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Role of primary closure after transoral robotic surgery for tonsillar cancer

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ABSTRACT

Objective: This study was performed to verify the efficacy and feasibility of primary closure for communication defects in the neck after transoral robotic surgery (TORS) for tonsillar cancer, and to verify the necessity of *en bloc* resection, which can create communication defects during TORS.
Methods: We applied a new primary closure technique in 13 cases of tonsillar cancer showing a communication defect with the neck after *en bloc* resection during TORS. This technique is composed of three steps: (1) suturing the remaining superior pharyngeal constrictor muscle and extrinsic tongue muscle complex; (2) suturing the digastric and mylohyoid muscles; and (3) securing reinforcement of the digastric–mylohyoid complex. We analyzed the medical records and pathology reports of these cases.
Results: On pathology review, 69.2% of the patients developed invasion of the constrictor muscle. The mean defect size was 3.3 cm; the largest defect was 4.5 cm in diameter. In all patients, primary closure of the defect was possible. With regard to functional results, decannulation was possible within 1 week, oral feeding was possible within 9 days, and none of the patients showed pharyngocutaneous fistula formation. Two patients developed complications independent of the surgery itself.
Conclusion: The invasion rate of the pharyngeal constrictor muscle is high. Therefore, *en bloc* resection creating a communication defect during TORS should be considered in all cases of tonsillar cancer to secure safe margins. In addition, with our primary closure technique, even large defects can be closed without complication and with good preservation of function.

1. Introduction

Since the first reported case in 2006, several groups have described success in the treatment of head and neck cancer with transoral robotic surgery (TORS) [1–3]. Robotic surgery offers several advantages, including three-dimensional visualization, wristed micro-instrumentation, and increased precision with motion scaling and tremor filtration; moreover, it does not require external pharyngeal incisions and it preserves a larger amount healthy tissue, enabling a rapid recovery and functional preservation. In December 2009, TORS was approved by the US Food and Drug Administration for use in benign and select malignant tumors of the head and neck [4]. In general, oropharyngeal and hypopharyngeal cancer are the best candidates for TORS. Holsinger et al. suggested an anatomical foundation for a transoral approach called transoral lateral oropharyngectomy (TLO), and Park et al. applied robotic surgery to TLO and confirmed the efficacy and feasibility of TORS in the treatment of tonsillar cancer [5,6]. As a result, tonsillar cancer has become a representative anatomical site for which TORS has been shown to be effective. In TLO and traditional TORS, the buccopharyngeal fascia provides a deep layer of protection between the superior constrictors and retrostyloid parapharyngeal space, and the submuscular plane of the superior constrictor provides a sufficient resection plane for tonsillar cancer.

However, in many cases, the excision range can be beyond this plane to secure deep margins in addition to safe mucosal margins. In addition, if neck dissection is performed concomitantly, direct connection with the soft tissues of the neck and exposure of the great vessels is inevitable, thus increasing the risk of pharyngocutaneous fistula. Therefore, proper reconstruction of the communication defect is necessary after TORS. Several reconstruction methods are available for this defect, including primary closure, musculomucosal adjacent tissue flaps, and free flap

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reconstruction [7,8]. Although primary closure is a simple, easy, and reliable method, it can be applied only in limited cases with small defects. For larger defects, local or free flap reconstruction is needed. However, these techniques require much more time and effort, and they carry the risk of complications. Therefore, we developed a new primary closure technique that is applicable to even larger defects, and evaluated its efficacy and feasibility. In addition, we reviewed the pathological results of TORS and verified the necessity of *en bloc* resection making communication defects with the neck.

2. Materials and methods

2.1. Patient inclusion

From January 2010 to February 2011, we prospectively screened and enrolled eligible patients with a diagnosis of tonsillar cancer for consideration of treatment with a primary TORS approach. 13 patients were enrolled in a nonrandomized prospective trial designed to assess the safety and feasibility of a new technique for primary closure after TORS for the treatment of tonsillar cancer, and to verify the necessity of making the communication defect during TORS in such cases. This project was approved by the institutional review board of our institute, and informed consent was obtained from all patients. The inclusion criteria for the study were as follows: (1) age ≥18 years, regardless of sex, race, or ethnicity, with tumors of the tonsil; (2) no previous treatment under the same diagnosis (cancer of the head and neck) before hospitalization; and (3) treatment with TORS and reconstruction of the defect with the primary closure technique. Prophylactic or therapeutic neck dissection was performed concomitant with TORS. The patients were staged according to the 2002 American Joint Committee on Cancer (AJCC) staging system.

2.2. Operative procedure

Prophylactic selective neck dissection was performed in clinically negative necks; modified radical neck dissection was performed in clinically positive necks prior to TORS. During neck dissection, lymphoadipose tissue in the parapharyngeal space was completely removed. At the end of the dissection, gauze was placed above the exposed carotid artery to protect it during TORS.

