unbiased group allocation.

Anesthetic Procedure

In the preoperative preparation area, each patient received administered 0.02 mg/kg of midazolam intravenously (IV). Anesthesia was induced using IV doses of propofol (2 mg/kg propofol, 1.5 μg/kg fentanyl, and 0.6 mg/kg rocuronium. Prior to attempting endotracheal intubation, patients underwent mask ventilation with pure oxygen for 3 min. Anesthesia was maintained using a mixture of 2% sevoflurane in 40% O_2 and 60% N_2O, along with a continuous intravenous infusion of remifentanil at a rate of 0.1 μg/kg/min. In the direct laryngoscopy group, a Macintosh blade was used, while in the video laryngoscopy group, a C-MAC D-Blade was employed for intubation. All operators performing the intubations were experienced anesthesiologists, each with at least five years of experience in both direct and video laryngoscopy.

DOI: 10.5455/medscience.2024.08.103

Data Collection

The researchers documented various patient characteristics, including age, sex, ASA classification, physical measurements (height, weight, and BMI), Mallampati score, intubation duration, thyromental distance, and any adverse events. During the intubation process, they noted the number of tube insertion attempts, the number of anesthesiologists involved, alternative method usage, Cormack-Lehane grading, force applied during laryngoscopy, external manipulation, and vocal cord visibility. The Intubation Difficulty Scale (IDS) was used to evaluate the complexity of intubation. Before induction, baseline measurements of systolic and diastolic blood pressure, heart rate, and peripheral oxygen saturation were obtained.

Statistical Analysis

SPSS (version 23.0; IBM Corp., Armonk, NY, USA) was used for the statistical analysis. To evaluate the normality of data distribution, histogram graphs and either the Kolmogorov-Smirnov or Shapiro-Wilk tests were utilized. The mean, standard deviation, median, minimum, maximum, and interquartile range (IQR) were used to present descriptive statistics. For variables that did not follow a normal distribution, comparisons between the two groups were conducted using the Mann-Whitney U-test. Frequencies and percentages were used to present categorical variables, which were analyzed using the chi-squared (Exact) test. Statistical significance was set at $p<0.05$.

Results

In total, 180 patients were included in this study. Of these, 50% underwent direct laryngoscopy, whereas the remaining 50% were intubated using video laryngoscopy. The study population consisted of 48.89% women, with participants averaging 40.45±14.10 years old. The patients' mean body mass index (BMI) was 28.04±5.60 kg/m². The BMI distribution was 34.44% below 25 kg/m², 31.67% between 25 kg/m² and 30 kg/m², and 33.89% exceeding 30 kg/m². All subjects were classified as having (American Society of Anesthesiologists) score of 1. The vast majority (96.67%) exhibited a mouth opening of at least 3 cm, whereas 86.67% had a thyromental distance of 6.5 cm or greater. Regarding the Cormack-Lehane score, 60.56% of the patients scored 1, whereas 3.33% scored 4, indicating more challenging intubation scenarios. Soft tissue trauma complications occurred in 1.11% of the cases. Intubation procedures lasted an average of 22.69±9.56 seconds. The Intubation Difficulty Scale (IDS) categorized 73.89% of the patients as easy, 20% as slightly difficult, and 6.11% as difficult. DL and VL were each performed on 50% of the patients (90 patients in each group). The majority of patients (92%, 83/90) were successfully intubated on the first attempt, with no significant differences between the VL and DL groups in terms of the number of intubation attempts ($p=0.15$) (Table 1).

