

Comparison of the time, ease, attempts to successful endotracheal intubation using macintosh laryngoscope, kingvision and anaesthetics video laryngoscope in general anaesthesia

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ABSTRACT

BACKGROUND AND AIMS: Endotracheal intubation is the first step to maintain the patency of airway during general anaesthesia. Problem with the airway management constitutes 17% of anaesthesia closed claim, most common being difficult intubation which is almost 5%. The aim of this study is to compare the time, ease, numbers of attempts taken, switching between the laryngoscopes if facing any difficulty during endotracheal intubation while using Macintosh laryngoscope, KingVision laryngoscope, Anaesthetics video laryngoscope.

MATERIAL AND METHODS: In this Prospective observational study Ninety patients, scheduled for elective surgery after getting approval from ethical committee and informed written consent from all patients, the prospective observational study was conducted on adult patients of either sex satisfying inclusion criteria. In our study patients were randomized into 3 groups (30 patients in each group), patient who got intubated with Macintosh laryngoscope (Group M), patient who got intubated with KingVision video laryngoscope (Group K), patient who got intubated with Anaesthetics video laryngoscope (Group A). All the three groups were compared for time, ease and attempts to successful endotracheal intubation while using Macintosh laryngoscope, KingVision laryngoscope, Anaesthetics video laryngoscope.

RESULTS: The mean time taken has been found to be significantly lesser in Group A as compared to Group M and Group K. The intubation difficulty score was found statistical insignificant in all the three groups (p value: 0.956). The comparison between Mallampati score and Cormack- Lehane grading was significant in Group A (p value <0.001) and Group K (p value < 0.033).

CONCLUSION: It can be concluded that Anaesthetic video laryngoscope is better when considering the intubation time (takes lesser time for intubation), number of attempts (takes lesser number of attempts for intubation) and stylet used (less stylet used in case of Anaesthetic video Laryngoscope).

KEYWORDS: Endotracheal Intubation, Macintosh laryngoscope, KingVision laryngoscope, Anaesthetics Video laryngoscope

1. INTRODUCTION

Endotracheal intubation is the first step to maintain the patency of airway during general anaesthesia. Problem with the airway management constitutes 17% of anaesthesia closed claim, most common being difficult intubation which is almost 5%. [1]

There is no single factor which can predict the existence of difficult airway and so it is only recognised after the induction of anaesthesia. The American society of Anaesthesiologists (ASA) defines difficult intubation as taking 3 attempts or more for endotracheal intubation when an average laryngoscope is used or when endotracheal intubation takes 10 min or more. [2]

The Macintosh laryngoscope has been the gold standard device for the endotracheal intubation and direct laryngoscopy. It is invented by Forreger in 1940s. [3] Direct laryngoscopic (Macintosh laryngoscope) intubation is difficult in 1%-4% of the cases and is almost impossible in 0.05%-0.35% of cases who seems to have normal airway. [4] The video laryngoscopes is a recently developed device which helps in providing the indirect visualization of the glottis with the help of camera. [5] Video laryngoscopes have become a well-establish tool for anaesthesiologists as well as for other health care providers (intensive care department, emergency department, and in prehospital settings) which involved in airway management. [6]

There are multiple techniques available which helps in securing the airway including the visualization of vocal cords with direct laryngoscope or by video laryngoscope, placement of endotracheal tube directly into the trachea via cricothyrotomy, visualization of vocal cords via fiberoptic laryngoscope and intubation done by nasal or oral route. [7]

Direct laryngoscopy and video laryngoscopy are the most common approaches used for endotracheal intubation. There are two basic styles of laryngoscope blade which are currently commercially available. The Macintosh blades which are curved laryngoscope blades are widely used while Miller blades are most popular straight blades. [7]

Direct laryngoscopy has been the conventional and accepted standard technique for endotracheal intubation, having the success rate that may equal or exceed 99% in elective settings or emergency conditions. [8] Endotracheal intubation via video laryngoscope is the most innovative advanced technique and a completely different experience and needs more skills as compared to the conventional Macintosh laryngoscope. [9]

Numerous video laryngoscopes are commercially available. They are GlideScope, Pentax AWS100 (Airway Scope, Pentax Corp, Tokyo, Japan), McGrath series 5, Storz DCI, CoPilot etc. [8]

