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The influence of the COVID-19 pandemic on videolaryngoscopy: a cross-sectional before-and-after survey

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Abstract

Background: Guidelines and consensus statements recommend the use of videolaryngoscopes (VLs) in airway management of patients with COVID-19. However, there is a lack of knowledge about which types of videolaryngoscopes are used, differences of use between countries, and how the COVID-19 pandemic influenced their use. The primary aim of this before-and-after cross-sectional survey study was to assess the frequency of the use of videolaryngoscopy in the operation theatres in different countries. Also, the preferred characteristics of videolaryngoscopes were assessed.

Methods: With Ethics Committee approval, a questionnaire was distributed among anaesthesiologists through the European Airway Management Society's network in 2019 before and in 2021 during the COVID-19 pandemic. Responses to the questions were analysed and presented as descriptive statistics.

Results: We reached out to 791 anaesthesiologists; 155 (19.5%) returned the first questionnaire, and 91 (11.5%) returned the second survey. Videolaryngoscopes were used in 24.1% of cases before COVID-19 and in 43.1% after the pandemic ($P < 0.001$). We revealed that the availability of videolaryngoscopes increased to 100% in all centres during the pandemic. Routine use of videolaryngoscopes in all cases increased from 12.5% to 38.9%. The type of videolaryngoscope and the blade preference did not change during this period ($P = 1.000$).

Conclusions: This survey reflects that the COVID-19 pandemic significantly increased the availability and use of videolaryngoscopes in operating theatres, and that more anaesthesiologists now use them routinely in all cases. The preferred type of VL or blade did not change during the pandemic.

Key words: airway management, videolaryngoscope, COVID-19, equipment, intubation.

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Videolaryngoscopes (VLs) are increasingly recommended in paediatric [1] and adult [2–5] difficult-airway guidelines. A Cochrane review showed decreased airway complications and fewer unsuccessful tracheal intubations when using VLs [6]. A high first-pass success rate [7], reduction in cervical spine motion [8], improvement of glottic visualization [9], and decreased mucosal trauma incidence [10] are among the proven advantages of VLs over direct laryngoscopes.

Although VLs improve first-attempt success rates and the laryngeal view, and seem to shorten intubation time, this improvement varies between different laryngoscopes [11]. However, the selection of an appropriate type of VL for specific situations is still controversial [12]. The availability of the VL, the conditions under which it is preferred, and the blade selection vary between hospitals and countries. National surveys about videolaryngoscopy are available from different countries with a broad variety of availability, distribution in clinics, and access, as well as the most commonly available videolaryngoscope types.

Today, with challenges posed by COVID-19, the VL is recommended as the first-line strategy for

airway management [13–15]. During the COVID-19 pandemic the importance of VLs was emphasized in reducing the risk of infection during tracheal intubation [16] because the use of a VL increases the spatial distance between the patient and the practitioner [17]. Thus, this potentially protective effect on personnel increases [18], and the routine use of VLs and is now recommended in the consensus guidelines of airway management in patients with possible SARS CoV-2 infection [19]. However, limited information is available how the COVID-19 pandemic has changed airway management practice. The primary aim of this before-and-after cross-sectional survey study was to assess the frequency of the use of VLs in the operation theatres in different countries before and after the first 3 COVID-19 pandemic waves. The secondary outcome measures included a comparison of the characteristics of preferred VLs.

METHODS

Following the approval of the University of Health Sciences Kartal Dr. Lutfi Kirdar City Hospital Ethics Committee (president: Nejdet Bildik, registration number: 2021/514/204/31, date of approval 22/06/2021) in Istanbul, Turkey, anaesthesiologists were invited to participate in the survey by e-mail through the European Airway Management Society's network (www.eamshq.org). Prospective data collection was performed in 2 stages. Two questionnaires were sent out and were open for one month, the first from January 2019 to February 2019 and the second from July 2021 to August 2021, using the online platform at www.surveymonkey.com. The questionnaire was composed of 16 questions arranged in different domains: participants' demographic data; the frequency of VL use; situations where VL was preferred; use of VLs as a rescue device; types of VLs used; rate of VL use in non-difficult airway management and in daily clinical practice; blade preferences; and a protocolized approach to easy laryngoscopy and during non-intubatable situations (Appendix 1). The survey also asked to evaluate channelled versus non-channelled VLs in terms of ease of use, learning curve, ease of cleaning (for reusable devices), costs, and specific features. The same questions were asked in the second survey after the COVID-19 outbreak.

