A chest tube after robotic thymectomy is unnecessary

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ABSTRACT

Objective: Chest tubes are frequently placed after thymectomy, without data to support this common practice. We report our experience in eliminating them after robotic thymectomy.

Methods: This is a retrospective database review of patients who underwent robotic thymectomy performed by a single surgeon in which intraoperative chest tube insertion was not planned. Patient characteristics and postoperative outcomes are presented.

Results: Between January 2018 and October 2022, 75 patients underwent robotic thymectomy performed by a single surgeon. Of those, 64 (85.3%) underwent a left-sided thoracic approach. The most common indication for resection was a suspicious anterior mediastinal mass. There were no conversions to an open operation. The median operative time was 72 minutes (range, 38-164 minutes), and the median estimated blood loss was 20 cc (range, 10-60 cc). Ten patients (13.3%) went home on the day of surgery, and all others (86.7%) were discharged on postoperative day 1. A chest tube was placed in 1 patient at time of closure because of a persistent air leak after extensive adhesiolysis from a prior thoracotomy; the tube was removed on the day of surgery after resolution of the air leak. No other patient required chest tube placement intraoperatively, immediately postoperatively, or within 60 days postoperation. Two patients underwent outpatient thoracentesis within 1 month postoperation for effusions. There were no 30- or 90-day mortality and no major morbidities.

Conclusions: A chest tube after robotic thymectomy is not necessary in almost all patients and can be safely omitted. The dogmatic routine practice of chest tube placement should be questioned. (JTCVS Open 2023;16:1004-7)

Well-healed incisions after robotic thymectomy without a chest tube.

CENTRAL MESSAGE

Chest tube placement after thymectomy is a common practice, yet there are little data on it. This study shows that omitting a chest tube after minimally invasive thymectomy is safe.

PERSPECTIVE

Chest tubes are associated with postoperative morbidity for patients and increased work for the surgical team. The value of placing a chest tube after minimally invasive thymectomy is unproven and is based on the surgeon's practice and mindset without scientific evidence. We present our experience with omitting chest tubes after robotic thymectomy.

Routine chest tube placement after thoracoscopic, robotic, or open thymectomy remains a common practice without scientific evidence to support it. Chest tubes slow in-hospital recovery, add pain, decrease mobility, worsen respiratory capacity, and often add chest X-rays (CXRs) and additional work for the surgical team.[1] Few studies have reported on the omission of chest tubes after thoracoscopic thymectomy, and those that do have included only immediate postoperative data. In this retrospective series from one surgeon, we report on the safety and feasibility of foregoing chest tube placement after robotic thymectomy.

METHODS

All patients who underwent thymectomy performed by a single surgeon (R.J.C.) from January 2018 to October 2022 were included in this study. Patient consent was waived by the Institutional Review Board at NYU Langone Health (Study i23-00668; approved June 6, 2023) for this retrospective quality improvement study. Our study design was to avoid patients leaving the operating room with a chest tube, unless tube placement was indicated based on an air leak that could not be sealed prior to closure

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Read at the 49th Annual Meeting of the Western Thoracic Surgical Association, Coeur d'Alene, Idaho, June 21-24, 2023.

Received for publication July 18, 2023; revisions received Sept 26, 2023; accepted for publication Sept 28, 2023; available ahead of print Nov 9, 2023.

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2666-2736

https://doi.org/10.1016/j.xjon.2023.09.041

Abbreviations and Acronyms
CXR = chest X-ray
NYU = New York University
PACU = postanesthesia care unit

and/or bleeding that could not be controlled. Primary study endpoints were postoperative chest tube placement, thoracentesis within 60 days postoperatively, major and minor morbidities, and 30- and 90-day mortality.

Descriptive statistics are reported as median (range) for continuous data and as number (percentage) for categorical data. Statistical analyses were performed with SPSS version 24.0 (IBM).