GlideScope was one of the first video laryngoscope which was invented in 2001 by a vascular and a general surgeon, named John Pacey of Canada. [9] The first generation of KingVision video laryngoscope (King Systems, NOBLESVILLE, IN, USA) was invented in 2013 and came in clinical practice in 2014. Video laryngoscopes may be advantageous for improved and easier visibility of laryngeal inlet, less force is required during intubation, visualization of the intubation process on monitor. [10]

After knowing all the advantages and disadvantages of the direct (Macintosh laryngoscope) and indirect (video laryngoscopes) laryngoscopes, we will compare the time, ease, numbers of attempts taken, switching between the laryngoscopes if facing any difficulty during endotracheal intubation while using Macintosh laryngoscope, KingVision laryngoscope, Anaesthetics video laryngoscope.

2. MATERIAL AND METHODS

After approval from ethical committee and informed written consent from all patients, the prospective observational study was conducted on adult patients of either sex satisfying inclusion criteria at Nehru Hospital in B.R.D. Medical College, Gorakhpur. In our study we have decided to take 30 patients in each group.

INCLUSION CRITERIA:

- Patients who give valid informed consent
- Patient in the age group of 18 to 60 years
- ASA I and ASA II
- Patients undergoing elective surgeries from all surgical specialities requiring endotracheal intubation

EXCLUSION CRITERIA

- Patients not willing to participate in the study.
- Patients with ASA grade III, IV & V.
- Patients with age less than 18 years
- Patients with tumour of oral cavity
- Pregnant women

- Morbid obesity
- Patients with unstable cervical spine

Cormack – Lehane Grading For Laryngoscopic View

Cormack and Lehane classified the laryngoscopic view of visualization of glottis and epiglottis in four grades.

Grade 1: Visualisation of entire laryngeal aperture

Grade 2: Visualisation of only the posterior portion of laryngeal aperture

Grade 3: Visualisation of only epiglottis

Grade 4: No visualisation of epiglottis and larynx

Grade 1 is the best view where epiglottis and vocal cords are in complete view and Grade 4 is the most difficult view where epiglottis and larynx are not visualized.

Grade 1 and Grade 2 are considered as “adequate exposure”

Grade 3 and Grade 4 are considered as “inadequate exposure”

Intubation difficulty score (IDS)[11]

N1: Number of attempts at intubation>1

N2: Number of operators>1

N3: Number of additional techniques used

N4: Glottic exposure (Cormack Lehane grade minus 1)

N5: amount of lifting force required during laryngoscopy (0= normal, 1= increased)

N6: Required laryngeal pressure (0 = not required, 1= required)

N7: Status of vocal cords (0 = abducted, 1 = adducted)

Total IDS = Sum of scores

IDS degree of difficulty:

0: easy

0< IDS≤5: slight difficulty

IDS >5 moderate to major difficulty

IDS infinity (∞) = impossible

Rules for calculating IDS score

N1- every additional attempt adds one point

N2- Every additional operator adds one point

N3- Each alternative technique adds one point

N4- Apply Cormack Lehane grade for first oral attempt

N6- Sellick’s manoeuvre adds no point

After the pre anaesthetic check-up, all the patients will be divided randomly using computer generated method into three study groups of-

Group M- Patient with endotracheal intubation done via Macintosh laryngoscope

Group K- Patient with endotracheal intubation done via KingVision video laryngoscope

Group A – Patient with endotracheal intubation done via Anaesthetics video laryngoscope

All the patients were undergone pre anaesthetic check-up a day before surgery which include a detailed history, general physical examination, systemic examination and airway assessment of the patient. All the routine investigations and other specific investigation were undertaken if seems to be necessary. All other necessary information of the patient noted down like age, sex, weight, intoxication history. All the patients were advised to keep fasting of at least 8 hours prior to surgery and received a dose of tab alprazolam 0.25 mg and Tab Rantac 150mg orally night prior to surgery.

On the morning of surgery intravenous access with 18 G or 20 G cannula was secured in preoperative room and I.V. fluid ringer lactate was started as per their requirement. From there the patient then shifted to operation theatre. In the operation theatre, standard monitoring being done using continuous ECG, saturation (Spo₂), ETCO₂, non-invasive BP monitoring baseline vitals will be recorded.