Participants who agreed to participate in the survey and gave consent to the study were included. The respondents' characteristics were recorded, including age, sex, and professional experience.

Statistical analysis

Participants' responses were reported as descriptive statistics and presented as mean ± standard deviation using IBM SPSS Statistics 22 (Armonk, NY: IBM Corp). Subgroup analysis evaluated differences between countries, bed capacities of the hospitals, and the location where the participants were working. In the pairwise comparison of numerical data groups, an independent samples *t*-test was used for those with normal distribution, Mann-Whitney *U* test, and one-way ANOVA test for those which did not. The χ^2 test was used to analyse discrete variables, and the Kruskal-Wallis *H* test was used to examine multiple groups. $P < 0.05$ was considered as significant.

RESULTS

A total of 791 anaesthesiologists were invited to participate in this survey; 155 (19.5%) responded to the first survey and 91 (11.5%) to the second survey. The invited anaesthesiologists were the same in both surveys, and the surveys were same. 91 participants answered both the first and second survey.

The survey cohort before and after the COVID-19 pandemic

The mean age of the participants in the survey before and after COVID-19 was similar ($P = 0.326$, Table 1). The level of experience with VLs was also similar in the before/after surveys ($P = 0.209$). Gender distribution, the duration of professional experience and bed capacity in the hospitals were also found to be similar (Table 1). After the pandemic, VL availability increased significantly, whereas experience with VLs did not change. The preference for use of VLs was 24.1 ± 27.5% before COVID-19 and 43.1 ± 37.7% after the COVID-19 pandemic ($P < 0.001$, Table 2).

The rate of VL use in all participants increased from 14.2% to 38.5% ($P < 0.001$, Table 2). The rate of VL use just for difficult intubation, the rate of use of the VL as a rescue device, the type of VL, and type of blade preference, and indications for use of a hyperangulated blade did not differ before and after the pandemic.

Participants evaluated the videolaryngoscopes according to the following questions regarding the use of channelled and non-channelled videolaryngoscopes: easy to use, easy to learn, easy to clean, low cost, anti-fog, reusable, connection with smart phone, pocket monitor, dedicated stylet, battery life, paediatric blade, lifetime of device, recording options, no waiting time before use, O_2 and suction line, and adjustable length. There was no difference in preferences and opinions before and after the COVID-19 pandemic ($P = 1.000$, Table 3).

DISCUSSION

Our findings may reflect an interesting attitude during the COVID-19 pandemic: on the one hand, the increased trend of use of VLs, clearly perceived

TABLE 1. The comparison of participants' characteristics, professional experience, and bed capacity of the hospitals they work in before and after COVID-19

Factor	Before COVID-19, $n = 155$	After COVID-19, $n = 91$	*P*-value
Age (years), mean ± SD, *n* (%)	46.3 ± 9.5	47.5 ± 9.8	0.326
< 40 years	42 (27.3)	21 (23.1)	0.715
40–49 years	48 (31.2)	32 (35.2)	
≥ 50 years	64 (41.6)	38 (41.8)	
Sex, *n* (%)			
Female	74 (48.1)	34 (37.4)	0.103
Male	80 (51.9)	57 (62.6)	
Professional experience (years), *n* (%)			
0–10	39 (25.3)	14 (15.4)	0.129
11–20	52 (33.8)	30 (33.0)	
≥ 21	63 (40.9)	47 (51.6)	
Bed capacity, *n* (%)			
Less than 400 beds	41 (26.6)	16 (17.6)	0.269
400–1000 beds	67 (43.5)	44 (48.4)	
More than 1000 beds	46 (29.9)	31 (34.1)	

as an effective, high-success, and safer device; on the other hand, maintaining the pre-pandemic preferences for type of VL and blade may reflect the preference of what is well known and what physicians feel confident with.