Surgical Technique

Our preoperative evaluation and operative technique have been described previously.[2,3] We do not routinely perform chest magnetic resonance imaging on all patients planned for thymectomy; however, many patients in this study did undergo preoperative imaging. In general, a double-lumen endotracheal tube is inserted, and three 8-mm robotic ports and an assist port are positioned. We have transitioned our patient positioning from a modified supine positioning with a towel under the patient's shoulder to a full lateral decubitus position. We also now prefer a left thoracic approach for patients with myasthenia gravis, to allow complete removal of the ectopic thymic tissue commonly present under the left innominate vein. However, a right thoracic approach is used for patients with right-sided dominant thymic lesions ≥6 cm without myasthenia gravis. A complete thymectomy was performed in all patients in this series.

After completion of the operation but before the specimen(s) is bagged and removed, we ensure the absence of lung injuries, air leaks, chyle leaks, and bleeding. In cases of suspected lung injury, the area in question is submerged under water, the CO_2 insufflation is turned off, and the lung is expanded. If a leak is present, we oversew it with a 4-0 nonabsorbable suture and/or place a lung sealant. If there is bleeding or a chyle leak, we ensure hemostasis using clips and other agents as needed.

At the conclusion of the operation, we place a suction tip that is not yet attached to suction through one incision and position it into the apex of the operated chest. Although both pleural spaces are entered routinely, we place the suction tip in the apex of the operated side. We watch both lungs completely inflate to ensure the absence of atelectasis. We then remove the camera and ask the anesthesiologist to measure the amount of air being delivered and the amount exhaled using a digital ventilator. A difference >50 mL ensures that we have not missed an air leak.

Once the absence of air leak is verified, we close all the other incisions. We then place suction on the suction tip remaining in the chest apex and the anesthesiologist provides a large breath hold. We slowly remove the suction tip while on suction to evacuate all the pleural air and then quickly close the deep layer of that incision.

Postoperative Care

All patients have a CXR performed in the postanesthesia care unit (PACU) to rule out pneumothorax or effusion. No further CXRs are obtained unless clinically indicated by increasing hypoxia on pulse oximetry, increasing subcutaneous emphysema, new or enlarging symptomatic pneumothorax, and/or clinical instability. A chest tube is inserted in any patient with increasing subcutaneous emphysema or new/enlarging symptomatic pneumothorax. After postoperative recovery, patients are transferred to a regular room until discharge the next morning, planned for 8 AM.

Our typical oral regimen for pain control consists of oral acetaminophen 1000 mg every 8 hours, oral gabapentin 100 to 300 mg every 8 hours, and oral ibuprofen 400 mg every 6 hours, with doses varying in selected patients. We add oxycodone as needed for breakthrough pain. Patients are not given intravenous pain medications after surgery, with the goal of controlling their pain on oral medications overnight before being discharged the following morning.

Follow-up Protocol

Once discharged to home, patients or their designated family member/caregiver are instructed to text the surgeon daily for 3 days and report the reading on their home pulse oximeter, as well as their general health and pain levels. Many of our patients travel from other states, across the country, and even from other countries. Those who are not local are still discharged on the morning of postoperative day 1, with instructions to text the surgeon as described above. If a patient or caregiver reports a concerning sign or symptom, we provide a video chat to address their concerns in a timely fashion. Patients who experience decreasing oxygen saturation, increasing subcutaneous emphysema, and/or increasing shortness of breath undergo a repeat CXR and/or chest ultrasound. We do not order or perform routine follow-up CXR or ultrasound in all patients or in asymptomatic patients. Indication for thoracentesis was a pleural effusion of ≥500 mL in a symptomatic patient or increasing pneumothorax. However, once home and under the care of their own home physician, a wide variety of tests and protocols can be performed, and the indication for thoracentesis is not standardized.

