

Modification of two-incision trans-axillary robotic thyroidectomy

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Abstract The objective of this study is to describe the modification of port placement for the four-arm technique of robotic thyroidectomy to avoid a chest incision and eliminate crowding of the working space provided by the trans-axillary incision. The study methodology involved description of port placement modification to avoid chest incision and report of two cases with appropriate literature review is presented. Trans-axillary robotic thyroidectomy (TART) is often performed with a second chest incision, but the move toward single incision operation and placement of four arms via a single incision require expertise. We describe two patients who underwent TART using a trans-axillary incision and a separate 1 cm incision in the anterior axilla 2.5-cm below the trans-axillary incision for placement of the fourth arm. This design allowed for a more ergonomic placement of the fourth arm while not compromising the working space provided by the trans-axillary incision. Additionally this port was used for surgical drain placement Robot-assisted trans-axillary thyroidectomy poses several challenges in the early surgical learning curve. One roadblock to exposure and efficiency is appropriate port and arm placement. Our modification offers an alternative where a four-arm technique is made possible without a chest port and not occupying the

working space provided by the trans-axillary incision. Use of this inferior axillary port is cosmetically acceptable, surgically efficient, and allows avoidance of a visible chest incision for placement of the fourth arm.

Keywords Trans-axillary robotic thyroidectomy · Single incision surgery · Axillary incision · Thyroidectomy · Four-arm technique

Introduction

Trans-axillary robotic thyroidectomy (TART) has become increasingly popular in the United States. TART was developed as patients increasingly desired to avoid visible scarring. TART allows avoidance of a neck incision and moves the incision to the less visible axilla.

When originally described by the South Korean group [1], TART was performed using an axillary incision as well as a smaller anterior chest wall incision [1, 2]. This second anterior chest wall incision was used for the placement of a fourth surgical instrument. This technique, however, left a visible scar on the chest. Thus, further modifications of robotic thyroidectomy were developed using a single incision in the axilla. While single incision TART has been successful with published reports from the United States and abroad using this technique, some authors have noted difficulties adapting this technique in patients with greater than average body mass index (BMI) [3–5]. Our preliminary experience with TART suggests that transitioning four arm surgery with a chest port placement to a single incision TART can be challenging. It may not be possible to use all four robotic arms via a single incision in some cases due to higher BMI, other anatomic factors or purely inadequate experience with the single incision technique. It

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Fig. 1 A second incision is made in the axilla 4–5 cm inferior to the primary incision. A port and fourth arm is inserted through this incision

is this scenario that led the authors to describe the modification of the placement of the fourth arm.

Our modification of using a second axillary incision allows for a four-arm technique for robotic thyroidectomy yet avoiding a chest incision and also eliminating crowding of the working space provided by the trans-axillary incision. We describe two cases using this modification and present a relevant literature review.

Materials and methods

Surgical technique

The patient is positioned as previously described for TART. The authors used a Nerve Integrity Monitor (NIM) endotracheal tube (Medtronic, Minneapolis, MN) for both cases.

A 6 cm axillary incision was utilized for access to the neck space. The surgical space over the pectoralis major muscle is widely elevated to create a working space for placement of the external retractor. The axillary incision is used for placement of three arms (camera arm and two instrument arms). A separate 1 cm incision is made 4–5 cm below the axillary incision and posterior to the anterior axillary line for placement of the fourth arm.

The da Vinci robot (Intuitive Surgical, Inc., Sunnyvale, CA) is then brought in and docked in the standard fashion. Three arms (30° camera arm and two surgical instruments; usually the Harmonic scalpel and Maryland forceps) can be introduced through the 6 cm incision. A fourth arm, containing the Prograsp instrument to provide counter traction during thyroidectomy (Intuitive Surgical, Inc., Sunnyvale,

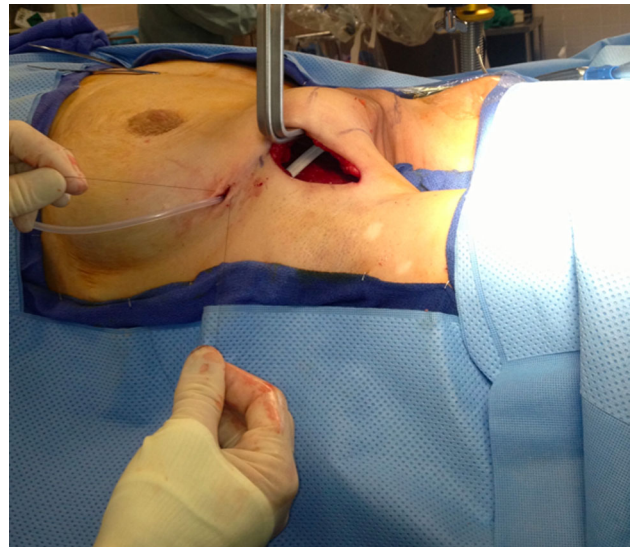


Fig. 2 After completion of the procedure, a suction drain is left in place in the wound bed and the previously created second incision is utilized as the exit site

CA) is inserted through the second inferior axillary incision (Fig. 1).