Table 1. Demographic and clinical characteristics of the study population

Characteristic	n/Mean±SD	%/Median (Min-Max)
Group		
Direct laryngoscopy	90	50.00
Video laryngoscopy	90	50.00
Gender		
Female	88	48.89
Male	92	51.11
Age (years)	40.45±14.10	41 (18-69)
BMI (kg/m²)	28.04±5.60	27.25 (18.5-44.8)
BMI		
<25	62	34.44
25-30	57	31.67
>30	61	33.89
ASA classification		
I	180	100.00
Systolic blood pressure	123.79±15.27	125.5 (111-160)
Heart rate	77.23±12.82	75 (10-120)
Diastolic blood pressure	75.64±10.50	75 (51-100)
Mouth opening		
>3 cm	174	96.67
<3 cm	6	3.33
Thyromental distance		
>6.5 cm	156	86.67
<6.5 cm	24	13.33
Cormack-Lehane grade		
Grade 1	109	60.56
Grade 2	41	22.78
Grade 3	24	13.33
Grade 4	6	3.33
Complications		
Yes	2	1.11
No	178	98.89
Intubation duration (sec)	22.69±9.56	20 (0-70)
IDS (intubation difficulty scale)		
Easy	133	73.89
Slightly difficult	36	20.00
Difficult	11	6.11

ASA: American Society of Anesthesiologists, BMI: body mass index, C-L: Cormack-Lehane (classification), IDS: intubation difficulty scale, IQR: interquartile range, SD: standard deviation

Statistical data were examined to evaluate notable variations in variable levels across different types of laryngoscopies. The analysis revealed significant disparities in mouth opening, thyromental distance, Cormack-Lehane grades, and Intubation Difficulty Scale (IDS) levels among the laryngoscopy types ($p<0.05$). In the video laryngoscopy group, a smaller percentage of patients (93.33%) had a mouth opening of 3 cm or more,

DOI: 10.5455/medscience.2024.08.103

whereas a larger percentage (6.67%) had an opening of 3 cm or less. For thyromental distance, the video laryngoscopy group showed a lower proportion of patients (75.56%) with a distance of 6.5 cm or greater, and a notably higher proportion (24.44%) with a distance below 6.5 cm. The video laryngoscopy group also exhibited a higher percentage of patients (67.78%) with Cormack-Lehane grade 1 than the direct laryngoscopy group (53.33%). Conversely, the direct laryngoscopy group had a higher proportion of patients (20%) with a Cormack-Lehane grade of 3. Regarding IDS, the video laryngoscopy group demonstrated a significantly higher percentage of patients (90%) with an "easy" rating, while the direct laryngoscopy group showed higher proportions of patients with "slightly difficult" (5.56%) and "difficult" (4.44%) ratings (Table 2).

Table 2. Comparison of demographic and clinical characteristics between direct and video laryngoscopy groups

Variable	Direct laryngoscopy (n/Mean±SD)	%/Median (IQR)	Video laryngoscopy (n/Mean±SD)	%/Median (IQR)	p
Gender					
Female	40	44.44	48	53.33	0.233
Male	50	55.56	42	46.67	
Age (years)	39.1±14.37	39.5 (26-46)	41.81±13.76	42 (30-51)	0.141
BMI (kg/m²)	27.76±5.65	27.2 (23.4-31.1)	28.32±5.56	27.65 (24-32.8)	0.532
BMI categories					0.887
<25	30	33.33	32	35.56	
25-30	30	33.33	27	30.00	
>30	30	33.33	31	34.44	
Systolic blood pressure (mmHg)	125.07±13.30	126 (116-134)	122.51±17.00	125 (115-130)	0.413
Heart rate (beats/min)	78.96±12.69	76.5 (71-88)	75.5±12.79	75 (70-84)	0.220
Diastolic blood pressure (mmHg)	74.58±9.75	74 (68-82)	76.71±11.16	76 (70-88)	0.186
Mouth opening					0.029
>3 cm	90	100.00	84	93.33	
<3 cm	0	0.00	6	Haz.67	
Thyromental distance					<0.005
>6.5 cm	88	97.78	68	75.56	
<6.5 cm	2	Şub.22	22	24.44	
Cormack-Lehane grade					0.049
Grade 1	48	53.33a	61	67.78b	
Grade 2	21	23.33	20	22.22	
Grade 3	18	20.00a	6	6.67b	
Grade 4	3	Mar.33	3	Mar.33	
Complications					1.000
Yes	1	1.Kas	1	1.Kas	
No	89	98.89	89	98.89	
Intubation duration (sec)	22.82±10.08	20 (17-25)	22.56±9.05	20.5 (18-23)	0.667
Intubation difficulty scale (IDS)				<0.001	
Easy	52	57.78a	81	90.00b	
Slightly difficult	31	34.44a	5	5.56b	
Difficult	7	7.78a	4	4.44a	

