

# Laser tongue base mucosectomy is a useful diagnostic tool in the management of unknown primary cancers of the head and neck region

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## Main Article

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## Abstract

**Objective.** Tongue base mucosectomy identified cancer in 78 per cent of cancers of unknown primary in a recent meta-analysis. The carbon dioxide laser is an alternative technique if there is no access to a robot. This study aimed to describe the steps for undertaking tongue base mucosectomy using the carbon dioxide laser and its diagnostic utility in cancers of unknown primary.

**Method.** This was a prospective feasibility study utilising carbon dioxide laser for tongue base mucosectomy in cancers of unknown primary. Data collected included demographic data and p16 status.

**Results.** There were 14 cancers of unknown primary with 86 per cent p16 positivity on immunohistochemistry. Laser tongue base mucosectomy alone identified the cancer primary in 7 of 12 (58 per cent) cancers of unknown primary among p16 positive tumours and 0 of 2 (0 per cent) among p16 negative tumours. Combining bilateral tonsillectomy with laser tongue base mucosectomy resulted in identification of the primary cancer in 8 of 12 (67 per cent) p16 positive tumours.

**Conclusion.** In centres without a robot, tongue base mucosectomy using the carbon dioxide laser is a viable alternative, especially in combination with bilateral tonsillectomy in p16 positive cases.

## Introduction

Cancers of unknown primary origin in the head and neck area require investigation and treatment as outlined by the ENT UK guidelines on the management of head and neck cancers.<sup>1</sup> Patients often present with a neck lump and undergo full ENT clinical examination including flexible nasendoscopy in out-patient clinics.<sup>2</sup> The anatomical sub-sites that undergo focused endoscopy to identify any mucosal or exophytic cancer lesions include the nasopharynx with fossae of Rosenmüller, oropharynx, hypopharynx, larynx and upper oesophagus.

An ultrasound-guided fine needle aspiration cytology (FNAC) or a core-biopsy of the neck lump is performed. A diagnosis of a squamous cell carcinoma (SCC) can be established from either FNAC or core biopsy. If clinical examination does not show the primary cancer, radiological investigations to find the origin of the cancer are performed, including magnetic resonance imaging of the neck and computed tomography (CT) scan of the chest.

Following reviews of all radiological and pathological results by the multidisciplinary team (MDT) for head and neck cancers, a positron emission tomography-CT (PET-CT) scan is undertaken if available. Following whole-body PET-CT scan, if the origin of the metastatic cancer remains unknown and the ultrasound-FNAC or core-biopsy shows an SCC positive result on p16 immunohistochemistry (indicative of a human papillomavirus driven (HPV) tumour), the MDT will recommend panendoscopy under general anaesthesia with simultaneous bilateral tonsillectomy.

In centres with skilled personnel and facilities available, a tongue base mucosectomy can be performed. Tongue base mucosectomy can be performed either using a robot (trans-oral robotic mucosectomy) or using carbon dioxide (CO<sub>2</sub>) laser techniques. In a recent meta-analysis, tongue base mucosectomy had a diagnostic rate of 78 per cent in unknown primary cancers.<sup>3</sup> This justifies the approach on diagnostic yield grounds. However, there is currently no published consensus on the operative outlines for performing laser tongue base mucosectomy. In this paper, we present the protocol in use at the Norfolk and Norwich University Hospitals NHS Trust UK for trans-oral laser tongue base mucosectomy as well as a case series of consecutive patients.

## Materials and methods

### Pre-operative considerations

Tongue base mucosectomy using CO<sub>2</sub> laser was performed simultaneously with panendoscopy and bilateral tonsillectomy. Adequate mouth opening that allowed fitting the mouth gag was a pre-requisite. Trismus that limited access was an absolute contraindication.

Relative contraindications included the presence of bleeding disorders or the use of anti-coagulants. Patients on anti-coagulants such as aspirin, clopidogrel or rivaroxaban were required to stop using these five days prior to their scheduled laser tongue base mucosectomy. There was no requirement for pre-operative neck dissection to clip lingual arteries. The operation theatre set-up with laser precautions is shown in Figure 1 and 2.

### Intra-operative steps

Patients were intubated with laser-safe, reinforced, metallic intubation tubes. These were secured by the anaesthetist using ties and not tape, to allow adjustment of the tube if required. Total intravenous anaesthesia was delivered by using propofol and remifentanyl. Thirty per cent oxygen was administered via the laser-safe endotracheal tubes. A stat dose of 1 g of tranexamic acid was given at induction of anaesthesia. A 1.0 silk stitch was inserted at the junction between the anterior two thirds and posterior one third of the tongue in the midline, aiming for a stitch that was 1.5 cm away from the midline either side of the postero-dorsal tongue. The Boyle–Davis gag size was then replaced with a smaller gag size (one size down). The gag comes as small, medium and large. The smaller-sized Boyle–Davis gag was then inserted, and the tongue was gently pulled forwards with the suture simultaneously. The gag was pushed down to allow visualisation of the tongue base. Gentle pressure on the hyoid bone can be used to improve visualisation of the tongue base if required.

