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Comparison of Video Laryngoscopy Versus Conventional Laryngoscopy in Anticipated Difficult Intubation in Patients Undergoing Thyroid Surgery

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ABSTRACT

Anticipated difficult airway in thyroid surgery is associated with failed intubation, hypoxia, and airway trauma, despite structured preoperative assessment. **Objectives:** To compare video laryngoscopy with conventional direct laryngoscopy in adult patients undergoing elective thyroid surgery with anticipated difficult intubation in terms of first- attempt and overall tracheal intubation success, glottic visualization, intubation time, and immediate oropharyngeal injury. **Methods:** A randomized controlled trial was conducted in the Department of Anesthesia, Sheikh Zayed Hospital, Rahim Yar Khan, from January 2025 to June 2025. Sixty patients (18–60 years) undergoing elective thyroidectomy with anticipated difficult intubation (ASA I–II, ≥1 airway predictor) were enrolled by non-probability consecutive sampling and randomized (1:1) to conventional laryngoscopy or video laryngoscopy. All intubations were performed by experienced anesthetists. **Results:** Among 60 randomized patients, baseline age (44.47 ± 7.66 vs 44.60 ± 8.02 years) and gender distribution (46.7 % vs 40.0 % males) were comparable between conventional and video- laryngoscopy groups. Video laryngoscopy improved Cormack–Lehane grade I view frequency (60.0% vs 13.3%, p=0.002) and increased first-attempt intubation success (93.3% vs 60.0%, p=0.002). Overall success was 100.0% with video laryngoscopy versus 93.3% with direct laryngoscopy (p=0.150). Mean intubation time was longer with video laryngoscopy (45.13 ± 8.38 vs 39.20 ± 9.83 seconds, p=0.015). Immediate oropharyngeal injury was numerically lower with video laryngoscopy (6.7% vs 20.0%, p=0.129). **Conclusions:** In anticipated difficult airways during thyroid surgery, video laryngoscopy significantly improved first-attempt intubation success and glottic visualization, while overall success remained similarly high in both groups.

INTRODUCTION

Difficult tracheal intubation is a recognized challenge in thyroid surgery owing to anatomical distortion caused by large goiters, tracheal deviation, reduced cervical extension, and limited mouth opening [1]. These factors can impair glottic visualization and increase the risk of airway complications during induction [2]. Anticipated difficult intubation occurs in approximately 1.1 percent to 3.8 percent of the general surgical population, but the risk is considerably higher in thyroid surgery, where airway distortion is common [3, 4]. Conventional direct laryngoscopy continues to be widely practiced; however, video laryngoscopy provides an indirect view that may enhance laryngeal exposure, reduce the need for optimization maneuvers, and mitigate physiologic stress responses [5]. Prior study in predicted difficult airways consistently reported superior glottic visualization and higher first-attempt success with video laryngoscopy, although findings for intubation time vary across devices and operator experience [6]. Meta-analyses further support reductions in failed or difficult intubation and

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airway trauma, yet highlight heterogeneity related to technique, device, and user proficiency [7]. Evidence specific to difficult airway management demonstrates consistent performance advantages with video laryngoscopy [8]. In a randomized trial of adults with anticipated difficult intubation, video laryngoscopy produced markedly more grade-1 views, higher first-attempt success, and fewer optimization maneuvers with only a small increase in intubation time relative to direct laryngoscopy [9]. In a randomized trial during thyroid surgery, first-attempt success was 66% with direct laryngoscopy versus 96% with video laryngoscopy ($p<0.001$) [10]. Among thyroid patients with difficult airways, intubation time was shorter with the optical stylet 42.4 ± 24.1 s and video laryngoscope (29.8 ± 22.3 s) than with direct laryngoscopy 68.8±26.6s; first-attempt success was higher with the stylet 90.0% and video laryngoscope 97.5% versus direct laryngoscopy 75.0% [11]. In 360 elective cases, video laryngoscopy achieved higher first-attempt success 96.1% versus 90.1% ($p=0.024$), higher overall success 100% vs 94.5% ($p=0.004$), and fewer immediate oropharyngeal injuries 1.1% vs 5.1% ($p=0.033$) [12]. Given the anatomical complexity of thyroid surgery and the higher likelihood of encountering a difficult airway, a focused evaluation of intubation methods is warranted [13].

