



Original Research Article

A COMPARATIVE STUDY OF KINGS VISION VIDEO LARYNGOSCOPE AND MACINTOSH LARYNGOSCOPE FOR THE FIRST ATTEMPT INTUBATION SUCCESS RATE IN ANTICIPATED DIFFICULT AIRWAY

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ABSTRACT

Background: First pass tracheal intubation is particularly crucial in patients with a predicted difficult airway, as repeated laryngoscopic attempts are associated with increased risks of hypoxia, mucosal trauma, aspiration, sympathetic stimulation, and airway related complications. Video laryngoscopes such as the King Vision video laryngoscope have been introduced to enhance glottic visualization, reduce the need for airway manipulation, and improve overall intubation success compared with conventional Macintosh direct laryngoscopy techniques. The aim and objective are to compare the efficacy of the King Vision video laryngoscope and Macintosh laryngoscope in anticipated difficult airway with respect to first attempt intubation success. Secondary objectives included comparison of laryngoscopic view, intubation time, number of attempts, hemodynamic response, and complications.

Materials and Methods: This prospective randomized controlled study included 60 adult patients aged 20 to 60 years with anticipated difficult airway undergoing elective surgery under general anaesthesia. Patients were randomly allocated into two groups of 30 each: King Vision video laryngoscope and Macintosh laryngoscope. Primary outcome was first attempt success rate. Secondary outcomes included Cormack Lehane grade, intubation time, attempts, and peri intubation complications.

Results: First attempt success was identical in both groups at 93.3 percent. Glottic visualization and complication rates were comparable. Mean intubation time was significantly shorter with King Vision 27.42 ± 8.31 seconds compared to Macintosh 34.18 ± 9.64 seconds, $p = 0.026$. Hemodynamic parameters showed no significant intergroup difference.

Conclusion: Both devices demonstrated comparable first pass success and safety profiles; however, King Vision facilitated faster intubation, making it an effective alternative to Macintosh in anticipated difficult airway management.

Keywords: King Vision video laryngoscope; Macintosh laryngoscope; anticipated difficult airway; first attempt intubation success; video laryngoscopy.

INTRODUCTION

Airway management is a core competency in anaesthesiology and includes facemask ventilation, supraglottic airway insertion, and endotracheal intubation using direct or video-assisted laryngoscopy.^[1] The laryngoscope, initially designed

for otorhinolaryngological examination, has become an essential anaesthetic instrument for visualization of the larynx and facilitation of tracheal intubation.^[2] Failure to secure the airway remains a major cause of anaesthesia-related morbidity and mortality. Reports from the Difficult Airway Society and the Royal College of Anaesthetists Fourth National Audit

Project have identified difficult tracheal intubation as a leading contributor to major airway complications during anaesthesia.^[3]

Predicting a difficult airway continues to be challenging. Although multiple preoperative bedside screening tests exist, their predictive performance is limited, and many difficult intubations remain unanticipated.^[4] No single assessment tool reliably predicts difficulty, and airway challenges often become apparent only after induction of anaesthesia.^[5] The Mallampati classification, widely used for airway evaluation, demonstrates approximately 50 percent sensitivity with high specificity, but its overall predictive value is insufficient when used alone. Consequently, unexpected difficult intubation occurs in approximately 1.5 to 8.5 percent of anaesthetic cases.^[6]

Optimal laryngeal visualization depends on appropriate positioning of the head and neck, a principle recognized since the early descriptions of laryngoscopy.^[7] Misalignment of the oral, pharyngeal, and laryngeal axes may lead to prolonged or failed intubation. Limited cervical spine mobility, whether due to trauma or degenerative disease, significantly increases the risk of difficult intubation.^[8] In patients with cervical spine pathology, the incidence of problematic intubation may reach up to 20 percent. Hypoxia during repeated or failed attempts at airway management substantially increases perioperative morbidity and mortality. Minor restrictions in head and neck movement are frequently overlooked causes of unexpected difficulty.^[9]

The first-attempt success rate is a critical determinant of airway safety. Guidelines emphasize maximizing initial attempt success because repeated laryngoscopy attempts are associated with increased complications. Studies have shown that successful intubation on the first attempt correlates with fewer adverse events, whereas multiple attempts increase failure rates and airway-related complications.^[10]

