

Non-Intubated Uniportal Subxiphoid Thoracoscopic Extended Thymectomy for Thymoma Associated with Myasthenia Gravis

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Research Article

Keywords: Non-intubated, uniport, subxiphoid, thymectomy, myasthenia gravis

Posted Date: February 25th, 2021

DOI: <https://doi.org/10.21203/rs.3.rs-253454/v1>

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Abstract

Background: To describe a technique of non-intubated uniportal subxiphoid thoracoscopic extended thymectomy.

Methods: Data were collected retrospectively. A single 3-cm transverse incision was made below the xiphoid process. This method for extended thymectomy entails adoption of uniportal subxiphoid VATS combined with use of non-intubated anaesthesia for thymoma associated with myasthenia gravis.

Results: 10 consecutive patients underwent this procedure successfully. Mean operative time was 102.5 minutes. Conversion to intubated ventilation or thoracotomy was not required.

Mean chest tube duration was 3.5 days. Mean postoperative hospital stay was 4.7 days. Histologic examination showed early-stage thymomas. Complications were rare. Quantitative MG scores decreased during follow-up.

Conclusions: Patients were uneventfully discharged with fast recovery. This technique may merge the potential benefits of a subxiphoid incision and the non-intubated anesthesia protocol.

Introduction

The traditional method for surgical treatment of thymoma with myasthenia gravis(MG) is extended thymectomy through median sternotomy⁽¹⁾. Uniportal subxiphoid thoracoscopic approach is an ideal way with less intercostal neuralgia, faster recovery, and lower cost, it also has better operative views of anterior mediastinum space, including the bilateral phrenic nerves and great vessels in the upper area⁽²⁾. Non-intubated anaesthesia might prevent injury of the laryngopharynx and trachea caused by intubation and extubation, it might be beneficial by reducing postoperative myasthenic crisis as well⁽³⁾.

We describe a novel technique of non-intubated uniportal subxiphoid thoracoscopic extended thymectomy.

Patients And Methods

The application of this new technique was approved by the institutional review board at Nanjing Chest Hospital, all patients provided written informed consent before operation.

Patients considered appropriate for this technique met the following criteria: age 18–65, preoperative diagnosis of thymoma with Myasthenia Gravis Foundation of America(MGFA) class I-II, American Society of Anaesthesiologists(ASA) grade of I-II, Masaoka stage I-II with maximal diameter < 5cm. Patients with a bleeding disorder, overweight(BMI > 28), pulmonary insufficiency, history of chest surgery and potential difficult airway for intubation were not considered suitable.

Patient was kept in lithotomy position. The anaesthesia protocol was previously reported⁽²⁾. In brief, after intravenous infusion of dexmedetomidine 1ug/kg by pump injection (completed within 15min), anesthesia was induced with intravenous dexamethasone 10.00mg, midazolam 0.10 mg/kg and sufentanil 0.1–0.2 µg/kg, with the target-controlled infusion (TCI) of propofol (target plasma concentration of 2–3µg/ml). To keep oxygen saturation above 95%, pre-lubricated laryngeal mask was inserted for spontaneous ventilation with 100% inspired oxygen (4–5 L/min). Skin infiltration was performed at operation site with 0.375% ropivacaine and 1.00% lidocaine. Maintenance of anesthesia was done with TCI of propofol (target plasma concentration of 1–2µg/ml), dexmedetomidine(0.5-1µg/kg/h) and remifentanyl(0.1 ~ 0.5ug/kg/h). We used train-of-four (TOF) monitoring during surgery and ensured full recovery prior to terminating the anesthetics. BIS monitoring was maintained at 40–60 during the operation.

A single 3-cm transverse incision was made below the xiphoid process. The retrosternal space was opened by blind blunt dissection. Plastic wound protector was used. A gradual and natural collapse of the lung occurred after opening pleural cavity.

During operation, a 10-mm 30-degree thoracoscope and several thoracoscopic instruments could be simultaneously fitted into the uni-port. A sternum retractor would be placed at the incision site to raise the sternum about 2cm and facilitate surgical maneuvers(Fig. 1).

Both side of mediastinal pleura should be opened till internal thoracic vessels. When lower edge of the thymus and the connecting pericardial fat was visualized, a thymectomy was started at the level of the diaphragm and proceeded gradually in an upward direction. Phrenic nerve should be identified and carefully protected. Thymic veins were ligated using ultrasonic scalpel, electric cautery or an appropriately sized clip, then the upper horns of the thymus was isolated. Dissection was continued above the innominate vein to fossa suprasternalis, radical removal of the tumor and the entire thymus gland, including perithymic fatty tissue between both phrenic nerves, from cardiophrenic angles inferiorly to the lower cervical region superiorly was accomplished to achieve an extended thymectomy(Fig. 2). Lymph nodes in anterior mediastinum was sampled. Specimen was placed into a bag and removed through the incision protector.

At the end of the operation, A single-lumen central venous catheter (7Fr, 20cm) was inserted in each side of thoracic cavity at the end of the operation. All patients were transferred to the post anaesthesia care unit for recovery.

Results

10 consecutive patients underwent this procedure successfully. The clinical features were listed in Table 1. Mean operative time was 102.5 minutes. The detectable mean lowest SpO₂ and EtCO₂ during operation was acceptable. Conversion to intubated ventilation or thoracotomy was not required.

