*The Journal of Laryngology & Otology (2014)*, ***128***, *991–995*.
© JLO (1984) Limited, 2014
doi:10.1017/S0022215114002576

**MAIN ARTICLE**

# New laryngoscope for endoscopic arytenoidectomies

T YILMAZ, N SÜSLÜ, M D BAJIN, R Ö GÜNAYDIN, S ÖZER, G ATAY

*Department of Otolaryngology-Head and Neck Surgery, Hacettepe University Faculty of Medicine, Ankara, Turkey*

## Abstract

*Objective*: During an endoscopic arytenoidectomy, an intubation tube must be elevated anteriorly with the laryngoscope to ensure an adequate surgical field. This paper describes a new laryngoscope that has a canal along the outer wall of the body and a ridge which runs along the canal.

*Method*: Ten patients underwent endoscopic total arytenoidectomy using this new laryngoscope and 10 patients underwent the same operation using a regular laryngoscope.

*Results*: The duration of all operations ranged between 25 and 65 minutes, with a median duration of 42.5 minutes. The median duration with the new laryngoscope was 39 minutes, and that with the regular laryngoscope was 49 minutes; this difference was statistically significant ($p < 0.05$).

*Conclusion*: This new laryngoscope shortened the duration of the endoscopic arytenoidectomy and facilitated the procedure by enlarging the surgical field. This new laryngoscope may be a beneficial surgical instrument for posterior endoscopic laryngeal operations.

**Key words:** Laryngoscopy; Laryngoscopes; Vocal Cords; Vocal Cord Paralysis; Arytenoid Cartilage; Laryngeal Diseases

## Introduction

During regular surgical laryngoscopies, the intubation tube is placed in the posterior part of the laryngeal lumen; the laryngoscope is inserted above the intubation tube and the operation is carried out in the anterior half of the larynx. When the operation must be carried out in the posterior half of the larynx (such as during posterior or transverse cordotomies; medial, partial or total arytenoidectomies; or surgical procedures for posterior glottis stenosis), the intubation tube blocks or narrows the view,[1–4] and must be elevated to the anterior half of the larynx by the laryngoscope (Figures 1 and 2). This procedure cannot be conducted easily with regular surgical laryngoscopes because the intubation tube will slide down to the posterior half of the larynx as a result of gravity and due to the round shape of the laryngoscope.

The canal and ridge on the body of the new surgical laryngoscope add novel features (Figures 3–5). These features elevate the intubation tube and keep it in an anterior position inside the larynx during surgical procedures that are carried out in the posterior half of the larynx. This new laryngoscope thereby enlarges the surgical field and facilitates the operation (Figures 6–9).

The current study was performed to compare the duration of endoscopic arytenoidectomy using the new laryngoscope with that conducted using the regular laryngoscope.

## Materials and methods

This study was approved by the institutional ethics committee and was performed in accordance with the ethical standards established by the 1964 Declaration of Helsinki. All patients gave their informed consent.

A prospective, non-randomised, non-blinded, case–-control study was performed in a university hospital setting (the hospital acted as a tertiary referral centre). Ten patients underwent endoscopic total arytenoidectomy using the new laryngoscope and 10 other patients underwent the same operation using a regular laryngoscope. The duration of each operation was recorded. The technique used to perform total arytenoidectomy has been described previously.[5,6]

The patent registration number of the new laryngoscope is 2010/07321, and it received approval from the Patent Cooperation Treaty system (an International Preliminary Examining Authority) with an application number of PCT/IB2011/053670.

Presented at the Fall Voice Conference, 4–6 October 2012, New York, New York, USA.
Accepted for publication 24 March 2014 First published online 15 October 2014

https://doi.org/10.1017/S0022215114002576 Published online by Cambridge University Press



FIG. 1
Total arytenoidectomy performed using a regular laryngoscope; the field is narrowed by the intubation tube (which is protected from the laser beam by a wet cottonoid).

