Feasibility, Safety, and Surgical Outcome of Robotic Hemithyroidectomy Via Transaxillary and Retroauricular Approach: an Institutional Experience

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Abstract

The aim of this observational prospective study was to determine the technical feasibility, safety, and adequacy of robotic hemithyroidectomy. From April 2015 to May 2016, 16 patients with solitary thyroid lesion underwent robotic hemithyroidectomy using the *Da Vinci® Si* Surgical system. Patients were observed and data were recorded on surgical time, blood loss, complications, and functional outcome of the patients. A total of 16 patients (3 males and 13 females; mean age 39.9 years) underwent robotic hemithyroidectomy after evaluation for solitary thyroid nodule with a mean nodule size of 2.2 ± 0.3 cm. Fiber-optic laryngoscopy (FOL) was normal in all cases pre-operatively. Five patients were operated by transaxillary approach, the rest by retroauricular (facelift) approach. Mean pocket dissection time was 42 min for transaxillary and 40 min for retroauricular approach. Mean operative console time was 59.4 min for transaxillary and 52.6 min for retroauricular approach. Average blood loss was 45 ml. Mean hospital stay was 1.5 days. None of the patients had any post-operative complication on follow-up. One patient had restricted left vocal cord mobility which improved in 3 months. Mean pain score was 0.25 ± 0.4 and average speech score was 0.5 ± 0.2 at 3 months. Post-operatively, all patients had adequate swallowing with no episode of aspiration. Robotic hemithyroidectomy is a safe, feasible, and oncologically safe procedure. It has benefits in terms of better scar cosmesis than open surgery.

Keywords Robotic thyroidectomy · Transaxillary · Retroauricular · Functional outcome

Introduction

Solitary thyroid nodule is a common entity. Proper pre-operative evaluation of solitary nodule with clinical examination, radiology, and cytopathological correlation helps in deciding the further management. Surgery is the mainstay of treatment for a solitary thyroid nodule especially for malignant and indeterminate lesions on fine-needle aspiration cytology (FNAC) and large benign lesions. A younger population coming with solitary thyroid nodule, along with disease treatment,

is also concerned with the cosmetic outcome of the surgery. Though open thyroidectomy with transverse skin crease incision has been the gold standard as it gives maximum exposure with less morbidity and mortality [1], the scar cosmesis with the open approach makes it psychologically and cosmetically unappealing for the patients, more so in patients with tendency of keloid formation and hypertrophic scarring.

Initially, endoscopic thyroidectomies were done without robotic assistance [2] but with the advent of the robotic technology in the field of head and neck surgery, Chung et al. from Korea performed the robot-assisted thyroidectomy via transaxillary approach [3]. Robotic thyroidectomy has shown similar results as compared to open thyroidectomy in terms of surgical feasibility and safety with improved scar cosmesis which has promoted the use of robotic surgical system for thyroidectomy with good outcomes [2, 4]. The *Da Vinci* Surgical system provides improved degree of freedom, magnified 3D visual field, and tremor-free, precise movements

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improving the surgical dissection [1]. The use of robotic system in thyroidectomies aims to provide better visualization, easy identification of recurrent laryngeal nerve, ease of nodal dissection both from the central and lateral compartments, lesser blood loss, and last but not the least, better cosmetic outcome.

In this study, we provide a first experience of robotic hemithyroidectomy with *Da Vinci®* Surgical system using both the transaxillary and retroauricular approaches in terms of surgical feasibility, safety, and outcome with a mean follow-up of 12.4 months (8–21 months) from the Indian subcontinent.

Material and Method

After obtaining the clearance from the Institutional Ethics Board, 16 patients with solitary thyroid nodule underwent robotic hemithyroidectomy from April 2015 to May 2016. They all underwent robotic hemithyroidectomy using the *Da Vinci® Si* Surgical system with all surgeries done by a single surgeon. The consent for remote access thyroidectomy was taken from all patients and the choice of transaxillary and retroauricular approach was left to the patient. The procedure was done under general anesthesia. Patients were observed and data were recorded on surgical time, blood loss, complications, and functional outcome of the patients.