Airway management is routinely applied by anaesthesiologists, emergency medicine physicians, and intensivists. However, airway management may be catastrophic and fatal if complications occur [20], and non-compliance with current guidelines is associated with poor patient outcomes [21]. Increasing the use of VLs in hospitals may result in an improvement in patient safety and needs to be an aim for anaesthesia and airway societies and their educational programs. Guidelines and consensus statements recommend the use of VLs in the airway management of patients with COVID-19 [22]. The aim behind this approach was clearly to enhance the first-pass success rate in physiologically difficult airway patients, ensuring at same time increased protection from SARS-CoV-2 infection for the intubation team [23]. We observed a significant increase in the percentage of VL users in the before/after pandemic responses. This finding may have multiple meanings: in the critical and relatively unknown setting of the SARS-CoV-2 challenge, physicians felt safer and more secure in following available guidelines, which included use of videolaryngoscopes, which shows the high rate of compliance with the guideline recommendations.

As a further point, we believe that enhanced and more frequent use of VLs during and after the pandemic, will represent a great opportunity for training [24], with significant implications for the future use and performance of VLs, given that recent data clearly show the impact of expertise with VLs on the rate of first-pass intubation success [25]. Furthermore, videolaryngoscopes favour the intubation of a physiologically difficult airway in a highly demanding environment [26]. Therefore, it is obvious that VLs should be used as primary devices for treating the airway in the pandemic.

Little is known about the availability of VLs, and even less during the COVID-19 outbreak. Before the pandemic, availability of VLs was reported with variable percentages in different countries: 65% from the Hungarian Society of Anaesthesiology and Intensive Therapy [27], 56.8% as found in Swedish hospitals [28], and as 57.5% in the UK [29]. The second (after pandemic) survey clearly showed an unprecedented result, i.e. the 100% availability and access to VLs reported by participants. In contrast, the earlier reports of the pre-pandemic survey found about 24.1% use of VLs, with 6% of centres not having a VL.

The second survey was conducted 1.5 years after the initial COVID-19 outbreak, in January 2020, and we believe that this time frame clearly depicts the actual situation, given that probably an earlier survey would have not shown such ubiquitous availability of VLs.

According to our knowledge, this study is the first one to compare the use of VLs before and after COVID-19. The lack of such data in the literature reveals one of the strongest aspects of our study. In another UK survey conducted before the COVID-19 pandemic, the rate of hospitals having VL access was reported as 92% [30]. But fewer than one in three of these hospitals were using VLs routinely to