Chi-Square Test, Mann-Whitney U Test; ASA: American Society of Anesthesiologists, BMI: body mass index, C-L: Cormack-Lehane (classification), DBP: diastolic blood pressure, ETI: endotracheal intubation, HR: heart rate, IDS: intubation difficulty scale, IQR: interquartile range, IV: intravenous, SBP: systolic blood pressure, SD: standard deviation, SpO2: peripheral oxygen saturation, VL: video laryngoscopy

DOI: 10.5455/medscience.2024.08.103

We investigated whether there was a significant difference in variable levels according to the type of laryngoscopy among patients with a body mass index (BMI) of less than 25 kg/m² and found significant differences in BMI and heart rate levels ($p<0.05$). The BMI measurement level was significantly lower (M=22.15) in the patients who underwent direct laryngoscopy. Conversely, the heart rate measurement level was significantly higher (M=81.5) in the patients who underwent direct laryngoscopy (Table 3).

Table 3. Comparison of demographic and clinical characteristics between direct and video laryngoscopy groups (BMI<25 kg/m²)

Variable	Direct laryngoscopy (n/Mean±SD)	%/Median (IQR)	Video laryngoscopy (n/Mean±SD)	%/Median (IQR)	p
Gender					0.765
Female	18	60.00	18	56.25	
Male	12	40.00	14	43.75	
Age (years)	30.8±11.52	27 (23-40)	35.06±11.84	34 (26-44.5)	0.098
BMI (kg/m²)	21.78±1.99	22.15 (20-23.4)	22.82±1.59	23.05 (21.8-24.2)	0.038
Systolic blood pressure (mmHg)	125.77±17.08	128 (113-136)	122.19±14.04	121.5 (112-130)	0.348
Heart rate (beats/min)	83.5±15.34	81.5 (74-91)	76.37±12.39	75 (69-81.5)	0.044
Diastolic blood pressure (mmHg)	73.8±10.60	72.5 (67-80)	79.38±11.44	79 (70-88)	0.063
Mouth opening					1.000
>3 cm	30	100.00	31	96.88	
<3 cm	0	0.00	1	3.13	
Thyromental distance					1.000
>6.5 cm	30	100.00	31	96.88	
<6.5 cm	0	0.00	1	3.13	
Cormack-Lehane grade					0.574
Grade 1	20	66.67	24	75.00	
Grade 2	8	26.67	5	15.63	
Grade 3	2	Haz.67	2	6.25	
Grade 4	0	0.00	1	3.13	
Complications					0.484
Yes	1	Mar.33	0	0.00	
No	29	96.67	32	100.00	
Intubation duration (sec)	22.6±10.76	20 (18-24)	23±8.66	21 (18-24)	0.515
Intubation difficulty scale (IDS)				0.325	
Easy	23	76.67	29	90.63	
Slightly difficult	5	16.67	2	6.25	
Difficult	2	6.67	1	3.13	

Chi-Square Test, Mann-Whitney U Test; ASA: American Society of Anesthesiologists, BMI: body mass index, C-L: Cormack-Lehane (classification), DBP: diastolic blood pressure, ETI: endotracheal intubation, HR: heart rate, IDS: intubation difficulty scale, IQR: interquartile range, IV: intravenous, SBP: systolic blood pressure, SD: standard deviation, SpO2: peripheral oxygen saturation, VL: video laryngoscopy

Among individuals with a body mass index (BMI) ranging from 25 to 30 kg/m², those who underwent video laryngoscopy exhibited a notably higher average age (M=49). The video laryngoscopy group had a smaller percentage of patients with a distance exceeding 6.5 cm (77.78%) and a larger percentage with a distance under 6.5 cm (22.22%). In addition, patients who underwent video laryngoscopy had significantly longer intubation times. The direct laryngoscopy group showed a markedly lower proportion of patients with an "easy" Intubation Difficulty Scale (IDS) score (53.33%), while simultaneously displaying a considerably higher proportion of patients with a "slightly difficult" IDS score (40%) (Table 4).

