

Bilateral Robotic-Assisted Transaxillary Surgery

Christine S. Landry, MD; Elizabeth G. Grubbs, MD; Nancy D. Perrier, MD

Hypothesis: Robotic-assisted transaxillary surgery (RATS) for the removal of thyroid glands is feasible by surgeons in the United States.

Design: Case report.

Setting: Academic research.

Patient: A 53-year-old woman.

Intervention: Total thyroidectomy via the transaxillary approach.

Main Outcome Measure: Successful completion thyroidectomy using bilateral RATS.

Results: Right thyroid lobectomy was performed via RATS to remove a 2.2-cm Hurthle cell neoplasm of the thyroid gland per cytologic analysis. Final pathologic analysis was consistent with minimally invasive follicular thyroid carcinoma. The patient then underwent completion thyroidectomy via left-sided RATS. There were no complications.

Conclusions: Bilateral RATS to perform total thyroidectomy is a feasible option in properly selected patients. To our knowledge, this is the first reported use of this technique in the United States.

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SINCE THE TURN OF THE 21ST century, there has been a trend toward minimally invasive approaches to thyroidectomy across the globe.¹⁻⁵ These range from videoscopic techniques through small cervical midline incisions to removal of the thyroid gland through the axilla.^{2,5} Some operations also require the use of carbon dioxide insufflation in the neck.⁶ Most recently, Kang et al^{7,8} in South Korea developed a robotic-assisted, gasless, transaxillary approach for removal of the thyroid gland to avoid a cervical scar. Initially, their experience with the transaxillary approach began laparoscopically and later transformed to a robotic approach with 1 axillary incision and 1 sternal incision.^{2,8} In 2 recent publications, Kang et al^{7,8} report performing total thyroidectomy using the robotic transaxillary approach in almost one-third of 338 cases. In those series, all operations were performed for known papillary thyroid carcinoma with resection of bilateral thyroid lobes at the same operation. None of these cases were performed with meta-chronous procedures. None of the thyroid lobe resections was staged. Other surgeons have described bilateral thyroid lobectomies via concomitant bilateral

axillary breast approaches.^{9,10} A combined axillary and sternal technique that is performed using a robotic surgical system (da Vinci; Intuitive Surgical, Sunnyvale, California) has been implemented by Lewis et al¹¹ in the United States.

Recently, Woong Youn Chung, MD, modified the technique to incorporate only 1 axillary incision while continuing to avoid a cervical scar. Our team of endocrine surgeons has adopted single-access robotic-assisted transaxillary surgery (RATS) for thyroid lobectomy. We present a case report of our initial experience with RATS for total thyroidectomy. Our major objective was to demonstrate feasibility of this technique in the American population. To our knowledge, this is the first reported use of the bilateral single-incision technique in the United States.

REPORT OF A CASE

CLINICAL HISTORY AND PREOPERATIVE EVALUATION

A 53-year-old woman palpated a tender mass in her neck on self-examination. There were no symptoms of dysphagia, hoarseness, or difficulty in breathing. She reported no previous exposure to radiation

Author Affiliations: Section of Surgical Endocrinology, Department of Surgical Oncology, University of Texas M. D. Anderson Cancer Center, Houston.



Figure 1. Patient positioning. This patient is asleep and intubated. The right arm is elevated in preparation for the right thyroid lobectomy. The patient is placed supine on the operating room table. The ipsilateral upper extremity is carefully positioned to expose the right axilla. Appropriate pads and cushions are used to prevent hyperextension of the extremity.



Figure 2. Planes of dissection on the right side of the patient. The chin is superior, and the right axilla is on the left side of the image. The anticipated planes of dissection are marked on the patient's skin with a marker. The lines shown represent important landmarks of the right-sided dissection. The 5-cm incision in the right axilla is shown, as well as the outline of the sternal notch. The uppermost extent of the anticipated dissection is the superior portion of the thyroid cartilage.

therapy or a personal or family history of thyroid cancer. The patient was thin and had excellent hyperextension of the neck. Physical examination demonstrated a 2- to 3-cm nodule in the right lobe of her thyroid gland that was mobile and nontender to palpation. Thyroid function test results were within normal limits.