Following neck dissection, the tumors were exposed using a Feyh-Kastenbauer (FK) retractor (Gyrus ACMI, Southborough, MA). Use of the da Vinci surgical robot (Intuitive Surgical Inc., Sunnyvale, CA) aided in tonsillar tumor extirpation via previously described techniques [5]. (Fig. 1; Video 1). The lateral superior pharyngeal constrictor muscle and buccopharyngeal fascia were resected in conjunction with the tumor, and there was communication between the oropharynx and neck. Through this "through-and-through" defect, gauze placed previously during neck dissection was visible with the camera of the da Vinci robotic system. After completing resection, surgical margins were sent for frozen biopsy. In all patients negative margins were confirmed.

After resection of the primary tumor, the FK retractor and da Vinci robot were removed from the patient and reconstruction was performed through the open wound in the neck. The new primary closure technique is composed of three steps. The first step involves direct closure of the defect by suturing the remaining superior pharyngeal constrictor muscle and extrinsic tongue muscle complex (Fig. 2; Video 2). The second step is reinforcement with muscular coverage of the closed defect. The digastric and mylohyoid muscles were sutured to cover the defect (Fig. 3; Video 3). The third and final steps involve reinforcement of the digastric–mylohyoid complex. Using an electric burr, two or three small holes were made in the lower border of the mandible. The sutured digastric–mylohyoid complex was anchored to the mandible by suturing through the holes using nonabsorbable sutures, and the closed defect was finally covered (Fig. 4; Video 4).

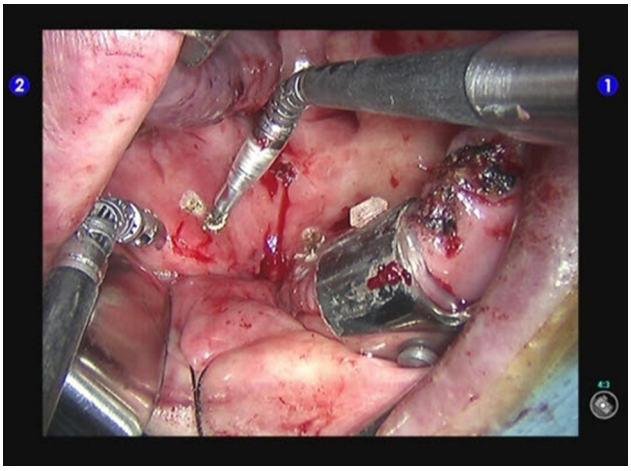

Fig. 1. Transoral robotic surgery.

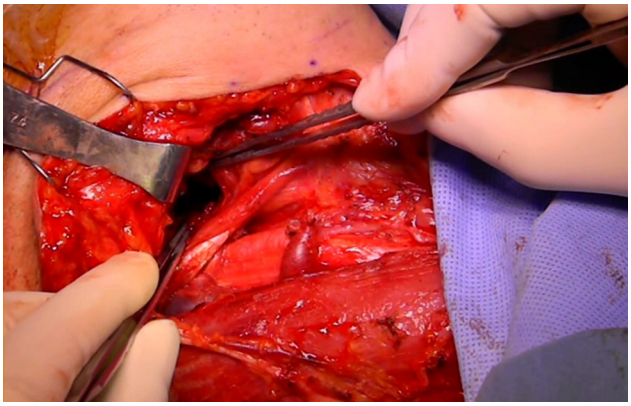

Fig. 2. The first step of reconstruction: suturing the remaining superior pharyngeal constrictor muscle and extrinsic tongue muscle complex.

Cervical drains were inserted to monitor the presence of a pharyngocutaneous fistula. All patients underwent nasogastric feeding tube placement intraoperatively and were made *nil per os* (NPO) for 24 h. On postoperative day 7, modified barium swallowing was performed to evaluate swallowing function and the occurrence of fistula formation. If no fistula was detected and swallowing function was tolerable, the nasogastric feeding tube

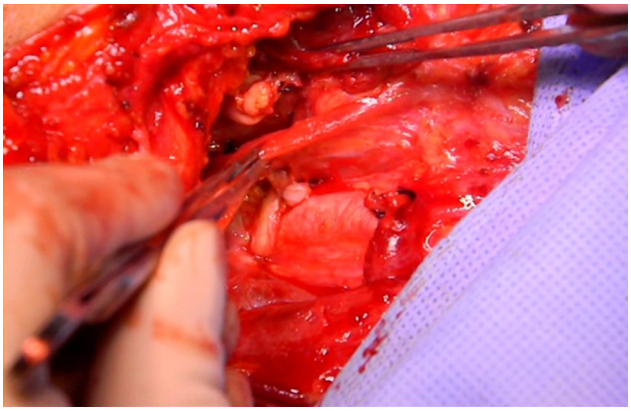

Fig. 3. The second step of reconstruction: suturing the digastric and mylohyoid muscles.