DOI: 10.5455/medscience.2024.08.103

Table 4. Comparison of demographic and clinical characteristics between direct and video laryngoscopy groups (BMI 25-30 kg/m²)

Variable	Direct laryngoscopy (n/Mean±SD)	%/Median (IQR)	Video laryngoscopy (n/Mean±SD)	%/Median (IQR)
Gender				
Female	13	43.33	9	33.33
Male	17	56.67	18	66.67
Age (years)	38.73±12.12	41 (28-44)	45.96±14.51	49 (34-57)
BMI (kg/m²)	27.36±1.08	27.2 (26.5-28.2)	27.61±1.55	27.8 (26.3-29.1)
Systolic blood pressure (mmHg)	123.47±10.95	125.5 (116-130)	125.33±11.31	130 (116-136)
Heart rate (beats/min)	76.23±10.75	72 (70-84)	71.93±15.27	73 (66-80)
Diastolic blood pressure (mmHg)	73.93±9.83	74 (68-82)	76.7±10.61	78 (70-84)
Mouth opening				
>3 cm	30	100.00	25	92.59
<3 cm	0	0.00	2	7.41
Thyromental distance				
>6.5 cm	30	100.00	21	77.78
<6.5 cm	0	0.00	6	22.22
Cormack-Lehane grade				
Grade 1	16	53.33	18	66.67
Grade 2	8	26.67	6	22.22
Grade 3	5	16.67	1	3.70
Grade 4	1	3.33	2	7.41
Complications				
Yes	0	0.00	1	3.70
No	30	100.00	26	96.30
Intubation duration (sec)	20±7.40	18 (15-25)	23.85±12.97	20 (19-22)
Intubation difficulty scale (IDS)				
Easy	16	53.33a	24	88.89b
Slightly difficult	12	40.00a	0	0.00b
Difficult	2	6.67	3	11.11

Chi-Square Test, Mann-Whitney U Test; ASA: American Society of Anesthesiologists, BMI: body mass index, C-L: Cormack-Lehane (classification), DBP: diastolic blood pressure, ETI: endotracheal intubation, HR: heart rate, IDS: intubation difficulty scale, IQR: interquartile range, IV: intravenous, SBP: systolic blood pressure, SD: standard deviation, SpO2: peripheral oxygen saturation, VL: video laryngoscopy

For individuals with a body mass index (BMI) exceeding 30 kg/m², notable variations were observed in sex distribution, thyromental distance, Cormack-Lehane classification, intubation time, and Intubation Difficulty Scale (IDS) scores depending on the laryngoscopy technique employed ($p<0.05$). Video laryngoscopy was more frequently used in female patients, whereas direct laryngoscopy was more common in males. Patients who underwent video laryngoscopy had a lower percentage of thyromental distances greater than 6.5 cm (51.61%) and a higher percentage below 6.5 cm (48.39%). Patients who underwent direct laryngoscopy showed a significantly higher proportion of Cormack-Lehane grade 3 (36.67%). Additionally, direct laryngoscopy resulted in a longer intubation time (M=24 seconds). The video laryngoscopy group had a higher percentage of "easy" IDS scores (90.32%) and a markedly lower percentage of "slightly difficult" IDS scores (9.68%) (Table 5).

