

## In this issue

Scott Chandrasiri takes responsibility for the integrity of the content of the paper Presented at the Australian Society of Otolaryngology Head and Neck Surgery ('ASOHNS') 71st Annual Scientific Meeting, 17–19 September 2021, Melbourne, Australia.

**Cite this article:** Chandrasiri S, Sahota RBS, Krishnan S, Foreman A, Bassiouni A, Jervis-Bardy J, Hodge JC. Applications of electrothermal bipolar vessel sealing devices in transoral head and neck surgery. *J Laryngol Otol* 2024;**138**:457–460. <https://doi.org/10.1017/S0022215123001718>

Received: 26 May 2022

Revised: 20 September 2023

Accepted: 23 September 2023

First published online: 9 October 2023

### Keywords:


Cancer; head and neck cancer; surgery; stridor; larynx; nasopharynx; oropharynx; pharynx

### Corresponding author:

Scott Chandrasiri;

Email: [scott.chandrasiri@student.adelaide.edu.au](mailto:scott.chandrasiri@student.adelaide.edu.au)

# Applications of electrothermal bipolar vessel sealing devices in transoral head and neck surgery

Scott Chandrasiri<sup>1</sup> , Raguwinder Bindu Singh Sahota<sup>1,2,3</sup>, Suren Krishnan<sup>1</sup>, Andrew Foreman<sup>1</sup>, Ahmed Bassiouni<sup>1</sup>, Jake Jervis-Bardy<sup>1</sup> and J C Hodge<sup>1</sup>

<sup>1</sup>Department of Otolaryngology, Head and Neck Surgery, Royal Adelaide Hospital, Adelaide, Australia, <sup>2</sup>ENT/Head and Neck Unit, University Hospitals of Derby and Burton NHS Foundation Trust, Derby, UK and <sup>3</sup>Department of Medical and Social Sciences, University of Leicester, Leicester, UK

## Abstract

**Objective.** Electrothermal bipolar vessel sealing devices are electrosurgical devices that seal tissues and blood vessels up to 7 mm in diameter. This paper discusses our experience using electrothermal bipolar vessel sealing devices in transoral head and neck surgery.

**Methods.** Electrothermal bipolar vessel sealing devices were used in five patients with lesions of varying size and type within the pharyngo-larynx. These were treated transorally by the otolaryngology department at the Royal Adelaide Hospital. Either the Medtronic LigaSure or BiZact devices were used for transoral resection, debulking or division of these lesions.

**Results.** Electrothermal bipolar vessel sealing devices were considered helpful in four out of the five cases. Success was dependent on suitable transoral access. A single unsuccessful case reflected the LigaSure jaw's inability to engage a large tumour effectively.

**Conclusion.** Electrothermal bipolar vessel sealing devices can be safely deployed transorally to treat lesions of the upper aero-digestive tract in selected patients. Further studies investigating additional indications would broaden applications of this approach.

## Introduction

Surgery of the upper aero-digestive tract can be undertaken via open or transoral approaches. One of the difficulties in performing transoral surgery is adequate haemostasis. There have been technological advances in the development of vessel sealing devices in recent years. Electrothermal bipolar vessel sealing devices were introduced during surgery in 1998,<sup>1</sup> to control intra-operative bleeding in a safe and controlled manner.<sup>2</sup> This paper describes our experience of using electrothermal bipolar vessel sealing devices through traditional transoral approaches with suspension laryngoscopy.

Electrothermal bipolar vessel sealing devices have found many uses in open general surgery, and in other surgical specialties such as urological, gastrointestinal and gynaecological surgery. These devices use bipolar energy transferred to tissue at a temperature to create a uniform, controlled denatured area that becomes suitable for haemostatic division.<sup>3</sup> Clinical trials have demonstrated limited collateral thermal injury.<sup>4</sup> These trials have also shown how damage to vital structures such as neurovascular bundles associated with traditional monopolar devices can be avoided.<sup>4</sup> Since their creation and commercial implementation, electrothermal bipolar vessel sealing devices have been used laparoscopically in specialties such as colorectal surgery;<sup>5</sup> however, other than the intra-oral use of the BiZact device (Medtronic, Minneapolis, Minnesota, USA) for tonsillectomy,<sup>6</sup> they have not widely been applied endoscopically or in an endoluminal manner within head and neck surgery.

