Robotic and robotic assisted approaches for the surgical management of glottic and supraglottic malignancies: Technical pearls and associated case reviews:

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Introduction

Glottic and Supraglottic malignancies are commonly addressed through open approaches which include vertical partial, supraglottic, supracricoid and total laryngectomy. For early stage lesions, there has been a trend toward endoscopic, transoral management of these tumors, which has resulted in improved post-operative function, decreased morbidity and shorter hospital stays as compared to open surgery. Coincident with this trend has been the advancement of robotic transoral approaches for oral cavity and pharyngeal malignancies. Herein we looked to evaluate our experience with robotic and robotic assisted approaches to the glottis and supraglottis.

Material and Methods

Transoral robotic cases, performed under the direction of the senior author over a 1 year period were reviewed. Cases were selected to represent the spectrum of approaches to the glottic and supraglottic larynx. Charts were reviewed in a retrospective fashion to include tumor size, characteristics, operative details, hospital course and complications.

Results

3 patients were selected over a 1 year period to demonstrate the varied approaches. The mean age was 64 years. All lesions were early stage lesions (T1 or T2). Adequate exposure was obtained in each case using the FF retractor. Approaches utilized included trans-oral robotic supraglottic laryngectomy and robotic assisted total laryngectomy. Mean robotic resection time was 119 minutes. Estimated blood loss averaged 30 cc. Mean hospital stay was 3 days. All patients were NED at most recent follow-up. 1 patient had a post-operative fistula.

Case 1

HPI: A 61 yo gentleman with a 2 month history of dysphagia and odynophagia without associated otalgia, hemoptysis and weight loss. He was noted to have a lesion of the right lateral epiglottis which was biopsied and revealed keratinizing, moderately differentiated, invasive squamous cell carcinoma. He was seen by our Tumor Board and staged as a T2N0M0 SCA of the right epiglottis after CT and PET revealed the mass without cervical adenopathy or distant metastasis. PFTs were normal. Both surgical and non-surgical options were discussed he opted for surgical treatment.

Operative details: The FF retractor was inserted into the mouth to expose the lesion. The patient was then suspended from the Mustarde table. Next, the da Vinci robotic system was brought into the field using a 30-degree up camera. The field was able to be completely exposed (Figure 1). A Maryland dissector and Bovie electrosurgery were placed on each of the robotic arms, and these were interchanged from right to left during the procedure. We began by making a midline incision in the epiglottis. Dissection was then carried anteriorly to separate the epiglottis from the pre-epiglottic space. Once the tumor had been mobilized anteriorly and medially, we proceeded to come laterally to transect the lesion at the AE fold just above the arytenoid cartilage. The lesion was then removed en bloc. At this point, circumferential margins were taken noted that the anterior margin of the lesion of the vallecula was positive for invasive squamous cell carcinoma. Further resection at the base of tongue and vallecula was performed. Further margin at the anterior vallecula was then obtained, and this was negative for neoplasm. The patient underwent a staged bilateral neck dissection which showed multiple microscopically positive nodes bilaterally.

Outcomes: He was treated with post-operative radiotherapy due to positive nodes on neck dissection and has done well. He is NED and swallowing using the supraglottic swallow technique.

Technical Pearls: The FF retractor affords excellent visualization of the supraglottic larynx when used with a 30-degree up camera. Supraglottic malignancies are notorious for bilateral lymphatic metastasis. Should the primary be addressed via TORS, bilateral neck dissections should be considered at the time of primary resection or in a staged fashion as micrometastases could upstage and require post-operative radiotherapy.

Case 2

HPI: 66 yo male with a history of T1N1MO SCC of the right vallecula treated with primary XRT at an outside hospital completing 70 Gy to the right vallecula and 56 Gy to the right neck. Initial post- treatment PET revealed resolution of the disease however a second PET showed a lesion at the right vallecula involving the supraglottis with an SUV of 5.1. A biopsy was performed and revealed SCC. He was referred to our Tumor Board and diagnosed with a recurrent SCCa of the right vallecula/supraglottic larynx. PFTs were <80% of expected FEV1/FVC. He was scheduled for TORS with neck dissection.