The present study has been designed to compare video laryngoscopy with conventional direct laryngoscopy in adult thyroid surgery patients who meet predefined clinical predictors of anticipated difficult intubation. The primary objective was to determine whether video laryngoscopy improves the first-attempt intubation success rate. Secondary objectives included comparing overall intubation success, intubation time, and the incidence of immediate oropharyngeal injuries between the two techniques. This study aims to provide procedure-specific evidence to guide optimal airway management in thyroid surgery patients with anticipated difficult intubation.

METHODS

A randomized controlled trial (NCT07113171) was conducted in the Department of Anesthesia, Sheikh Zayed Hospital, Rahim Yar Khan, after obtaining approval from the Institutional Review Board (803/IRB/SZMC/SZH; Dated 18th October, 2023) from January 2025 to June 2025. A sample size of 60 patients, with thirty allocated to each group, was calculated using an expected first-attempt intubation success rate of 66% with direct laryngoscopy and 96% with video laryngoscopy, at 80% power and a 95% confidence level [10]. Participants were enrolled through non-probability consecutive sampling. Adults aged 18 to 60 years of either sex who were scheduled for elective thyroid surgery under general anesthesia and met predefined criteria for anticipated difficult intubation were included. Eligible patients had an ASA physical status of I or II and demonstrated at least one airway predictor such as limited neck mobility, short thyromental distance, restricted mouth opening, visibly enlarged goiter, or obesity. Patients with neck trauma, cervical spondylopathy, emergency surgical indications, pre-existing oropharyngeal or laryngeal pathology, or significant cardiovascular or respiratory disease were excluded. After written informed consent, enrolled patients were randomized into two groups using computer-generated numbers. Group A underwent endotracheal intubation with conventional direct laryngoscopy, performed by extending the proximal cervical spine and flexing the distal cervical spine to align the oral, pharyngeal, and laryngeal axes. A Macintosh blade was used to retract the tongue and expose the glottis for endotracheal tube placement. Group B underwent intubation using a video laryngoscope, which permitted visualization of the vocal cords without the need for extensive neck extension. All intubations were carried out by experienced anesthetists trained in both techniques. Baseline demographic and clinical variables, including age, gender, BMI, diabetes mellitus, hypertension, COPD or asthma, ASA class, Mallampati score, and airway predictors, were recorded. Cormack–Lehane grading, intubation method, first-attempt intubation success, overall success, number of attempts, intubation time measured in seconds, and the presence or absence of immediate oropharyngeal injuries (bleeding or soft tissue injury) were documented. The CONSORT flow diagram is given (Figure 1).

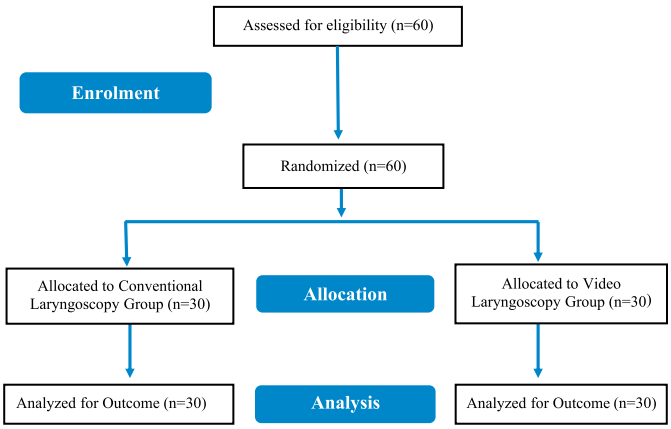

Figure 1: CONSORT Flow Diagram

Data analysis was performed using SPSS version 26. Categorical variables (gender, comorbidities, ASA class, Mallampati class, airway predictors, Cormack–Lehane grade categories, first-attempt success, overall success, number of attempts, immediate oropharyngeal injury) were expressed as frequencies and percentages, while continuous variables (age, body mass index, intubation time) were summarized as means with standard deviations. Normality of quantitative variables was assessed by using

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the Shapiro–Wilk test. Differences in categorical outcomes between the two groups were analyzed using the Chi-square test. Continuous variables were compared using the Independent Samples t-test. A p-value less than 0.05 was considered statistically significant.