TABLE 2. Videolaryngoscope use before and during the COVID-19 pandemic

Factor	Before COVID-19, $n = 155$	After COVID-19, $n = 91$	*P*-value
Professional experience (years), mean ± SD	18.4 ± 9.3	19.9 ± 8.8	0.209
Preference of VL (%)	24.1	43.1	< 0.001
The rate of VL use in general, *n* (%)			
0–25%	107 (69.2)	44 (48.35)	<0.001
26–50%	26 (16.7)	15 (16.48)	
51–75%	7 (4.5)	6 (6.59)	
> 76%	15 (9.6)	26 (28.57)	
The rate of VL use for all participants, *n* (%)			
No	133 (85.8)	56 (61.5)	< 0.001
Yes	22 (14.2)	35 (38.5)	
If no, why?, *n* (%)			
Not available at all	6 (5.1)	0 (0)	0.003
Educational purpose	17 (14.5)	8 (17.8)	
Economic reasons	16 (13.7)	7 (15.6)	
Not necessary	43 (36.8)	21 (46.7)	
Impractical	6 (5.1)	8 (17.8)	
Not available everywhere	29 (24.8)	1 (2.2)	
The rate of VL use for just difficult intubation, *n* (%)			
No	75 (49.7)	48 (52.7)	0.643
Yes	76 (50.3)	43 (47.3)	
If yes, why?, *n* (%)			
Economic reasons	3 (4.5)	2 (7.4)	< 0.001
Educational purposes	14 (21.2)	7 (25.9)	
Practical	1 (1.5)	8 (29.6)	
Useful	27 (40.9)	10 (37.0)	
Necessary	9 (13.6)	0 (0)	
Not available everywhere	7 (10.6)	0 (0)	
Not necessary	5 (7.6)	0 (0)	
Is VL a rescue device?, *n* (%)			
No	17 (11.2)	16 (18.0)	0.139
Yes	135 (88.8)	73 (82.0)	
Type of VL preference?, *n* (%)			
Channelled	18 (12.7)	11 (12.6)	0.997
Unchannelled	79 (55.6)	48 (55.2)	
Both	45 (31.7)	28 (32.1)	
Type of blade preference?, *n* (%)			
Macintosh	67 (44.4)	50 (54.9)	0.111
Hyperangulated	84 (55.6)	41 (45.1)	
Using a hyperangulated blade is more successful, *n* (%)			
Agree	79 (52.3)	45 (50.0)	0.873
Neutral	52 (34.4)	31 (34.4)	
Don't agree	20 (13.2)	14 (15.6)	
Novice users should use a hyperangulated blade, *n* (%)			
Agree	13 (8.7)	13 (14.4)	0.209
Neutral	53 (35.3)	24 (26.7)	
Don't agree	84 (56.0)	53 (58.9)	

VL – videolaryngoscope

TABLE 3. Comparison of channelled and unchannelled videolaryngoscopes

	Before COVID-19, $n = 155$ (mean ± SD)	After COVID-19, $n = 91$ (mean ± SD)	*P*-value
Easy to use			
AWS-Pentax	13 ± 11.6	7 ± 11.5	1.000
McGrath	25 ± 17.5	13 ± 17.6	
King Vision	25 ± 22.3	14 ± 23.0	
C-MAC	77 ± 53.8	40 ± 54.1	
Airtraq	46 ± 41.1	25 ± 41.0	
Glidescope	37 ± 25.9	19 ± 25.7	
Other Channelled VL	28 ± 25.0	15 ± 24.6	
Other Unchannelled VL	4 ± 2.8	2 ± 2.7	
Easy to learn			
AWS-Pentax	13 ± 12.6	7 ± 12.5	0.708
McGrath	22 ± 16.4	13 ± 17.3	
King Vision	23 ± 22.3	17 ± 30.4	
C-MAC	75 ± 56.0	40 ± 53.3	
Airtraq	42 ± 40.8	19 ± 33.9	
Glidescope	34 ± 25.4	18 ± 24.0	
Other Channelled VL	25 ± 24.3	13 ± 23.2	
Other Unchannelled VL	3 ± 2.2	2 ± 2.7	
Easy to clean			
AWS-Pentax	9 ± 9.8	6 ± 11.3	0.904
McGrath	33 ± 28.0	18 ± 25.7	
King Vision	28 ± 30.4	15 ± 28.3	
C-MAC	50 ± 42.4	30 ± 42.9	
Airtraq	27 ± 29.3	14 ± 26.4	
Glidescope	30 ± 25.4	18 ± 25.7	
Res Q Scope	1 ± 1.1	0 ± 0.0	
Trueview	0 ± 0.0	2 ± 2.9	
Other Channelled VL	27 ± 29.3	18 ± 34.0	
Other Unchannelled VL	5 ± 4.2	2 ± 2.9	
Low cost			
AWS-Pentax	2 ± 2.2	4 ± 7.1	0.228
McGrath	30 ± 31.2	19 ± 32.8	
King Vision	18 ± 19.4	10 ± 17.9	
C-MAC	19 ± 19.8	8 ± 13.8	
Airtraq	53 ± 57.0	25 ± 44.6	
Glidescope	24 ± 25.0	16 ± 27.6	
Other Channelled VL	20 ± 21.5	17 ± 30.4	
Other Unchannelled VL	12 ± 12.5	12 ± 20.7	
Anti-fog			
AWS-Pentax	13 ± 16.2	10 ± 20.4	0.690
McGrath	12 ± 11.1	8 ± 13.3	
King Vision	18 ± 22.5	8 ± 16.3	
C-MAC	51 ± 47.2	32 ± 53.3	
Airtraq	23 ± 28.7	16 ± 32.7	
Glidescope	40 ± 37.0	17 ± 28.3	
Res Q Scope	2 ± 2.5	0 ± 0.0	
Trueview	2 ± 1.9	0 ± 0.0	
Other Channelled VL	24 ± 30.0	15 ± 30.6	
Other Unchannelled VL	3 ± 2.8	3 ± 5.0	

