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StyleTubation: A New Chapter for Endotracheal Intubation in 21st Century

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Abstract

Laryngoscopy, including direct (DL) and videolaryngoscopy (VL), is the preferred initial technique for endotracheal intubation with continuous evolution over decades. Among conventional laryngoscopes and blades, videolaryngoscopes (VL) have been devised and applied in a variety of patient populations, including complex airway presentations. The safety and effectiveness of VL have been observed and extensively researched in various normal and challenging airway scenarios over recent decades. The superiority of VL then has been advocated as a standard of care for universal and routine first-line application. In contrast to videolaryngoscopy, the development of the video intubating stylet has permitted the introduction and clinical application of the Shikani technique for difficult endotracheal intubation. Since then, numerous clinical experiences of clinical use (both for normal and complex airways) have appeared in literature. In this narrative review article, we presented our substantial experience with styleTubation (71,139 patients from 2016 to 2025), with an additional million clinical applications in Taiwan since. This technique enables swift (time to intubate: 3 s to 10 s), smooth (first-attempt success rate: 100%), safe (no airway complications), and easy intubation (high subjective satisfaction and fast learning curve for the novice trainees) in majority of normal airway circumstances. Even in identified difficult airway scenarios, the intubating time is efficient (e.g., within 30 s) with first-pass success. Therefore we propose that styleTubation has applications in universal routine use for most endotracheal intubation – normal or difficult.

Keywords: StyleTubation; Video stylet, Video intubating stylet, Shikani technique, Laryngoscopy, Endotracheal intubation, Airway management, Difficult airway

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Laryngoscopy-The Old Skill for Endotracheal Intubation

Conventional laryngoscopy (direct laryngoscopy, DL) has been the mainstay technique for endotracheal intubation since last century. Prior to the appearance of videolaryngoscopy (indirect laryngoscopy, VL) in the 21st century, DL has been one of the essential clinical skills for medical staff that novice airway managers/practitioners requiring rapid acquisition and proficient mastery (for review, see (Burkle et al., 2004) (Szmuk et al., 2008)(Pieters et al., 2015). Laryngoscopy, together with other airway adjuncts, has been advocated as the standard technique for endotracheal intubation. The role of laryngoscopy has been widely applied for clinical anesthesia and airway management in various hospital and pre-hospital settings, clinical scenarios—including operating rooms (OR), non-operating rooms anesthesia (NORA), general wards, emergency rooms (ER), intensive care units (ICU), and field intubation by emergency medical services (EMS) personnel in the pre-hospital setting (Pepe et al., 1985) (Wang & Yealy, 2006)(Savino et al., 2017)(Benger et al., 2018) (Lee et al., 2022). Since then, laryngoscopy has been used as the standard-of-care comparator (or a predicate device) against all interventions under various physiologically and anatomically difficult airway scenarios.

The use of DL by Ear-Nose-Throat (ENT) professionals (e.g., for diagnosis and treatment) differs from anesthesiologists (i.e., for endotracheal intubation and general anesthesia) (Magil, 1936). Therefore, the roles and functions of laryngoscope-blades for endotracheal intubation have undergone re-design and reconstruction by pioneers in this field over subsequent years. Despite anatomic variations clinically, the traditional operating principle is to indirectly lift the epiglottis to expose the glottis with various laryngoscopic blades. The acquisition of optimal airway visualization is consistently emphasized (Macintosh, 1943).

In order to successfully and smoothly pass an endotracheal tube (ET tube) under direct vision via DL, the classic seven technical tips for endotracheal intubation under general anesthesia have been proposed (Bannister & Macbeth, 1944). Since then, several recommended technical tips (e.g., proper head/neck positioning, smoothly insertion of a laryngoscopic blade, and effectively lifting of the epiglottis with the blade tip) have demonstrated to be critical to successful laryngoscopy-endotracheal intubation. Both the learning curve and performance of laryngoscopy by novice airway practitioners remain a core area of developmental stagnation (Mulcaster et al., 2003). To acquire an optimal glottic visualization and subsequent placement of ET tube into patient's trachea, significant upward lifting force on the laryngoscope handle-blade unit is often required. Upward lifting may require a certain degree of force and difficulty arises in patients with limited cervical spine mobility or pathological anatomy around head-neck region (Hindman, 2014) (Schmutz et al., 2024). Therefore, the incidence of difficult airway (DA) and difficult intubation (DI) under direct vision with DL varies widely in the related literature, e.g., 1.41% (Nørskov et al., 2015), 4.5% (Endlich et al., 2020), 4.46% (Yuan et al., 2024), 4.7% (Schnittker et al., 2020), and 22.3% (Ruderman et al., 2022). Several clinical predictors for difficult laryngoscopy have been reported, e.g., patient's age, body mass index (BMI), neck circumference, history of snoring and obstructive sleep apnea (OSA) syndrome, degree of neck mobility, thyro-mental (TMD) and sterno-mental distance (SMD) (Joffe et al., 2019)(Apfelbaum et al., 2022).

Laryngeal exposure and mechanics of actual ET tube advancement, delivery, and insertion are both regarded as important key factors for successful endotracheal intubation with DL. Unfortunately, such critical clinical and technical demands have not been met until the prominent appearance of VL in the early 21st century (Kaplan et al., 2002)(Cooper, 2003). In contrast to DL, the excellent designs of various commercial VL products have shown reduced failed-intubation rates, higher first-attempt success rates, and comparable or superior glottic visualization (Paolini et al., 2013)(Hansel et al., 2022). When using VL, the direct line of sight achieved via the conventional three-axes or two-axes alignment theory is not a prerequisite to acquire an optimal view of the glottis (Greenland et al., 2008)(Greenland, 2020). Meanwhile, different designs of the laryngoscope blades, VL included, still result in higher mechanical lifting forces applied to the pharynx and larynx (Schmutz et al., 2024). As anticipated, numerous incidents have been reported with use of VL, possibly caused by patient's head and neck position and provider experience (Aziz et al., 2016)(Aziz et al., 2016). Since the invention and application of VL for endotracheal intubation post 2000, its clinical role as a standard and routine airway modality has been extensively and repeatedly advocated (Cooper et al., 2005)(Saul et al., 2023). Prior to contemporary advancements, VL appears to be a preferable approach for intubating patients undergoing surgical procedures in operating rooms (Ruetzler et al., 2024) and among critically ill adults (in an emergency department or intensive care unit) (Prekker et al., 2023)(Prekker et al., 2023). In comparison with the invaluable role of flexible fiberoptic bronchoscope (FFB), it remains premature for VL be the definitive holy grail of airway management (Sgalambro & Sorbello, 2017).

StyleTubation-The New Skill for Endotracheal Intubation

While VL could be the definitive solution for routine endotracheal intubation and the FFB technique be the gold standard for DA management, it is not surprising that the combination technique with FFB and VL proved to be advantageous in several DA scenarios (Guo et al., 2024)(Hu et al., 2024). Namely, both visibility and maneuverability of intubating tools are advantageous and essential for successful endotracheal intubation. Meanwhile, other types of the optical/visualizable intubating devices, e.g., WuScope, Bullard laryngoscope, and Upsherscope, have emerged (Wu & Chou, 1994) (Borland & Casselbrant, 1990) (Pearce et al., 1996). These novice airway intubating tools are a kind of rigid fiberoptic laryngoscope aided with visualization of the glottic opening even when impossible to align the oral, pharyngeal, and laryngeal axes. In contrast to the rigid fiberoptic laryngoscope, a light-wand rigid stylet was later designed to facilitate difficult endotracheal intubation (Hung et al., 1995) (Agro et al., 2001).

Unfortunately, after a decade of trial-and-error, the applicability of lightwand or similarly designed tools faded away due to the visual based conundrum of "not to see, not to believe" (Hung, 2025). Instead, an old invention quickly filled the knowledge gap of clinical relevance and technological improvement. Returning to 1979, 1983, and 1999, a new kind of visualizable intubating stylet was invented and applied for endotracheal intubation by Berci, Bonfils, and Shikani, respectively (Katz & Berci, 1979) (Bonfils, 1983)(Shikani, 1999).

Impressively, in his pioneer work, Shikani systemically and prospectively applied a new "seeing stylet-scope" in 120 patients (both adult and pediatric patients) who were scheduled to undergo routine ENT procedures (Shikani, 1999). This new intubating technique allowed continuous visualization of the airway during introduction of the ET tube into the glottis. The stylet facilitates the management of the DA with minimization of airway trauma, and allows endotracheal intubation without rigid (and sometimes bulky) laryngoscope blades retracting/depressing the base of the tongue. In contrast to the traditional concept of laryngoscopy, such "seeing intubating stylet technique" has a greater chance to evolve into a new applicable alternative for endotracheal intubation in future generations of airway management (Figure 1). Figure 1 demonstrates an evolution from DL to VL, and eventually to styleTubation over the last several decades. Figure 1 (left panel) highlights that direct inspection and good visualization of the vocal cords have always been the major issues for airway practitioners when DL is utilized. Successful endotracheal intubation by airway novices and trainees using DL requires a steeper learning curve (e.g., more than 47 attempts) and several criteria (e.g., proper insertion and lifting of the laryngoscope, in addition to proper sniff position) (Pieters et al., 2015). With the invention of VL (Figure 1, middle panel), enhanced vision and superior glottic views were able to be achieved, despite the limited or lack of prior device experience. Most notably, successful intubation was generally achieved with difficult airways. Nevertheless, expertise in VL skills and competency still requires extensive training and practice (Ruetzler et al., 2024).