Direct laryngoscopy using the Macintosh blade has traditionally been regarded as the gold standard for tracheal intubation. However, this technique requires a direct line of sight to the glottis and allows visualization only to the operator, limiting teaching and supervision opportunities. Additionally, direct laryngoscopy has a significant learning curve and demands substantial technical proficiency.^[11]

Video laryngoscopy represents a significant advancement in airway management. Since the introduction of devices such as the GlideScope®, numerous video laryngoscopes with varying blade designs have been developed.^[12] These devices provide an indirect glottic view using a camera positioned near the blade tip, transmitting images to an external monitor. Video laryngoscopes improve glottic visualization and may increase intubation success, particularly in difficult airway scenarios. The technology eliminates the need for strict alignment of airway axes and allows visualization

without direct line of sight. High-resolution microcameras and portable flat-screen displays further enhance visibility and procedural success. Current guidelines recommend that anaesthetists maintain access to and proficiency in video laryngoscopy, especially for difficult intubations.^[13] Video laryngoscopes are broadly classified into channeled and non-channeled devices. Channeled devices, such as Airtraq, Airwayscope, and King Vision, incorporate a guiding channel to direct the endotracheal tube without requiring a stylet. Non-channeled devices, including GlideScope, C-MAC, and McGrath, require a stylet for tube advancement. The Truview PCD provides an indirect perspective of the vocal cords as an alternative to traditional laryngoscopes.^[14] The King Vision video laryngoscope is a portable, battery-operated system featuring a disposable blade with or without a guiding channel and a built-in monitor. It accommodates adult tube sizes ranging from 6.0 to 8.0 mm and requires minimal mouth opening, approximately 1.8 cm for channeled blades and 1.2 cm for unchanneled blades. Its portability, disposability, and cost-effectiveness enhance its applicability in clinical practice.^[15]

Comparative studies between Macintosh direct laryngoscopy and video laryngoscopy have yielded mixed findings. Earlier meta-analyses suggested limited superiority of video laryngoscopy over direct laryngoscopy in certain critical care settings.^[16] However, subsequent systematic reviews, including a Cochrane analysis, reported improved glottic visualization and higher success rates with video laryngoscopes, particularly in elective surgical settings. King Vision, as a newer video laryngoscope, has demonstrated promising performance in both normal and difficult airway management. Nevertheless, rigorous randomized controlled trials comparing first-attempt success rates between Macintosh laryngoscopy and King Vision in anticipated difficult airways remain limited. Recommendations emphasize that new airway devices should be evaluated against established standards through randomized controlled trials before widespread adoption. Given the importance of first-pass success and reduction of airway-related complications, comparative evaluation of the Macintosh laryngoscope and King Vision video laryngoscope is clinically significant. Assessing their efficacy in anticipated difficult airway situations may provide valuable insights for improving patient safety and optimizing airway management strategies during general anaesthesia.^[17]

The aim of this study is to compare the efficacy of the Macintosh direct laryngoscope and the King Vision video laryngoscope in patients with anticipated difficult airway undergoing general anaesthesia. The objectives are to evaluate first attempt intubation success rate, laryngoscopic view, time required for intubation, number of attempts, and incidence of airway related complications.

MATERIALS AND METHODS

This prospective, randomized controlled study was conducted in the Department of Anaesthesia at Rajshree Medical Research Institute, Bareilly, from March 2024 to March 2025 after institutional ethical approval and informed consent. Sixty adult patients aged 20 to 60 years with anticipated difficult airway scheduled for elective surgery under general anaesthesia were enrolled and randomly allocated into two groups of 30 each: King Vision video laryngoscope and Macintosh laryngoscope. Standard preoperative airway assessment was performed. Following uniform anaesthetic induction, tracheal intubation was attempted using the assigned device. Primary outcome was first attempt success rate; secondary outcomes included Cormack Lehane

grade, intubation time, attempts, haemodynamic response, and complications.

