

# Combined laser and robotic approach for the management of a mixed laryngomucocele

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**Abstract** Treatment of laryngoceles is surgical resection, through an external approach for external laryngoceles and through an endoscopic approach for internal laryngoceles. We report the first case of a mixed laryngomucocele treated with transoral robotic surgery. A patient presented with a history of chronic cough. Nasolaryngoscopy showed a sub-mucosal swelling into the larynx. Computed tomography confirmed the diagnosis of a right mixed laryngomucocele. A transoral robotic- and laser-assisted surgery was performed. Oral feeding was started on the first post-operative day. No post-operative complication was observed. There has been no evidence of recurrence during the following months. The generally used external and endoscopic approaches each have their limits in the treatment of laryngoceles. Transoral robotic surgery allows a minimally invasive approach with a wide exposure, making possible an absence of scar and a good functional recovery after the operation. Transoral robotic approach seems to allow an endoscopic approach for mixed and external lesions. Transoral robotic surgery combined with laser is an efficient minimally invasive technique and is the best option for the treatment of mixed laryngoceles and laryngomucoceles.

**Keywords** Larynx · Laryngomucocele · Transoral robotic surgery · Minimally invasive surgery

## Introduction

A laryngocele is an abnormal dilatation of the laryngeal saccule [1]. It can expand internally or externally through the opening of the superior laryngeal pedicle in the thyrohyoid membrane. Mixed laryngocele presents both components. The laryngocele can be filled with air, with mucus and not communicating with the laryngeal lumen (laryngomucocele) or be filled with pus (laryngopyocele). Surgical excision is the treatment. Traditionally, an external laryngocele is treated with an external neck approach and an internal laryngocele is treated with an endoscopic approach [2, 3]. A combined approach, external and endoscopic, can be performed for mixed laryngoceles, as well as an entirely external approach. Transoral robotic surgery (TORS) has several advantages. It offers the possibility to treat mixed or external laryngoceles with an exclusive endoscopic approach. We report the first case of a mixed laryngomucocele treated with TORS.

## Case report

A 61-year-old patient was referred to the department of ENT with a history of chronic cough. The nasolaryngoscopy showed a sub-mucosal swelling on the right pharyngo-epiglottic fold. Computed tomography showed a right cervical mass, homogeneous, with a fluid-density, on both sides of the thyrohyoid membrane (Fig. 1). The diagnosis of a right mixed laryngomucocele was made.

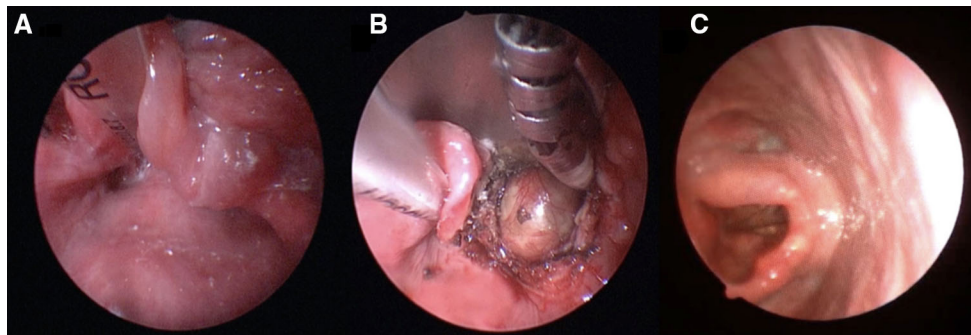
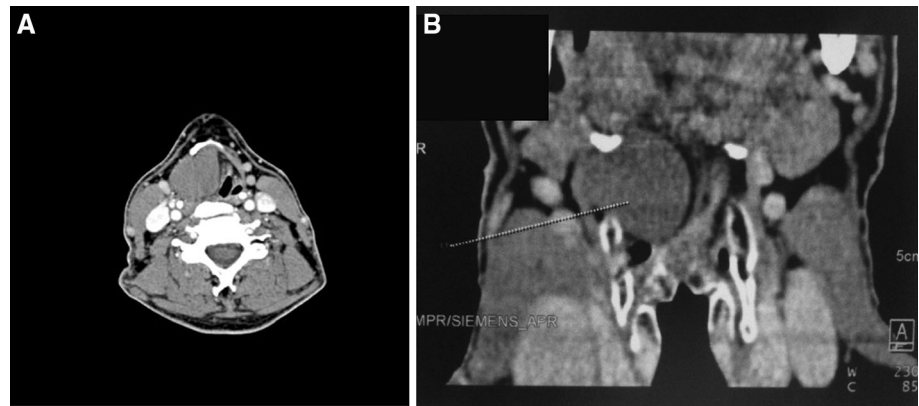
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**Fig. 1** Cervical CT-scan: this right mixed laryngomucocele is characterized by a homogeneous, isodense, non-contrast enhanced mass, expanded on both sides of the right thyrohyoid membrane. **a** Axial view, **b** frontal view



**Fig. 2** Intraoperative and post-operative views. **a** Intraoperative view, before starting the dissection, showing a right submucosal swelling. **b** Dissection of the laryngomucocele. **c** Post-operative laryngoscopic view