As aforementioned, a semi-rigid intubating stylet (a hockey-stick type of seeing-stylet scope) for endotracheal intubation was reported even before creation of VL (Katz & Berci, 1979) (Bonfils, 1983) (Shikani, 1999). It should be emphasized that this novel seeing-stylet scope was proposed for the management of difficult airways both in adult and pediatric populations by improving the maneuverability and providing better glottic visualization. In addition, this removed the need for a rigid laryngoscope blade to retract the tongue base, minimizing the associated injury risk to the hypopharynx or larynx. Later, such role of video stylet technique (styleTubation, Shikani technique) also demonstrated to be very effective in the routine intubation of normal subjects (Shikani, 1999) (Halligan & Charters, 2003) (Thong & Wong, 2012). Figure 1 (right panel) shows such performance of the styleTubation technique. In comparison to the DL and VL, styleTubation shows further advantages and enhancement, including an extremely high first-pass success rate, a shorter comparative intubation time, strong subjective satisfaction, ease of application, and a fast learning curve. Several sporadic clinical experiences have been reported with fiberoptic stylet scopes and it has been suggested as an efficient alternative to FFB for difficult airway management (Kitamura et al., 1999) (Kim et al., 2010) (Godai et al., 2020) (Nabecker et al., 2021). Such technological advancements of the visual intubating tool, unfortunately, lacked appeal to specialists in clinical applications by 2000.

A decade after invention of the Shikani's seeing stylet, a new generation of such visible rigid/semi-rigid stylet-scopes have been re-engineered and become commercially available. Inclusive of 2026, there are in excess of 30 analogous tools available on the market (Figure 2). The market price of each styleTubation product ranges from few hundred to several thousand US dollars. It should be emphasized that such seeing/visualizable stylets include the following key structural and operational design features:

- A rigid/semi-rigid metal and unchanneled intubating stylet designed for both routine and difficult airways.
- A tip (inflexible or flexible) integrated with a LED light source (e.g., LED) and video camera (providing real-time and high-quality images on the mounted/attachable/portable video monitor).
- Enhanced visual capability without a need to pressure on tongue and hypopharyngeal structures.
- Effective maneuverability.
- Compatibility to accommodate various size of endotracheal tubes (ET tubes).
- Efficiency: Designed for rapid, direct-view intubation, often serving as a preferred method for difficult or awake/sedated intubation scenarios

Since 2016, we have systematically implemented the styleTubation technique (Figure 3) for routine and first-line endotracheal intubation in our medical center (Luk et al., 2022) (Luk et al., 2023) (Luk et al., 2023) (Lan et al., 2023) (Luk & Qu, 2024) (Lee et al., 2024). In Taiwan, such styleTubation has universally been accepted and adopted for endotracheal intubation in most medical centers, regional hospitals, and some local private clinics, with clinical applications north of a million patients. In our own clinical experience, the universal scope of styleTubation has increased exponentially during these recent years (Table 1). In this review article, we attempt to demonstrate the clinical coverage, pearls

Table 1: Universal use coverage of styleTubation technique for routine first-line endotracheal intubation in the Department of Anesthesia, Hualien Tzuchi Medical Center, Hualien, Taiwan from 2016 to 2025.

		2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Total anesthesia number		16077	17831	17998	19307	19721	19244	19765	22438	25046	25660
GA number		15339	16893	17497	18481	19009	18574	19061	22099	24368	25210
LMA-GA number		5544	5134	5816	5902	5863	5714	4932	5763	6585	6127
ET-GA number		5953	6504	6920	6966	7418	6982	7602	8329	8889	7852
	VL	0	0	20	100	635	336	305	280	350	250
	StyleTubation	**5953**	**6504**	**6900**	**6866**	**6783**	**6646**	**7297**	**8049**	**8539**	**7602**

GA: General Anesthesia; LMA: Laryngeal Mask Airway; ET: Endotracheal Tube; VL: Videolaryngoscope

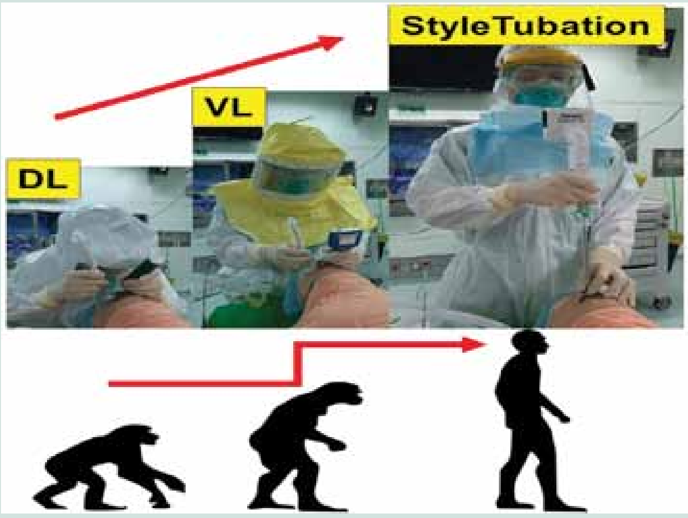

Figure 1. Evolution and revolution of endotracheal intubation techniques from (**A**) conventional Direct Laryngoscopy (DL), to (**B**) Videolaryngoscopy (VL), and finally to (**C**) styleTubation. In addition to improved glottis visualization on the monitor, the styleTubation technique can allow the airway operator to maintain a safer distance from the patient and avoid airway contamination incidents during airway management.

Figure 2. The rapid emergence of various styleTubation products into the airway management tools market in 21st century. The basic structures of such optic intubating devices are similar, including a video monitor, handle, and a hockey stick-shaped (or J-shaped) semi-rigid/rigid stylet mounted with a CMOS camera and light source.

Figure 3. The styleTubation (video intubating stylet technique for endotracheal intubation). The ET tube is mounted onto the intubating stylet with/without a stopper. The tip of the intubating stylet contains a high-resolution CMOS camera lens and an LED light source at the tip of the malleable intubating stylet - connected to a detachable video monitor. The resolution of the acquired image is excellent. Note that the video intubating stylet is situated inside the ET tube. Several examples of commercial products of styleTubation are ubiquitously available in each operating room in our department.

and pitfalls of such unique intubation technique, and areas for future advancement and research.

There are 19 operating rooms in the surgical theatre. The anesthesia team is composed of 16 anesthesiologists and 65 certified registered nurse anesthetists (CRNA). In this table, all the data were registered and collected for routine administrative purpose. All the patients received for both regulated and emergency operations on daily basis. Anesthesia and airway management were routinely performed by the anesthesia team, including attending physicians, anesthesia residents, and PGY trainees.

Pearls and Pitfalls of styleTubation

Conventional midline and retromolar approaches are the acceptable pathways to complete styleTubation. Note that the midline approach can provide easier and better glottic exposure, and a shorter time to intubation when using VL for tracheal intubation (Jiang et al., 2019). Similarly, when applying Bonfils intubating endoscope for endotracheal intubation, the scope should be advanced midline until the epiglottis is visualized, in contrast to the original proposed retro-molar approach (Thong & Wong, 2012). Reportedly, maintaining a midline position of the intubating stylet-ET tube unit along the oropharyngeal path is much easier for both beginners and first-line airway practitioners to visually locate the glottis. In accordance with technical feedback regarding video intubating stylet (e.g., Bonfils-type endoscope) (Shikani, 1999) (Thong & Wong, 2012), we adopted the midline approach for standard styleTubation while conducting endotracheal intubation. In Figure 4, an apparent normal airway scenario is sequentially demonstrated via a routine application of styleTubation. The anesthetized patient's mouth was opened wide and the jaw was lifted using the Shikani technique, or facilitated by an assistant. The patient's tongue, palate (Figure 4A) and uvula (Figure 4B) are easily visualized. A suction tube was used prior to intubation to clear any existing saliva and secretions. Then, the airway operator moved the intubating stylet-ET tube unit forward along the posterior pharyngeal wall until both the tongue base and the epiglottis were visualized (Figure 4C and 4D). In this case, the space between the epiglottis and the posterior pharyngeal wall remained wide enough for passage of the assembly. The operator could easily and gently maneuver the intubating stylet-ET tube apparatus downward, forward, and pass it beneath the epiglottis at this point. After passing the intubating assembly beneath the epiglottis, the operator needed to lift it up and tilt the tip of the apparatus until the full glottis view could be clearly acquired (Figure 4D and 4E). Finally, the ET tube could be smoothly dislodged from the intubating stylet, advanced forward, and placed into the patient's trachea, guided by the centrally located tracheal rings (Figure 4F). Using the step-by-step guide and technical suggestions denoted above, the midline approach of StyleTubation can easily complete endotracheal intubation.

The composition of an airway management team for routine anesthesia can vary with each individual medical infrastructure and differing policies in specific medical facilities. When difficult airways are anticipated or unexpectedly encountered during en-

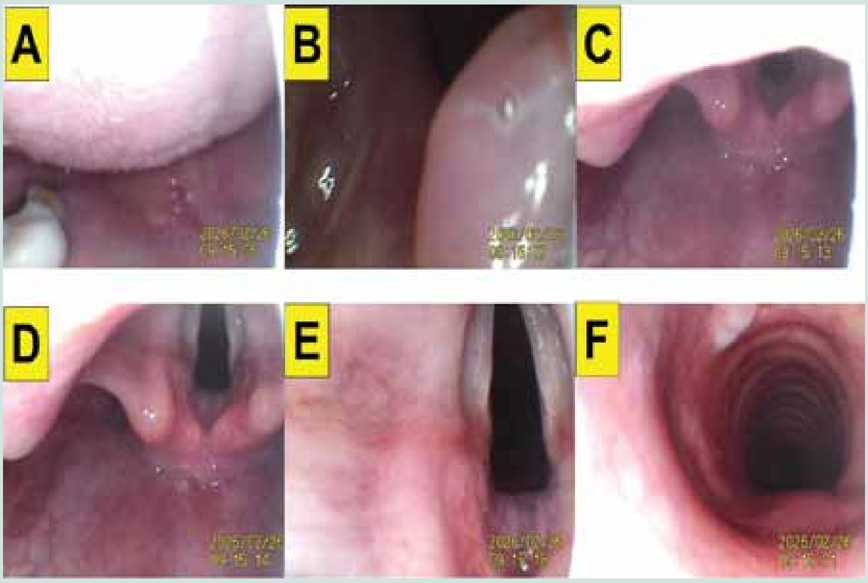

Figure 4. Midline approach of styleTubation in a normal airway scenario. A 36-year-old woman (body mass index-BMI: 20.5 kg/m^2) underwent calf reduction surgery under general anesthesia. (**A**) Position of tongue and palate. (**B**) Uvula. (**C**) Epiglottis. (**D** & **E**) Glottic visualization. (**F**) Tracheal rings.