Ultrasonographic examination of soft tissues in the cervical region identified a 2.2-cm mass in the right lobe of the thyroid gland. Increased vascular flow of the nodule was noted. No cervical adenopathy was present. Cytologic evaluation following fine-needle aspiration was consistent with a Hurthle cell neoplasm. Chest radiography revealed no evidence of tracheal deviation or metastatic disease. Right-sided thyroid lobectomy was recommended for definitive diagnostic purposes to rule out the presence of follicular carcinoma. The patient opted for the RATS approach.



Figure 3. Retractor system. The retractor has been attached on the contralateral side of the bed. It is used to elevate the skin and subcutaneous tissue off the right pectoralis major muscle. The retractor will maintain the space for insertion of the robotic and its instruments (da Vinci; Intuitive Surgical, Sunnyvale, California).

OPERATIVE PROCEDURE

To ensure concealment, the incision site in the right axilla was marked in the preoperative area with the patient in the upright position. Intravenous access was obtained in the left upper extremity. The patient was brought to the operating room and placed in a supine position. The right arm was positioned comfortably with the shoulder internally rotated and flexed at approximately 160°. Appropriate padding was secured on potential pressure points. The patient was then sedated and intubated by the anesthesia team (**Figure 1**).

A 5-cm longitudinal incision was made lateral to the right pectoralis muscle. Skin flaps were created superficial to the pectoralis muscle and extended medially to the sternal notch, superiorly to the thyroid cartilage, and inferiorly to the clavicle (**Figure 2**). The plane between the sternal and clavicular heads of the sternocleidomastoid muscle was separated, and the lateral border of the strap muscles was exposed. The strap muscles were then dissected off the anterior surface of the thyroid parenchyma, and a bladed thyroid robotic retractor (Marina Medical, Inc, Sunrise, Florida) was deployed (**Figure 3**).

Once adequate exposure of the superior and inferior poles of the thyroid gland was achieved, the robotic apparatus was docked into place. A 5-mm curved harmonic scalpel, a 5-mm Maryland retractor, and an 8-mm dissector were secured into the robotic arms. The trocars were then aligned along the incision to achieve maximal range of motion.

Using the robotic instrumentation, the console surgeon (N.D.P.) removed the right thyroid gland and isthmus in the usual standard fashion. The medial aspects of the superior and inferior parathyroid glands were gently swept laterally on the vascular pedicle. The recurrent laryngeal nerve was identified as it coursed in the tracheoesophageal groove. The superior and inferior poles were dissected, and the vessels were divided using the harmonic scalpel. As the thyroid parenchyma was separated from the cricopharyngeal muscle, care was taken to identify and preserve the external branch of the superior laryngeal nerve. The tissue medial to the ligament of Berry was divided under direct and magnified visualization. The thyroid tissue at the isthmus was then longitudinally transected off the anterior surface of the trachea. The specimen was removed using the laparoscopic grasper through the axillary incision.

The wound was irrigated, and hemostasis was ensured. The instruments were removed under direct visualization. A 7F round Jackson-Pratt drain was placed overlying the lateral neck and supraclavicular planes of dissection and fashioned to exit at the midaxillary line. The wound was closed in layers with absorbable suture. Total operative time was 1 hour and 56 minutes. There were no complications.

POSTOPERATIVE COURSE

The patient had an uneventful postoperative course and was discharged on postoperative day 1 after drain removal. Final pathologic diagnosis was consistent with a 1.8-cm follicular thyroid carcinoma. As a result, the decision was made to proceed with completion thyroidectomy. The patient opted for a contralateral symmetric procedure. Approximately 7 weeks later, left-sided RATS thyroid lobectomy was performed in an identical fashion as previously described. The total operative time for completion thyroidectomy was 2 hours and 12 minutes, and there were no complications. The final pathologic report was negative for malignant disease in the left lobe. The postoperative course from the second procedure was also uneventful.