All the patients were preoxygenated with 100% oxygen through a face mask

for three to five minutes, then Premedication with Inj. Glycopyrrolate 0.004 mg/kg, Inj. Midazolam 0.05mg/kg and Inj. Fentanyl 2µg/kg was given and all the patients were induced with Inj. Propofol 2-3 mg/kg and Vecuronium 0.1 mg/kg. Airway was secured with Endotracheal tube.

All the parameters such as time, ease, number of attempts, switching between the laryngoscope were recorded at the time of intubation.

3. RESULTS AND OBSERVATION

Table 1: Comparison of frequencies of different Mallampati score in between group A, group M and group K

	Group A	Group M	Group K	Chi Sq.	p-Value
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Mallampati score	n	%	n	%	n	%		
I	12	40.00	9	30.00	12	40.00	2.99	0.811
II	12	40.00	18	60.00	14	46.67		
III	4	13.33	2	6.67	3	10.00		
IV	2	6.67	1	3.33	1	3.33		

Table 1 showed the comparison of frequencies of different Mallampati score in between group A, group M and group K. The percentage of I, II, III and IV Mallampati score were 40.00%, 40.00%, 13.33% and 6.67% in group A, 30.00%, 60.00%, 6.67% and 3.33% in group M and 40.00%, 46.67%, 10.00% and 3.33% in group K respectively. The frequencies of different MPS were comparable in between groups.

Table 2: Comparison of mean time taken for intubation (sec) in between group A, group M and group K

	Group A		Group M		Group K		f	p-Value
	Mean	±SD	Mean	±SD	Mean	±SD		
Time taken for intubation (sec)	13.53	1.22	15.17	1.15	18.73	1.14	154.45	<0.001*

*=Significant (p<0.05)

Table 2 showed the comparison of mean time taken for intubation (sec) in between group A, group M and group K. The mean time taken for intubation (sec) was 13.53±1.22 sec in group A, 15.17±1.15 sec in group M and 18.73±1.14 sec in group K. The mean time taken for intubation (sec) was significantly different in between groups.

Table 3: Comparison of frequencies of different Intubation difficulty score (IDS) in between groups

Intubation difficulty score (IDS)		Group A		Group M		Group K		Total	Chi Sq.	p-Value
		n	%	n	%	n	%			
Number of attempts >1 (N1)	0	29	96.67	25	83.33	27	90.00	81	2.27	0.296
	1	1	3.33	5	16.67	3	10.00	11		
	2	0	0.00	0	0.00	0	0.00	0		
Number of Operator >1 (N2)	0	30	100.0	30	100.0	30	100.0	90	-	-
	1	0	0.00	0	0.00	0	0.00	0		
Number of alternative technique used (N3)	0	28	93.33	25	83.33	27	90.00	80	1.58	0.455
	1	2	6.67	5	16.67	3	10.00	10		
	2	0	0.00	0	0.00	0	0.00	0		
Cormack-Lehane grade minus 1 (N4)	0	16	53.33	19	63.33	19	63.33	54	4.33	0.363
	1	12	40.00	6	20.00	9	30.00	27		
	2	2	6.67	5	16.67	2	6.67	9		
	3	0	0.00	0	0.00	0	0.00	0		
Lifting force required (N5)	0	21	70.00	20	66.67	22	73.33	63	0.32	0.853
	1	9	30.00	10	33.33	8	26.67	27		
Laryngeal pressure (N6)	0	24	80.00	21	70.00	27	90.00	72	3.75	0.153
	1	6	20.00	9	30.00	3	10.00	18		
Vocal cords status (N7)	0	30	100.0	30	100.0	30	100	90	-	-
	1	0	0.00	0	0.00	0	0	0		

Table 3 showed the comparison of frequencies of different Intubation difficulty score (IDS) in between groups. The frequency of Intubation difficulty score (IDS) was not significantly different in between groups.

Table 4: Comparison of frequencies of IDS degree of difficulty in between groups

IDS degree of difficulty		Group A		Group M		Group K		Total	Chi Sq.	p-Value
		n	%	n	%	n	%			
Easy	0	16	53.33	16	53.33	15	50.00	47	0.09	0.956

Slightly Difficult	≤5	14	46.67	14	46.67	15	50.00	43		
Difficult	>5	0	0.00	0	0.00	0	0.00	0		

Table 4 showed the comparison of frequencies of IDS degree of difficulty in between groups. The frequencies of different IDS degree of difficulty (Easy, Slightly Difficult and Difficult) were not significantly different in between groups and intra-groups.