dotracheal intubation, a call-for-help for additional assistants and team-based approaches should be implemented (Apfelbaum et al., 2022)(Ahmad et al., 2026). Figures 5~8 illustrate various clinical models to routinely conduct styleTubation in operating rooms and other clinical settings in the hospital: with (Figures 5 and 6) and without an assistant (Figures 7 and 8). Most often, when an airway assistant is present, his or her main responsibility is to perform effective jaw-thrust and mouth-opening maneuvers on the patient to assist endotracheal intubation (Figure 5). The principal airway operator can subsequently concentrate on performing styleTubation in a stepwise manner. In expectant or unanticipated DA scenarios, the two-person team-based approach became helpful and practical (Figure 6). The assistant used VL (or DL) to adequately open the patient's collapsed airway, while

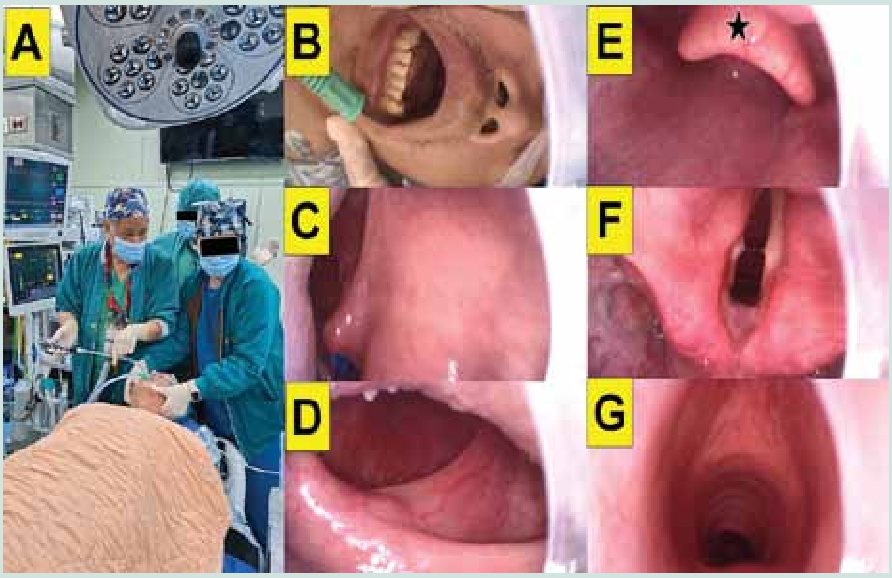

Figure 5. Two-person model for performance of styleTubation. A 68-year-old man with BMI 23.7 kg/m^2 undergoing laparoscopic appendectomy. (**A**) The airway assistant stood alongside the operator. (**B**) Mouth-opening. A suction tip was used to clear airway secretions. (**C** & **D**) Tongue, palate and uvula. (**E**) Epiglottis (denoted by a black star). (**F**) Glottic opening. (**G**) Tracheal rings. Intubation time: 18 s (for step-by-step demonstration) with first-pass success.

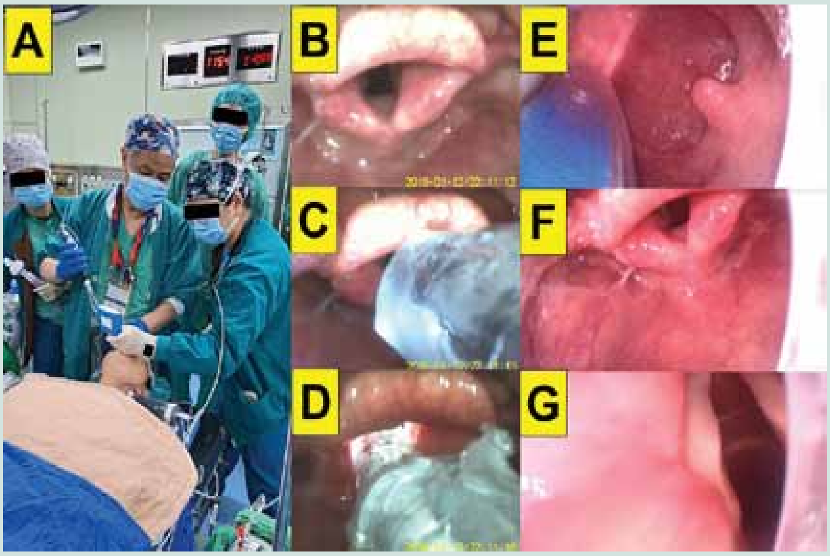

Figure 6. Two-person model for combined laryngoscopy-styleTubation technique. A 56-year-old woman with BMI 22.3 kg/m^2 undergoing partial mastectomy with sentinel lymph node biopsy. (**A**) The airway assistant, standing alongside the operator, performed video-laryngoscopy. The operator performed styleTubation with the aid of laryngoscopy. (**B~D**) Laryngoscope views of the glottis, and the placement of ET tube-video stylet unit. (**E~G**) Excellent views of airway from uvula, larynx and glottis. Intubation time: 9 s (in combination of laryngoscopy by an assistant) with first-pass success

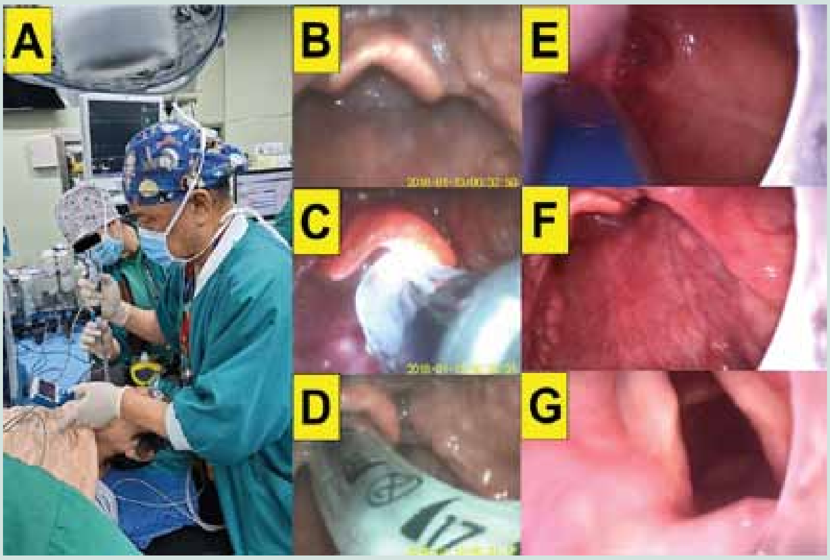

Figure 7. Single-person model for performance of combined laryngoscopy-styleTubation technique. A 71-year-old woman with BMI 31.5 kg/m^2 undergoing partial mastectomy with sentinel lymph node biopsy. She received anterior cervical discectomy (C6/C7) and spinal fusion two years prior to this surgery. Pre-operative airway examination showed limited neck mobility. (**A**) The airway operator performed video-laryngoscopy with his left hand and then performed styleTubation with his dominant right hand. (**B~D**) Laryngoscope views of epiglottis, and the placement of ET tube-video stylet unit. (**E~G**) Excellent views of uvula, larynx and glottis from styleTubation. Intubation time: 8 s (in combination of laryngoscopy) with first-pass success.

the operator confidently approached with styleTubation. When there is an individual airway operator conducting endotracheal intubation, a frequent experience encountered, styleTubation could be concurrently performed with DL (Katz & Berci, 1979) or VL (Luk et al., 2022)(Luk et al., 2023)(Luk et al., 2023) (Figure 7). Combined styleTubation and VL dual-vision can significantly assist the novice trainee when a DA situation is encountered (either expected or un-anticipated). Similarly, when styleTubation is performed by a lone operator, one can adopt the Shikani technique (Figure 8) (Shikani, 1999). Briefly, the patient is placed in sniff position before endotracheal intubation proceeds. The operator then manipulates the patient's mandible with the non-dominant hand for both mouth-opening and jaw-thrust maneuvers. Once the patient's epiglottis is gently and indirectly lifted by the jaw-thrust maneuver, enough space is created between the epiglottis and posterior pharyngeal wall. Then, the intubating stylet-ET tube assembly is placed between the vocal cords. The ET tube is then dislodged from the assembly and advanced into the patient's trachea under continuous and direct visualization. The intubating stylet is then smoothly withdrawn from the ET tube. Finally, the operator smoothly advances and places the ET tube into patients' trachea at the adequate depth. The ideal intubating process and sequence would be similar to the presentation in the Figure 8.

The Mallampati score is a 4-class assessment system used to predict the difficulty of endotracheal intubation by laryngoscopy (Mallampati, 1983). The Mallampati scoring system classifies the visibility of oropharyngeal structures (soft palate, uvula, faucial pillars, tonsils) when patients open their mouth and protrude their tongue (e.g., in the upright position). Higher Mallampati classes (e.g., class 4 in Figure 9B) indicate a smaller, more obstructed airway and are associated with greater intubation difficulty. However, the predictive sensitivity and accuracy of this pre-intubation evaluation tool is limited by factors such as inter-observer variability, patient cooperation, and lack of sensitivity when used in isolation. Therefore, the Mallampati score is used in conjunction with other airway assessment methods (e.g., Cormack-Lehane grade, Thyro-Mental Distance (TMD) or Sterno-Mental Distance (SMD), Upper Lip Bite Test (ULBT), etc.) to improve clinical reliability. The Cormack-Lehane classification, e.g., is a system used to grade the visualization of the larynx and glottis during direct laryngoscopy (from grade 1 to 4) (Cormack & Lehane, 1984) (Krage et al., 2010). In addition, specificity and accuracy of other bedside evaluation tests (e.g., ULBT, SMD) have also been studied in conjunction with Mallampati score to predict or unanticipated difficult laryngoscopy (Khan et al., 2009)(Roth et al., 2019) (Detsky et al., 2019).