RESULTS

The mean age of the patients was 44.54 ± 7.78 years, with 22 (36.7%) patients aged 18 to 40 years and 38 (63.3%) aged 41 to 60 years. Gender distribution was comparable, with 26 (43.3%) males and 34 (56.7%) females overall. The mean body mass index was 27.67 ± 2.32 kg per m^2 in the conventional laryngoscopy group and 28.91 ± 2.04 kg per m^2 in the video-laryngoscopy group (Table 1).

Table 1: Baseline Demographics and Clinical Characteristics by Intubation Method

Variables	Category	Group A: Conventional Laryngoscopy (n=30), Mean ± SD/ n (%)	Group B: Video Laryngoscopy (n=30), Mean ± SD/ n (%)	p-value
Age	Years	44.47 ± 7.66	44.60 ± 8.02	0.948
Age Group	18–40 Years	12 (40.0%)	10 (33.3%)	0.592
	41–60 Years	18 (60.0%)	20 (66.7%)	
Gender	Male	14 (46.7%)	12 (40.0%)	0.602
	Female	16 (53.3%)	18 (60.0%)	
ASA Physical Status	I	10 (33.3%)	16 (53.3%)	0.118
	II	20 (66.7%)	14 (46.7%)	
Body Mass Index	kg/m^2	27.673 ± 2.320	28.907 ± 2.037	0.033
Diabetes Mellitus	Yes	8 (26.7%)	6 (20.0%)	0.542
Hypertension	Yes	10 (33.3%)	8 (26.7%)	0.573
COPD/Asthma	Yes	4 (13.3%)	6 (20.0%)	0.488

Independent t-test used for continuous variables; Pearson's Chi-square test applied for categorical variables. COPD: chronic obstructive pulmonary disease; ASA: American Society of Anesthesiologists

Airway assessment showed Mallampati Class I in 4 (13.3%) versus 2 (6.7%), Class II in 14 (46.7%) versus 6 (20.0%), Class III in 10 (33.3%) versus 16 (53.3%), and Class IV in 2 (6.7%) versus 6 (20.0%) for the conventional and video-laryngoscopy groups, respectively. Limited neck mobility was present in 10 (33.3%) versus 12 (40.0%) (Table 2).

Table 2: Airway Assessment and Predictors of Anticipated Difficult Intubation by Intubation Method

Variables	Category	Group A: Conventional Laryngoscopy (n=30)	Group B: Video Laryngoscopy (n=30)	p-value
Mallampati Class	I	4 (13.3%)	2 (6.7%)	0.064
	II	14 (46.7%)	6 (20.0%)	
	III	10 (33.3%)	16 (53.3%)	
	IV	2 (6.7%)	6 (20.0%)	
Limited Neck Mobility	Yes	10 (33.3%)	12 (40.0%)	0.592
Short Thyromental Distance <6 cm	Yes	10 (33.3%)	8 (26.7%)	0.573
Limited Mouth Opening <3 cm	Yes	6 (20.0%)	10 (33.3%)	0.243
Visibly Large Goiter	Yes	20 (66.7%)	26 (86.7%)	0.067
Obesity (BMI>30 kg/m^2)	Yes	6 (20.0%)	10 (33.3%)	0.243

Independent t-test used for continuous variables; Pearson's Chi-square test applied for categorical variables

Intubation performance showed more favorable laryngeal view with video laryngoscopy, with Cormack–Lehane grade I observed in 4 (13.3%) patients in the conventional group compared with 18 (60.0%) in the video-laryngoscopy group (p=0.002). First-attempt intubation success was higher with video laryngoscopy, achieved in 28 (93.3%) patients compared with 18 (60.0%) in the conventional group (p=0.002). Overall success remained high in both groups at 28 (93.3%) versus 30 (100.0%) (p=0.150). Immediate oropharyngeal injuries occurred in 2 (6.7%) patients in the video-laryngoscopy group and 6 (20.0%) in the conventional group (p=0.129). Mean intubation time was 45.13 ± 8.38 seconds with video laryngoscopy and 39.20 ± 9.83 seconds with conventional laryngoscopy (p=0.015) (Table 3).