Table 1
Peri-operative data of patients

	Patient 1	Patient 2	Patient 3	Patient 4	Patient 5	Patient 6	Patient 7	Patient 8	Patient 9	Patient 10
Sex	Male	Male	Female	Male	Female	Female	Male	Female	Female	Male
Age	41	55	39	51	53	36	58	43	36	45
FEV1(L)	2.94	3.11	2.52	2.77	2.98	2.85	3.38	2.46	3.02	3.46
Smoking status	Cessation	No	No	Cessation	No	No	Cessation	No	No	No
Body mass index (kg/m ²)	23.7	22.4	25.1	24.2	23.9	22.6	23.5	22.1	24.7	23.5
ASA score	1	1	1	1	1	1	1	1	1	1
Thoracic adhesion	No	No	No	Mild	No	No	No	No	No	No
Operation time (min)	95	105	115	125	90	95	100	85	110	105
Chest tube drainage(d)	3	3	5	4	3	4	3	4	3	3
Postoperative hospital stay (d)	4	5	7	5	4	5	4	5	4	4
Pain in postoperative day 1 (VAS)	2	3	1	2	2	2	2	1	1	2
Pain in postoperative day 3 (VAS)	2	3	1	2	1	1	2	1	1	1
Pain in postoperative day 7 (VAS)	1	1	1	1	1	1	1	1	1	1
Myasthenia gravis classification (before operation)	IIB	IIA	I	I	IIA	IIA	I	I	IIA	I
Preoperative QMG score	6	6	2	3	5	5	2	3	5	3
Preoperative duration of symptoms(mo)	9	3	2	1	2	6	2	3	2	12
Pathology type	AB	B1	A	B2	AB	B2	B1 + B2	B1	B1	AB
Masaoka Stage	I	IIA	I	IIA	I	IIA	IIA	I	IIA	I
Maximal diameter(mm)	29	22	19	45	33	23	35	28	30	26
Lymph node invasion	No									
Follow-up (mo)	21	19	17	16	13	12	10	9	9	8
Postoperative QMG score(6 months)	1	2	2	1	2	2	2	1	3	1

	Patient 1	Patient 2	Patient 3	Patient 4	Patient 5	Patient 6	Patient 7	Patient 8	Patient 9	Patient 10
Myasthenic crisis	No									
Myasthenia gravis status(after operation)	Improved									
Thymoma recurrence	No									

The postoperative course was uneventful. Mean chest tube duration was 3.5 days. Mean postoperative hospital stay was 4.7 days. Histologic examination showed early-stage thymomas. Complications were rare. Quantitative MG scores decreased during follow-up. Outcomes of the patients are detailed in Table 1.

Discussion

With a combination of uniportal subxiphoid access and non-intubated anesthesia, this method resulted in minimal invasiveness and good perioperative outcomes.

Postoperative myasthenia crisis after thymectomy is reported from 6–34%⁽³⁾. In patients with MG, avoiding using muscle relaxants and intubation may lead to relief of symptoms, reduction of complications and fast recovery.

Visualization of the entire anterior mediastinumspace up to the lower cervical area was highly satisfactory during operation^(4,5). Extended thymectomy with dissection of fat tissue could be achieved using this approach.

The oxygen saturation might be low with high peak EtCO₂ level. We use a laryngeal mask as a safety precaution for ventilatory management to maintain satisfactory oxygenation during spontaneous respiration, even after opening of both mediastinal pleura^(2,6).

The duration of postoperative hospital stay was relatively long. Patients in China usually do not have to pay high costs for prolonged hospitalization,they usually prefer to stay in the hospital for an additional 1 or 2 days after an operation despite having met the criteria for discharge.

Conclusions

Extended thymectomy through a single subxiphoid incision without intubation was feasible for thymoma with MG.

Abbreviations

VATS: Video-Assisted Thoracoscopic Surgery

MGFA: Myasthenia Gravis Foundation of America

ASA: American Society of Anaesthesiologists

TOF: train-of-four monitoring

Declarations

Ethics approval and consent to participate: This study for the application of non-intubated uniportal subxiphoid thoracoscopic extended thymectomy was approved by the institutional review board at Nanjing Chest Hospital(number of the ethics approval: 2018-KL-002-01), written informed consent about operative techniques and to the data-use agreement was obtained from all patients before surgery.

Consent for publication: Not Applicable.

Availability of data and material: The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests: The authors declare no conflict of interest.

Funding: Key projects of nanjing medical science and technology(ZKX17045), Jiangsu medical talents program(QNRC2016124), Natural Science Foundation of Jiangsu Province(BK20200156). (The funding organizations had no role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; preparation, review, or approval of the manuscript; and decision to submit the manuscript for publication.)

Authors' contributions: All authors have read and approved the manuscript.

JZ contributions to the acquisition, analysis, interpretation of data.

YS contributions to the conception of the work.

ZL contributions to the conception and design of the work, have drafted the work or substantively revised it.

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Acknowledgements: None

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Figures



Figure 1

A single transverse incision was made below the lower edge of the xiphoid.



Figure 2

Radical removal of the lesion and the entire thymus gland with fat tissue was accomplished.