In contrast to the Cormack-Lehane grading systems for laryngoscopy, the laryngeal/glottic visualization acquired by styleTubation can be practically classified into three degrees. The new scoring system (coined as the LQS grading system) is classified into three tiers (Luk et al., 2022)(Luk et al., 2023) (Luk et al., 2023)(Lan et al., 2023)(Luk & Qu, 2024)(Lee et al., 2024). Briefly, under the condition of a simple effective jaw-thrust maneuver, patient's epiglottis could be lifted up to certain degree and be able to expose any part of the vocal cords (VC), it is then classified as LQS grade 1. (Figure 10, left panels). When no part of the VCs can be visualized, but there is enough space between the epiglottis and posterior pharyngeal wall created by simple jaw-thrust maneuver, it is then defined as LQS grade 2 (Figure 10, middle panels). Both the grade 1 and grade 2 airway scenarios are usually regarded as soft targets for experienced or trained airway operators to intubate. In contrast, when the epiglottis cannot be lifted up by simple jaw-thrust maneuvers and completely lays down against the posterior pharyngeal wall, the glottis cannot be even partially visualized. Such austere scenario is then defined as LQS grade 3 (Figure 10, right panels). The grade 3 scenario, although very rare, could result in a difficult intubation for many operators but it is not impossible via styleTubation. Fortunately,

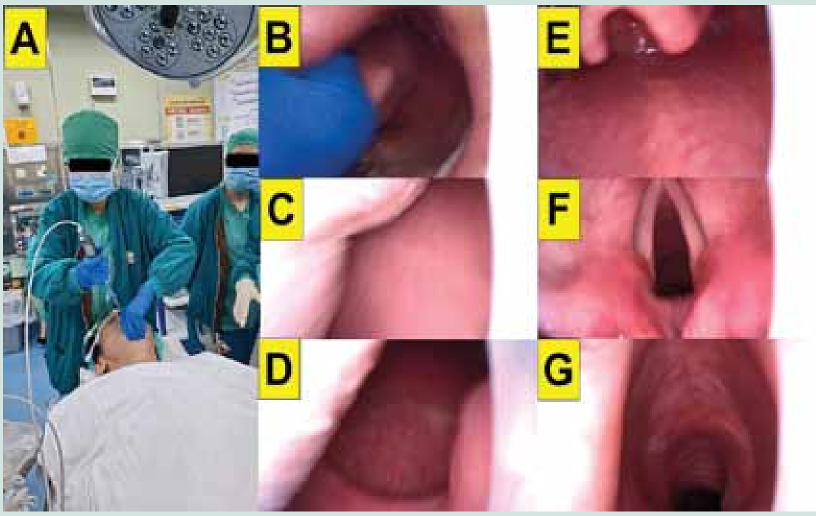

Figure 8. Single-person model with Shikani-technique used for styleTubation. A 41-year-old man with BMI 27.4 kg/m^2 undergoing bilateral functional endoscopic sinus surgery. (**A**) The airway operator performed styleTubation with Shikani technique. (**B**) The thumb of the operator can be seen. (**C** & **D**) Tongue, palate and uvula. (**E**) Epiglottis. (**F**) Glottis. (**G**) Tracheal rings. Intubation time: 8 s with first-pass success.

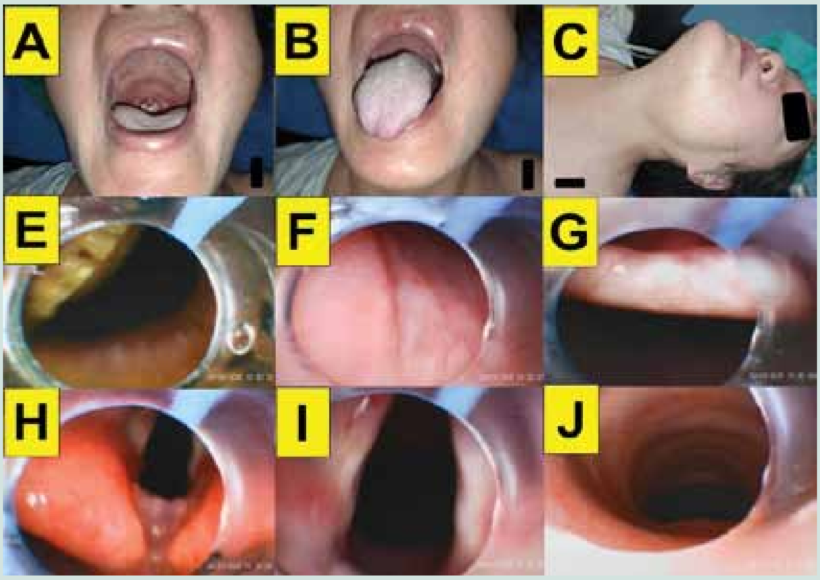

Figure 9. Examples of swift, smooth and easy endotracheal intubation by styleTubation in normal airway scenarios. An emergency surgery for nerve and tendon repairs due to cutting injury. A 48-year-old woman with BMI: 20.5 kg/m^2 and MMC: class II.Intubation time: 3 s with first-pass success.

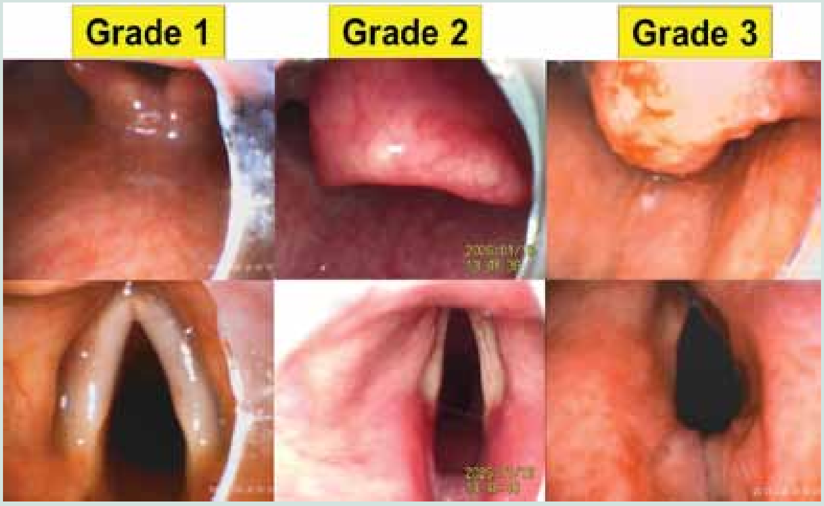

Figure 10. The LQS grading score on glottic visualization by styleTubation technique. (**Left panels**) Grade 1: Able to see any part of the vocal cords through the lower edge of the epiglottis in a 76-year-old woman (BMI: 22.5 kg/m^2). Intubating time: 30 s (for step-by-step demonstration) with first-pass success. (**Middle panels**) Grade 2: None of glottis, except the epiglottis, can be observed in a 42-year-old man (BMI: 31.4 kg/m^2). Enough space retained between the epiglottis and posterior pharyngeal wall to allow the ET tube-stylet unit to pass through. Intubating time: 27 s (for step-by-step demonstration) with first-pass success. (**Right panels**) Grade 3: A 63-year-old man (BMI: 20.4 kg/m^2) undergoing laryngomicrosurgery for biopsy to rule out hypopharyngeal carcinoma. Upper lip bite test (ULBT): class 2; modified Mallampati scoring (MMT): class IV; neck circumference 35 cm; sterno-mental distance (SMD) 14 cm). The space under the epiglottis is extremely narrow and restricted hence passage of ET tube-stylet unit appears challenging and difficult. Intubating time: 20 s with second-pass success.

the incidence of LQS grade 3 scenarios is very low (< 0.5 %) and are usually encountered in patients with predicted or anticipated difficult airway scenarios (e.g., limited cervical spine mobility, morbid obesity, neck radiation fibrosis, oro-pharyngeal tumors, etc.). It should be noted that the value and the validity of the LQS grading system is still preliminary and awaits for external validation and inter-observer reliability test.

In literature, to compare the clinical effectiveness of VL versus DL, intubation time (i.e., time to intubate) is usually the preliminary comparator, in conjunction with clinical outcome indices such as first-pass success rate, total success rate, complications, autonomic nervous stimulation and other metrics (Kriege et al., 2023) (Kriege et al., 2024). StyleTubation demonstrated superiority relative to direct laryngoscopy with significantly shorter intubation time, among all other relevant clinical comparators for effectiveness in patients with DA (Tsay et al., 2022) (Zhang et al., 2023). Figure 11 shows an example of styleTubation conducted in a patient with normal airway during routine endotracheal intubation. The time to intubation (defined as "from lip to trachea") in this patient was only 6 s. It is imperative to delineate that shorter time to intubation should be used as an auxiliary outcome parameter in comparative clinical studies. Explicitly, the first-pass success rate, smoothness of intubation, and subjective ease for airway operators represent higher clinical relevance regarding parameters. Faster intubation time (e.g., 3 s to 5 s) should not be taken as the best quality and safety indicator for endotracheal intubation. Instead, smooth operational sequence, visualization of anatomical signposts/landmarks along the airway, and capability to "look around the corner" are primary considerations in broad airway scenarios when styleTubation is applied.