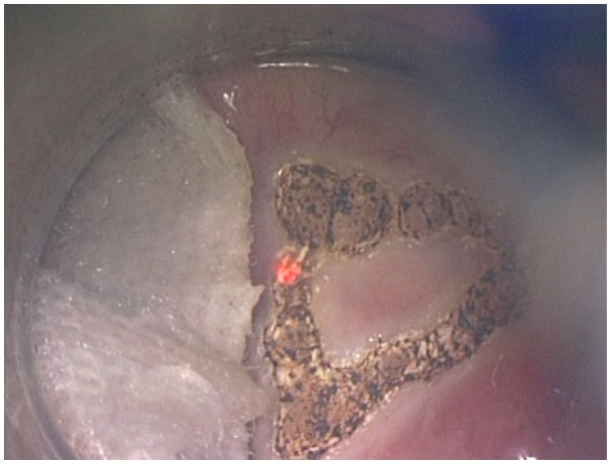


FIG. 2
Another view of total arytenoidectomy performed using a regular laryngoscope, showing the field narrowed by the intubation tube (which is protected from the laser beam by a wet cottonoid).

The new surgical laryngoscope includes a canal and ridge on the body of a regular surgical laryngoscope, which elevate the intubation tube and keep it above the laryngoscope in the anterior part of the larynx. The canal and ridge are located between the 10 and 12 o'clock position of the body of the laryngoscope for operations on the right side of the larynx, between the 12 and 2 o'clock position for operations on the left side of the larynx, and between 11 and 1 o'clock for operations in the posterior midline of the larynx. The canal is a semi-circle with a diameter of 8.4 mm which is used to hold an intubation tube; it has an internal diameter of 6 mm. Posterior laryngeal procedures can be easily carried out using intubation tubes with internal diameters of 5.5 mm and 6.0 mm. The canal and ridge are approximately 5 cm long. The free edge of the ridge is blunted to keep trauma to laryngeal mucosa to a minimum.



FIG. 3
External view of the new laryngoscope.

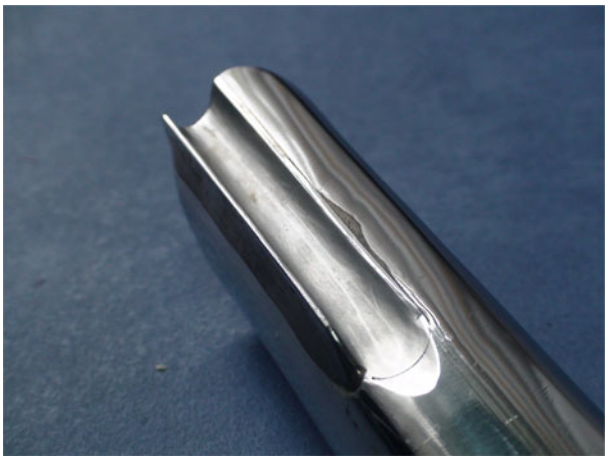


FIG. 4
Closer view of the canal on the new laryngoscope.

## Results

The duration of all total arytenoidectomies ranged between 25 and 65 minutes, with a mean duration of 43 minutes and median of 42.5 minutes. The median duration of the operation performed with the new laryngoscope was 39 minutes, and that performed with the regular laryngoscope was 49 minutes. This difference in duration was statistically significant (Mann–Whitney U test: $U = 21.5$, $Z = -2.16$, $p = 0.031$).

## Discussion

Direct laryngoscopy is one of the most common surgical procedures performed in ENT practice. Using a microscope, this operation is carried out within the narrow tip of the laryngoscope. During regular surgical laryngoscopies, when the operation is carried out in the anterior half of the larynx, the intubation tube is located in the posterior part of the laryngeal lumen, and the laryngoscope is inserted above the intubation tube. When the operation must be carried out in the posterior half of the larynx (such as during posterior or transverse

https://doi.org/10.1017/S0022215114002576 Published online by Cambridge University Press



FIG. 5

Internal view of the new laryngoscope; the canal does not narrow the operative field too much.

