Avens Publishing Group

Inter J Otorhinolaryngology
December 2017 Volume 4, Issue 2

Open Access Review Article

International Journal of Otorhinolaryngology

Transoral Robotic Supraglottic Laryngectomy in Laryngeal Squamous Cell Carcinoma

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Submission: 06 November, 2017
Accepted: 04 December, 2017
Published: 05 December, 2017

Keywords: Robotic surgery; Supraglottic laryngectomy; Squamous cell carcinoma

Abstract

The most common histological type of laryngeal cancer is squamous cell carcinoma, and the supraglottic and glottic regions are the most common sites of this type. Supraglottic laryngectomy is the most common treatment in supraglottic squamous cell carcinoma. Recently, robotic surgery has become widespread in laryngeal surgery. This review summarizes publications on Transoral Robotic Supraglottic Laryngectomy (TORSL).

Introduction

Laryngeal cancer represents 2% to 5% of all malignancies and 20% to 25% of all head and neck tumors [1]. Squamous cell carcinoma in the head and neck region is the sixth most common cancer [2]. The most important risk factor of laryngeal cancer is smoking. The effect of alcohol is to increase the effectiveness of the smoking [1]. Treatment is generally surgery [2]. Laryngeal cancer surgery is particularly challenging because the larynx contains important functional structures related to speech, swallowing, and breathing [3].

Traditionally, an open total laryngectomy was performed for laryngeal squamous cell carcinoma. This practice subsequently declined and the use of open technical partial laryngectomy increased. In the last two decades, surgical techniques have developed rapidly. Endoscopic and laser microsurgery methods have begun to be applied. These methods are advantageous because they use the natural openings of the body, reach directly through the laryngeal structures, and cause minimal damage to surrounding tissues. However, their indications are very limited. In recent years robotic surgery has begun to take its place due to the advantage of 3- Dimensional (3D) image [3,4].

The use of the da Vinci robotic system (Intuitive, Sunnyvale, CA, USA) in head and neck surgery has furthered these developments. Initially, robotic methods were used to treat the tongue base and oropharynx, and subsequently the hypopharynx and for laryngeal surgery [3,4]. In 2005, Weinstein et al. reported on Transoral Robotic Supraglottic Laryngectomy (TORSL) [4]. Another robotic system, the Medrobotics Flex Robotic System (Medrobotics, Raynham, MA, USA), received approval for head and neck surgery in 2015 [3].

Preoperative Evaluation and Patient Selection

Treatment planning is a very important step with cancer patients in TORSL. Because TORSL is a recent method, the choice of the right patient is possible only with a good preoperative evaluation. There are rules about which patients can be treated with TORSL, although there are different indications in some cases.

Reported the indications for TORSL: sufficient exposure of the surgical field, T1-2-3 tumors (mobile vocal cords at T3), and minimal invasion of the pyriform sinus [5]. They also reported contraindications: insufficient exposure (trismus, macroglossia, micrognathia, or retrognathia), poor pulmonary reserve (FEV_1/FVC<50%), anterior commissure or thyroid cartilage invasion, vocal cord fixation or paraglottic area invasion, bilateral arytenoid cartilage invasion, and pyriform sinus apex or postcricoid mucosa invasion.

However, there are different applications, particularly in terms of tumor stage and neck dissection. Some authors have performed simultaneous neck dissection, some after 2-4 weeks, and others have performed it on N0 patients 2-4 weeks later and N+ necks simultaneously [6-15]. Some authors have performed TORSL only in T1 and T2 tumors, some in T1, T2, and T3 tumors, and some rarely in T4 tumors [6-16].

When choosing patients for TORSL, the surgeon's focus should be surgical anatomical suitability. The most common cause of conversion from TORSL is anatomic problems. Gun et al. reported that the most challenging stage of transoral robotic surgery is the adaptation to the oropharynx and hypopharynx anatomy, particularly for inexperienced surgeons [2]. In patients who underwent TORSL, Kayhan et al. evaluated short neck, retrognathia, prominent teeth, and soft tissues preoperatively because these pathologies may prevent the application of the Feyh-Kastenbauer (F-K) laryngeal retractor (Gyrus Medical, Maple Grove, MN, USA) [11]. Ansarin et al. reported that two patients were discharged because of anatomical inconvenience in publications involving 10 patients [13]. According to the same authors, the appropriate field of view must totally expose the supraglottis, glottis, and pyriform sinuses. Mendelsohn and Park also recommended an evaluation of the anatomical exposure preoperatively with the F-K retractor [9,14].