Technical difficulties arise with fiberoptic scopes/video intubating devices like view limitations caused by blood, copious secretions, fogging of the lens, and soft tissue contact along the upper airway (Shikani, 1999)(Thong & Wong, 2012). Figure 12 shows an example of interference by secretions and saliva during styleTubation in a patient undergoing an emergency operation caused by a deep neck infection. Despite the 4th-year anesthesiology resident's success in intubating this challenging and technically difficult case, it is paramount for competent airway management to include clearance of airway secretions before styleTubation commences (Lan et al., 2023)(Wang et al., 2022)(Bonilla Gonzalez et al., 2025).

StyleTubation for Difficult Airway

Senior airway clinicians encounter DAs daily. Failure to identify DAs in advance results in improper preparation, and results in clinicians not creating contingency plans. Clinicians should create at least three plans for emergencies where airway security is in question to avoid serious complications (Crawley & Dalton, 2015). Among all the clinical tests to predict DAs, the upper lip bite test (ULBT) displayed the greatest diagnostic accuracy (Roth et al., 2018). The advantageous roles of VL in patients with difficult airway have been reported, e.g., in Pierre-Robin syndrome or extreme obesity situations (Kim et al., 2014)(Peterson et al., 2021). Juxtaposed to VL, Figure 13 demonstrates a valid and useful application of styleTubation in an obese patient. The patient suffers from morbid obesity and severe snoring. During styleTubation evaluation, a collapsed and crowded airway, omega-shaped epiglottis, and LQS grade-2 glottis visibility were visualized. Enlarged and hypertrophic ventricular folds (i.e., false vocal folds or plica ventricularis, folds of mucous membrane located above the true vocal folds in the larynx) were observed compressing the true vocal cords and interfered with their visualization (Figure 13E ~ 13G). When applying styleTubation, such hypertrophic plica ventricularis did not cause any expectant difficulties for endotracheal intubation (Figure 13H). The intubating time was 30 s with first-pass success.

A "difficult airway "(DA) describes when a trained or experienced clinician anticipates or encounters certain difficulty with aspects of airway management, including facemask ventilation, supraglottic airway placement, endotracheal intubation, or invasive emergency front-of-neck access (Apfelbaum et al., 2022) (Ahmad et al., 2026)(Law et al., 2021) (Law et al., 2021). Underlying contributions that increase DA complexity include anatomical, physiological, and situational factors. Clinicians are required to apply systematic assessment, escalation strategies, and gener-

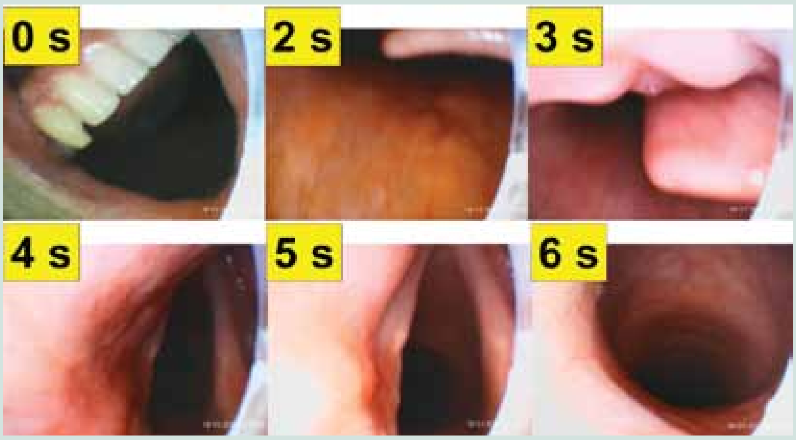

Figure 11. An example of an uncomplicated smooth styleTubation inclusive of the "look around the corner" enabling procedural simplicity. A 19-year-old man (BMI: 27.0 kg/m^2) undergoing laparoscopic subcutaneous mastectomy. LQS grade 1. Time from lip to trachea is 6 s with first-pass success.

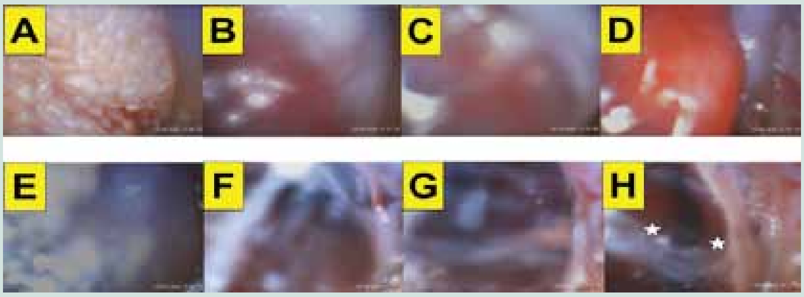

Figure 12. The obscured visual field caused by salivation during styleTubation. A 48-year-old man with BMI 25.0 kg/m^2 undergoing emergency incision and drainage due to deep neck infection. Pre-operative examination confirmed the DA scenario. Intubating time: 34 s with the first-pass success. The airway operator was a 4th-year anesthesiology resident.

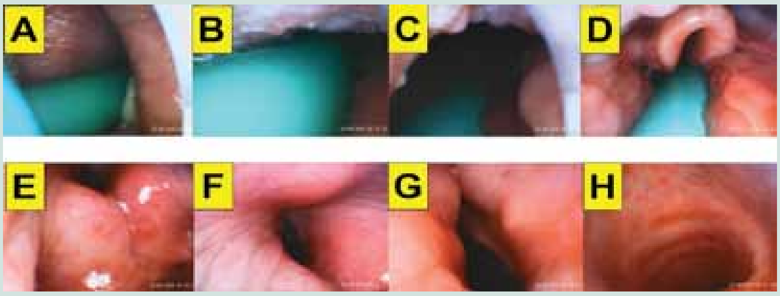

Figure 13. Application of styleTubation in a morbid obesity patient. This is a 46-year-old man with a BMI 55.4 kg/m^2 undergoing laparoscopic gastric bypass surgery and cholecystectomy. MMC: class II.; inter-incisor distance 4.5 cm; neck circumference 53 cm; sterno-mental distance (SMD) 15 cm; with OSAS history. (**A~C**) Narrow and crowded oro-pharyngeal space; (**D**) An omega-shaped epiglottis; (**E~G**) glottis visualization with plica ventricularis; (**H**) Tracheal rings. The nasal airway-suction tube assembly (in green color) was engaged to clear secretions and guide subsequent styleTubation. The intubating time was 30 s with first-pass success.

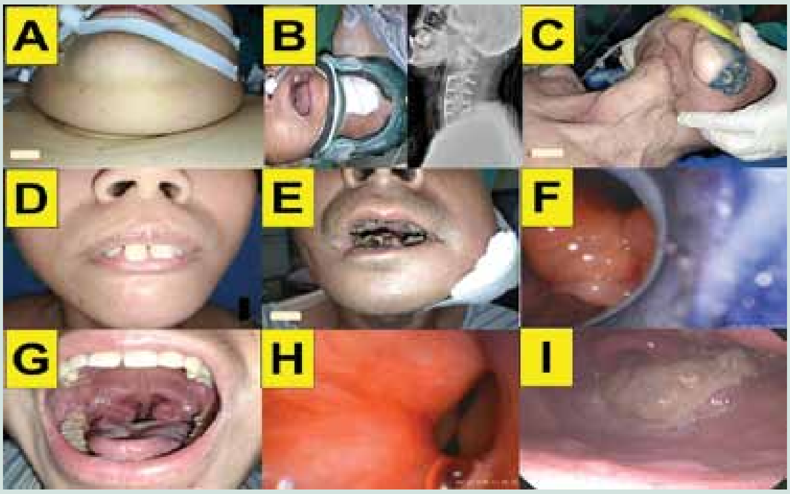

Figure 14. Application of styleTubation in various DA scenarios. (**A**) Obesity with OSA undergoing bariatric surgery. A 41-year-old woman with BMI 64.0 kg/m^2. Intubating time: 11 s. (**B**) Restricted cervical spine mobility with cervical collar after C3-C6 laminoplasty and C3-C7 anterior cervical discectomy & fusion surgery (ACDF). A 64-year-old woman with BMI 24.6 kg/m^2 undergoing ventriculo-peritoneal shunt. Intubating time: 10 s. (C) Retromolar approach of styleTubation in a 62-year-old man (BMI 28.0 kg/m^2) with prior buccal carcinoma and reconstruction flap. Intubating time: 18 s. (D) A 42-year-old woman with BMI (28.8 kg/m^2) with buck teeth undergoing laryngomicrosurgery. Intubating time: 24 s. (**E**) A 46-year-old man (BMI 19.5 kg/m^2) with lower gum cancer and trismus undergoing tumor wide excision. Intubating time: 8 s. (**F**) StyleTubation for double-lumen endobronchial tube intubation. A 47-year-old woman with BMI 28.8 kg/m^2 underwent video-assisted thoracoscopic surgery (VATS). A 2nd-year anesthesiology resident performed styleTubation. Intubating time: 24 s. (**G**) A 22-year-old man (BMI 32.1 kg/m^2) of bilateral grade-3 tonsillar hypertrophy and OSAS (obstructive sleep apnea syndrome) for tonsillectomy and uvulopalatopharyngoplasty (UPPP). Intubating time: 20 s. (**H**) A 54-year-old woman with BMI 21.3 kg/m^2 undergoing incision & drainage for deep neck infection. Intubating time: 12 s. (**I**) A 57-year-old man (BMI 16.8 kg/m^2) with hypopharyngeal carcinoma. Intubating time: 35 s. All cases outlined in this figure were intubated with first-pass success using styleTubation.

ate solutions. Therefore, modern airway management emphasizes the roles of early recognition and declaration of DAs. Through early recognition, structured planning, execution, and maintenance of oxygenation, maximization of first-pass success occurs. Additionally, human factor principles, effective team resource management, and use of cognitive aids are recognized as essential components of safe airway practice that optimizes patient outcomes. It is important to mention that so-called "evidence-based" techniques and airway devices are still not satisfactory to serve as the final solution for a DA. In the past decade, we have routinely integrated video intubating stylets into our working environment and universally applied the styleTubation technique as the first-line airway modality on a daily basis (Luk et al., 2022) (Luk et al., 2023)(Luk et al., 2023) (Lan et al., 2023) (Luk & Qu, 2024) (Lee et al., 2024). In contrast to VL, Figure 14 shows our experiences of clinical performance and applicability of the styleTubation in various DA scenarios.