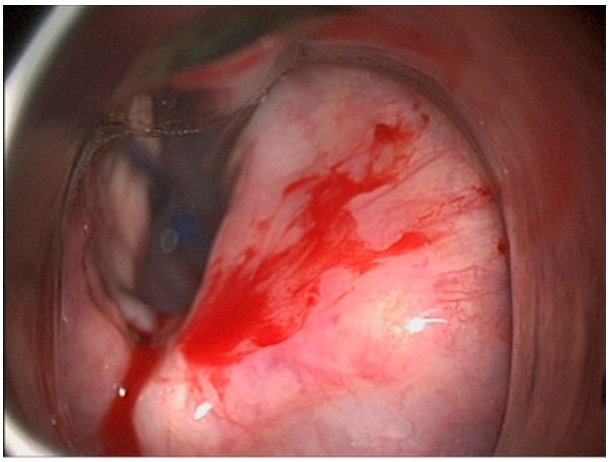


FIG. 6

Total arytenoidectomy performed using the new laryngoscope; the intubation tube is elevated anteriorly by the laryngoscope, making the operative field much larger.



FIG. 7

Another view of total arytenoidectomy performed using the new laryngoscope, showing a much larger operative field (as a result of anterior elevation of the intubation tube). The intubation tube is not in the operative field and does not need to be protected from the laser beam.

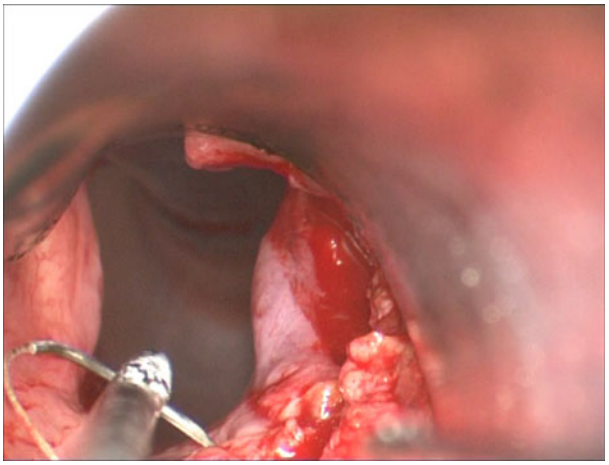


FIG. 8

Endoscopic suturing is much easier with the new laryngoscope; this image shows the first suture to the posteroinferior mucosal advancement flap.

cordotomies, partial or total arytenoidectomies, or surgical procedures for posterior glottis stenosis), the intubation tube blocks or narrows the surgeon's view, occupying nearly half of the surgical field. The intubation tube must therefore be elevated to the anterior half of the larynx by the laryngoscope. This cannot be achieved easily with regular surgical laryngoscopes, as the intubation tube will slide down to the posterior half of the larynx.

During surgical interventions performed in the posterior half of the larynx, the intubation tube must stay elevated. As both the intubation tube and laryngoscope are cylindrical in shape, and because there is no structure to fix the intubation tube onto the regular laryngoscope, the intubation tube slides from the top of the laryngoscope and falls to the posterior part of the larynx. In this case, the operation must be paused and the intubation tube must be re-elevated above the laryngoscope. This process slows the operation and is taxing for the surgeon.

The new surgical laryngoscope includes a canal and ridge on the body of a regular surgical laryngoscope. These features elevate the intubation tube and keep it above the laryngoscope in the anterior part of the larynx during intralaryngeal surgical procedures performed in the posterior half of the larynx. By elevating the intubation tube out of the microsurgical area, the new laryngoscope enlarges the surgical field. Furthermore, as the intubation tube is out of the surgical field, the tube does not need protecting from laser beams by a wet cottonoid; thus, the operation becomes safer. However, the surgical team must still follow the required laser precautions, including using the laser endotracheal tube.

https://doi.org/10.1017/S0022215114002576 Published online by Cambridge University Press