Table 3: Intubation Performance Outcomes by Intubation Method (Group A: Conventional Laryngoscopy; Group B: Video Laryngoscopy; n=60)

Variables	Category	Group A (n=30)	Group B (n=30)	Test Statistic (χ^2 / t)	p-value
Cormack-Lehane Grade (First Attempt)	I	4 (13.3%)	18 (60.0%)	χ^2 =15.366	0.002
	IIa	8 (26.7%)	6 (20.0%)		
	IIb	10 (33.3%)	4 (13.3%)		
	III	8 (26.7%)	2 (6.7%)		
First-Attempt Intubation Success	Yes	18 (60.0%)	28 (93.3%)	χ^2 =9.317	0.002
Overall Intubation Success	Yes	28 (93.3%)	30 (100.0%)	χ^2 =2.069	0.150
Number of Intubation Attempts	1	18 (60.0%)	28 (93.3%)	χ^2 =9.774	0.008
	2	8 (26.7%)	2 (6.7%)		
	≥3	4 (13.3%)	0 (0.0%)		
Immediate Oropharyngeal Injury	Present	6 (20.0%)	2 (6.7%)	χ^2= 2.308	0.129
Intubation Time (Seconds)	Mean ± SD	39.20 ± 9.83	45.13 ± 8.38	t= −2.515	0.015

Independent t-test used for continuous variables; Pearson's Chi-square test applied for categorical variables

DISCUSSION

This randomized comparison of video laryngoscopy and conventional direct laryngoscopy in adults undergoing thyroid surgery with anticipated difficult intubation showed that video laryngoscopy provided a substantially better laryngeal view and a markedly higher first-attempt success rate. Cormack–Lehane grade I views were

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achieved in 18 patients (60.0%) with video laryngoscopy compared with 4 (13.3%) with conventional laryngoscopy (p=0.002), and first-attempt success increased from 18 (60.0%) to 28 (93.3%) (p=0.002). Overall success remained high in both groups at 93.3% and 100.0%, whereas immediate oropharyngeal injury was numerically lower with video laryngoscopy, 2 (6.7 %) versus 6 (20.0%), and mean intubation time was modestly prolonged from 39.20 ± 9.83 seconds to 45.13 ± 8.38 seconds (p=0.015). The glottic visualization in the present trial is consistent with and directionally similar to previous studies. Downey et al. reported that video laryngoscopy yielded Cormack–Lehane grade I views in 98% compared with 44% with direct laryngoscopy (p<0.001) [14]. Mohammed *et al.* likewise found that video laryngoscopy converted glottic views to grade I in 51.5 % versus 9.1 % patients intubated with direct laryngoscopy (p<0.001) [15]. In a larger randomized series, Kriege *et al.* reported that video laryngoscopy shifted the Cormack–Lehane distribution to 84.6 % grade I views compared with 36.9% grade I views with direct laryngoscopy (p<0.001) [10]. The increase in grade I views from 13.3% to 60.0% in the present series falls within this spectrum. In this study, first-attempt success rose from 60.0% with conventional laryngoscopy to 93.3 % with video laryngoscopy (p=0.002). Similar patterns have been reported by Downey *et al.* who documented first-attempt success of 90% versus 44% for video versus direct laryngoscopy (p<0.001) [14]. Larger meta-analyses corroborate these findings: Vargas *et al.* reported that video laryngoscopes reduced difficult intubation, with a pooled risk ratio of 0.48 (95% CI 0.35–0.65) and modestly increased first-attempt success (risk ratio 1.03, 95 % CI 1.00–1.07) [16]. In the present study, first-attempt success appears greater than the pooled averages in these reviews, likely reflecting the combination of anticipated difficult anatomy and the focused use of video laryngoscopy in a high-risk thyroid surgery population. In this trial, overall success reached 93.3% with conventional laryngoscopy and 100.0 % with video laryngoscopy, comparable to the 99% versus 92% overall success and 97.8% versus 77.8% success in the difficult-view subgroup reported by Jungbauer *et al.* with video laryngoscopy versus direct laryngoscopy (p=0.017 and p<0.001, respectively) [17]. Polo *et al.* found that video laryngoscopy improved first-attempt success with a pooled risk ratio of 1.12 (95% CI 1.04–1.21) and dental injuries (risk ratio 0.32, 95% CI 0.16–0.67) across 15 randomized trials involving 4582 intubations [18]. Immediate oropharyngeal injury in the present study was less frequent with video laryngoscopy, occurring in 6.7 % compared with 20.0 %, consistent with previous literature. Liu *et al.* reported that lip or mucosal trauma was present in 50 % patients intubated with conventional laryngoscopy versus 10 % with video laryngoscopy (p<0.05) [11]. Taboada *et al.* found that oral trauma occurred in 21.4% Macintosh patients versus 5% video laryngoscopy (p=0.012) [19]. Meta-analysis has confirmed lower airway trauma with video laryngoscopy, with Lewis *et al.* documenting reduced laryngeal or airway trauma (odds ratio 0.68, 95% CI 0.48–0.96) and hoarseness (odds ratio 0.57, 95 % CI 0.36–0.88) [20]. In this study, mean intubation time increased by approximately 6s with video laryngoscopy, from 39.20 ± 9.83 to 45.13 ± 8.38 seconds (p=0.015). Downey *et al.* similarly reported longer intubation times with video laryngoscopy, 37.82 ± 5.21 versus 35.18 ± 4.21s (p=0.006) [14]. In contrast, Jungbauer *et al.* found shorter total intubation time with video laryngoscopy, 40 ± 31 versus 60 ± 77 (p=0.017), and Liu *et al.* reported that video laryngoscopy reduced intubation time from 68.8 ± 26.6s with direct laryngoscopy to 29.8 ± 22.3s in difficult thyroid airways [17]. In thyroid surgery with goiter and tracheal deviation, the combination of improved view and more complex tube steering likely explains the small increase in time observed here, which appears clinically acceptable in the context of much higher first-pass success. These findings carry important implications for clinical practice in thyroid surgery with anticipated difficult airways. Video laryngoscopy in this setting converted a high proportion of challenging airways with Mallampati class III–IV, large goiters, and obesity into laryngoscopies with grade I or IIa views and raised first-attempt success to over 90%, while maintaining 100% overall success and a numerically lower rate of oropharyngeal injury. The combination of fewer attempts and better views is particularly relevant in thyroid surgery, where repeated instrumentation may increase the risk of laryngeal trauma. When considered alongside the broader evidence from elective surgery, difficult airway management, and critical care, showing reduced failed intubations and less dental trauma with video laryngoscopy [18].