RESULTS

Age distribution was comparable between the two study groups, indicating effective randomization and reducing age related confounding. Participants were represented across all age brackets, with the highest proportions in 41 to 50 and 51 to 60 years in the KVVL group, while the Macintosh group showed more patients in 31 to 40 years. Gender distribution was also balanced, with a slight male predominance overall. KVVL included 18 females and 12 males, whereas Macintosh had 17 females and 13 males, minimizing demographic bias and strengthening internal validity.

Table 1: Mallampati Classification in KVVL and Macintosh Groups

Mallampati Class	KVVL (n=30)	Macintosh (n=30)	Total (n=60)
Class III	27	25	52
Class IV	3	5	8

The distribution of Mallampati classification was comparable between the KVVL and Macintosh groups, with the majority of patients belonging to Class III 90 percent in KVVL and 83.3 percent in Macintosh, while Class IV constituted a smaller proportion 10 percent and 16.7 percent respectively. The overall predominance of Class III 86.7 percent indicates a study population with anticipated

moderate airway difficulty. The similar class distribution between groups suggests adequate baseline comparability, minimizing airway related selection bias. Hence, any observed differences in intubation outcomes are more likely attributable to device performance rather than variation in preoperative airway grade.

Table 2: Comparison of Airway Parameters Between KVVL and Macintosh Groups

Parameter	KVVL (Mean ± SD)	Macintosh (Mean ± SD)
Mouth Opening (cm)	2.31 ± 0.33	2.24 ± 0.41
Thyromental Distance (cm)	5.12 ± 0.48	4.98 ± 0.51
Neck Extension (°)	9.83 ± 7.91	11.94 ± 9.34

Airway parameters were comparable between the KVVL and Macintosh groups, with similar mean mouth opening 2.31 ± 0.33 cm versus 2.24 ± 0.41 cm and thyromental distance 5.12 ± 0.48 cm versus 4.98 ± 0.51 cm. Neck extension showed minor variation but with wide overlap. This baseline homogeneity minimizes anatomical confounding. Hence, outcome differences are likely attributable to device performance rather than airway morphology. The majority of patients in both KVVL and Macintosh groups achieved successful intubation on the first attempt, with only a minimal proportion requiring a second attempt. The nearly identical distribution of attempts reflects comparable first pass success rates between devices. The low incidence of repeated attempts suggests effective laryngoscopic performance in both groups. Thus, neither device

demonstrated a clear advantage in terms of initial intubation success.

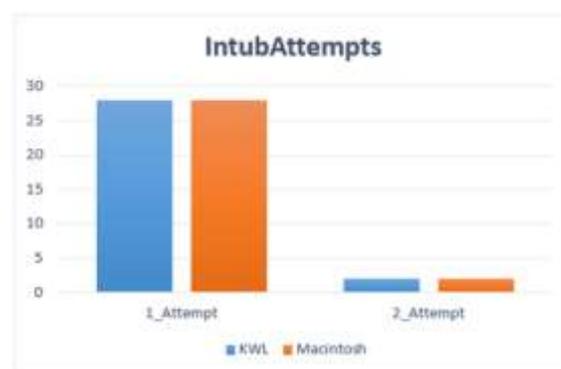


Figure 1: Intubation attempt distribution among KVVL and Macintosh groups.

Table 3: First-Attempt Intubation Success Rates in KVVL and Macintosh Groups

First Attempt Success	KVVL (n=30)	Macintosh (n=30)	Total (n=60)
Yes	28	28	56
No	2	2	4

First attempt intubation success was identical in both groups, with 28 out of 30 patients 93.3 percent

achieving successful intubation in each arm. Only 6.7 percent in both groups required a second attempt.

This equal distribution indicates no statistical or clinical difference in first pass efficacy between KVVV and Macintosh. Therefore, both devices

demonstrated comparable reliability in achieving initial intubation success.

Table 4: Cormack–Lehane Grade Distribution in KVVV and Macintosh Groups

CL Grade	KVVV (n=30)	Macintosh (n=30)	Total (n=60)
I	14	15	29
II	6	9	15
III	7	4	11
IV	3	2	5

Cormack Lehane Grade I and II views constituted 66.7 percent in KVVV 20 out of 30 and 80 percent in Macintosh 24 out of 30, indicating predominantly favorable glottic visualization in both groups. Higher grades III and IV were observed in 33.3 percent in KVVV and 20 percent in Macintosh. Although Macintosh showed a numerically greater proportion of optimal Grade I views 50 percent versus 46.7 percent, the overall distribution was comparable. These findings suggest no major clinically significant difference in laryngoscopic view between the two devices.