Table 5: Distribution of cases in MPS and CL Grading

Grading		Group A				Group M				Group K			
		I	II	III	IV	I	II	III	IV	I	II	III	IV
MPS	n	12	12	4	2	9	18	2	1	12	14	3	1
	%	40.0	40.0	13.3	6.6	30.0	60.0		3.3	40.0	46.6	10.0	3.3
CL grading	n	16	12	2	0	19	6	5	0	19	9	2	0
	%	53.3	40.0		0.0	63.3	20.0	16.6	0.0	63.3	30.0		0.0
		0	0	6.67	0	3	0	7	0	3	0	6.67	0

Table 5 showed the distribution of cases in Mallampati score and CL Grading.

30 patients of group A showed MPS I in 12 cases, MPS II in 12 cases, MPS III in 4 cases and MPS IV in 2 cases whereas CL grading I in 16 cases, CL grading II in 12 cases, CL grading III in 2 cases and CL grading IV in 0 case. 30 patients of group M showed MPS I in 9 cases, MPS II in 18 cases, MPS III in 2 cases and MPS IV in 1 case whereas CL grading I in 19 cases, CL grading II in 6 cases, CL grading III in 5 cases and CL grading IV in 0 case. 30 cases of group K showed MPS I in 12 cases, MPS II in 14 cases, MPS III in 3 cases and MPS IV in 1 case whereas CL grading I in 19 cases, CL grading II in 9 cases, CL grading III in 2 cases and CL grading IV in 0 case.

Table 6: Comparisons of Mallampati score in between CL Grading in group

Group	TOTAL no. of patients according to MPS	Mallampati score	CL Grading								Chi Sq.	p-Value
			I		II		III		IV			
			n	%	n	%	n	%	n	%		
Group A	12	I	11	68.75	1	8.33	0	0.00	0	0.00	43.22	<0.001*
	12	II	5	31.25	7	58.33	0	0.00	0	0.00		
	4	III	0	0.00	4	33.33	0	0.00	0	0.00		
	2	IV	0	0.00	0	0.00	2	100.00	0	0.00		
		Total	16	100.00	12	100.00	2	100.00				
Group M	9	I	8	47.06	1	16.67	0	0.00	0	0.00	8.40	0.078
	18	II	11	64.71	4	66.67	3	60.00	0	0.00		
	2	III	0	0.00	1	16.67	1	20.00	0	0.00		
	1	IV	0	0.00	0	0.00	1	20.00	0	0.00		
		Total	17	100.00	6	100.00	5	100.00	0	0.00		
Group K	12	I	7	36.84	5	55.56	0	0.00	0	0.00	4.36	0.033*
	14	II	12	63.16	1	11.11	1	50.00	0	0.00		
	3	III	0	0.00	2	22.22	1	50.00	0	0.00		
	1	IV	0	0.00	1	11.11	0	0.00	0	0.00		
		Total	19	100.00	9	100.00	2	100.00	0	0.00		

*=Significant (<0.05)

Table 6 shows the comparisons of Mallampati score in between CL Grading in group. The frequencies of Mallampati score were more significant more in group A and K, whereas it was comparable in group M.

Group A: 12 patients of MPS I showed CL grading I in 11 patients whereas 1 patient showed CL grade II. 12 patients of MPS II showed CL grading II in 7 patients whereas 5 patient showed CL grade I. 4 patients of MPS III showed CL grading III in 0 patient whereas all 4 patients showed CL grade II. 2 patients of MPS IV showed CL grading IV in 0 patient whereas all 2 patients showed CL grade III.

Group M: 9 patients of MPS I showed CL grading II in 8 patients whereas 1 patient showed CL grade II. 18 patients of MPS II showed CL grading II in 4 patients, CL grade I in 11 patients whereas 3 patient showed CL grade III. 2

patients of MPS III showed CL grading III in 1 patient whereas 1 patient showed CL grade II. 1 patient of MPS IV showed CL grading IV in 0 patient whereas 1 patient showed CL grade III.

