

Research Article

Curved video laryngoscope assisted a new curved rigid forceps to overcome the difficult laryngeal exposure in endolaryngeal surgery

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Difficult laryngeal exposure (DLE) during endolaryngeal surgery is common; it is more likely to require prolonged or multiple attempts and associates with complications. To overcome this problem, we have developed curved video laryngoscope, and demonstrated its clinical application in the patients with difficult laryngeal exposure. We also developed forceps and a suction device with the same curvature to manipulate the lesion in the larynx. This new device provides excellent glottic visualization in five patients with DLE. We successfully completed surgery for laryngeal lesions and biopsy without any complications. Postoperative morbidity was minimal. In conclusion, curved video laryngoscopes with an upward curved cutting forceps may provide better laryngeal visualization and less traumatic manipulation in the patients with DLE.

Keywords: Laryngoscope, Difficult laryngeal exposure, Laryngoscopic surgical procedures.

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Introduction

Micro-laryngosurgery using a direct straight laryngoscope is the common approach used to remove laryngeal lesions. Commonly, the rigid laryngoscope is placed through oral cavity and the larynx is exposed under general anesthesia without difficulty [1, 2]. Laryngeal surgery can then be performed using various micro-laryngeal forceps, scissors, and delicate instruments without optical aids. Difficult laryngeal exposure (DLE) is encountered in some patients; however, in such situation, inadequate larynx exposure can cause abortion of the procedure, incomplete surgery, or unnecessary trauma to the

normal vocal fold microstructure [3]. Possible factors that lead to exposure difficulties during rigid laryngoscopy include difficulties in opening the mouth, retrognathia, a short neck, a stiff and muscular neck, obesity, macroglossia, and extension limitations of the cervical spine [4-6]. To overcome the DLE during endolaryngeal surgery, several techniques have been introduced. Many authors have attempted to use various positions and/or achieve videoendoscopic observation of the larynx from several different directions [1, 2, 3, 5, 6]. These methods and instruments effectively overcome DLE in some patients, although not all. Telescopic micro-laryngeal surgery with angled telescopes has been reported to be a useful

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alternative to the conventional microlaryngeal surgery with a straight laryngoscope[1]. With the modern telescope, a high quality device and monitor system, we can obtain adequate magnification with the telescope for clinical use. However, there are still limitations. To visualize laryngeal lesions, the laryngoscope should be introduced into the supraglottis at least, which is sometimes impossible. Therefore, failure of laryngeal exposure and trauma may occur in patients with limitations in neck extension or opening of the mouth[Fig1]. Under general anesthesia via a laryngeal mask airway, a flexible fiberscope is also used for DLE [7]. This technique does not provide full anteroposterior extension of the larynx to visualize laryngeal lesions adequately because up-lifting of the larynx is not possible. Another disadvantage in using the flexible fiberscope laryngoscope is lack of manipulations comparing with the conventional bimanual microlaryngeal surgery.

A curved video laryngoscopes was developed to gain adequate exposure of the larynx with minimal trauma and pressure during endolaryngeal surgery in patients with DLE. This Curved video laryngoscope can provide excellent laryngeal visualization through a screen without internal or external excessive pressure in patients with DLE. We here describe the endolaryngeal procedure using curved video laryngoscopes and its clinical usefulness with DLE in patients undergoing microlaryngosurgery.



Fig 1. patients with retrognathia and a short neck limitations

Materials and Methods

Procedures and evaluation of laryngeal exposure This study included 5 patients[table 1]. From January 2012 to May 2016, the 5 patients who had lesions of the larynx underwent microlaryngosurgery at the Third Affiliated Hospital of Sun Yat-sen University China and they were prospectively evaluated for DLE. The laryngeal view was first assessed by experienced anesthesiologists using optimal head and neck positioning and machintosh laryngoscope blade 3 or 4 was used. The laryngeal view was first assessed using Cormack-Lehane score without external laryngeal compression [7]. The classification of the laryngeal view was graded as followed: Grade 1, full view of the vocal fold; Grade 2A, partial view of the vocal folds but the anterior commissure was not seen; grade 2B, partial view of the vocal folds (less than half); grade 3, only the arytenoids visible; Grade 4, the entire glottis and arytenoids hidden.

The patients were intubated with an endotracheal tube (5.5 or 6.0 mm in diameter) under general anesthesia and muscle relaxation. First, curved video laryngoscopes passed the right-hand side of the mouth alongside the tongue and slide behind the base of tongue in the midline to expose the epiglottis by left hand. A lifting action is

required for this maneuver. Further gentle extended the holder device or manual external pressure on the neck over the inferior half of thyroid cartilage to improve the glottic visualization. The patient was maintained in the sniffing position and was placed with full extension of the head and slight flexion of the chest with pillows under the head, neck, or chest to facilitate the best exposure of the anterior glottis. Then, the upward curved cutting forceps was inserted into the mouth along the side of tongue and the base of tongue to remove the lesion with the guidance of Curved video laryngoscopes by right hand [Fig2,3,4].



Fig 2. Microlaryngeal upward curved cutting forceps used to remove the lesion (UE Visual laryngoscope, VL300L, The length of the lens: 140mm, The thickness of the lens: 17mm, Tai Zhou Han Chuang Medical equipment technology co. LTD, Made In China).