The majority of patients in both groups experienced no complications, observed in approximately 86.7 percent in KVVV 26 out of 30 and 90 percent in Macintosh 27 out of 30. Minor airway trauma occurred in 10 percent in KVVV and 6.7 percent in Macintosh, while dental injury was reported in 3.3 percent in KVVV and none in Macintosh. The overall

complication rates were low and comparable between groups. These findings indicate similar safety profiles for both laryngoscopic techniques.



Figure 2: Complications associated with intubation using KVVV versus Macintosh.

Table 5: Comparison of Operator Experience, Blade Size Used, and Intubation Time in KVVV and Macintosh Groups

Parameter	KVVV (Mean ± SD)	Macintosh (Mean ± SD)
Operator Experience (yrs)	3.96 ± 2.11	4.31 ± 2.25
Blade Size Used	3.17 ± 0.38	3.13 ± 0.35
Intubation Time (sec)	27.42 ± 8.31	34.18 ± 9.64

Operator experience was comparable between KVVV and Macintosh groups 3.96 ± 2.11 versus 4.31 ± 2.25 years, minimizing performance bias related to skill level. Blade size used was also similar 3.17 ± 0.38 versus 3.13 ± 0.35, indicating procedural

standardization. However, mean intubation time was shorter with KVVV 27.42 ± 8.31 seconds compared to Macintosh 34.18 ± 9.64 seconds. This suggests relatively faster airway securing with KVVV under comparable operator conditions.

Table 6: Comparison of Intubation Time Between KVVV and Macintosh Groups

Parameter	KVVV (n=30) Mean ± SD	Macintosh (n=30) Mean ± SD	t-value	df	p-value	Mean Difference	95% CI (Lower–Upper)
Intubation Time (sec)	27.42 ± 8.31	34.18 ± 9.64	2.276	58	0.026*	-6.76	-12.88 to -0.64

Mean intubation time was significantly shorter in the KVVV group 27.42 ± 8.31 seconds compared to Macintosh 34.18 ± 9.64 seconds. The mean difference was -6.76 seconds with a t value of 2.276, df 58, and p value 0.026, indicating statistical

significance. The 95 percent confidence interval -12.88 to -0.64 did not cross zero, confirming a true difference between groups. These findings demonstrate that KVVV facilitates faster intubation under similar clinical conditions.

Table 7: Comparison of First-Attempt Intubation Success Between KVVV and Macintosh Groups

First Attempt Success	KVVV (n=30)	Macintosh (n=30)	Total (n=60)
Yes	28	28	56
No	2	2	4

First attempt success was identical in both groups, with 28 out of 30 patients 93.3 percent achieving successful intubation in KVVV and Macintosh groups. Failure on first attempt occurred in 2 patients 6.7 percent in each group. The equal distribution

indicates no statistically significant difference in first pass success between devices. Thus, both laryngoscopes demonstrated comparable efficacy for initial intubation.

Table 8: Comparison of Hemodynamic Parameters Between KVVl and Macintosh Groups

Parameter	KVVl (Mean ± SD)	Macintosh (Mean ± SD)	F-value	p-value
Baseline Heart Rate (bpm)	76.57 ± 14.07	76.37 ± 14.01	0.003	0.956
Baseline SBP (mmHg)	125.23 ± 14.85	124.37 ± 14.62	0.052	0.821
Baseline SpO ₂ (%)	98.03 ± 1.33	98.13 ± 1.14	0.098	0.755
Heart Rate at 1 min (bpm)	82.10 ± 14.56	82.63 ± 13.08	0.022	0.882
SBP at 1 min (mmHg)	135.10 ± 18.99	135.47 ± 17.28	0.006	0.938
SpO ₂ at 1 min (%)	97.73 ± 1.68	97.77 ± 1.46	0.007	0.935

Baseline hemodynamic parameters were comparable between KVVl and Macintosh groups, with no significant differences in heart rate 76.57 ± 14.07 versus 76.37 ± 14.01 bpm, SBP 125.23 ± 14.85 versus 124.37 ± 14.62 mmHg, or SpO₂ 98.03 ± 1.33 versus 98.13 ± 1.14 percent, all p values greater than 0.05. At 1 minute post intubation, heart rate, SBP, and SpO₂ remained statistically similar between groups, with p values 0.882, 0.938, and 0.935 respectively. The very low F values further confirm absence of significant intergroup variability. These findings indicate comparable hemodynamic responses with both devices during the peri intubation period.