### Instruments

The laser tongue base mucosectomy instruments included those used for suction diathermy and the Steiner instruments with suction incorporated into the grasper.

### Laser settings

The CO<sub>2</sub> laser used at Norfolk and Norwich University Hospital was the AcuPulse™ SurgiTouch™ (Acupulse Duo), which is a

super-pulse, continuous laser beam with 5.0 watts power and a 2.0 mm aiming beam laser with a vertical straight shape.

### Procedure

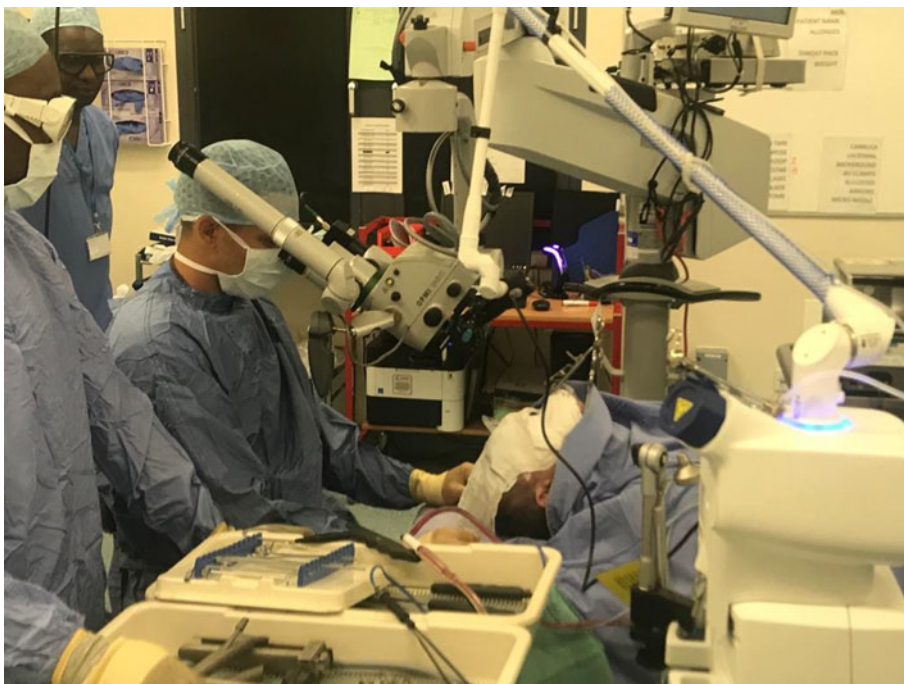
The first laser cut on the tongue base is placed in the midline and used as a marker. This cut should ideally be taken to a depth of 1 cm. Laser dissection can start at the base of the midline marker cut with another horizontal laser cut that is aimed laterally. Dissection technique can be either single instrument or two instrument. The laser can be positioned in the midline view, and the tongue base tissues can be moved as required towards the laser beam using monopolar suction. One side of the tongue base from the midline is dealt with before the other. The specimen is appropriately orientated for histopathological examination.

### Boundaries of the dissection

The anterior boundary was the circumvallate papillae and the boundary line between tongue base muscle and lymphoid tissue. It should be noted that muscle fibres retract away during laser dissection. The lateral boundary was the glossotonsillar sulcus. The posterior boundary was the vallecula (mucosal layer containing blood vessels). The monopolar diathermy instrument is run along this border until the tip of the epiglottis comes into view. The medial boundary was the midline laser cut on the tongue base. With regard to blood vessels, there is usually a blood vessel in the antero-lateral corner. Ligaclip® can be used to control bleeding if required. The lingual artery runs deep and lateral. In the midline in the vallecula, there is often a small vessel that can be controlled with monopolar diathermy.

### Post-operative management

Tonsil swabs soaked in 5 ml of 0.5 per cent Chirocaine® were applied topically to the tongue base fossa for 5 minutes following resection. Oramorph® was also used in recovery. The patient should be encouraged to eat and drink as tolerated.



**Fig. 1.** Operation theatre set-up for carbon dioxide laser tongue base mucosectomy.



**Fig. 2.** Operation theatre ergonomics for carbon dioxide laser tongue base mucosectomy.

Oral analgesia (co-codamol: 30 mg codeine and 500 mg paracetamol in combination) can be given as 2 tablets every 6 hours for 10 days simultaneously with either Ibuprofen® (400 mg) or diclofenac 50 mg every 8 hours for 10 days. There was no requirement for routine use of nasogastric tubes. Patients were kept for one to two nights in hospital depending on post-operative progress. There was also outpatient clinic follow up two weeks later for histopathology results after multidisciplinary team review for presence of cancer and p16 immunohistochemistry for presence of HPV.