Obesity

One should always be prepared to encounter a DA in obese patient populations because of their unique predictive parameters (e.g., MMT score, thyro-mental distance, ratio of neck circumference/thyro-mental distance) (De Jong et al., 2015) (Thota et al., 2022). The superior roles of VL in obese patients have been reported (Ndoko et al., 2008) (Hoshijima et al., 2018) (Lee et al., 2024). Figure 14A demonstrates the application of styleTubation in an obese patient with OSAS undergoing bariatric surgery (a 41-year-old woman with BMI: 64.0 kg/m2). The short sterno-mental distance (SMD) and grade-3 Cormack-Lehane glottis exposure did not cause any further difficulties and styleTubation was smooth with an intubating time of 11 s. Similar outstanding experiences of styleTubation in obese patients has been reported (Lee et al., 2024)(Wu et al., 2023).

Limited neck mobility

Patients undergoing cervical spine surgery and/or wearing cervical collar/halo vest instrumentation have restricted/limited cervical mobility and are immediately recognized as a DA scenario. The role of VL in DA scenarios involving morbid obesity-bariatric surgery or severely restricted cervical spine mobility has also previously been explored (Suppan et al., 2016) (Dutta et al., 2020) (Paik & Park, 2020). Figure 14B shows the performance of styleTubation was uncomplicated and swift as predicted in a 64-year-old woman with restricted cervical spine mobility (BMI: 24.6 kg/m2; intubating time: 12 s). Increased clinical effectiveness of styleTubation has been compared to VL in patients with cervical neck immobilization (Kim et al., 2011) (Nam et al., 2019) (Yoon et al., 2020)(Park et al., 2021). Recently the role of styleTubation in such clinical scenarios has garnered more attention (Hung et al., 2021) (Chen et al., 2022) (Sanu & Ahmed, 2024). We also routinely apply the styleTubation technique in complex patient populations daily (Shih et al., 2022).

Anatomical anomaly in the oral cavity

Patients undergoing head and neck reconstructive surgeries usually present significant challenges for endotracheal intubation, and carry a higher incidence of DA scenarios (e.g., scar contracture with a reconstructed flap over the neck, pharyngo-laryngeal cancer) (McCauley et al., 2022)(Yokogawa et al., 2022). Figure 14C shows retromolar styleTubation technique in a 63-year-old man with buccal cancer and prior reconstructive flap surgery. The styleTubation procedure was smooth with first-pass success (intubating time: 20 s). Similarly, patients undergoing oral cancer surgery display multiple predictors of anticipated DA and unique challenges (Nagarkar et al., 2019). Conventional airway management (e.g., laryngoscopy) often results in failed intubation, even after several subsequent attempts. In such patients, more advanced airway management techniques for tracheal intubation are recommended (Shah & Chaggar, 2023). Figure 14-D shows a 42-year-old woman (BMI 28.8 kg/m2) displaying prominent (buck) teeth with poor ULBT grade who underwent laryngomicrosurgery (LMS) for removal of vocal polyps. The buck teeth or receding chin (retrognathia) did not posit any difficulty for styleTubation (24 s). With traditional laryngoscopy, teeth damage or intubation failure is plausible (Neto et al., 2023) (Chari et al., 2023). Predictably, patients with oropharyngeal/laryngeal cancers receiving head/neck radiotherapy (HNRT) face significant threats and risks to airway management during tracheal intubation. While previous treatment with HNRT was not always associated with additional risk of having a DA, MMT score may be a sensitive predictor in this patient population (Zheng et al., 2019). In Figure 14E, the styleTubation technique was applied in a 46-year-old man (BMI: 19.5 kg/m2) with lower gum cancer and severe trismus (less than 2 cm mouth-opening). The styleTubation procedure had a smooth first-pass success (intubating time: 10 s).

Placement of double-lumen endobronchial tube (DLEB tube)

Intubation with a DLEB tube for one-lung ventilation can be difficult even in patients with normal airways and adequate direct laryngoscope view. The role of VL for placement of DLEB tube has been repeatedly studied, however results fail to consistently show the superiority of VL over DL (Huang et al., 2020)(Yao et al., 2022) (Kim et al., 2022) (Rajagopal et al., 2023) (Yoo et al., 2018). Similarly, styleTubation has shown inconsistent superiority over DL for placement of DLEB tube (Yang et al., 2013) (Xu et al., 2015) (Gu et al., 2023). In contrast, we applied styleTubation as a routine first-line intubating modality for such DLEB tube intubation for one-lung ventilation daily. Figure 14F shows that a 35-Fr DLEBT placed with styleTubation in a 47-year-old woman with BMI: 18.0 kg/m2 who underwent single-port video-assisted thoracoscopic surgery (VATS). The intubating time was 24 s with first-pass success.

Pathological obstruction over throat

Tonsillectomy with or without adenoidectomy is one of the most common procedures performed worldwide with around two thirds occurring in children under 15 years old. Obstructive sleep-disordered breathing alongside recurrent throat infections are the most dominate indications for these surgeries in both pediatric and adult patients. Endotracheal intubation with reinforced or preformed ET tube traditionally has been the standard used to secure the airway in pediatric patients undergoing adenotonsillectomy. Note the use of a laryngeal mask airway (LMA) has been advocated as a viable alternative (Sierpina et al., 2012) (Khoury et al., 2024) (Ooi et al., 2025). Laryngoscopy presents difficulties such as soft tissue injuries in the presence of high grade enlarged tonsils. Instead, styleTubation makes intubating easier and safer when passing through the jammed/collided tonsils - minimizing trauma risk, reducing hemodynamic stimulation and sore throats post operatively. Figure 14G reflects a man (BMI 32.1 kg/m2) with grade-3 tonsillar hypertrophy and OSAS (obstructive sleep apnea syndrome) indicated for tonsillectomy and uvulopalatopharyngoplasty (UPPP). StyleTubation for orotracheal intubation was performed smoothly and effectively in this patient (intubating time: 20 s).

Deep Neck Infection (DNI) is a pathology which might cause jugular vein thrombosis, airway obstruction, acute respiratory distress syndrome, sepsis, and disseminated intravascular coagulation. Treatment involves timely multidisciplinary action (Cobzeanu et al., 2025) (Huang et al., 2004). Patient with DNIs might present with varying magnitudes of DAs, including neck swelling/stiffness, limited cervical mobility, trismus, dysphagia, massive upper airway swelling/edema/narrowing/obstruction, distorted airway anatomy, salivary stasis, copious secretions, and stridor/dyspnea. Therefore, airway management in patients with a DNI introduce a challenging aspect (Karkos et al., 2007) (Cho et al., 2016) (Ma et al., 2019). Both awake trans-nasal-optic bronchoscopy (FOB) and laryngoscopy (DL or VL), in conjunction with awake tracheostomies, have been advocated and employed in patients with DNIs (Potter et al., 2002) (Ovassapian et al., 2005)(Tapiovaara et al., 2017)(Kim et al., 2022). Figure 14H shows our experience of applying styleTubation in a patient with a DNI. In the absence of severe trismus, a critical prerequisite for trans-oral intubation, the styleTubation technique offers a fast and smooth intubating modality.

Understandably, patients with oropharyngeal/laryngeal cancers receiving head/neck radiotherapy (HNRT) can face significant airway management risk during endotracheal intubation. While previous treatment with HNRT was not always associated with additional risk of DA, MMT score may be a sensitive predictor in this patient population (Zheng et al., 2019). Endotracheal intubation with VL after induction of general anesthesia can be a feasible alternative for managing DAs in patients with supraglottic masses (Hofmeyr et al., 2020) (Jeong et al., 2024). StyleTubation plays a vital role in managing the airway of such patients (Tsay et al., 2022) (Yang et al., 2024). Figure 11I shows a 57-year-old man with recurrent hypopharyngeal squamous cell carcinoma (cT4N3B, stage IVB) undergoing elective tracheostomy and laparoscopic Stamm gastrostomy. Even with the styleTubation technique, challenges arise due to obstructive tumor lesions encroaching the airway canal, soft tissue swelling, and copious saliva and secretions present in these patients. The styleTubation procedure was timely and smooth with first-pass success (intubating time: 38 s).

Trans-Nasal styleTubation

In adult patients who undergo dental, oral, maxillofacial, head, and neck cancer surgery, the advantages of VL for nasotracheal intubation include a shorter intubation time, better glottis views, similar first-pass success rates, less use of the Magill forceps and the BURP maneuver (backward, upward, rightward, and posterior pressure on the larynx) (Ho et al., 2022). In contrast to the well-established roles of fiberoptic bronchoscope (FOB) and VL for nasotracheal intubation, the styleTubation requires markedly reduced intubation time and fewer airway-assisted maneuvers in adult patients undergoing head and neck surgery (Amir et al., 2017)(Cheng et al., 2021)(Osman & Abd El-Azizi, 2023). Similar applications of styleTubation for nasotracheal intubation have been reported (Lee et al., 2016) (Huang et al., 2021) (Wang et al., 2022). Figures 15 and 16 show the application of styleTubation for nasotracheal intubation in a 55-year-old man (BMI: 22.3 kg/m2) with history of squamous cell carcinoma over his oral cavity, hard palate, and buccal area (pT3N0). Previous operations include tumor wide excision, mandibulectomy, maxillectomy, and flap reconstruction. The trans-nasal endotracheal intubation was required for the operative release of scar contractures residing over his lower lip and perioral area, followed by a Z-plasty reconstruction. Trans-nasal styleTubation, instead of FOB, was smoothly and effectively performed. The intubating time was 8 s with first-pass success.