Fig 3. Curved video laryngoscopes with an upward curved cutting forceps

Results

When applying the curved video laryngoscopes, we achieved full view of the larynx in all the patients (grade 1). All of the vocal fold lesions were successfully removed in all patients for the diagnostic or therapeutic purposes. There

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Evaluation of postoperative complications we evaluated the possible postoperative complication using a self scoring questionnaire at 1 week after the endolaryngeal surgery. The questionnaire included the following items severity and duration of postoperative throat pain, degree of tongue pain, change of tongue sensation, impairment of tongue movement, disturbance of speech, difficulty in swallowing, injury to the oropharyngeal wall, and injury of teeth. Each item was graded from zero (none) to four (severe symptoms and signs) by self scoring. Since both a rigid straight and a curved video laryngoscope was used in every subject, it was not clearly determined whether straight or curved video laryngoscopes caused the postoperative complications when they were present. However, prolonged internal and external excessive pressure using the straight laryngoscope could be avoided; the straight laryngoscope was used only to evaluate the degree of laryngeal exposure, not to manipulate the lesion in the larynx. Based on these assumptions, we considered the answers on the questionnaire as postoperative complications mainly from use of the Curved video laryngoscopes.



Fig 4. Curved video laryngoscopes with an upward curved cutting forceps

were no postoperative complications related to the tongue, teeth and speech production. One patient subjected a 1 cm mucosal erosion at the posterior oropharyngeal wall, which was probably caused by the operator inexperienced with the Curved video laryngoscopes. All subjects recovered fully from their complications 1 week post-surgery.

Table 1. Possible causes of difficult laryngeal exposure and grade of laryngeal exposure by using a rigid straight (conventional) or curved visual Laryngoscope

Case no.	Age/sex	Clinical diagnosis	Causes of difficult laryngeal exposure	Laryngeal exposure (grade)	
				Rigid straight laryngoscope	curved visual laryngoscope
1	M/45	Polyp	Short and obese neck	3	1
2	M/50	Polyp	Cervical spinal rigidity	4	1
3	M/38	Polyp	Short and obese neck	4	1
4	M/47	Polyp	Retrognathia	3	1
5	M/46	Polyp	Short and obese neck	4	1

The grading of laryngeal exposure: 1, full view of laryngeal exposure; 2A, partial view of vocal folds, but anterior commissure not seen; 2B, partial view of vocal folds, less than half; 3, only arytenoids visible; 4, entire glottis and arytenoids hidden

Discussion

When microlaryngosurgery is performed under endotracheal general anesthesia, the larynx and the lesion must be directly viewed through the direct laryngoscope. The microflap technique has been developed to minimize surgical damage to the vocal fold mucosa, and maintain function as much as possible. It is essential to obtain sufficient laryngeal exposure to perform this precise surgical procedure. In some cases, laryngeal exposure with a direct laryngoscope is difficult because of a variety of reasons. One of them is the association with the increasing rate of obesity. In the 5 patients in this study, the causes of the difficulty in laryngeal exposure were short neck, obesity, and receding lower jaw. In these patients, a procedure to secure the better exposure of the larynx with reduced trauma was needed. Although several techniques have been introduced for patients with DLE, they all have some limitations [1,2,4,5-7]. Therefore we describe the Curved video laryngoscopes with upward curved cutting forceps for easier and better access to laryngeal lesions in patients with DLE. Similar attempts have been reported by Andrea et al and Yeh, Huang, and Chen [8,9]. However, those authors inserted a long rigid endoscope through the main lumen of the direct laryngoscope itself to make videoendoscopic observations of the larynx. The key to our method was the insertion of a curved visual direct laryngoscope and an upward curved cutting forceps through the left side tube of the visual laryngoscope. We used this device for endolaryngeal surgery in the 5 patients with benign lesions which were difficult to expose the larynx with a straight laryngoscope.

There are still some limitations with curved video laryngoscopes, the modification of conventional

laryngoscope used indirect visualization of laryngeal lesions with a visual laryngoscope, instead of direct visualization by using the straight laryngoscopy. The image quality for conventional laryngoscopy surgery is very fine and well magnified, as compared to the visual laryngoscope. The curved video laryngoscope may not perform precise endolaryngeal surgery from the point of direct visualization, and straight access for surgical instrumentation. However, with the advance of imaging technology, the image quality of the visual laryngoscope is expected to be improved and provide the resolution and magnification required for clinical use.

Another disadvantage is that a curved working pathway, through the Curved video laryngoscopes laryngoscope, prevents surgeons from using the CO2 laser systems for endolaryngeal surgery. In these cases, as a second choice, the contact type laser systems, through the fine fiber transmitting laser, can be used.

However, we achieved better laryngeal exposure including the region of the anterior commissure; vocal fold lesions were successfully removed for the therapeutic or diagnostic purposes in all patients with DLE. The complications previously reported in the tongue including loss of taste, hypoesthesia, and immobility did not occur because the curved video laryngoscopes did not require the excessive pressure of the oral tongue or the base of tongue. Moreover, there was no iatrogenic injury to the upper teeth because the curved video laryngoscopes did not contact the upper teeth directly, which sometimes occurs in endolaryngeal surgery using the conventional straight laryngoscope. In addition, laceration of the lateral tonsillar pillar, which can occur with excessive internal pressure, was observed in one case.

Conclusions

In conclusion, the curved video laryngoscopes with an upward curved cutting forceps can be used for the procedures to manage laryngeal lesions in patients with DLE.

Disclosure of conflict of interest

None.

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