## Materials and methods

A retrospective case series was conducted over eight months within the Department of Otolaryngology, Head and Neck Surgery at the Royal Adelaide Hospital where the LigaSure (Medtronic) or BiZact devices had been applied in head and neck tumours treated transorally. Four suitable cases were identified. A further case was identified and included in the study, in which an electrothermal bipolar vessel sealing device was deployed to divide an anterior post-laryngectomy pharyngeal pouch.

Pre-operative radiology and case notes were reviewed. Intra-operative images were acquired. The data collected included: demographics, tumour pathology, ease of deployment of the electrothermal bipolar vessel sealing device, whether the device allowed for successful haemostatic removal of the tumour, intra-operative blood loss, other intra- or post-operative complications, and length of hospital stay.

## Results

### Case one: LigaSure used within larynx

A 63-year-old woman presented with dysphagia and dysphonia over 4 years which had deteriorated over the previous 12 months. In-office flexible nasendoscopy identified a submucosal supraglottic lesion centred on the right arytenoid. The lesion partly occluded the glottic introitus. On computed tomography (CT), the lesion measured  $22 \times 25 \times 22$  mm. Incisional biopsy under general anaesthesia demonstrated a schwannoma. The patient requested a completion excision because of her airway symptoms. A resection under general anaesthesia was planned.

A microlaryngoscopy endotracheal tube was inserted, and suspension laryngoscopy was performed to allow access to the lesion. Excision was performed using the LigaSure (Maryland 7 mm Jaw Laparoscopic Sealer/Divider) under endoscopic visualisation. The schwannoma was readily accessible to allow removal with the electrothermal bipolar vessel sealing device (Figure 1). The device's heat sealant mechanism allowed immediate haemostasis. The LigaSure device was successfully used to separate the mass from the arytenoid cartilage (Figure 1). Histopathological analysis confirmed the lesion as the schwannoma, which was completely excised with clear margins. There were no reported complications post-operatively, with all functions of the larynx preserved. The patient underwent an uneventful recovery and was discharged 1 day post-operatively.

### Case two: LigaSure used within hypopharynx

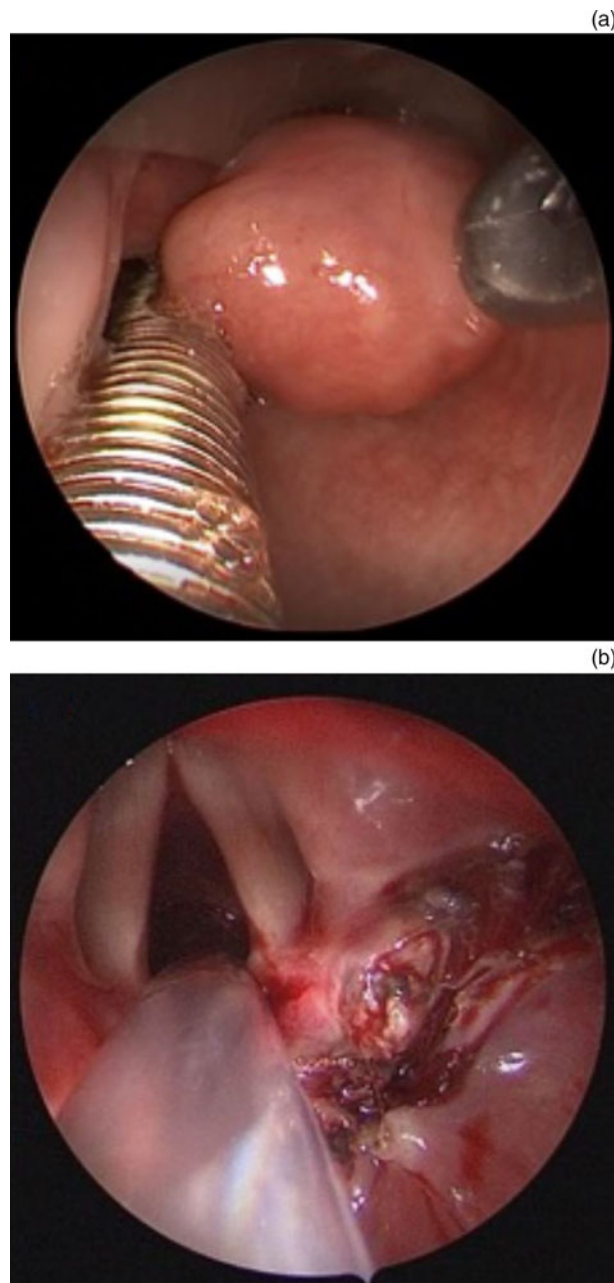
A 59-year-old man presented with acute respiratory stridor, on a background of haemoptysis, odynophagia and dysphonia over 3 months. Clinical examination revealed a large, exophytic mass in the left hypopharynx, spilling into the airway, with a limited view of the contralateral cord. The patient was taken to the operating theatre for an awake tracheostomy to secure the airway. Subsequent panendoscopy was performed to characterise and debulk the obstructive lesion.