In addition, some authors do not consider TORSL to be appropriate for patients who have previously undergone surgery in the head and neck region and received radiotherapy [9,15].

Surgical Technique

The patient is intubated in the supine position. Intubation can be nasal or oral. After this step, Park et al. routinely prefers to open the

ISSN: 2380-0569

tracheotomy [9]. They reported that a tracheotomy tube can increase the difficulty of this operation because of narrowing of the surgical site, and can increase the risk for postoperative airway obstruction and bleeding. Mendelsohn et al. do not open the tracheotomy and prefer to follow patients while they remain intubated for 1 day [14]. Ansarin et al. performed a tracheotomy in patients with simultaneous neck dissection, using anticoagulants, and observed excess hemorrhage [13]. General practice is to perform a tracheotomy in higher-risk patients [5,6,10,11,15-18].

The F-K retractor ensures transoral exposure. The instruments used in this surgery are a 30° robotic telescope, Maryland dissector, and monopolar cautery spatula arms. For some patients, surgeons use a CO_2 laser fiber instead of monopolar cautery [8,12,14]. The first step in the surgery is the vertical division of the epiglottis. Then the hyoid bone is reached by lengthening the incision laterally. The thyrohyoid membrane and then the thyroid bone are reached inferiorly. Next, the pre-epiglottic space is dissected from the thyroid cartilage and thyrohyoid membrane. The dissection is extended laterally to the pharyngoepiglottic fold. Here, the superior laryngeal vessels are cauterized. The incision is extended inferiorly to the aryepiglottic folds. The false cords are dissected adjacent to the arytenoids. Finally, the transaction is completed in the lateral direction of laryngeal ventricles. The same process is performed on the other side [4]. With this method, there may be differences based on tumor location and size. After frozen sections are examined, the tumor is removed en-bloc with the required safe margins [9].

Postoperative follow-up in TORSL is based on the extent of the surgery, the method of feeding, and the presence or absence of a tracheotomy. Oral nutrition may be initiated in the first 24 h in patients undergoing minimal surgery [5]. However, a nasogastric tube is generally preferred [6,7,11,14,16]. A gastrostomy can be performed when required. In two previous studies, the nasogastric tube was left in use for 2 to 58 days [6,7]. Kayhan et al. reported resuming a normal diet in an average of 10.8 days [11]. Mendelsohn et al. performed a fiberoptic endoscopy evaluation and then a modified barium test 1 day postoperatively before starting an oral diet [14]. Studies have compared TORSL with open techniques [7,16]. Park et al. reported that the time to starting a normal diet, decannulation time, and hospitalization stay are longer with open surgery [7]. They found no difference in terms of surgical margin negativity and recurrence between the two groups and that the total operating time was longer with open surgery. They also reported that subjective swallowing status is better with TORSL. In their study, there were no differences in voice quality between two groups. Slama et al. reported that blood loss is greater with the open technique than with TORSL, while the M. D. Anderson Dysphagia Inventory (MDADI) score is better in TORSL [15]. In addition, studies involving T3 and T4 tumors did not report difference rates in terms of recurrence and surgical success between open technique and robotic technique [6-9,12-14].

Complications due to TORSL are similar to those with the open technique. However, few studies have reported the rates of these complications. Park et al. reported more complications with the open technique [7]. No significant major intra-operative complications have been reported with TORSL. The most commonly reported postoperative complications are laryngeal stenos is, tracheotomy because of laryngeal edema, and pneumonia [7,8,11,13,15].

Many studies have demonstrated the applicability of TORSL and have reported that it causes less morbidity and less laryngeal dysfunction. Consequently, in experienced centers, TORSL may be the first choice in well-selected patients. The disadvantages are that it is expensive and it requires experience. More research on the oncological outcomes is needed.

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