International Journal of Surgery 18 (2015) 118–122

Contents lists available at ScienceDirect

International Journal of Surgery

journal homepage: www.journal-surgery.net

Original research

Initial learning curve of single-incision transaxillary robotic hemi- and total thyroidectomy – A single team experience from Europe

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HIGHLIGHTS

- The main advantage of transaxillary robotic thyroid surgery is to avoid a neck scar.
- This is associated with potential risks otherwise not present with thyroidectomy.
- The learning curve for transaxillary robotic thyroid surgery is relatively steep.
- Reasonable progress may be achieved within the first 10 cases.
- A consistent team and careful patient selection are paramount.

ARTICLE INFO

Article history:
Received 11 November 2014
Received in revised form
9 April 2015
Accepted 19 April 2015
Available online 24 April 2015

Keywords:
Robotic thyroidectomy
Transaxillary robotic surgery (TARS)
Learning curve

ABSTRACT

Introduction: The primary advantage of robotic thyroidectomy is to avoid a neck scar. On the other hand, this sophisticated technique implies some potential risks otherwise not associated with conventional thyroidectomy, increased costs, and prolonged operating times. With all these factors being an important issue, we analysed the data of our initial European series in order to understand the nature of the learning curve for this technique.

Methods: Ten patients underwent transaxillary robotic thyroidectomy for benign disease, performed consistently by the same surgeon with the same team, within a timeframe of 12 months. There were four total thyroidectomies and six hemithyroidectomies. Operating times broken down into creating the working space, docking the robot, and console work (including wound closure), were prospectively recorded and evaluated.

Results: By the end of the initial learning curve comprising ten patients, the total operating time for a robotic hemithyroidectomy and for a total thyroidectomy has decreased by 49% to 190 min, and by 31% to 229 min, respectively. Intraoperative complications were successfully managed without conversion to open access surgery.

Conclusion: The learning curve for transaxillary robotic thyroidectomy is rather steep; reasonable progress in terms of operating times can be achieved within the first ten cases. Consistency in the team and careful patient selection are paramount factors for success.

1. Introduction

Transaxillary robotic thyroidectomy has become well established in the past few years as described by several large-volume authors [1,2], even on a multi-institutional comparative level [3]. A framework for the training, assessment and safe implementation of robotic thyroidectomy was developed by Perrier et al. [4]. Differences between the Asian and Western population in cultural background and in body habitus have been taken into account when considering proper indications for this procedure [5]. Also, there are recent systematic reviews and meta-analyses regarding the outcomes [6], completeness of resection [7], complications [8], and safety [9] of robotic thyroidectomy approaches.

We see transaxillary robotic thyroidectomy as part of the TARS-spectrum, standing for Trans Axillary Robotic Surgery, as we suggest to refer to the group of transaxillary performed procedures,

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http://dx.doi.org/10.1016/j.ijsu.2015.04.053

analogous to TORS referring to a range of transorally performed procedures. TARS includes hemi- and total thyroidectomy, parathyroidectomy, and several types of selective and modified radical neck dissections.

While the open cervical approach to thyroidectomy still is and possibly will remain the gold standard [10], there is a certain, increasing demand for remote access thyroidectomy that leaves the patient with a scarless neck [11]. Introduction of robotic surgery to head and neck surgeons has led to the development of the modified facelift-approach [12,13], the unilateral retroauricular approach [14], the latter combined with concomitant neck lift surgery [15], and the transaxillary robotic thyroidectomy techniques [13,16].

The latter was initially performed with an auxiliary chest wall incision for the third robotic instrument arm [17], which has been gradually abandoned in most centers, including ours, with progression of the learning curve [18]. This process has led to the gasless unilateral single-incision transaxillary robotic thyroidectomy, even for the total removal of the gland, which currently represents the state of the art in this field.

2. Patients and methods

To assess the initial learning curve for transaxillary robotic thyroidectomy, ten patients were operated with this technique within 12 months in 2012 and 2013 at our department. All procedures were performed by the same, head and neck/thyroid-fellowship-trained console surgeon assisted by the same team. This team had gained significant previous experience with conventional, open cervical thyroidectomies as well as with transoral robotic procedures using the daVinci Surgical System (Intuitive Surgical, Sunnyvale, CA, USA).