Operative details: The patient was taken to the operating room and placed in supine position on the operating room table. General anesthesia was then induced via the nasotracheal airway. Next, the patient was positioned for the procedures to be performed. The FF retractor was used to expose the supraglottic and vallecular area, and then the patient was suspended from the Mustarde table. Next, the robot was brought onto the field. Using the 30-degree camera, the tumor was visualized. The Bovie spatula was placed in the right arm and the Maryland grasps in the left arm. The medial incision was made down to the preepiglottic space. The specimen was then mobilized posteriorly and the AE fold was divided. The specimen was then removed from the supraglottis at the level of the false vocal cord. The anterior incision was made in the BOT past the vallecular portion of the lesion. Hemostasis was achieved. Circumferential margins were obtained which were negative for any invasive carcinoma.

Outcomes: Final pathology revealed a positive margin anteriorly on the permanent specimen and he was taken back for re-excision of the pre-epiglottic space using the robot which revealed no evidence of malignancy.

Technical Pearl: Most pathologists will be unfamiliar with en bloc transoral supraglottic specimens and margin assessment can be challenging. It is always helpful to walk the specimen over to pathology and orient them to true margins.

Case 3

HPI: 66 yo male with a history of stage one squamous cell carcinoma of the right vocal cord, who completed XRT 4 months prior was noted to have edema on in office exam at an outside hospital. He was taken for a biopsy which revealed invasive carcinoma. PFTs were 40% FEV1/FVC. He was deemed a poor candidate for partial laryngectomy and was scheduled for a robotic assisted total laryngectomy.

Operative details: The procedure was started with subplatymidal flap, division of the thyroid isthmus, a tracheostomy between the first and second tracheal rings. The suprathyroid muscles were divided. Inner and outer tunnels were made. At this point the larynx was rotated medially and the constrictors were divided. The thyroid cartilage was freed from surrounding tissue and the mucosa of the perifromm sinus was gently elevated from its attachment to the thyroid cartilage on both sides. The posterior tracheal wall was incised with a 5 blade until esophageal fibers were noted. Blunt dissection was used to elevate the trachea from the anterior esophagus superiorly to the level of the post cricoid region. The FF retractor was then placed into the oral cavity for exposure of the epiglottis (Figure 2). Using the Davinci surgical robot, a 30-degree endoscopic scope with Bovie spatula and Maryland bipolar forceps in arms 1 and 3 respectively, internal mucosal cuts were made in the vallecula surrounding the epiglottis and along the post cricoid and medial to the profund to preserve as much murocosa as possible. Once these internal cuts were made using the robot attention was turned externally and the larynx was able to be removed en bloc at this point. Attention was turned back to pharyngeal exposure. The da Vinci surgical robot was used to internally close the pharyngotomy with Vicryl sutures in a horizontal mattress fashion. Once the majority of the internal pharyngotomy was closed attention was turned to the neck. The remaining pharyngotomy was closed using horizontal mattress sutures making sure the mucosa was inverted into the pharynx. Once this was closed the strap muscles were closed for a second layer and the constrictors were reapproximated. The stoma was then sutured to the surrounding skin.

Outcomes: The patient was discharged on POD 3 and after passing an initial swallow study, was noted to have a salivary leak which was closed with a second surgical procedure.

Technical Pearl: Exposure of the supraglottic and glottic larynx is feasible with the da Vinci surgical robot. Robotic approaches can be combined with open approaches, however attempting resection with inadequate exposure can lead to complications and need for full conversion to open approaches.

Take home points:

Tips
1) Obtain thorough pre-operative tumor mapping and PFTs
2) Gain extensive trans-oral robotic experience with oral cavity or oropharyngeal lesions prior to attempting supraglottic lesions.
3) Always prepare the patient for a possible conversion to an open approach.
4) The FF retractor and 30-degree up camera provide excellent visualization of the supraglottic and glottic larynx.

Pitfalls
1) Failing to accurately map the tumor
2) Attempting resection with inadequate exposure
3) Neglecting treatment of the necks in supraglottic tumors

Discussion

Robotic and robotic assisted approaches to the glottic and supraglottic larynx have the advantage of improved visualization with decreased morbidity but with increased operative times. Graded approaches are feasible progressing from epiglottic to supraglottic and glottic malignancies. While there are benefits to these approaches, their implementation should be performed only after experience is gained with oral cavity and oropharyngeal tumors.

Conclusion

Robotic and robotic assisted approaches to the glottic and supraglottic larynx have the aim of decreasing morbidity without compromising oncologic outcomes. Varied approaches are feasible and strategies should be employed to improve outcome and decrease morbidity.