After thyroidectomy is completed, the suction drain was placed through the 1 cm, inferior axillary incision (Fig. 2).

Data collection

A retrospective chart review was conducted after receiving Institutional Review Board approval. All robotic trans-axillary thyroid cases were reviewed. The first TART procedure at our institution was performed in October 2011; cases were reviewed from that date to 30 June 2013. Review of the charts identified the two cases utilizing our modification technique. Patient demographics, operative details, outcomes and complications are discussed.

Results

Two patients underwent TART using a 6-cm trans-axillary incision and a separate inferior axillary incision. Both patients were women and the first was 54 years old with a BMI of 30.8. She underwent thyroid lobectomy. The lobe was $4.4 \times 2.2 \times 1.9$ cm and pathologic analysis showed a follicular adenoma. There were no surgical complications. The second patient was 35 years old and had a BMI of 31.8, who also underwent thyroid lobectomy. The thyroid lobe measured $5.7 \times 3.5 \times 2.2$ cm. The pathology showed benign multinodular goiter. The second patient had temporary ipsilateral vocal cord paresis that was noted in the recovery room, which resolved by the first postoperative visit.

Discussion

In a surgical technique designed to minimize scarring, it is undesirable to use a chest incision as an additional port if this can be avoided. The modification presented here provides an additional port but in a less visible location. The incision provides a site for surgical drain placement that improves the overall efficiency of the procedure.

Several studies with large patient numbers have described the ability to perform trans-axillary thyroidectomy safely through a single, axillary incision. The initial studies and the largest series have been performed in South Korea [1, 2]. North American groups have also reported on the feasibility of a single-incision approach [3–5]. Koppersmith et al. [3] safely performed single-incision trans-axillary robotic thyroidectomy in 16 cases and Landry et al. published a series of 12 cases utilizing a single axillary incision.

On the other hand, some authors have described difficulties with this technique in patients with a larger body habitus. Lin et al. [4] reviewed 18 thyroid lobectomies in 16 patients and encountered difficulty in inserting all instruments through the single incision in 5 cases. A chest incision had to be added in one case and in the other four cases, fewer robotic arms were used, limiting the number of surgical instruments in the field. Lin et al. [4] noted that the mean BMI of patients in his study (28.7) was higher than those of reported by Koppersmith et al. [3] (24.7) and Landry et al. [5] (25.2).

When looking at any new technique, safety is the first priority. The South Korean group has found no difference or lower complication rates in their single incision cohort compared to the two-incision cohort [2]. This, however, reflects the results of highly experienced surgeons who were proficient in the two-incision technique prior to moving toward single incision surgery. There is a learning curve to trans-axillary robotic thyroidectomy. From our preliminary experience, we learned that several factors can affect successful transition from a two-incision technique to single incision TART including patient anatomy, higher BMI, inadequate experience with a single incision technique, and younger teams with relatively early experiences with TART.

Both in a surgeon's early experience and even for more experienced centers, there may be a need to perform a two-incision TART or to convert to a two-incision technique. The suggested modification allows optimization of surgical

exposure, maximal instrumentation, while avoiding a chest wall incision. The authors also hypothesize that for TART surgeons who want to transition to a single axillary incision; this modification may serve as a step closer to understanding the dynamics involved in optimizing surgical docking and arm placement for single incision TART.

Conclusions

TART can be done through a single axillary incision. However, in some cases, a second incision is helpful or may be necessary for placement of the fourth robotic arm. This second incision can be placed in the axillary space and subsequently used as the exit point for a drainage tube. Use of this inferior axillary port is surgically efficient, permits maximal surgical exposure and instrumentation and allows avoidance of a visible chest incision for placement of the fourth arm.

Conflict of interest Meghan N Wilson, Daniel Noel, Michael Di-Leo, and Rohan R Walvekar declare that they have no conflicts of interest.

Ethical standard All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000 (5). Informed consent was obtained from all patients for being included in the study.

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