Group K: 12 patients of MPS I showed CL grading I in 7 patients whereas 5 patient showed CL grade II. 14 patients of MPS II showed CL grading II in 1 patient, CL grade I in 12 patients whereas 1 patient showed CL grade III. 3 patients of MPS III showed CL grading III in 1 patient whereas 2 patients showed CL grade II. 1 patient of MPS IV showed CL grading IV in 0 patient whereas showed CL grade II.

Table 7: Comparison of frequencies of different no. of attempts taken for intubation, switching between the laryngoscopes, Stylet used, and Intra operative CL Grading in between groups

PARAMETERS		Group A		Group M		Group K		Chi Sq	p-Value
		N	%	n	%	n	%		
No. of attempts taken for intubation	1	29	96.67	25	83.33	27	90.00	2.96	0.227
	2	1	3.33	5	16.67	3	10.00		
Switching between the laryngoscopes	Yes	0	0.00	0	0.00	0	0.00	-	-
	No	30	100.00	30	100.00	30	100.00		
Stylet used	Yes	2	6.67	5	16.67	3	10.00	1.58	0.455
	No	28	93.33	25	83.33	27	90.00		
Intra operative CL Grading	1	16	53.33	19	63.33	19	63.33	15.87	0.058
	2	12	46.67	6	20.00	9	30.00		
	3	2	0.00	5	16.67	2	6.67		
	4	0	0.00	0	0.00	0	0.00		

Table 7 showed the comparison of frequencies of different no. of attempts taken for intubation, switching between the laryngoscopes, Stylet used, and Intra operative CL Grading in between groups. The frequencies of different no. of attempts taken for intubation, switching between the laryngoscopes, Stylet used, and Intra operative CL Grading was not significantly different in between groups.

4. DISCUSSION

Various laryngoscopes have been designed in order to improve the laryngeal view. With the advent of video laryngoscopes, the necessity to line up the oral- pharyngeal- laryngeal axes need not be lined up as in direct laryngoscopy. These laryngoscopes also help in providing improved glottic visualization with limited mouth opening and neck mobility. But due to the two-dimensional view and decreased depth perception and view might get obscured due to fogging. Our study is to compare the time, ease and attempts to successful endotracheal intubation using Macintosh Laryngoscope, KingVision Video Laryngoscope and Anaesthetic Video Laryngoscope in patients undergoing surgeries under general anaesthesia.

Table 1 shows the comparison of frequencies of different Mallampati score in between all the three groups. On statistical evaluation no significant difference was found in Mallampati score among all the three groups. Table 2 shows the meantime taken for intubation was 13.53 seconds in Group A, 15.17 seconds in Group M and 18.73 seconds in Group K. The mean time taken has been found to be significantly lesser in Group A as compared to Group M and Group K. Rameez Raja et al [12]., did a study comparison of Macintosh laryngoscope and KingVision video laryngoscope for first pass success rate and number of attempts required for intubation in anticipated difficult airway and observed similar results where lesser time taken for intubation with Macintosh laryngoscope than KingVision video laryngoscope. Our results were also in congruence with a study conducted by B. Edrivanli et al [13]., which is a prospective randomized controlled clinical trial of comparison between KingVision video laryngoscope and Macintosh laryngoscope. Table 3 and 4 shows that the intubation difficulty score (IDS) was assessed based on the number of attempts required for intubation (N1), number of operators required for intubation (N2), number of alternative techniques used (stylet, bougie, change of blade, BURP) (N3), Cormack Lehane grading minus one (N4), lifting force applied during laryngoscopy (N5), required laryngeal pressure (N6) and position of vocal cords (N7). On the basis of difficulty, the intubation difficulty score is categorized into 4: Score 0 that is easy intubation: in our study a comparable number of patients were found with easy intubation in all the three groups (16 patients in group A, 16 patients in group M, 15 patients in group K), no statistical difference was found. Score ≤ 5 that is slightly difficult intubation: in our study a comparable number of patients were found with slight difficult intubation in all the three groups (14 patients in group A, 14 patients in group M, 15 patients in group K), no statistical difference was observed. Score >5 that is moderate to major difficulty: in our study no patients were found to have moderate to major difficulty in all the three groups (score >5). Score ∞ that is impossible: in our study no patients were found that are unable to intubate in all the