StyleTubation for pediatric population

Difficult pediatric airway management involving DL can result in multiple intubation attempts. Multiple attempts are associated with serious risks and potential complications (Lingappan et al., 2023)(Stein et al., 2024). Despite VL showing superiority over DL in certain adult patients, this superiority has not been consistently demonstrated in the pediatric population (Riveros et al., 2013). VL improves glottis visualization in routine pediatric intubation without DAs, but this comes with prolonged intubation time and subsequent increased failure rates comparative to DL (Sun et al., 2014). Importantly, in pediatric patients with DA scenarios, VL had the same intubation failure rates and times as DL (Takeuchi, 2023). In neonates and infants, VL with standard blades in conjunction with supplemental oxygen may have better first-pass percentages of tracheal intubation relative to DL (Garcia-Marcinkiewicz et al., 2020)(Riva et al., 2023). Similar beneficial effectiveness was observed (higher first-attempt success rates) regarding VL for urgent intubation of newborn infants (Geraghty et al., 2024). The styleTubation has long been reported in pediatric patients (Shikani,1999)(Pfitzner et al., 2002). In our medical institution, the styleTubation technique has routine applications in pediatric patient populations. Figure 17 demonstrates an 8-year-old boy with childhood cerebral X-linked adrenoleukodystrophy undergoing elective gastrostomy. Intubating time was 9 s - with first-pass success.

Learning curve for styleTubation

A plethora of clinical studies have demonstrated improved glottic visualization using VL, with shorter learning curves for novice airway practitioners and trainees. Findings are observed in both easy and difficult airway scenarios (McElwain et al., 2010) (Maartens & de Waal, 2017)(Yong et al., 2020) (Ghotbaldinian et al., 2021)(Pujari et al., 2021)(Yi et al., 2021)(Nalubola et al., 2022)(Malito et al., 2023). Similarly, the learning curves and performance of novices/trainees using styleTubation have also been studied (Webb et al., 2011)(Tseng et al., 2012)(Hung et al., 2013)(Ong et al., 2016)(Pius & Noppens, 2020). In our medical institution, we provided the novices/trainees (medical students, post-graduate doctors, residents) a full-scale training curriculum and hands-on courses. After completing the introductory courses (airway mannequins and cadavers), the novices/trainees have an opportunity to observe bedside in real presentations. Subsequently, from the second week of training, the trainees have the chance to attempt styleTubation in the operating rooms on patients with simple airway complexity under the supervision of experienced anesthesiologists. Figure 18 shows the performance of styleTubation by a third year anesthesiology resident. Figure 19 shows two individual trainees learning the styleTubation technique. As expected, an undergraduate student (clerk) had a shallow learning curve with first-pass success rate of 26.6%, while another post-graduate year-2 doctor (PGY-2) had an outstanding first-pass success rate of 87.5%.

Discussion

Although the majority of airway management cases are uneventful, clinical situations may swiftly deteriorate and result in

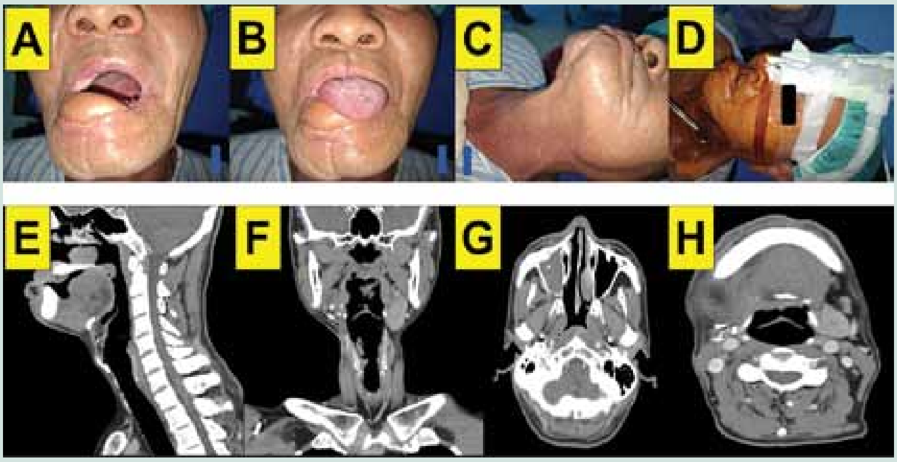

Figure 15. Trans-nasal styleTubation. A 55-year-old man (BMI 22.3 kg/m^2) with squamous cell carcinoma over oral, palate, and buccal area (SqCC, pT3N0,) underwent scar contracture release and Z-plasty. (**A~C**) Pre-operative physical airway examination. (**D**) Post-trans-nasal intubation. (**E~H**): Pre-operative imaging study.

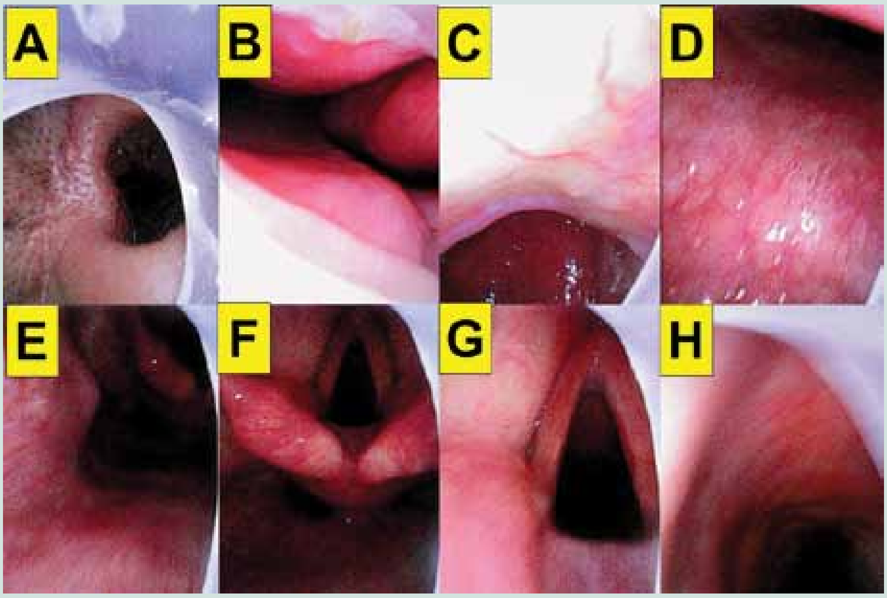

Figure 16. Trans-nasal styleTubation. Same patient as in the **Figure** 15. Serial images of styleTubation from nostril (**A~D**) to the glottis region (**E~G**) and finally into trachea (**H**). Intubation time (from nostril to trachea): 8 s with first-pass success.

Figure 17. Application of styleTubation in a pediatric patient. A 9-year-old boy with BMI 16.0 kg/m^2 underwent gastrostomy under general anesthesia. (**A~C**) Oral cavity. (**D**) Epiglottis. (**E~G**) Glottis. (**H**) Tracheal rings. Intubation time: 9 s with first-pass success.

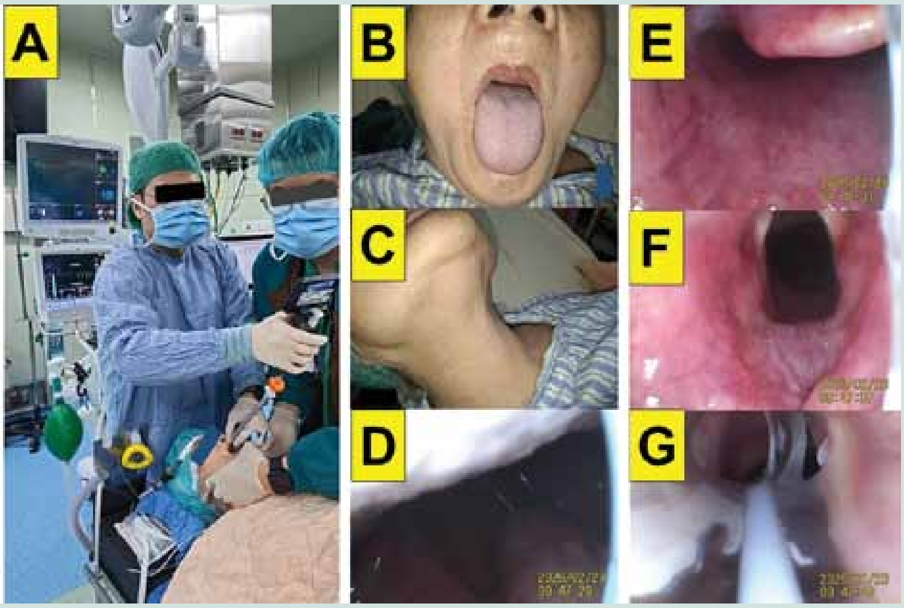

Figure 18. The learning curve for the "green" airway management trainees in the real world. (**A**) A 3rd-year anesthesiology resident performed styleTubation. (**B** & **C**) Pre-operative airway examination. (**D**) Uvula (**E**) Epiglottis. (**F**) Glottic opening. (**G**) Advancement of ET tube into trachea. Intubation time: 13 s with first-pass success