TABLE 3. Cont.

	Before COVID-19, $n = 155$ (mean ± SD)	After COVID-19, $n = 91$ (mean ± SD)	*P*-value
Reusable			
AWS-Pentax	14 ± 17.5	8 ± 16.3	0.918
McGrath	20 ± 16.3	13 ± 18.1	
King Vision	22 ± 27.5	13 ± 26.5	
C-MAC	70 ± 56.9	38 ± 52.8	
Airtraq	17 ± 21.2	8 ± 16.3	
Glidescope	28 ± 22.8	16 ± 22.2	
Other Channelled VL	25 ± 31.2	19 ± 38.8	
Other Unchannelled VL	5 ± 4.1	5 ± 6.9	
Connection with smart phone			
AWS-Pentax	5 ± 6.3	6 ± 12.2	0.280
McGrath	6 ± 9.5	5 ± 10.6	
King Vision	2 ± 2.5	4 ± 8.2	
C-MAC	20 ± 31.7	14 ± 29.8	
Airtraq	50 ± 63.3	26 ± 53.1	
Glidescope	10 ± 15.9	11 ± 23.4	
Other Channelled VL	22 ± 27.8	13 ± 26.5	
Other Unchannelled VL	26 ± 41.3	15 ± 31.9	
Pocket monitor			
AWS-Pentax	9 ± 11.0	7 ± 14.3	0.824
McGrath	26 ± 26.0	18 ± 28.6	
King Vision	23 ± 28.0	12 ± 24.5	
C-MAC	52 ± 52.0	29 ± 46.0	
Airtraq	29 ± 35.4	15 ± 30.6	
Glidescope	13 ± 13.0	7 ± 11.1	
Other Channelled VL	21 ± 25.6	15 ± 30.6	
Other Unchannelled VL	8 ± 8.0	8 ± 12.7	
Special stylet			
AWS-Pentax	5 ± 7.9	6 ± 15.4	0.821
McGrath	3 ± 2.9	3 ± 5.4	
King Vision	8 ± 12.7	4 ± 10.3	
C-MAC	30 ± 29.1	18 ± 32.1	
Airtraq	9 ± 14.3	6 ± 15.4	
Glidescope	60 ± 58.3	27 ± 48.2	
Res Q Scope	5 ± 7.9	3 ± 7.7	
Trueview	1 ± 1.0	2 ± 3.6	
Other Channelled VL	36 ± 57.1	20 ± 51.3	
Other Unchannelled VL	9 ± 8.7	6 ± 10.7	
Battery life			
AWS-Pentax	9 ± 11.5	10 ± 21.7	0.265
McGrath	21 ± 22.8	11 ± 18.6	
King Vision	23 ± 29.5	8 ± 17.4	
C-MAC	39 ± 42.4	28 ± 47.5	
Airtraq	21 ± 26.9	11 ± 23.9	
Glidescope	26 ± 28.3	16 ± 27.1	
Other Channelled VL	25 ± 32.1	17 ± 37.0	
Other Unchannelled VL	6 ± 6.5	4 ± 6.8	

TABLE 3. Cont.