This trial had several methodological strengths. It was a prospective randomized comparison with clearly defined inclusion criteria for anticipated difficult intubation in thyroid surgery, with balanced baseline demographic and airway characteristics between groups. Detailed documentation of multiple airway predictors, Cormack–Lehane grades, number of attempts, success rates, and immediate oropharyngeal complications allowed a nuanced assessment in a clinically relevant high-risk population. However, the study was conducted at a single center with a relatively small sample size, which limits statistical power for less frequent outcomes and may restrict generalizability beyond elective thyroid surgery. Peri-intubation hemodynamic responses were not measured in the present trial. Future research should

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include larger multicenter trials across different surgical settings, incorporate operator experience stratification, and include hemodynamic and longer-term airway outcomes.

CONCLUSIONS

In adults with an anticipated difficult airway presenting for thyroid surgery, video laryngoscopy demonstrated clear clinical advantages over conventional laryngoscopy. Video-laryngoscopy yielded better glottic visualization and higher first-attempt intubation success, while maintaining a very high overall success rate comparable to conventional laryngoscopy. Oropharyngeal trauma was not increased, and the only trade-off was a modest prolongation of intubation time, which did not appear clinically relevant in the elective setting. Taken together, these findings support the preferential use of video laryngoscopy as the primary intubation strategy in similar high-risk thyroid populations.

Authors' Contribution

Conceptualization: UR, FA
Methodology: SS, FA, MIJ
Formal analysis: UR, ZM, SS, AA
Writing and Drafting: UR, ZM, SS, AA, FA, MIJ
Review and Editing: UR, ZM, SS, AA, FA, MIJ

All authors approved the final manuscript and take responsibility for the integrity of the work

Conflicts of Interest

All the authors declare no conflict of interest.

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