three compared groups. These results were however, not congruent with the results obtained from the study conducted by Q E Ali et al [14]., in which comparison was made between Macintosh, Mc Coy and KingVision laryngoscopes in patients with immobilized cervical spine, where the difficulty scoring was found to be greater with Macintosh laryngoscope as compared to the other two laryngoscopes because king vision video laryngoscope provides an indirect view of glottis without need to align oral, pharyngeal and tracheal axes and therefore requires no cervical spine movements. Table 5 and 6 shows the distribution and comparison of cases in Mallampati score (MPS) and Cormack-Lehane grading (CL). This shows that Mallampati scoring did not always correlate with Cormack-Lehane grading on direct laryngoscopy. However, the comparison between Mallampati score and Cormack-Lehane grading was significant in Group A (p value < 0.001) and Group K (p value < 0.033) whereas insignificant in Group M (p value < 0.078). Similar results with significant relationship between the MPS and CL grade was observed in study conducted by Dr. Ruchi Ohri et al [15]., where Correlation between the Mallampati score and Cormack-Lehane Grading was done. The number of attempts taken for intubation (Table 7) were lesser in order of Group A (out of 30 patients only 1 patient needed two attempts) then in Group K (out of 30 patients 3 patients needed two attempts) and Group M (out of 30 patients 5 patients needed two attempts). However, the difference was not significant in between the three groups. Similar result with no significant difference between the intubation attempts has been observed by Sherif M et al [16]., in which a comparative study between the Macintosh laryngoscope and the KingVision video laryngoscope in endotracheal intubation was done. In a study conducted by Humaira Bashir et al [17]., where comparison was made between KingVision video laryngoscope and Macintosh laryngoscope in patients requiring endotracheal intubation, it was observed that intubation was successful in the first attempt in more patients with the king vision video laryngoscope as compared to the Macintosh laryngoscope. It has been observed in our study that there has been no necessity to switch between the laryngoscopes for any patient belonging to all the three groups (refer to table no. 7). Our results were not similar with the study which was conducted by Tanvi Mallick et al [18]., where a prospective study was done to compare the time to successful endotracheal intubation using the Macintosh laryngoscope and KingVision video laryngoscope in the emergency department. In their study crossover between the laryngoscopes was done due to technical issues and difficult airway in emergency department. In our study the stylet usage (Table 7) has been observed to be higher in the patients who were intubated with Macintosh laryngoscope (stylet used in 5 patients out of 30 patients) as compared to those who were intubated with Anaesthetic video laryngoscope (stylet used in 2 patients out of 30 patients) and KingVision video laryngoscope (stylet used in 3 patients out of 30 patients). Our results are congruent with the study conducted by Humaira Bashir et al [17]., where a comparative study was done between the KingVision video laryngoscope versus Macintosh laryngoscope in patients requiring endotracheal intubation for general anaesthesia. In their study optimization manoeuvres were required more in patients undergoing intubation with Macintosh laryngoscope as compared to patients who were intubated with King vision video laryngoscope. KingVision video laryngoscope performed better with respect to optimization manoeuvres because it provides the indirect view of vocal cord on LCD screen, the tube needs to be blindly inserted until it can be seen on the video laryngoscope screen, so some manipulation may be required. While in case of Macintosh laryngoscope the oral, laryngeal and pharyngeal axes need to be align in a straight line for which much more manipulations may be required. Reena [19] conducted a study on comparison of KingVision laryngoscope (channeled blade) with Macintosh laryngoscope for tracheal intubation using armored endotracheal tubes, where optimization manoeuvres were required for lesser number of patients in KingVision group compared to Macintosh group.

LIMITATIONS

- 1) The study was performed in the American Society of Anaesthesiologists 1/2 patients posted for elective surgeries, the intubation condition might be different in emergency, awake and critical care settings.
- 2) All the endotracheal intubation insertions performed by an experienced user and our results may not be extrapolate to the users with limited experience with the device

5. CONCLUSION

With careful appraisal of our study, it can be concluded that Anaesthetic video laryngoscope is better when considering the intubation time (takes lesser time for intubation), number of attempts (takes lesser number of attempts for intubation) and stylet used (less stylet used in case of Anaesthetic video Laryngoscope).

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