	Before COVID-19, $n = 155$ (mean ± SD)	After COVID-19, $n = 91$ (mean ± SD)	*P*-value
Paediatric blade			
AWS-Pentax	10 ± 11.9	4 ± 7.8	0.737
McGrath	11 ± 10.6	6 ± 9.4	
King Vision	8 ± 9.5	7 ± 13.7	
C-MAC	54 ± 51.9	34 ± 53.1	
Airtraq	38 ± 45.2	21 ± 41.2	
Glidescope	28 ± 26.9	16 ± 25.0	
Other Channelled VL	28 ± 33.3	19 ± 37.3	
Other Unchannelled VL	10 ± 9.6	7 ± 10.9	
Lifetime of device			
AWS-Pentax	15 ± 19.7	10 ± 21.3	0.710
McGrath	12 ± 11.4	7 ± 11.3	
King Vision	15 ± 19.7	8 ± 17.0	
C-MAC	61 ± 58.1	33 ± 53.2	
Airtraq	20 ± 26.3	9 ± 19.1	
Glidescope	28 ± 26.7	18 ± 29.0	
Res Q Scope	1 ± 1.3	0 ± 0.0	
Trueview	2 ± 1.9	1 ± 1.6	
Other Channelled VL	25 ± 32.9	20 ± 42.6	
Other Unchannelled VL	2 ± 1.9	3 ± 4.8	
Recording options			
AWS-Pentax	18 ± 24.7	12 ± 25.0	0.867
McGrath	6 ± 5.7	6 ± 9.7	
King Vision	4 ± 5.5	4 ± 8.3	
C-MAC	74 ± 69.8	37 ± 59.7	
Airtraq	24 ± 32.9	13 ± 27.1	
Glidescope	22 ± 20.8	14 ± 22.6	
Other Channelled VL	27 ± 37.0	19 ± 39.6	
Other Unchannelled VL	3 ± 2.8	4 ± 6.5	
No waiting time before use			
AWS-Pentax	11 ± 11.7	8 ± 15.4	0.299
McGrath	30 ± 26.1	13 ± 21.0	
King Vision	26 ± 27.7	11 ± 21.2	
C-MAC	53 ± 46.1	30 ± 48.4	
Airtraq	35 ± 37.2	17 ± 32.7	
Glidescope	26 ± 22.6	17 ± 27.4	
Res Q Scope	0 ± 0.0	2 ± 3.8	
Trueview	1 ± 0.9	0 ± 0.0	
Other Channelled VL	22 ± 23.4	14 ± 26.9	
Other Unchannelled VL	5 ± 4.3	2 ± 3.2	
O_2 and suction line			
AWS-Pentax	11 ± 18.0	9 ± 20.9	0.674
McGrath	1 ± 1.4	4 ± 8.5	
King Vision	4 ± 6.6	3 ± 7.0	
C-MAC	26 ± 37.7	16 ± 34.0	
Airtraq	6 ± 9.8	4 ± 9.3	
Glidescope	14 ± 20.3	6 ± 12.8	
Res Q Scope	6 ± 9.8	1 ± 2.3	
Trueview	10 ± 14.5	5 ± 10.6	
Other Channelled VL	34 ± 55.7	26 ± 60.5	
Other Unchannelled VL	18 ± 26.1	16 ± 34.0	

TABLE 3. Cont.

	Before COVID-19, $n = 155$ (mean ± SD)	After COVID-19, $n = 91$ (mean ± SD)	*P*-value
Adjustable length			
AWS-Pentax	8 ± 14.3	7 ± 17.5	0.880
McGrath	20 ± 27.8	8 ± 19.0	
King Vision	8 ± 14.3	3 ± 7.5	
C-MAC	23 ± 31.9	12 ± 28.6	
Airtraq	5 ± 8.9	4 ± 10.0	
Glidescope	10 ± 13.9	7 ± 16.7	
Res Q Scope	1 ± 1.8	1 ± 2.5	
Trueview	3 ± 4.2	4 ± 9.5	
Other Channelled VL	34 ± 60.7	25 ± 62.5	
Other Unchannelled VL	16 ± 22.2	11 ± 26.2	

manage the airway. In our study, we observed that the routine use of VLs in all cases increased 3-fold during the pandemic. This issue was even advocated before the pandemic [31].