DOI: 10.5455/medscience.2024.08.103

Table 5. Comparison of demographic and clinical characteristics between direct and video laryngoscopy groups (BMI>30 kg/m²)

Variable	Direct laryngoscopy (n/Mean±SD)	%/Median (IQR)	Video laryngoscopy (n/Mean±SD)	%/Median (IQR)	p
Gender					0.003
Female	9 (30.00)		21 (67.74)		
Male	21 (70.00)		10 (32.26)		
Age (years)	47.77±14.33	47.5 (37-60)	45.15±12.60	46 (39-54)	0.493
BMI (kg/m²)	34.14±3.68	33 (31.1-36.3)	34.63±3.63	33.7 (32.7-36)	0.387
Systolic blood pressure (mmHg)	125.97±11.30	128 (120-136)	120.39±23.04	126 (115-131)	0.288
Heart rate (beats/min)	77.13±10.53	78.5 (70-85)	77.71±10.35	80 (72-85)	0.548
Diastolic blood pressure (mmHg)	76±8.91	76 (70-80)	73.97±11.01	73 (65-83)	0.398
Mouth opening					0.238
>3 cm	30 (100.00)		28 (90.32)		
<3 cm	0 (0.00)		3 (9.68)		
Thyromental distance					<0.001
>6.5 cm	28 (93.33)		16 (51.61)		
<6.5 cm	2 (6.67)		15 (48.39)		
Cormack-Lehane grade					0.026
Grade 1	12 (40.00)		19 (61.29)		
Grade 2	5 (16.67)		9 (29.03)		
Grade 3	11 (36.67)a		3 (9.68)b		
Grade 4	2 (6.67)		0 (0.00)		
Complications					
Yes	0 (0.00)		0 (0.00)		
No	30 (100.00)		30 (100.00)		
Intubation duration (sec)	25.87±11.12	24 (19-30)	20.97±3.93	20 (18-22)	0.028
Intubation difficulty scale (IDS)					<0.001
Easy	13 (43.33)a		28 (90.32)b		
Slightly difficult	14 (46.67)a		3 (9.68)b		
Difficult	3 (10.00)		0 (0.00)		

Chi-Square Test, Mann-Whitney U Test; ASA: American Society of Anesthesiologists, BMI: body mass index, C-L: Cormack-Lehane (classification), DBP: diastolic blood pressure, ETI: endotracheal intubation, HR: heart rate, IDS: intubation difficulty scale, IQR: interquartile range, IV: intravenous, SBP: systolic blood pressure, SD: standard deviation, SpO2: peripheral oxygen saturation, VL: video laryngoscopy

Discussion

The findings of our study provide important insights into the comparison between DL and VL in different BMI categories, particularly with respect to intubation difficulty. Our results revealed significant differences in various clinical parameters, including thyromental distance, Cormack-Lehane grade, and intubation. IDS scores are crucial for the successful management of the airway during general anesthesia. Our study focused on patients with a Mallampati I score to minimize variability in airway management and create a more controlled setting for comparing VL and DL outcomes. This controlled focus allows us to examine intubation difficulty primarily influenced by BMI.

The relationship between BMI and DTI has been the subject of ongoing debate, with studies yielding inconsistent results. For instance, Lundstrøm et al. conducted a large cohort study involving over 91,000 patients and found that, while a BMI of 35 kg/m² or higher was associated with an increased risk

DOI: 10.5455/medscience.2024.08.103

of DTI, the predictive value of BMI alone was relatively weak [14]. A meta-analysis by Carvalho suggested that videolaryngoscopes and Macintosh direct laryngoscopes may be considered clinically equivalent in terms of the time taken for tracheal intubation. The analysis indicated that despite the rankings provided, the current evidence does not sufficiently demonstrate the significant superiority of one device over the other for intubation-related outcomes. This underscores the need for further research to definitively determine whether a particular laryngoscope has clear advantages in clinical practice [15]. This suggests that, while obesity is an important factor, it should not be considered in isolation when predicting DTI. Instead, other factors such as neck circumference, Mallampati score, and patient positioning should also be considered, which is consistent with the results of our study, in which thyromental distance and C-L grades differed significantly between DL and VL, particularly in obese patients.