The exophytic tumour arose along a broad base from the lateral hypopharyngeal wall (Figure 2). The LigaSure was used to endoscopically debulk the tumour down to its base (Figure 2). The length of the device was adequate to access the lesion. The debulking occurred with excellent haemostatic control. There were no intra- or post-operative complications. Intra-operative biopsies confirmed a poorly differentiated squamous cell carcinoma. It was subsequently resected via an open left pharyngectomy.

### Case three: BiZact used within nasopharynx and intraorally on palate

A 77-year-old man presented with a 2-year history of obstructive nasal symptoms and blood-stained rhinorrhoea. Clinical examination demonstrated a large nasopharyngeal mass extending into the nasal cavity anteriorly, and involving the full thickness of the palate inferiorly with a large intra-oral exophytic component. The CT scan showed a  $23 \times 43 \times 48$  mm nasopharyngeal tumour. Examination under anaesthesia, incisional biopsy, and debulking of the palatal surface and posterior nasal space using the BiZact device were then performed.

The oral component was accessed using a standard tonsil set-up. The nasopharyngeal component was accessed

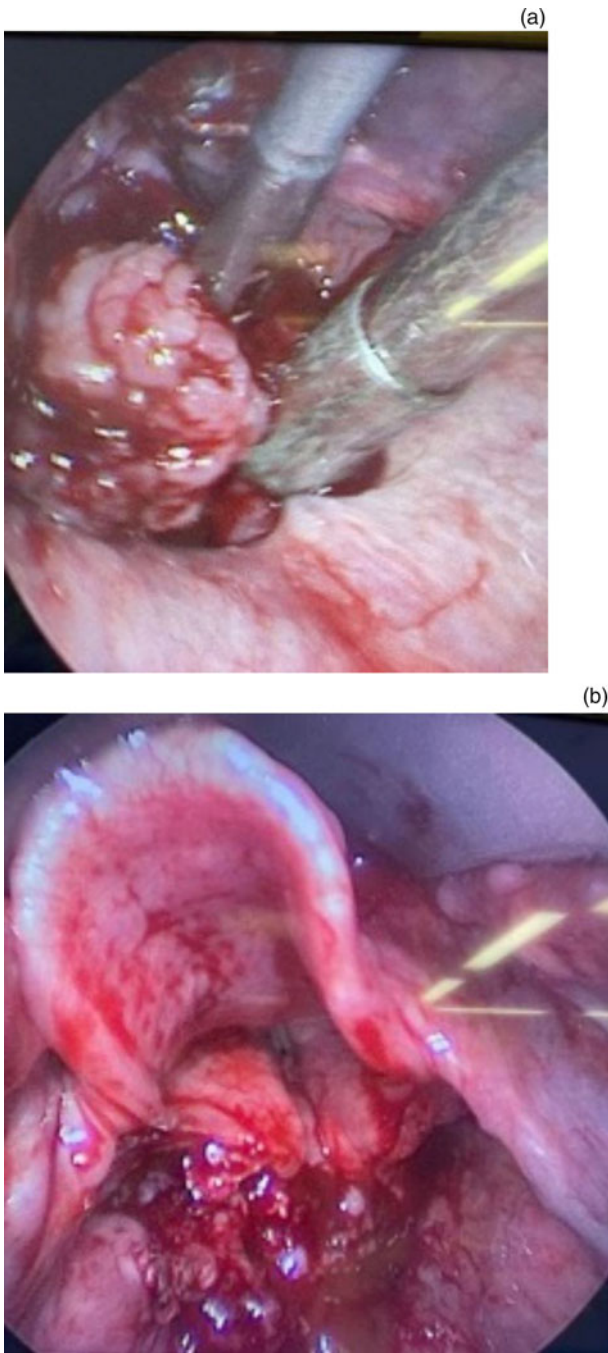


**Figure 1.** Transoral view of right supraglottic schwannoma before resection (a) and after resection (b).

transnasally with a 30° endoscope and debulked using the BiZact device. The endoscope was positioned through one nasal cavity, with the BiZact device in the other. This provided a clear view of the operative site for the surgeon and gave good access to debulk, with excellent haemostatic control. The biopsies demonstrated a poorly differentiated nasopharyngeal carcinoma. There were no post-operative complications and the patient was discharged the next day. The patient subsequently underwent radical radiotherapy.