All the patients were evaluated for the solitary thyroid nodule with thorough pre-operative evaluation consisting of clinical examination, radiological evaluation using neck ultrasonography, and cytopathological confirmation of the nature of disease using the Bethesda classification and pre-operative assessment of thyroid function test.

We included patients with the following:

1. Age $\geq$ 18 years
2. Solitary thyroid nodule $<$ 3.5 cm limited to single lobe
3. Absence of extrathyroidal invasion, trachea-esophageal invasion, vocal cord paralysis, bilateral cervical nodal, or distant metastasis
4. No prior history of any surgery or radiation over the neck

Nine of the 16 patients had follicular neoplasm (Bethesda category IV) on pre-op FNAC, 6 patients had papillary carcinoma (Bethesda category VI), and 1 patient had adenomatous lesion (Bethesda category III).

Three of the 16 patients were diabetic. All patients underwent pre-operative fiber-optic laryngoscopy (FOL) and bilateral cords were mobile in all cases. Baseline speech score of all patients undergoing robotic thyroidectomy was noted and was normal in all patients. None of the patient had any history of prior head and neck surgery, radiation, or thyroiditis. Average BMI of the population

was 26.1. Mean ECOG performance score was 1. In 5 patients, robotic hemithyroidectomy was done by transaxillary approach, and in 11 patients retroauricular (facelift) approach was used according to the choice of the patient. Further treatment was based on the final histopathology report. Serum TSH and neck imaging was done for all patients on follow-up. Direct laryngoscopy was done for all patients in the post-operative period. All the complications and morbidity related to the procedures were recorded and treated accordingly.

Technique

All cases were operated by *Da Vinci® Si* Surgical system.

The operative procedure for both techniques was divided into three parts:

- (a) Pocket dissection time
- (b) Docking time
- (c) Console time

Transaxillary Approach

The patient was positioned in supine position with ipsilateral arm extended over the head to expose the axilla. Incision marking was done (Fig. 1a). Pocket dissection is performed above the pectoralis major muscle to make space by elevating the skin, subcutaneous tissue, and platysma with the help of retraction given by an assistant (Fig. 1b). The dissection done is guided by the incision marking and continued over the clavicle to reach a space between the two heads of the sternocleidomastoid. Further, the space is opened superiorly, the omohyoid was divided, and the sternohyoid and sternothyroid muscles are elevated off the thyroid gland. Chung's Retractor (Fig. 2) is used and placed under the strap muscle and is mounted.

Docking of the robotic system is done. Three robotic arms with a 0° telescope, Maryland dissector, and harmonic scalpel are docked through the axillary incision.

Thyroid dissection is started from inferior to superior pole. Inferior thyroid pedicle, middle thyroid vein, and superior thyroid pedicle are dissected and transected with harmonic shear (Fig. 1c) after identification and preservation of both superior and inferior parathyroids and recurrent laryngeal nerve. Isthmus is divided and thyroid lobe is dissected of the trachea.

The specimen is removed via the axillary incision and skin closure is done after placing a suction drain in the axillary pocket.

Fig. 1 **a** Incision marking for the transaxillary approach, **b** pocket dissection through the axillary incision and tunnel to the thyroid lobe created, **c** intraoperative robotic dissection of the thyroid lobe, and **d** post-operative scar and cosmesis with transaxillary approach

Retroauricular Approach (Facelift Approach)

A retroauricular facelift incision is given (Fig. 3a) and dissection is continued in the subcutaneous plane over the sternocleidomastoid muscle, keeping the greater auricular nerve and external jugular vein (EJV) on to the patient side. The platysma is identified just medial to EJV and subsequent dissection is carried in the subplatysmal plane until the anterior border of sternocleidomastoid (Fig. 3b). The fascia over the sternocleidomastoid is opened at its anterior border and strap muscles are identified and lifted off the thyroid gland.