Our study showed that in patients with a BMI greater than 30 kg/m², the use of VL resulted in a significantly higher rate of easy IDS scores and a lower rate of difficult IDS scores than DL. This aligns with previous research that highlighted the advantages of VL in providing better glottic visualization, especially in patients with difficult airways [9,11-13,16,17]. The improved visualization offered by the VL is particularly beneficial in obese patients, where anatomical challenges such as increased neck circumference and fatty tissue deposition make direct visualization difficult.

The study by Wang et al. found that while BMI is associated with difficult tracheal intubation when using DL, the introduction of VL significantly mitigated these difficulties, resulting in fewer failed intubation attempts [6]. A meta-analysis conducted by Hoshijima et al. demonstrated that in obese patients, videolaryngoscopy was superior to the Macintosh laryngoscope in several key areas related to tracheal intubation. Specifically, the study found that VL had a higher success rate (GRADE: low), reduced intubation time (GRADE: very low), and provided better glottic visualization (GRADE: very low) than the Macintosh laryngoscope. These findings highlight the potential advantages of using VL in obese patients, particularly in situations where traditional laryngoscopy techniques may be more challenging [10]. This is consistent with our findings, where VL demonstrated superior performance in patients across all BMI categories, particularly in those with a higher BMI. However, it is important to note that while VL showed a clear advantage in our study, it is not without its limitations. The intubation time was longer in the VL group, which could be attributed to the learning curve associated with the use of video laryngoscopes and the need for careful navigation of the device within the airway. This is particularly relevant in emergency situations where time is essential, and the increased time required for VL may offset some of its benefits. Moreover, the variability in thyromental distance between the DL and VL groups across different BMI categories underscores the importance of individualized patient assessment. In our study, patients with a BMI greater than 30 kg/m² showed a significantly lower thyromental distance in the VL group, which highlights the need for careful consideration of airway anatomy and the potential challenges that may arise with VL despite its overall benefits.

Study Limitations

This study has several limitations. First, the sample size, although sufficient for detecting significant differences, may limit the generalizability of the findings. Larger, multicenter studies are needed to confirm these results and offer broader insights into the effectiveness of VL versus DL across diverse patient populations. Second, the study's controlled clinical setting may not fully represent the challenges in emergency or less-controlled environments, where intubation is more difficult and time-sensitive, potentially affecting intubation time outcomes. Finally, while the study included patients with varying BMI categories, factors such as neck circumference, degree of airway obstruction, and patient positioning during intubation were not independently assessed, which could have influenced the outcomes. Future studies should include these variables to provide a more nuanced understanding of the factors affecting intubation success with VL and DL. Neck circumference was not measured during this study, which is a potential limitation. Future studies should include this variable to assess its potential impact on intubation difficulty, particularly in obese patients. Although including patients with higher Mallampati scores might offer a broader range of airway challenges, this study's focus on Mallampati I patients provided a controlled comparison between VL and DL outcomes based on BMI alone. These limitations suggest that while our findings are promising, they should be interpreted cautiously, and further research is necessary to validate and expand these results.

Conclusion

Our study reinforces the growing evidence that VL, particularly with the use of the D-Blade, is a valuable tool for managing difficult airways, especially in obese patients. The favorable outcomes in terms of intubation duration, C-L grade, and IDS score indicate that VL provides significant advantages over DL, particularly in patients with challenging anatomical features. The more angled blade of the D-Blade facilitates better oropharyngeal and glottic visualization and allows intubation without the need to align the oral-pharyngeal-laryngeal axes perfectly, which is often a challenge in obese patients.

Conflict of Interests
The authors declare that there is no conflict of interest in the study.

Financial Disclosure
The authors declare that they have received no financial support for the study.

Ethical Approval
This prospective study was conducted following the approval from the Ethics Committee of Manisa Celal Bayar University Faculty of Medicine, granted on January 20, 2020 (Approval Number: 20.478.486).