### Case four: LigaSure division of anterior pouch post-laryngectomy

A 71-year-old man laryngectomy patient presented with post-prandial pharyngeal discomfort. A barium swallow study confirmed the presence of an anterior pouch with contrast retention, which did not clear on subsequent swallows. Examination



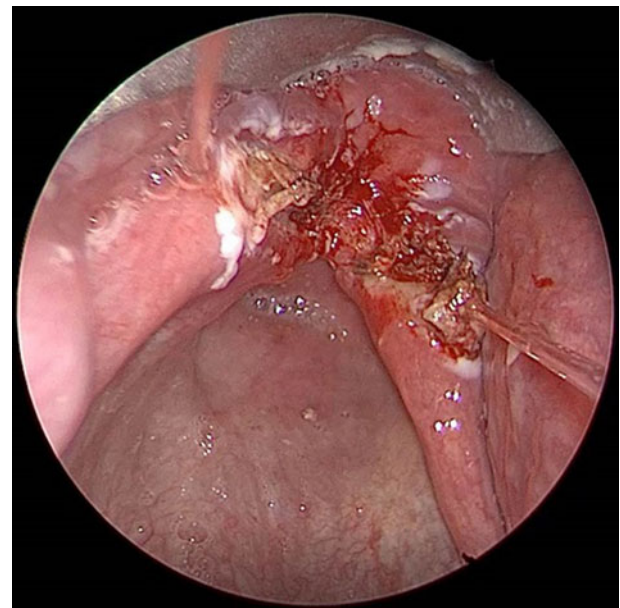
**Figure 2.** Transoral view of left hypopharyngeal squamous cell carcinoma. LigaSure before debulking (a) and after debulking (b).

under anaesthesia and division of the anterior pouch partition wall using the LigaSure device were subsequently performed.

A Lindholm suspension laryngoscope and endoscope were used for access. The LigaSure was used to divide the pouch partition wall in the midline (Figure 3). There were no peri-operative complications, with excellent haemostasis achieved. The surgery was conducted as a day-case procedure. The patient had complete resolution of his post-prandial discomfort.

**Case five: attempted LigaSure debulking of transglottic tumour**

A 79-year-old woman presented to the emergency department with respiratory stridor. Clinical examination demonstrated a fixed hemi-larynx with a transglottic tumour centred on the

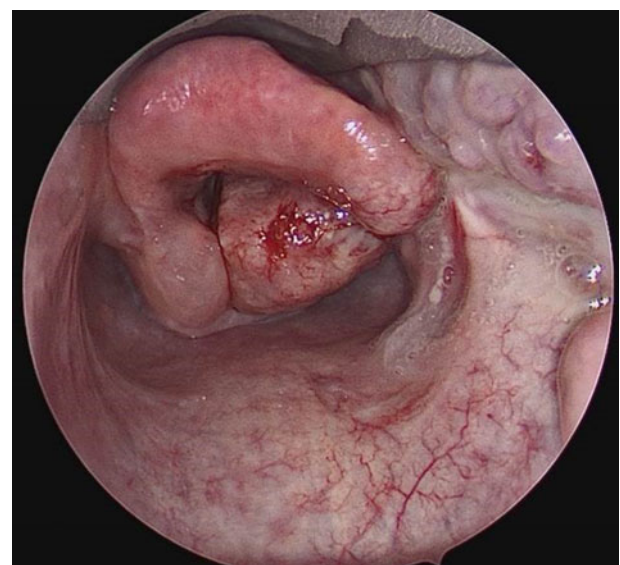


**Figure 3.** Post-division of anterior pouch.

right supraglottis (Figure 4). An awake tracheostomy was performed to secure her airway. This was followed by a panendoscopy for assessment, with biopsy and debulking for symptom management. Debulking was attempted via a suspension laryngoscopy using the endoscopic LigaSure (Maryland tip). The tumour had an extensive sessile base, which the jaws of the LigaSure device were unable to traverse to allow successful debulking. Debulking of the tumour proceeded with cupped forceps.