DISCUSSION

This study evaluated the efficacy of the King Vision Video Laryngoscope in comparison with the Macintosh direct laryngoscope in patients with anticipated difficult airways, focusing on first attempt success, glottic visualization, intubation time, airway complications, operator feedback, and hemodynamic response. Baseline demographic and airway predictors including Mallampati grade, thyromental distance, BMI, micrognathia, and neck extension were comparable between groups, eliminating confounding from pre existing airway difficulty. Mean intubation time was significantly shorter with KVVl at 27.42 seconds compared with 34.18 seconds using Macintosh, $p = 0.026$. Similar findings were reported by Raja R et al., Dharanindra M et al, all demonstrating faster intubation with KVVl due to superior glottic visualization and reduced need for optimization maneuvers. Shah SN et al. also observed reduced intubation time and fewer external manipulations with King Vision. However, contrasting results were noted by Pillai LS et al., Bhaire VS et al. and Harjai M et al, where longer intubation times were attributed to hyperangulated blade navigation and operator learning curve.^[18-23]

First attempt success was identical in both groups at 93.3 percent with no statistical difference, $p = 1.000$. Singh K et al. similarly reported comparable first pass success between devices. However, several studies demonstrated higher first pass rates with KVVl, including Raja R et al. reporting 88.6 percent versus 76.5 percent, Dharanindra M et al. reporting 95.7 percent, and Ruderman BT et al. showing 89.1 percent versus 77.7 percent in registry data. Pillai LS et al., Moturu D et al., Shah SN et al., Bhaire VS et al., and Keshari U et al. also observed trends favoring KVVl. The comparable performance in the present

study likely reflects experienced operators and controlled operating room conditions.^[11,18-20,22,24]

Glottic visualization significantly favored KVVl with better Cormack Lehane grades, $p = 0.043$. Choudhary J et al. demonstrated improvement from 63 percent CL I II with Macintosh to 100 percent with KVVl. Raja R et al. reported 100 percent CL I visualization in the KVVl group compared to 29.4 percent with Macintosh. Similar superiority was documented by, Moturu D et al., Shah SN et al. and Dharanindra M et al.. These consistent findings confirm the visualization advantage of video laryngoscopy.^[18-20,25,26]

Complication rates were low and comparable. Minor airway trauma occurred in three patients in each group with one dental injury in the KVVl group. Singh K et al, Moturu D et al. and Bari MN et al. similarly reported no significant difference in airway morbidity between devices, indicating that improved visualization does not increase trauma risk.^[22,24,26]

Hemodynamic responses were comparable between groups with no significant difference in heart rate or blood pressure. Singh K et al., Bhaire VS et al, and reported similar findings. Moturu D et al. noted modest attenuation in stress response with KVVl, while Dharanindra M et al. reported improved stability in ICU settings. Overall evidence suggests KVVl is hemodynamically comparable or slightly advantageous. KVVl demonstrated superior glottic visualization and shorter intubation time with comparable first attempt success, complication profile, and hemodynamic response. These findings, supported by multiple studies, establish KVVl as an effective and safe alternative to Macintosh in anticipated difficult airway management.^[19,22,24,26]

CONCLUSION

In this study, the King Vision video laryngoscope and Macintosh direct laryngoscope demonstrated comparable first attempt intubation success rates in patients with anticipated difficult airway, with 93.3 percent success in both groups. Glottic visualization and complication rates were similar, and hemodynamic responses did not differ significantly. However, King Vision facilitated significantly shorter intubation time, indicating procedural efficiency. These findings suggest that while both devices are reliable for first pass success, King Vision offers the advantage of faster intubation without compromising safety, making it an effective alternative in anticipated difficult airway management.

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