Chung's Retractor (Fig. 2) is used and placed under the strap muscle and is mounted.

Docking of the robotic system is done. Three robotic arms with a 0° telescope, a Maryland dissector, and a harmonic scalpel are docked through the retroauricular incision.

Thyroid dissection is started from inferior to superior pole. Inferior thyroid pedicle, middle thyroid vein, and superior pedicle are similarly dissected and transected after identification and preservation of both superior and inferior parathyroids and recurrent laryngeal nerve. The specimen is delivered from the retroauricular incision.

Fig. 2 Chung's Retractor applied after pocket dissection to elevate the flap which helps in robotic docking and further dissection

Fig. 3 **a** Incision marking for the retroauricular (facelift) approach, **b** pocket dissection through the retroauricular incision and tunnel made to the thyroid lobe, **c** post-operative scar with drain placement, and **d** post-operative cosmesis with no transverse neck scar as compared to conventional approach

Central and lateral cervical nodal clearance is required if performed robotically from the same incision using the Maryland dissector and harmonic scalpel.

Results

A total of 16 patients (3 males and 13 females) underwent robotic hemithyroidectomy with ipsilateral neck dissection performed in 1 of the patients. Mean age of population undergoing surgery was 39.9 years (24–56 years). All the patients with differentiated thyroid cancer in the study were < 45 years of age. Average nodule size in our study was 2.2 ± 0.3 cm. Mean pre-operative serum TSH was 1.8 ± 0.4 . On pre-operative FNAC, 9 patients had follicular neoplasm, 6 patients had papillary carcinoma, and 1 patient had adenomatous lesion. In 5 patients, robotic hemithyroidectomy was done by transaxillary approach and in the rest of the patients, retroauricular (facelift) approach was used.

Mean pocket dissection time for transaxillary approach was 42 min (32–56 min) and 40 min (28–49 min) for retroauricular approach, with an overall mean pocket dissection time of 40.63 min. Mean robot docking time was 6.9 min. Mean operative console time for transaxillary approach was 59.4 min (49–72 min) and for retroauricular approach was 52.6 min (46–68 min) with overall mean console operative time of 54.53 min. Mean total operative time was 101.2 min. Average blood loss during surgery was 45 ± 16 ml.

One patient was converted to open thyroidectomy because of dense posterior adhesion which on final histopathology came out as thyroid lymphoma.

Average hospital stay was 1.2 ± 0.5 days. Mean follow-up of the patients was 12.4 months (8–21 months). On final

histology, 7 patients had papillary carcinoma, 2 patients had follicular carcinoma, 5 had follicular adenoma, 1 patient had thyroid lymphoma, and 1 patient had lymphocytic thyroiditis. The mean nodule size in the cases of differentiated thyroid cancer was 1.3 ± 0.2 cm.

One of the patients with papillary carcinoma had enlarged lymph nodes on pre-operative ultrasonography, but they did not have characteristic features of metastatic lymph nodes like loss of hilar architecture, presence of intranodal necrosis, and calcification. During surgery, this patient underwent hemithyroidectomy with central compartment clearance along with ipsilateral lateral neck dissection (II–IV). Clinically, the nodes did not look suspicious and hence the decision to not do completion thyroidectomy was taken as the nodule size was 1 cm with no lesion in the opposite lobe with no lymph nodes in the contralateral neck. On final histopathology, all nodes were found to be free of tumor. Patients of thyroid carcinoma (papillary and follicular carcinoma; 9/16 patients) were kept on post-operative TSH suppression with thyroid replacement therapy with target serum TSH below 0.5 mU/L. None of the patients has had any recurrence on follow-up.

Post-operatively, FOL was done in all cases and 1 patient had restricted left vocal cord mobility which gradually improved after 3 months of surgery. Three of 16 patients initially reported hoarseness with normal cord mobility on FOL which gradually improved in 1 month follow-up.