RESULTS

Between January 2018 and October 2022, 77 patients underwent thymectomy performed by a single surgeon at our institution. Two patients had known preoperative invasion of the vena cava, mammary artery, and/or part of the sternum. Although we started robotically to mobilize these large invasive masses and to rule out metastatic disease, both of these patients ultimately underwent sternotomy with cardiopulmonary bypass or caval shunting and were not included in this study. The remaining 75 patients underwent robotic thymectomy.

Patient demographics and characteristics are shown in Table 1. Sixty-four of the 75 patients (85.3%) underwent a left-sided thoracic approach, and 11 (14.7%) underwent a right-sided thoracic approach (Table 2). Twenty-two patients (29.3%) had myasthenia gravis. The median tumor size on preoperative cross-sectional imaging was 2.5 cm (range, 1.1-10 cm). There were no conversions to an open operation, and the median operative time was 72 minutes (range, 38-164 minutes). The median estimated blood loss was 20 mL (range, 10-60 mL). Ten patients (13.3%) went home on the day of surgery, and 65 patients (86.7%) were discharged on postoperative day 1. One unplanned chest tube was placed in the operating room at time of closure secondary to extensive adhesiolysis from a prior thoracotomy and a persistent air leak after underwater testing and lung inflation. The chest tube was removed on the day of surgery after confirming air leak resolution, as indicated by the digital drainage system. No patient required intensive care unit admission after surgery.

Follow-up Postdischarge Data

The 60-day follow-up data showed that no patient required readmission or chest tube placement. One patient

TABLE 1. Patient demographics and tumor pathology

Parameter	Value
Age, y, median, (range)	67 (20-80)
Sex, n (%)	
Female	39 (52)
Male	36 (48)
Body mass index, kg/m^2, median (range)	24.9 (16.4-45.8)
Myasthenia gravis, n (%)	22 (29.3)
Tumor size, cm, median (range)	2.5 (1.1-11)
Postoperative pathology, n (%)	
Thymic hyperplasia	35 (46.6)
Thymic cyst	20 (26.6)
Thymoma	15 (20)
Others	5 (6.6)
Previous ipsilateral thoracic surgery, n (%)	11 (10.2)

reported shortness of breath to the surgeon postoperatively. This patient lived locally and was instructed to come to our emergency department for evaluation. This patient was monitored under observation status. Two patients who did not live close to our institution underwent outpatient thoracentesis at outside institutions during home follow-up. The indication for the procedure was effusion on home CXR; however, both patients were asymptomatic, and neither reported any concerning symptoms to the surgeon. There was no 30- or 90-day mortality and no major morbidity.

DISCUSSION

The safety and feasibility of robotic thymectomy has been established.[4] In one meta-analysis comparing thoracoscopic and robotic-assisted thymectomy, the estimated blood loss, postoperative length of stay, and chest tube drainage volume and duration were all lower in the robotic-assisted approach.[5] To further improve our patients' experience and decrease their pain, and also to reduce our team's workload and potentially the cost of the operation, we decided to challenge the dogma that a chest tube is needed after routine robotic thymectomy.

TABLE 2. Operative details and postoperative outcomes

Parameter	Value
Total robotic cases, n	75
Left robotic thymectomy, n (%)	64 (85.3)
Right robotic thymectomy, n (%)	11 (14.7)
Estimated blood loss, mL, median (range)	20 (10-60)
Operative time, min, median (range)	72 (38-164)
Chest tube inserted in the operating room, n (%)	1 (1.3)
Home with chest tube, n	0
Postoperative hospital length of stay, n (%)	
Discharge on same day	10 (13.3)
Discharge on postoperative day 1	65 (86.7)
Ipsilateral effusion requiring chest tube insertion within 30 or 90 d, n	0
Thoracentesis within 30 or 90 d, n (%)	2 (2.7)
30- or 90- d readmission, n (%)	1 (1.3)
30-d mortality, n	0
90-d mortality, n	0