## Results

A total of 14 unknown primary cancers with p16 status were included in this feasibility study assessing diagnostic efficacy of CO<sub>2</sub> laser tongue base mucosectomy. A finding of p16 positivity on immunohistochemistry was the surrogate marker for HPV positivity. There were 12 of 14 (86 per cent) p16 positive cases and 2 of 14 (14 per cent) p16 negative cases.

Carbon dioxide laser tongue base mucosectomy was performed on all cases as described. The cancer was identified in 7 of 12 (58 per cent) p16 positive cases and 0 of 2 (0 per cent) p16 negative cases.

Bilateral tonsillectomy was performed in all cases. Only in one additional case in the p16 positive group was the unknown primary found in a tonsil sample. So, in combination, bilateral tonsillectomy and tongue base mucosectomy identified the cancer origin in 8 of 12 (67 per cent) cases analysed. Complications for tongue base mucosectomy included primary haemorrhage (1 of 14; 7 per cent), secondary haemorrhage (1 of 14; 7 per cent) and nasogastric tube use (1 of 14; 7 per cent). The procedure was well tolerated by patients with pain controlled on simple analgesia, and patients were discharged home the next day in all but one case.

## Discussion

Identifying the cancer origin in head and neck cancers is important for staging, determining prognosis and in guiding

treatment strategies. In cases where the primary cancer focus remains unknown despite conventional investigations including CT scans and PET-CT scans, cancer teams should consider panendoscopy, bilateral tonsillectomy and tongue base mucosectomy (if facilities and expertise exist) as set out in the 2016 UK Head and Neck Cancer Multidisciplinary Guidelines.<sup>1</sup> In this HPV era (once skin cancers are excluded), the majority of HPV-positive cancers of unknown primary originate from the oropharynx.<sup>2</sup> It is therefore prudent to focus the search for the primary in this region.

A recent systematic review and meta-analysis<sup>3</sup> showed tongue base mucosectomy using trans-oral robotic surgery or trans-oral laser microsurgery identified the cancer primary in 433 of 556 (78 per cent) cases included in 21 studies. A multi-centre UK study (with a similar population) showed trans-oral robotic tongue base mucosectomy identified the cancer origin in 53 per cent of head and neck cancers of unknown primary.<sup>4</sup> The use of the CO<sub>2</sub> laser in performing tongue base mucosectomy is a recognised alternative technique.<sup>5-7</sup> Our Norwich study corroborates this as it shows that CO<sub>2</sub> laser tongue base mucosectomy had a 58 per cent diagnostic rate in HPV-positive cancers. In HPV-positive cancers, the diagnostic yield is higher at 67 per cent when CO<sub>2</sub> laser tongue base mucosectomy is combined with bilateral tonsillectomy. These small datasets suggest CO<sub>2</sub> laser tongue base mucosectomy is a viable technique especially in centres without access to trans-oral robotic surgery. Most National Health Service (NHS) hospital trusts have the CO<sub>2</sub> laser available in operating theatres, so this technique can be readily adapted to meet the needs of the local cancer population. Patients do have the option of referral to another centre with robotic capability for these procedures.

In addition, the post-operative outcomes and patient-reported quality of life measures following CO<sub>2</sub> laser tongue base mucosectomy are also encouraging. There was low morbidity from the procedure with only one case of post-operative bleeding (7 per cent) and only one patient requiring use of a nasogastric tube (7 per cent). The vast majority of patients (93 per cent) were able to tolerate oral intake without any

nasogastric tube and were discharged the next day. Although a direct comparison has not been made with trans-oral robotic surgery mucosectomy, this Norwich cohort did not report significant pain post-CO<sub>2</sub> laser tongue base mucosectomy and only simple analgesia was required. The authors postulate that the perceived differences in reported post-operative pain between trans-oral robotic surgery and laser mucosectomy are partly because of the CO<sub>2</sub> laser causing minimal surrounding tissue damage compared with the unipolar diathermy used in trans-oral robotic surgery mucosectomy. The depth of resection is also another potential consideration for the higher rates of post-operative pain in trans-oral robotic surgery cases. A comparative study is required to definitely conclude this, but it appears that patients can benefit from the best of both worlds if CO<sub>2</sub> laser tongue base mucosectomy can be executed via a robot arm. Indeed, flexible fibre delivery is becoming a useful prospect for CO<sub>2</sub> laser, which helps to bypass the ergonomic challenges of line-of-sight surgery. Future studies should investigate this further.