Being able to combine these two different kinds of experience has helped us a great deal in learning to perform transaxillary robotic thyroidectomy safely and effectively. However, we still found this technique initially quite challenging [19], and we benefited largely from having been observed and advised by three expert proctors and trainers of this field: Mr. Neil Tolley from London, UK (Case #1), Dr. Micaela Piccoli from Modena, Italy (Case #3, the first-ever robotic total thyroidectomy in the German-speaking countries) and Professor Kyung Tae from Seoul, Korea (Case #6). Their unselfish expertise and generous help is truly appreciated.

2.1. Indications for the remote access procedure

Patient characteristics and diagnoses are listed in Table 1. All cases had benign disease. Altogether, there were six hemithyroidectomies and four total thyroidectomies; four men and six women, aged between 26 and 56 years. Body mass index (BMI) was below 30 in all cases. Largest thyroid lobe (gland) size was 7 cm cranio-caudally and largest nodule size was 4 cm.

Table 1
Patient characteristics.

Patient#	Hemi/ Total	Age (years)	Gender	Body Mass Index (BMI)	Indication
1	Hemi	48	male	22.96	Uninodular goitre
2	Hemi	46	female	27.60	Goitre with follicular cells/adenoma
3	Total	56	female	18.47	Multinodular goitre
4	Hemi	45	female	29.05	Uninodular goitre
5	Hemi	45	male	24.31	Binodular goitre
6	Total	42	female	22.84	Goitre with bilat. follicular cells/adenoma
7	Hemi	42	male	20.68	Binodular goitre
8	Hemi	32	female	18.31	Uninodular goitre
9	Total	30	female	25.95	Graves' disease
10	Total	26	male	23.55	Multinodular goitre

The indication for a remote access (extracervical) procedure was in most cases primarily of cosmetic nature, except for two male patients, who found that revealing the fact that they underwent neck surgery simply by the existence of a cervical, visible scar might be of disadvantage when doing business. Both of them were highly ranked corporate executives playing golf and tennis with potential business partners on a regular basis or taking part in casual dinners without wearing a tie.

2.2. Surgical technique

The patients were intubated with a NIMS endotracheal tube (Medtronic Xomed, Jacksonville, FL, USA) to allow intraoperative monitoring and stimulation of the recurrent laryngeal nerve and the external branch of the superior laryngeal nerve. A shoulder roll was placed to extend the neck and the ipsilateral arm was positioned cephalad with the elbow in a 90-degree angle, letting the forearm rest on a soft padded arm-holder above the forehead. The blood supply of the arm in its extended position was being monitored using a second oxygen saturation sensor on the thumb.

The 5–6 cm axillary skin incision was marked preoperatively in a standing position of the awake patient, ensuring that it stays completely hidden behind the leading edge of the major pectoral muscle also postoperatively. The working space was created and maintained as previously described by other authors [3,16], the only difference being that we use the Modena retractor system (Ceatec, Wurmlingen, Germany) instead of the Chung or Kuppersmith retractors.

All robotic arms were docked through a single axillary incision, except the first two cases, where an additional 8 mm parasternal trocar-incision was placed in order to accommodate the third instrument arm. From the third case on, we have abandoned this additional incision because it did not provide any significant advantage in our experience. In the camera arm, a downward facing 30-degree stereo endoscope was loaded, and in the instrument arms, a 5 mm Harmonic Curved Shears, a 5 mm Maryland dissector and an 8 mm ProGrasp forceps were loaded in arm 1, arm 2 and arm 3, respectively, as described initially by Kang et al. [20] and Holsinger et al. [16].

We have replaced the 8 mm ProGrasp with an 8 mm Fenestrated bipolar forceps from the 8th case on, because we found its bipolar capability to be very valuable when dealing with small capsular bleedings, especially when operating on a patient with Graves' disease [21]. While larger vessels were sealed safely with the Harmonic scalpel, all minor capsular surface bleedings could be immediately stopped using the 8 mm Fenestrated bipolar forceps at a power of just 15 Watts. A low power setting and meticulous bipolar technique is required to avoid thermal injury to the nerve structures in the thyroid bed as well as to fully preserve the original blood supply of the parathyroid glands.

3. Theory

Ultimately, our goal is to incorporate transaxillary robotic thyroidectomy into routine thyroid practice and to increase the rate of robotically performed thyroid surgery up to 20% of all thyroidectomies, from its current proportion of 10% in our department. In order to do so, it will be essential to reduce the operating times close to those of conventional open access thyroidectomies. According to the highest volume European center in Modena, Italy, this is reliably possible after 60–80 cases (personal communication by BBL with Micaela Piccoli, Modena).