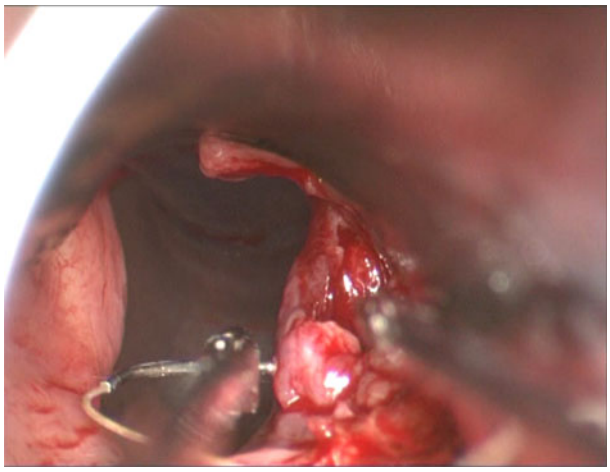


FIG. 9
Image showing the second suture to the posteroinferior mucosal advancement flap, performed using the new laryngoscope.

When a regular laryngoscope is used, the posteroinferiorly-based mucosal advancement flap sits next to the intubation tube; thus, suturing of this flap is very difficult. However, when the new laryngoscope is used, this flap is much easier to suture because of the empty medial space (Figures 8 and 9). The results of this study also showed that the use of the new laryngoscope significantly shortened the duration of endoscopic total arytenoidectomy when compared with procedures performed using a regular laryngoscope.

In 1983, Ossoff *et al*. reported using a laryngoscope developed for microlaryngeal laser surgery, in the posterior commissure of the larynx.[7] The tip was designed to facilitate exposure of one entire arytenoid and the posterior commissure. There is a concavity on the superior lip of the tip, less than 1 cm in length, which is used to hold the endotracheal tube anteriorly. With such a short concavity, it is very difficult to keep the endotracheal tube anteriorly within the larynx; thus, it is likely to slip down within a very short period of time. Furthermore, with such a laryngoscope, with a midline concavity on its tip, exposure of one entire arytenoid is not possible; only posterior commissure and medial surfaces of both arytenoids can be visualised. In order to expose one entire arytenoid, the concavity of the laryngoscope must be located lateral to its tip, it must be at least 5 cm long and it must have lateral extension to be able to hold the endotracheal tube anteriorly. If it does not hold the tube anteriorly, the tube can easily slip downwards. This laryngoscope is one (inadequate) version of the three laryngoscopes (left canal, right canal and midline canal) designed. Thus, use of this laryngoscope has never been popular.

In 2001, Kawaida *et al*. described a posterior glottis direct laryngoscope to be used in microlaryngosurgery for benign posterior glottal lesions.[8] This laryngoscope has a concave groove in the shape of an isosceles triangle on the upper portion of its distal tip. The triangle's base is 12 mm wide, and the distance from the base to the apex is 100 mm. This laryngoscope is curved inward in the form of an ellipse; it is 2.5 mm deep at the midpoint of the line joining the two sides of the base. The distal tip is very narrow, which creates a small surgical field, resulting in greater difficulties when performing surgery. This laryngoscope can only be used in the midline posterior commissure. One cannot visualise and operate on an entire arytenoid because of the laryngoscope's small distal end and because it cannot be turned laterally.

During endolaryngeal procedures, there are two alternatives to endotracheal intubation: jet ventilation and apnoeic ventilation. Jet ventilation is beneficial for short endolaryngeal surgical procedures, such as polyp removal; there is no space occupying the endotracheal tube, so all endolaryngeal space can be comfortably used by the surgeon. Jet ventilation is not advantageous for long procedures, such as arytenoidectomies, which take approximately 40 to 60 minutes. During such a long surgical procedure, carbon dioxide ($CO_2$) retention develops because $CO_2$ does not have enough time to diffuse out of the alveoli. After approximately 20 to 30 minutes of jet ventilation, the anaesthesiologist must check blood $CO_2$ levels and, if they are high, the patient must be intubated through the laryngoscope and ventilated to decrease $CO_2$ levels. When $CO_2$ levels reach their normal level, the intubation tube is removed and surgery starts again. This required break makes jet ventilation a time-consuming alternative. Furthermore, puffed air refluxes back through the laryngoscope, and this rapid airflow through the endoscope makes suturing very difficult. In light of these disadvantages, jet ventilation is not surgeons' preferred option for arytenoidectomies.