Chest tubes have been shown to increase postoperative pain, decrease respiratory capacity, increase the risk of infectious complications, and increase hospital length of stay.[1] Several studies have shown the safety of omitting chest tubes after thoracoscopic lung biopsy or wedge resections,[6-8] and other retrospective studies have evaluated the safety and feasibility of omitting chest tubes after minimally invasive thymectomy.[9] Xu and colleagues[10] reported a retrospective case series of 20 patients who underwent thoracoscopic thymectomy without chest tube placement, in which no patients experienced postoperative complications and no patients required a postoperative drainage procedure. Li and colleagues[11] reported a comparative retrospective study of 205 patients who underwent subxiphoid thoracoscopic thymectomy, in which chest tubes were placed in 115 patients and omitted in 90 patients. Significantly lower pain scores were observed in the patients who did not receive a chest tube. The need for drainage with thoracentesis was not greater in the group without chest tubes, suggesting that a tube did not seem to reduce the need for a postoperative drainage procedure.

The foregoing studies, although compelling, reported only on immediate postoperative data. One major concern that many surgeons have is that if a tube is not used for some time postoperatively, the patient will be more likely to have a large postoperative effusion leading to shortness of breath and/or requiring drainage. In our retrospective series, we included 30- and 60-day follow-up that largely corroborate the findings in the existing literature. Only 2 patients (2.6%) in our series required delayed thoracentesis for pleural effusion within 60 days after surgery. Both of these interventions were performed at home, with unclear indications for the need for drainage besides a CXR that showed "a significant effusion." Neither patient required readmission. Although we do not have a comparison or control group in this study, we believe that this incidence is low.

In our study, we did not attempt to quantify the size or extent of a pneumothorax postoperatively. We have attempted to do so in the past[12] but found it arduous, inaccurate, and clinically meaningless. Unless the patient is symptomatic, the size of a pneumothorax seems to be irrelevant. In our experience, even a very large, worrisome pneumothorax that leads to significant angst and calls from the radiologist, surgical team, and nurses can be safely observed if the patient is in a hospital setting, asymptomatic, monitored for subcutaneous emphysema, and has stable vital signs. We send many patients home with a pneumothorax after overnight observation and with stable repeat CXR in the morning.

Our study has several limitations. First is the retrospective design, making it subject to all the limitations of that type of study. Second, it was limited to a single surgeon, who has performed more than 250 robotic thymectomies. Third, we did not have a control group. Fourth, we had only 60 days of follow-up data for the development of effusion drainage data. Fifth, we did not perform routine follow-up CXR or ultrasound in all patients but did so in any patient who was hypoxic, had decreasing pulse oximetry values, or complained of significant shortness of breath.

We believe that our process as described here is applicable to robotic thymectomies for both malignant and benign lesions. We perform the same operation, complete thymectomy, for all patients regardless of pathology, comorbidities, or previous surgeries. For these reasons, our approach can be easily adapted by other surgeons with minor modifications if necessary. For example, we have described our technique for eliminating pleural air at the conclusion of the operation, but if a digital ventilator is not available, the surgeon may choose to skip this step or rule out an air leak by other means.

One strength of this study is its consecutive series of patients rather than a selected series. Also, our goal in the study was only to show safety, not to demonstrate the superiority of one technique over another. And finally, several of our partners, including the surgeon's junior and less experienced partners, are now omitting chest tubes after their robotic thymectomies as well and finding that the practice is safe.

CONCLUSIONS

In conclusion, it is safe to omit chest tube placement after a routine robotic thymectomy in most patients. Patients do not seem to develop symptomatic effusions, and omission was not associated with any significant adverse events. We believe that chest tube omission has the potential advantage of minimizing postoperative pain and enhancing recovery while reducing cost and work for the postoperative care team.

Conflict of Interest Statement

The authors reported no conflicts of interest.

The *Journal* policy requires editors and reviewers to disclose conflicts of interest and to decline handling or reviewing manuscripts for which they may have a conflict of interest. The editors and reviewers of this article have no conflicts of interest.

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Key Words: robotic thymectomy, chest tube