Post-operatively, all patients were evaluated with speech score (communication score) [5] and pain score (VAS) [6]. Mean pain score on day 7 was 2.06 ± 0.7 which in 1 month decreased to 0.6 ± 0.5 and in 3 months was 0.25 ± 0.4 . Similarly, the average speech score on day 7 was 1.06 ± 0.5 which in 1 month was 0.5 ± 0.5 and in 3 months was 0.25 ± 0.4 . All the patients were satisfied with the scar cosmesis. No

swallowing difficulty or aspiration was reported on follow-up. No shoulder dysfunction or chyle leak was reported. All of the patients are on regular follow-up with no evidence of disease.

Discussion

Due to recent introduction of robotic surgical system for thyroidectomy, literature from robotic thyroidectomy is sparse especially in Indian context. From India, single-center work on transaxillary robotic thyroidectomy was reported for benign conditions [7]. Robotic thyroidectomy is a safe and feasible approach for solitary thyroid nodule [8]. Initially transaxillary approach was commonly performed and has shown good outcomes [9, 10]. Cha et al. reported disadvantage of transaxillary approach such as injury to the brachial plexus, internal jugular vein, carotid artery, and esophagus. Retroauricular (facelift approach) was introduced to overcome these drawbacks [11, 12]. Initial experience with facelift approach has been reported as a safe alternative [10]. Our experience with both approaches for robotic hemithyroidectomy is the first report in Indian literature in terms of feasibility and safety for management of both benign and malignant thyroid nodules. Oncological outcome for malignant cases needs a longer follow-up with a larger subset of population. Koreans have reported their outcome for this procedure in terms of disease management [9, 13–15].

Robotic surgery with 3D magnified vision, seven degrees of freedom with endowrist movement, and a short learning curve has made surgery easy in a smaller working space with similar precision and control with preservation of parathyroid and RLN as compared to conventional open approach [1].

Recent reports have reported similar results of robotic thyroidectomy as compared to open thyroidectomy [10, 16]. Our study had a mean docking time of 6.9 min, mean console time for hemithyroidectomy of 54.53 min, and mean total operative time of 101.2 min which are comparable to Somashekhar et al. [17]. Also, our complications rates were the same as with Somashekhar et al.'s, with only 1 patient showing transient vocal cord paresis on FOL and 3 patients complaining of immediate post-operative hoarseness, with normal vocal cord mobility, all of which improved within 1 month post-op. None of our patients reported any brachial plexus injury. Similar results were reported by Thankappan et al. in a multicentric study. [18].

Studies have reported complication like shoulder weakness and brachial plexus injury with transaxillary approach. With the retroauricular approach, these complications could be avoided. In our study, we report no difference between both the approaches in terms of complication and morbidity but retroauricular approach was found to be technically more comfortable and feasible for central and lateral lymph node clearance with easier upper pole dissection in our experience,

though a large number of patients are needed to sum up this conclusion regarding difference in ease of surgery between the two techniques. Tae et al. [1] reported temporary vocal cord paresis with temporary speech dysfunction after robotic thyroidectomy. In our study, we reported 1 patient with restricted vocal cord mobility on day 7 post-operatively and 3 patients with temporary speech dysfunction which gradually improved on 3 months follow-up. We reported no other post-operative complication in our series. Initial operative time was more as compared to open surgery but with increase in number of cases and experience in robotic surgery, it showed a decreasing trend. Mean operating time was 101.2 min. All the patients were satisfied with the scar cosmesis.

Conclusion

Robotic hemithyroidectomy is a safe, feasible, and oncologically safe procedure in patients with solitary thyroid nodule. It offers benefits in terms of superior cosmetic satisfaction than conventional approach, though still larger studies with longer follow-up are needed to determine oncological outcome in comparison with open approach.