Eight weeks later, the patient underwent radioactive iodine imaging. The image revealed negligible uptake in the cervical region.

COMMENT

Our team of 3 endocrine surgeons (E.G.G. and N.D.P. and a colleague) and a surgical endocrinology fellow (C.S.L.) attained proficiency with the robotic surgical system in training facilities using inanimate prototypical and animal models. Our group then traveled to South Korea to observe Chung (personal observation, September 14, 2009) perform multiple cases of robotic-assisted thyroid lobectomy and total thyroidectomy through a single incision. After obtaining experience with the operative approach on multiple cadavers, we began to perform the RAT technique as a team of 3 surgeons. Specific logistics were addressed such as proper positioning and padding of the ipsilateral upper extremity, precise positioning of the robotic arms, and the need for a small drain to eliminate seroma formation on the anterior chest wall. Operations that were performed on this patient represented our fifth and seventh cases of thyroid lobectomy using the RAT approach. Total operative times for both procedures were comparable to those in the initial experience by Kang et al.⁸ The team approach to RATS allowed for enhanced efficiency while safely decreasing total operative times. The benefits of performing this procedure as a team include safe implementation and group troubleshooting.

Recent results by Kang et al⁸ suggest that RATS is safe for the resection of malignant disease. In our initial experience with RATS, we limited our cases to thyroid nodules with a low suspicion of harboring malignant neoplasms. Because the risk for malignant neoplasm was low for this patient with a preoperative cytologic diagnosis of Hurthle cell neoplasm, RATS was an acceptable initial surgical option.¹² Final pathologic analysis revealed

minimally invasive follicular thyroid carcinoma. Because the lesion was small and encapsulated,¹³ our patient had a favorable prognosis. She was offered completion thyroidectomy based on current guidelines supported by the American Thyroid Association for treatment of well-differentiated thyroid carcinoma.¹⁴

The decision to proceed with completion thyroidectomy via contralateral RATS was made for several reasons. Completion thyroidectomy from a cervical approach was unappealing to the patient because of her preference to avoid a visible scar. As such, we concluded that cosmetic concerns did not compromise oncologic principles because there was no evidence of malignant disease in the contralateral lobe. In addition, because preoperative imaging did not suggest adenopathy in the central compartment and the tumor was a T1NxMx lesion, we believed that ipsilateral central lymph node dissection was unwarranted. The potential added benefit of a central neck dissection in a reoperated on neck for clinically negative central compartment disease did not outweigh the risk of a recurrent laryngeal nerve or parathyroid gland injury in our patient with an otherwise favorable prognosis.^{13,14} Furthermore, we thought that the initial procedure offered excellent magnified optics of the central compartment, and no clinically evident adenopathy was appreciated on visual inspection. Likewise, approaching completion thyroidectomy from the previous right-sided axillary incision would make the dissection challenging because of scarring and difficulty in visualizing the contralateral side.

The technique of RATS lobectomy is complex, even for an experienced thyroid surgeon. The operating surgeon must pay special attention to patient positioning, robotic configuration, and details of the procedure to maintain patient safety. Complications such as transient ipsilateral arm paralysis, recurrent laryngeal nerve injury, Horner syndrome, hematoma, and seroma have been reported with this procedure.⁷

In conclusion, RATS is a feasible option for thyroid lobectomy. If necessary, this procedure can also be safely performed from a contralateral approach for total or completion thyroidectomy. In selected patients, bilateral RATS may be considered for safe removal of bilateral thyroid lobes. Further study involving a randomized controlled trial assessing the efficacy of this technique is warranted.

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Correspondence: Nancy D. Perrier, MD, Section of Surgical Endocrinology, Department of Surgical Oncology, University of Texas M. D. Anderson Cancer Center, 1515 Holcombe Blvd, Unit 444, Houston, TX 77030 (nperrier@mdanderson.org).

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