**Discussion**

We have demonstrated that electrothermal bipolar vessel sealing devices provide a useful adjunct in selective transoral head and neck surgical procedures. The laparoscopic design of both the LigaSure and BiZact instruments allows access to all parts of the pharyngolarynx and the nasal cavity using conventional techniques. Their use is facilitated with simultaneous deployment of an endoscope, either via a suspension laryngoscopy



**Figure 4.** Intra-oral view of large transglottic tumour. The LigaSure was unsuccessful in engaging this lesion.

or transnasally. The heat sealant capabilities of these devices enables relatively haemostatic division of native tissue and the removal of tumours. The combination of the reach provided by the length of both devices and the heat sealant action for haemostasis resulted in a clear view of the surgical site for the operating team. Tumours that are pedunculated or exophytic are most readily dealt with by the electrothermal bipolar vessel sealing device.

Electrothermal bipolar vessel sealing devices are a useful addition to the armamentarium of head and neck surgeons. They have a role in the excision of benign tumours and in the debulking of airway compromising malignant tumours. Although lacking the precision of 'cold steel' or laser dissection for R0 (microscopically margin-negative) resections, their haemostatic prowess in transecting vascularised tumour is formidable.

- Electrothermal bipolar vessel sealing devices seal and divide tissue and blood vessels up to 7 mm in diameter
- The transoral use of such devices is a novel, minimally invasive surgical approach for pharyngolaryngeal lesions
- The technique was trialled in five patients with pharyngolaryngeal lesions varying in type and size
- In four out of five cases, this technique was useful and safe for resecting, debulking or dividing these lesions
- Advantages include ease of haemostasis while dissecting and minimal external scarring
- The predominant limitation of this technique lies with the difficulty of the device in grasping large lesions

The curved nature of the activated jaws also facilitates the surgeon's view of the distally engaged tip when dividing native tissue (such as a pharyngeal bar), and reduces accidental trauma to adjacent normal tissue when debulking a tumour.

## Conclusion

This case series reports a novel use for electrothermal bipolar vessel sealing devices in transoral head and neck surgery. They can be safely deployed to resect, debulk or divide lesions of the upper aero-digestive tract in suitably selected patients. Their main advantage over conventional techniques is their potent haemostatic dissection capability.

The presented cases represent a subset of operative indications in the aero-digestive tract. Further studies investigating other indications may broaden the applications of this novel approach.

**Competing interests.** None declared

## References

- 1 Rubinstein M, Armstrong WB. Transoral laser microsurgery for laryngeal cancer: a primer and review of laser dosimetry. *Lasers Med Sci* 2010;**26**:113–24
- 2 Santini M, Vicidomini G, Fiorello A, Laperuta P, Busiello L. Electrothermal bipolar tissue sealing systems in lung surgery. *Multimed Man Cardiothorac Surg* 2008;**2008**:mmcts.2007.003111
- 3 Karande VC. Ligasure™ 5-mm blunt tip laparoscopic instrument. *J Obstet Gynaecol India* 2015;**65**:350–2
- 4 Družijanić N, Pogorelić Z, Perko Z, Mrklić I, Tomić S. Comparison of lateral thermal damage of the human peritoneum using monopolar diathermy, Harmonic Scalpel and Ligasure. *Can J Surg* 2012;**55**:317–21
- 5 Grieco M, Apa D, Spoletini D, Grattarola E, Carlini M. Major vessel sealing in laparoscopic surgery for colorectal cancer: a single-center experience with 759 patients. *World J Surg Oncol* 2018;**16**:101
- 6 Stepan L, Du C, Padhye V, Bassiouni A, Dharmawardana N, Ooi EH *et al.* Tonsillectomy using the BiZact: a pilot study in 186 children and adults. *Clin Otolaryngol* 2019;**44**:392–6