In a study including 3668 cases at study baseline and 3786 cases at follow-up, routine use of VLs is an effective factor in reducing the incidence of adverse airway events [32]. In the specific setting of COVID-19, VLs may provide at the same time a higher rate of successful tracheal intubation compared to standard direct laryngoscopes [33, 34], while giving more protection for airway providers due to increased mouth-to-mouth distance, minimized risk of aerosolization [35], and shorter patient-contact time.

We believe that this finding may have implications also on the endemic phase of COVID-19 in the coming years: with an estimated SARS-CoV-2 infection rate in elective surgical patients of 1–9% [36], and given the time and cost burdens of preoperative nasopharyngeal swab testing [37], wider routine use of VLs may increase healthcare providers' safety and reduce infection risks, especially with SARS-CoV-2 asymptomatic or incubating patients.

There are several comparative studies on the performance of different VLs in COVID-19 patients [38, 39]. We evaluated that the frequency of VL use increased during the COVID-19 pandemic without differences in preferred blade or VL type. Studies comparing channelled versus non-channelled VLs have reported controversial results. Biro *et al.* [40] reported that non-channelled VL shortened the time to achieve glottis visualization but extended the total airway management duration. Padhy *et al*. [41] reported higher success rate and shorter time with the Airtraq (Prodol, Vizcaya, Spain) channelled VL compared to the McGrath VL (Medtronic, USA). On the other hand, another study comparing the channelled and non-channelled versions of different VLs did not show any difference in terms of first-pass intubation success rate [42]. We explored both channelled and non-channelled VLs in detail regarding their different features, including the ease of use, cleaning, and learning, cost, dedicated stylet, and some technical specifications, finding that there was no significant change after COVID-19. Current airway guidelines provide no clear recommendations regarding the use of different blade types. Further studies are required in this field.

The most important limitation of this study is the relatively low response rate to our invitation. There might be limitations regarding language use in such an international survey in English, and there might be also a bias towards airway enthusiasts participating in such a survey. We ascertained that the COVID-19 pandemic influenced the availability and the use of VLs. However, further studies are needed to see if this increase leads to a reduction in the complication rate or the incidence of emergency front of neck access.

The survey reflects that the COVID-19 pandemic significantly increased the availability and use of VLs in operating theatres, and that a larger number of anaesthesiologists now use it routinely in all cases. This finding may have important implications on training and expertise development, with long-term results in terms of the proficiency and efficacy of VLs. The preferred type of VL or blade did not change during the pandemic. Further studies are needed to address specific unanswered questions.

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APPENDIX 1.

The first part of the survey

Which kind of Videolaryngoscope (VLS) do you use in your practice?

If you participate in this survey, you agree that all data will be analysed in an anonymized form for publication and presented at international conferences. If you do not agree with that, we cannot use your data for this survey.

I agree: yes no

1. Age: years
2. Gender: Female/Male/Other
3. Experience in anaesthesiology, years
4. Your institution has: less than 400 beds, 400–1000 beds, more than 1000 beds
5. In how what % of your intubations do you use a VLS?
6. Do you use your VLS for all your "every day cases"?: yes/no, and why
7. Do you use your VLS only for difficult cases: yes/no, and why
8. Is your VLS a rescue tool if your usual approach does not work? Yes/no, and why
9. In case of yes with the former question – what is your "usual" way of intubation?
   Do you have: channelled, unchannelled, both, non? in your institution?
   Which type to you have?
10. Which one is mostly used in your clinic/department?
    What is the main reason: …….
11. Which kind of VLS do you need in your daily practice?
    What is the main reason: …….
12. Which features are important when you buy a new VLS for your clinic/department?
13. Which features are important for the available VLS in your clinic/department?
14. Which blade do you prefer – hyperangulated or Macintosh blade? Hyper Y N – Mac Y N
15. Please rate the following sentence (1: don't agree, 2: neutral, 3: agree)
    a) Hyperangulated blades usually have a higher success rate
    b) Usually, beginners should start with hyperangulated blades
16. What do you do when you have an easy laryngoscopy but cannot intubate right away ("You see that you fail")?