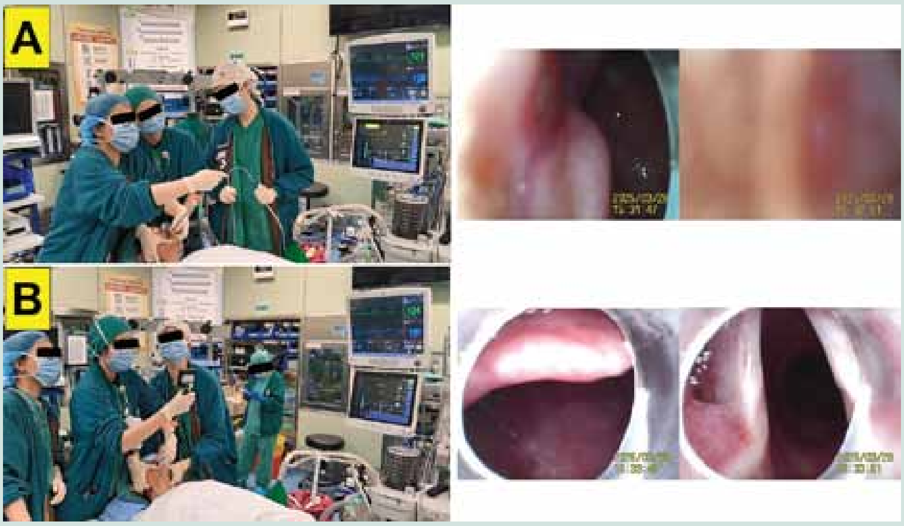

Figure 19. The learning curve for "green" airway management trainees in the real world. The patient is a 36-year-old woman (BMI 20.4 kg/m^2) undergoing Eustachian tube dilation (balloon tuboplasty). (**A**) A medical student (clerk), who has gone through the conventional airway-training program, failed to intubate this patient with styleTubation. The trial duration was 60 s and the glottis was not visualized (middle and right panels). The first-pass success rate for all her experience in styleTubation is 26.6% (failure in 11 cases out of 15 intubated patients) during her two-week training course). (**B**) A post-graduate year 2 (PGY-2) doctor had prior experience using laryngoscopy and completed the intubation. The time to intubation was 10 s with first-pass success. The epiglottis and vocal cords were clearly identified (middle and right panels). The first-pass success rate for her experience in styleTubation is 87.5% (failure in 8 cases out of 64 intubated patients during her 4-week training course).

patient harm. During the last two decades, the role of VL has often been shown to be superior to DL, based on common applied comparators such as first-pass intubation success, failed intubation rates, intubating time, laryngeal visualization, airway-related complications, operators' subjective satisfaction, learning curve, etc. (Hansel et al., 2022)(Kleine-Brueggeney et al., 2016). While VL has been recommended as a rescue in DA scenarios and in critically ill patients (Apfelbaum et al., 2022)(Zhang et al., 2024)(Azam et al., 2024), the possible role of VL as a universal, first-intention technique for routine airway management is still up for debate] (De Jong et al., 2022)(Cook & Aziz, 2022)(Lyons & Harte, 2023)(Mirrakhimov & Torgeson, 2023)(Saul et al., 2023)(Orrock et al., 2024) (Gómez-Ríos et al., 2025).

Laryngoscopy may have well-recognized drawbacks/limitations when being routinely used for endotracheal intubation or DA scenarios, such as difficulty acquiring optimal oro-pharyngeal space, imperfect glottic visualization, difficulty advancing, and misplacing the ET tube. Conversely, styleTubation has the advantages of VL, but does not necessarily require a direct line of sight (e.g., axes of alignment theory). More importantly, styleTubation can be performed under conditions where exposure of the oropharyngeal space is restricted (e.g., oral-facial tumor, tumor around

Table 2: Comparison between (video) laryngoscopy, flexible fiberoptic bronchoscope (FOB), and styleTubation. An experience from Hualien Tzuchi Medical Center during 2016-2025

	Laryngoscopy	FOB	StyleTubation
Require wide enough mouth-opening	+++	-	+
Require displacing the tongue to expose glottis	+++	+	+
Require high-grade Cormack-Lehane score	+++	-	-
Need a blade	Yes	No	No
Need a stylet	Sometimes	No	No
Good POGO score	Sometimes	Always	Always
External laryngeal maneuvers are helpful	Often	No	No
Maneuverability along the airway path	Limited	High	High
First-pass success rate	Moderate to high	Excellent	Excellent
Overall success rate	Moderate to high	High	High
Time to intubate	Moderate	Long	Swift
Subjective feeling of easiness to operate	Acceptable	Varied	Excellent
Impinge on arytenoid / vocal cords	Sometimes	Often	Very rare
Dental damage/soft tissue injuries	Sometimes	Seldom	Very rare
Impacted by secretions/blood/vomitus	Yes	Strongly	Strongly
Over-stimulation on airway	Often	Less	Much less
Require an adjunctive tool	Sometimes	Sometimes	Seldom
Learning curve	Reasonable	Slow	Steep
Affordability	Yes	Expensive	Yes
Availability	Yes	Limited	Yes
Speedy preparedness, easy maintenance	Yes	No	Yes
Applicability to awake or asleep intubation	Yes	Yes	Yes
Real time imaging/video recording/documenting	Yes	Yes	Yes

Note: The descriptors are presented in a subjective manner and totally based on our single-institutional clinical experiences observed during 2016~2025 in Taiwan. The relevant clinical indicators (e.g., first-pass success rate, overall success rate, time to intubate) can be referred to each figure in this paper.

Table 3: Subjective experience on performance of styleTubation in real-world airway scenarios in Hualien TzuChi Medical Center, Taiwan (from 2016 to 2025).

	Easy Airway	Difficult Airway
Laryngeal view	Always excellent	Could be difficult
First-pass success rate	Near 100%	Acceptable
Overall success rate	Near 100%	Acceptable
Intubating time (routine operation)	3 sec to 10 sec	30 sec to 120 sec
Intubating time (for demonstration purpose)	30 sec to 60 sec	NA
Hypoxemia	Very rare	Preventable
Airway injuries	Very rare	Seldom
Learning curve	20% to 90%	NA
Awake/asleep intubation	NA	Applicable
Combined with laryngoscopy	Applicable	Applicable

Note: The descriptors are presented in a subjective manner and totally based on our single-institutional clinical experiences observed during 2016~2025 in Taiwan. The relevant clinical indicators (e.g., first-pass success rate, overall success rate, time to intubate) can be referred to each figure in this paper.

neck region, cervical spine immobility, morbid obesity, etc.). The general comparative features and characteristics between laryngoscopy, FOB and styleTubation are listed in Table 2. It should be stressed that the data on the comparison between styleTubation and FOB is still very limited so far. Both airway modalities serve important and meaningful roles in endotracheal intubation, especially in predicted difficult airway and awake intubation.

In this narrative review paper, we present our own clinical experiences of styleTubation in various airway conditions, including both normal and complicated airway scenarios (Figures 4 ~ 17). There are two main technical advantages of styleTubation over laryngoscopy, one is the easily attainable clear glottic view and the other is the easy progressive placement of the ET tube into trachea. With these two advantages of styleTubation, the adopted clinical performance indicators are extremely promising (Table 3).

The Bonfils endoscope is an example a rigid and straight fiberoptic stylet device with a 40-degree curved tip. It was originally designed for the retromolar approach in pediatric DA scenarios (e.g., Pierre Robin syndrome) (Thong & Wong, 2012). Advantages include optical and slim stylet shape, which provides clear visualization and better maneuverability along the airway. The product design showed promise and use for difficult and normal airway presentations (Shikani, 1999) (Webb et al., 2011). Common pitfalls and limitations of using VL or styleTubation include fogging, contact with soft tissue or secretions/blood which can stain the lens and obscure the laryngeal view (Thong & Wong, 2012). Therefore, it is imperative that proper suctioning to adequately clear the airway while using styleTubation is completed. Other pitfalls include inadequate lifting of the patient's epiglottis which can result in failure to visualize the glottis and inability to safely enter the ET tube into trachea. In order to ensure enough space between the epiglottis and posterior pharyngeal wall is achieved, the following technical tips are useful: (1) An airway assistant effectively conducting jaw-thrust maneuvers and increasing interincisor distance; (2) lifting up the patient's mandible using the Shikani technique; (3) when necessary, using an accessory laryngoscope blade to further lift up the epiglottis (Levitan, 2006)(Van Zundert & Pieters, 2012)(Jhuang et al., 2022) (Villa et al., 2022) (Witkam et la., 2025); and (4) if needed, using a soft nasal airway tube as a lead conduit to pass the stylet-ET tube unit underneath the epiglottis (Lan et al., 2023).

The Future Perspective

The role of styleTubation for airway management has been reported widely in literature (Zhang et al., 2023)(Theiler et al., 2020)(Oh et al., 2021) (Chen et al., 2022) (Weng et al., 2024). Our own clinical experiences of universally applying styleTubation as the routine first-line tracheal intubation modality is substantial (71,139 cases from 2016 to 2025). In Taiwan, in excess of one million clinical airway intubations with styleTubation have been completed in over 30 medical centers. It is associated with excellent performance/outcome indicators (i.e., first-attempt success rate, intubating time, failed intubation rate, complications, etc.). Another important issue is the potential role of styleTubation in NORA and critically ill patient population (e.g., in ER, ICU). More work is needed to extend its potential application in the ICU and emergency rooms. We have completed studies comparing styleTubation to DL and VL cited in literature, nevertheless large-scale prospective head-to-head clinical comparative studies, evaluating the clinical effectiveness and safety of styleTubation against other intubation techniques, still are required.

Conclusions

Since 2016, styleTubation has attracted more attention for airway management, and significantly improved patient outcomes and clinical safety. The striking objective evidence for its clinical advantages and superiority over laryngoscopy is simply our experience. Whether styleTubation can become the standard of care for endotracheal intubation still requires more robust clinical trials evidence to support. In our institution, styleTubation has been ubiquitously equipped and universally adopted as the first-line airway management technique, already replacing the roles of DL and VL. We need to emphasize that the current report data support styleTubation as a promising and potentially valuable airway modality, but not yet as a definitive replacement for videolaryngoscopy or fiberoptic bronchoscopy. Future large-sized prospective clinical trials results to support this notion are still required. Continuously improving clinical demonstration, education and hands-on training of the concept and styleTubation technique are not only fundamentally useful in achieving a widespread awareness of its superior aspects, but also crucial in maximizing its clinical effectiveness and ensuring its sustained and ubiquitous clinical utilization in the foreseeable future.

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