- Laser tongue base mucosectomy is a useful diagnostic tool in the management of unknown primary cancers of the head and neck region
- Trans-oral laser tongue base mucosectomy is useful in identifying unknown primary cancers and is readily available and cheaper than the robotic approach
- The anatomic boundaries for laser tongue base mucosectomy extend from the circumvallate papillae (anteriorly) to glossotonsillar sulci (laterally) and the vallecula (inferiorly)
- Laser tongue base mucosectomy alone identified 58 per cent of unknown primary cancers in human papillomavirus positive oropharyngeal cancers
- Patient outcomes were satisfactory with minimal post-operative pain and no need for nasogastric tube feeding (93 per cent)
- There was a single post-operative primary haemorrhage (7 per cent) and a single secondary haemorrhage (7 per cent)

Finally, trans-oral robotic tongue base mucosectomy is shown to be a useful adjunct in the management of cancers of unknown primary;<sup>3,4,8,9</sup> however, there is a significant difference in the cost of offering CO<sub>2</sub> laser tongue base mucosectomy compared with trans-oral robotic surgery mucosectomy in resource-limited settings. Many NHS hospitals do not have a robot and cannot afford the overhead expenses for such equipment. Patients with unknown primary cancers in those regions can still be offered CO<sub>2</sub> laser tongue base mucosectomy in addition to bilateral tonsillectomy to increase the chances of finding their cancer primary. All ENT surgeons are trained in trans-oral laser surgery as part of their curriculum in the UK and as such can easily adapt the laser protocol used in this Norwich cohort. This is also a useful addition in standardising surgical technique as there is currently variation in surgical approaches to laser tongue base mucosectomy in the UK.

## Conclusion

Trans-oral laser tongue base mucosectomy is a viable surgical procedure in the diagnostic algorithm for head and neck cancers of unknown primary. Laser tongue base mucosectomy alone identified 58 per cent of unknown primary cancers in HPV-positive oropharyngeal cancers, and when utilised in combination with bilateral tonsillectomy, the cancer diagnosis rate increased to 67 per cent. It can be particularly useful in cancer centres without access to or expertise in trans-oral robotic tongue base mucosectomy. There is currently no consensus on how to perform CO<sub>2</sub> tongue base laser mucosectomy in the UK. We have presented our protocol at the Norfolk and Norwich University Hospital and have satisfactory outcomes in a consecutive cohort of patients.

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**Competing interests.** None declared

## References

- 1 Mackenzie K, Watson M, Jankowska P, Bhide S, Simo R. Investigation and management of the unknown primary with metastatic neck disease: United Kingdom National Multidisciplinary Guidelines. *J Laryngol Otol* 2016;**130** (suppl S2):170–5
- 2 Strojjan P, Ferlito A, Medina JE, Woolgar JA, Rinaldo A, Robbins KT *et al*. Contemporary management of lymph node metastases from an unknown primary to the neck: a review of diagnostic approaches. *Head Neck* 2013;**35**:123–32
- 3 Farooq S, Kanadavilli S, Dretzke J, Moore D, Nankivell P, Sharma N *et al*. Transoral tongue base mucosectomy for the identification of the primary site in the work-up of cancers of unknown origin: systematic review and meta-analysis. *Oral Oncol* 2019;**91**:97–106
- 4 Winter SC, Ofo E, Meikle D, Silva P, Fraser L, O'Hara J *et al*. Trans-oral robotic assisted tongue base mucosectomy for investigation of cancer of unknown primary in the head and neck region: the UK experience. *Clin Otolaryngol* 2017;**42**:1247–51
- 5 Karni RJ, Rich JT, Sinha P, Haughey BH. Transoral laser microsurgery: a new approach for unknown primaries of the head and neck. *Laryngoscope* 2011;**121**:1194–201
- 6 Graboyes EM, Sinha P, Thorstad WL, Rich JT, Haughey BH. Management of human papillomavirus-related unknown primaries of the head and neck with a transoral surgical approach. *Head Neck* 2015;**37**:1603–11
- 7 Nagel TH, Hinni ML, Hayden RE, Lott DG. Transoral laser microsurgery for the unknown primary: role for lingual tonsillectomy. *Head Neck* 2014;**36**:942–6
- 8 Durmus K, Patwa HS, Gokozan HN, Kucur C, Teknos TN, Agrawal A *et al*. Functional and quality-of-life outcomes of transoral robotic surgery for carcinoma of unknown primary. *Laryngoscope* 2014;**124**:2089–95
- 9 Mehta V, Johnson P, Tassler A, Kim S, Ferris RL, Nance M *et al*. A new paradigm for the diagnosis and management of unknown primary tumors of the head and neck: a role for transoral robotic surgery. *Laryngoscope* 2013;**123**:146–51