References

1. Tae K, Ji YB, Jeong JH, Lee SH, Jeong MA, Park CW (2011) Robotic thyroidectomy by a gasless unilateral axillo-breast or axillary approach: our early experiences. *Surg Endosc* 25(1):221–228
2. Kang SW, Lee SC, Lee SH et al (2009) Robot-assisted endoscopic surgery for thyroid cancer: experience with the first 100 patients. *Surg Endosc* 23(11):2399–2406
3. Kang SW, Lee SC, Lee SH, Lee KY, Jeong JJ, Lee YS, Nam KH, Chang HS, Chung WY, Park CS (2009) Robot assisted endoscopic thyroidectomy for thyroid malignancies using a gas less transaxillary approach and the Da Vinci system: the operative outcome of 338 consecutive patients. *Surgery* 146(6):1048–1055
4. Lee J, Yun JH, Nam KH, Soh EY, Chung WY (2011) The learning curve for robotic thyroidectomy: a multicentre study. *Ann Surg Oncol* 18(1):226–232
5. Mercante G, Ruscito P, Pellini R (2013) TORS for tongue base tumours. *Acta Otorrhinolaryngol Ital* 33(4):230–235
6. Bodian CA, Freedman G, Hossain S, Elsenkraft JB (2001) The visual analog scale for pain: clinical significance in postoperative patients. *Anesthesiology* 95(6):1356–1361
7. Bhargava PRK, Kumbhar US, Satyam G, Gayathri KB (2013) Gasless single incision trans-axillary thyroidectomy: the feasibility and safety of a hypomorbidity endoscopic thyroidectomy technique. *J Minim Access Surg* 9(3):118–121
8. Jackson NR, Yao L, Tufano RP, Kandil EH (2014) Safety of robotic thyroidectomy approaches: meta-analysis and systemic review. *Head Neck* 36(1):137–143
9. Lee YM, Yi O, Sung TY, Chung KW, Yoon JH, Hong SJ (2014) Surgical outcomes of robotic thyroid surgery using a double incision gasless transaxillary approach: analysis of 400 patients treated by same surgeon. *Head Neck* 36(10):1413–1419

10. Kandil EH, Noureldine SI, Yao L, Slakey DP (2012) Robotic transaxillary thyroidectomy: an examination of the first one hundred cases. *J Am Coll Surg* 214(4):558–564
11. Singer MC, Seybt MW, Terris DJ (2011) Robotic facelift thyroidectomy: I. Preclinical simulation and morphometric assessment. *Laryngoscope* 121(8):1631–1635
12. Lee J, Na KY, Kim RM, Oh Y, Lee JH, Lee J, Lee JS, Kim CH, Soh EY, Chung WY (2012) Postoperative functional voice changes after conventional open or robotic thyroidectomy: a prospective trial. *Ann Surg Oncol* 19(9):2963–2970
13. Kandil E, Saeed A, Mohamed SE, Alsaleh N, Aslam R (2015) Modified robotic-assisted thyroidectomy: an initial experience with the retroauricular approach. *Laryngoscope* 125(3):767–771
14. Lee J, Yun JH, Nam KH, Choi UJ, Chung WY, Soh EY (2011) Perioperative clinical outcomes after robotic thyroidectomy for thyroid carcinoma: a multicenter study. *Surg Endosc* 25(3):906–912
15. Lee J, Lee JH, Nah KY, Soh EY, Chung WY (2011) Comparison of endoscopic and robotic thyroidectomy. *Ann Surg Oncol* 18(5):1439–1446
16. Noureldine SI, Jackson NR, Tufano RP, Kandil E (2013) A comparative North American experience of robotic thyroidectomy in a thyroid cancer population. *Langenbeck's Arch Surg* 398(8):1069–1074
17. Somashekhar SP, Ashwin KR (2017) Robot-assisted thyroidectomy using a gasless, transaxillary approach for the management of thyroid lesions: Indian experience. *J Minim Access Surg* 13(4):280–285
18. Thankappan K, Dabas S, Deshpande M (2017) Robotic retroauricular thyroidectomy: initial experience from India. *Gland Surg* 6(3):267–271