- **The new laryngoscope shortens endoscopic arytenoidectomy duration by enlarging the surgical field**
- **It takes the intubation tube out of the surgical field, making the procedure much safer; however, laser safety precautions must still be followed**
- **The new laryngoscope may be a beneficial surgical instrument for arytenoidectomies and other posterior endoscopic laryngeal operations**

Apnoeic ventilation is very useful in paediatric laryngoscopies and for laryngeal stenosis, where the endolaryngeal space is too small for both the endotracheal tube and surgical equipment. During apnoeic ventilation, the surgeon operates until the oxygen ($O_2$) saturation level drops. When $O_2$ saturation falls below a certain level, the patient is intubated through the laryngoscope and ventilated to increase $O_2$ saturation to 100 per cent. Then, the intubation tube is removed and the operation continues. During arytenoidectomy, there is no

https://doi.org/10.1017/S0022215114002576 Published online by Cambridge University Press

need for apnoeic ventilation, as the surgical space is adequate and the surgeon does not need to wait for ventilation.

In conclusion, this new laryngoscope shortens the duration of endoscopic total arytenoidectomy by enlarging the surgical field. It also makes the procedure much safer by removing the intubation tube from the surgical field. This new laryngoscope may be a beneficial surgical instrument for posterior endoscopic laryngeal operations.

## References


1 Hillel AD, Benninger M, Blitzer A, Crumley R, Flint P, Kashima HK *et al*. Evaluation and management of bilateral vocal cord immobility. *Otolaryngol Head Neck Surg* 1999; **121**:760–5

2 Crumley RL. Endoscopic laser medial arytenoidectomy for airway management in bilateral laryngeal paralysis. *Ann Otol Rhinol Laryngol* 1993;**102**:81–4

3 Young VN, Rosen CA. Arytenoid and posterior vocal fold surgery for bilateral vocal fold immobility. *Curr Opin Otolaryngol Head Neck Surg* 2011;**19**:422–7

4 Bosley B, Rosen CA, Simpson CB, McMullin BT, Gartner-Schmidt JL. Medial arytenoidectomy versus transverse cordotomy as a treatment for bilateral vocal fold paralysis. *Ann Otol Rhinol Laryngol* 2005;**114**:922–6

5 Thornell W. A new intralaryngeal approach in arytenoidectomy in bilateral abductor paralysis of the vocal cords. *Arch Otolaryngol* 1949;**50**:634–9

6 Yılmaz T. Endoscopic total arytenoidectomy for bilateral abductor vocal fold paralysis: a new flap technique and personal experience with 50 cases. *Laryngoscope* 2012;**122**:2219–26

7 Ossoff RH, Karlan MS, Sisson GA. Posterior commissure laryngoscope for carbon dioxide laser surgery. *Ann Otol Rhinol Laryngol* 1983;**92**:361

8 Kawaida M, Fukuda H, Kohno N. Microlaryngosurgery for benign posterior glottal lesions using a posterior glottis direct laryngoscope. *ORL J Otorhinolaryngol Relat Spec* 2001;**63**: 127–30



Address for correspondence:
Dr Taner Yılmaz,
Department of Otolaryngology-Head and Neck Surgery,
Hacettepe University Faculty of Medicine,
06100 Sıhhiye,
Ankara, Turkey

Fax: +90 312 3113500
E-mail: tyilmaz@hacettepe.edu.tr



Dr T Yılmaz takes responsibility for the integrity of the content of the paper
Competing interests: The senior author (TY) owns the patent for this laryngoscope.
The other authors do not have any conflict of interest related to the material in the manuscript.


https://doi.org/10.1017/S0022215114002576 Published online by Cambridge University Press