The patient was offered TORS for excision. He accepted and a consent form was signed. The surgery was performed with the da Vinci<sup>®</sup> surgical robotic system (Intuitive Surgical<sup>®</sup>, Inc., Sunnyvale, CA, USA) under general anesthesia. The Feyh–Kastenbauer Retractor<sup>®</sup> (Gyrus, Maple Grove, MN, USA) was positioned and suspended. The surgical robot was set with three arms: the 3D camera endoscope in the middle, a Maryland dissector on the left and a monopolar cautery on the right. The high-resolution, magnified, three-dimensional view of the operative field provided by TORS allows for excellent visualization of the laryngomucocele (Fig. 2a). We started with a mucosal incision of the right pharyngo-epiglottic fold. A sub-mucosal dissection was performed, exhibiting the superior and posterior faces of the laryngomucocele (Fig. 2b). Further dissection was carried out staying in contact with the laryngomucocele all along the procedure, including for the dissection of the inferior part of the lesion, and no removal of the hyoid bone was necessary. The mass was grasped and pulled medially to complete the dissection. There was a break of the laryngomucocele during the surgery. To limit the risk of recurrence, we decided to perform the resection of the right ventricle and of the ventricular fold with the CO<sub>2</sub> laser. In a second step, we resected right false vocal fold and the ventricle with transoral laser

microsurgery. We did not use electrocautery, not to injure the vocal cords (thermal effects). This opening created immediately a communication with the resection cavity of the laryngomucocele.

A tracheostomy was not necessary. We did not set up a nasogastric feeding tube. Oral feeding was started on the first post-operative day. Drug treatment consisted of antibiotics and corticosteroids for 5 days. The pathologic examination confirmed the diagnosis of laryngomucocele and did not find any malignant cells.

After a 6-month follow-up, the patient showed no clinical signs of recurrence. Swallowing and phonation functions were normal. There was no functional disorder. The nasofibroscopy confirmed the absence of recurrence (Fig. 2c).

## Discussion

From a large series of patients, the incidence of laryngocele is estimated to be 3 % of the lesions involving the larynx [4]. In 60–80 % of the cases, they occur in men in the fifth or sixth decade [2–5]. The etiology remains unknown, although acquired factors are strongly suspected as risks factors inducing weakness of the laryngeal walls (history of laryngeal or para-laryngeal surgery, presence of laryngeal

cancer, amyloidosis or smoking) or risks factors inducing chronic increase in air pressure inside the larynx (chronic cough, glassblower, wind-instrument player and singer) [2, 5, 6].

The treatment is surgery. The gold standard approaches are cervicotomy for external laryngoceles and transoral CO<sub>2</sub> laser microsurgery for internal ones [2, 3, 7, 8]. The main complications of these interventions are hematoma, dyspnea requiring a tracheostomy and neck infection or fistula [3, 9]. They occur far more commonly among patients treated via cervicotomy than to those treated by endoscopic surgery [9]. The external approach is also responsible for more challenging post-operative course in terms of swallowing function, for increased incidence of delayed discharge and of course leaves a noticeable scar [2, 3]. Thus, the transoral laser surgery is a minimally invasive surgery, with fewer complications than an external cervical approach [3]. However, the main limitation is the laterally limited scope provided by the transoral laser surgery because of its direct line-of-sight, which is a significant disadvantage when dealing with a mixed laryngomucocele [2, 7]. Therefore, mixed laryngocele or laryngomucocele is still a surgical dilemma.

TORS is a method that has proven its efficacy and safety in the treatment of lesions of the upper aerodigestive tract, since the work of Weinstein and O'Malley [10, 11]. The high-resolution, magnified, three-dimensional view of the operative field provided by TORS allows for excellent visualization of the target anatomy. The surgeon's fine hand and finger movements are translated into precise motion-scaled movement of the robotic instruments within the narrow confines of the upper aerodigestive tract [11, 12]. Compared to exclusive laser microsurgery, TORS with monopolar cautery is the best device for endoscopic surgery of the supra-glottic part of the larynx: it overcomes the inherent limitations of the direct line-of-sight lasers and allows more rapid and less hemorrhagic resections [13]. Conversely, the laryngeal mucosa located close to the vocal folds should be removed by laser, rather than monopolar cautery, to limit the damages due to thermal effects and their consequences on voice outcomes. Flexible CO<sub>2</sub> laser fibers are now available and may be set on one robot's arm, allowing the surgeon to use the most suitable device at each level of the larynx.

In the literature, we found only one case describing the excision of a mixed laryngocele by TORS [7]. Oral feeding was started at the first post-operative day and there was no complication. Comparatively, our case highlights several new aspects. First of all, our case is about a laryngomucocele while the previously published case is about a laryngocele. Second, the previous case did not specify any follow-up data. Thus, authors did not discuss the possibility of a recurrence, which is a major challenge in this surgery.

## Conclusion

We believe that TORS combined with laser is an efficient minimally invasive technique and is the best option for the treatment of mixed laryngoceles and laryngomucoceles. It is the only solution to perform an exclusive endoscopic approach for mixed and external lesions.

## Compliance with ethical standards

**Conflict of interest** Q. Lisan, C. Hoffmann, T. Jouffroy and S. Hans declare that they have no conflict of interest.

**Consent section** Written informed consent was obtained from the patient for publication of this Case Report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

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