DOI: 10.5455/medscience.2024.08.103

References

1. De Jong A, Molinari N, Pouzeratte Y, et al. Difficult intubation in obese patients: incidence, risk factors, and complications in the operating theatre and in intensive care units. Br J Anaesth. 2015;114:297-306.
2. Ghebremeskel YM, Tesfamariam EH, Idris IM, Beraki G. Multiple intubation trials and body weight increase the risk of post-operative sore throat after tracheal intubation in National Referral Hospitals in Asmara: a prospective observational study. Int J Anesthetic Anesthesiol. 2022;9:145.
3. Schnittker R, Marshall SD, Berecki-Gisolf J. Patient and surgery factors associated with the incidence of failed and difficult intubation. Anaesthesia. 2020;75:756-66.
4. Saleh LM, Mohammed HF, Afat AN, et al. Problems of endotracheal intubation in obese patient: endotracheal intubation and obesity. International Journal of Medical Sciences, 2023;6:19-27.
5. Narra LR, Udongwo N, Dominic JL, et al. Obesity and the other independent predictors in elective endotracheal tube intubations: a narrative review. J Clin Med Res. 2022;14:177-87.
6. Wang T, Sun S, Huang S. The association of body mass index with difficult tracheal intubation management by direct laryngoscopy: a meta-analysis. BMC Anesthesiol. 2018;18:79.
7. Moon TS, Fox PE, Somasundaram A, et al. The influence of morbid obesity on difficult intubation and difficult mask ventilation. J Anesth. 2019;33:96-102.
8. Yumul R, Elvir-Lazo OL, White PF, et al. Comparison of three video laryngoscopy devices to direct laryngoscopy for intubating obese patients: a randomized controlled trial. J Clin Anesth. 2016;31:71-7.
9. Lewis SR, Butler AR, Parker J, et al. Videolaryngoscopy versus direct laryngoscopy for adult patients requiring tracheal intubation: a cochrane systematic review. Br J Anaesth. 2017;119:369-83.
10. Hoshijima H, Denawa Y, Tominaga A, et al. Videolaryngoscope versus Macintosh laryngoscope for tracheal intubation in adults with obesity: a systematic review and meta-analysis. J Clin Anesth. 2018;44:69-75.
11. Ruetzler K, Bustamante S, Schmidt MT, et al.; Collaborative VLS trial group. Video laryngoscopy vs direct laryngoscopy for endotracheal intubation in the operating room: a cluster randomized clinical trial. JAMA. 2024;331:1279-86.
12. Hansel J, Rogers AM, Lewis SR, et al. Videolaryngoscopy versus direct laryngoscopy for adults undergoing tracheal intubation. Cochrane Database Syst Rev. 2022;4:CD011136.
13. Ruetzler K, Rivas E, Cohen B, et al. McGrath video laryngoscope versus macintosh direct laryngoscopy for intubation of morbidly obese patients: a randomized trial. Anesth Analg. 2020;131:586-93.
14. Lundstrøm LH, Møller AM, Rosenstock C, et al. High body mass index is a weak predictor for difficult and failed tracheal intubation: a cohort study of 91,332 consecutive patients scheduled for direct laryngoscopy registered in the Danish Anesthesia Database. Anesthesiology. 2009;110:266-74.
15. de Carvalho CC, da Silva DM, Lemos VM, et al. Videolaryngoscopy vs. direct Macintosh laryngoscopy in tracheal intubation in adults: a ranking systematic review and network meta-analysis. Anaesthesia. 2022;77:326-38.
16. Yousef GT, Abdalgalil DA, Ibrahim TH. Orotracheal intubation of morbidly obese patients, comparison of GlideScope(®) video laryngoscope and the LMA CTrach™ with direct laryngoscopy. Anesth Essays Res. 2012;6:174-9.
17. Ander F, Magnuson A, Berggren L, et al. Time-to-intubation in obese patients. A randomized study comparing direct laryngoscopy and videolaryngoscopy in experienced anesthetists. Minerva Anestesiol. 2017;83:906-13.