

# Video-Assisted Thoracoscopic Thymectomy: A Single-Center Study

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## SUMMARY

As a part of the multimodal treatment of myasthenia gravis patients, thymectomy is an established method with positive effects in some patients. The traditional surgical approach, sternotomy, was modified over the years from total to partial sternotomy, but despite this offers a suboptimal aesthetic result with a scar in the décolletage region in mostly female patients. At the Jordanovac Department of Thoracic Surgery, a minimally invasive video-assisted method has been performed since 2016 in the treatment of patients with myasthenia gravis who, in collaboration with a neurologist, are estimated to be able to benefit from thymectomy.

We present the results of a new method at the Jordanovac Department of Thoracic Surgery in the multimodal treatment of patients with myasthenia gravis. In the first 4 years, we operated on 50 patients with extremely low perioperative complications, short hospitalization time, and low need for postoperative analgesic therapy.

In the first year, we operated on 14 patients. Access was generally right-sided through three or four thoracic ports. In case of suspected thymoma, access depended on tumor localization. In the second year, we operated on 8 patients, in the third 9, and in the fourth 19 patients. The thoracic drainage was removed on the 1<sup>st</sup> post-operative day in all patients. Hospitalization duration was 2–4 days.

Video assisted thymectomy is the standard in the treatment of patients with myasthenia gravis and patients with thymoma up to 5 cm in diameter. The outcomes significantly outperform those of a sternotomy and maintain equivalent oncological efficacy.

## KEYWORDS

VATS thymectomy; Myasthenia gravis; Minimally invasive surgery

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## Introduction

Myasthenia gravis (MG) mostly affects young women. Treatment includes medication and thymectomy at the optimal moment<sup>1</sup>. The role of thymectomy is well established and the first one was performed over a hundred years ago by Schumacher and Roth<sup>1</sup>.

The advantages of minimally invasive, video-assisted thoracic surgery (VATS) thymectomy are multiple and well established<sup>2,3</sup>. For the patient, this approach offers a faster recovery, a shorter hospital stay, improved postoperative pain control, and a superior aesthetic outcome. Importantly, in patients with MG, one of the most significant advantages of the minimally invasive approach compared to median sternotomy is related to perioperative management and anesthesia. VATS thymectomy is associated with reduced surgical trauma and less impairment of respiratory function, which is particularly beneficial in MG patients, who are highly sensitive to neuromuscular blockade and at an increased risk of postoperative respiratory complications and myasthenic crisis. There are also notable benefits for the healthcare system, including shorter hospitalization, a reduced need for postoperative analgesic therapy, a faster return to full physical activity, and consequently shorter overall sick leave<sup>2,3</sup>.

In this paper, we present our experience with VATS thymectomy as part of the multimodal treatment of MG in a total of 50 patients over a four-year period.

## Materials and methods

We retrospectively analyzed the data of 50 patients who underwent VATS thymectomy over a four-year period between March 2016 and August 2020. We included all patients treated with VATS for MG or thymoma. Procedures performed by sternotomy

for tumors larger than 5 cm were excluded from the study. Prior to surgery, all patients were treated in the Center for neuromuscular disorders of the Department of Neurology, University Hospital Centre Zagreb. The timing of the operation and corrections in drug therapy were previously discussed with a neurologist. All patients had a computed tomography scan or magnetic resonance of the thorax. We prepared for this operation at multiple international workshops and congresses. The equipment necessary for VATS thymectomy includes a video thoracoscope (Karl Storz, Tuttlingen, Germany), 30-degree optics (Karl Storz, Tuttlingen, Germany), and specially designed instruments for VATS operations (Karl Storz, Tuttlingen, Germany; Dufner, Tuttlingen, Germany; Scanlan, Saint Paul, Minnesota, USA). The patients were positioned in a semi-lateral position on the back with one arm extended over the side of the operation table and intubated with two lumen tubes for separate ventilation of the right and left



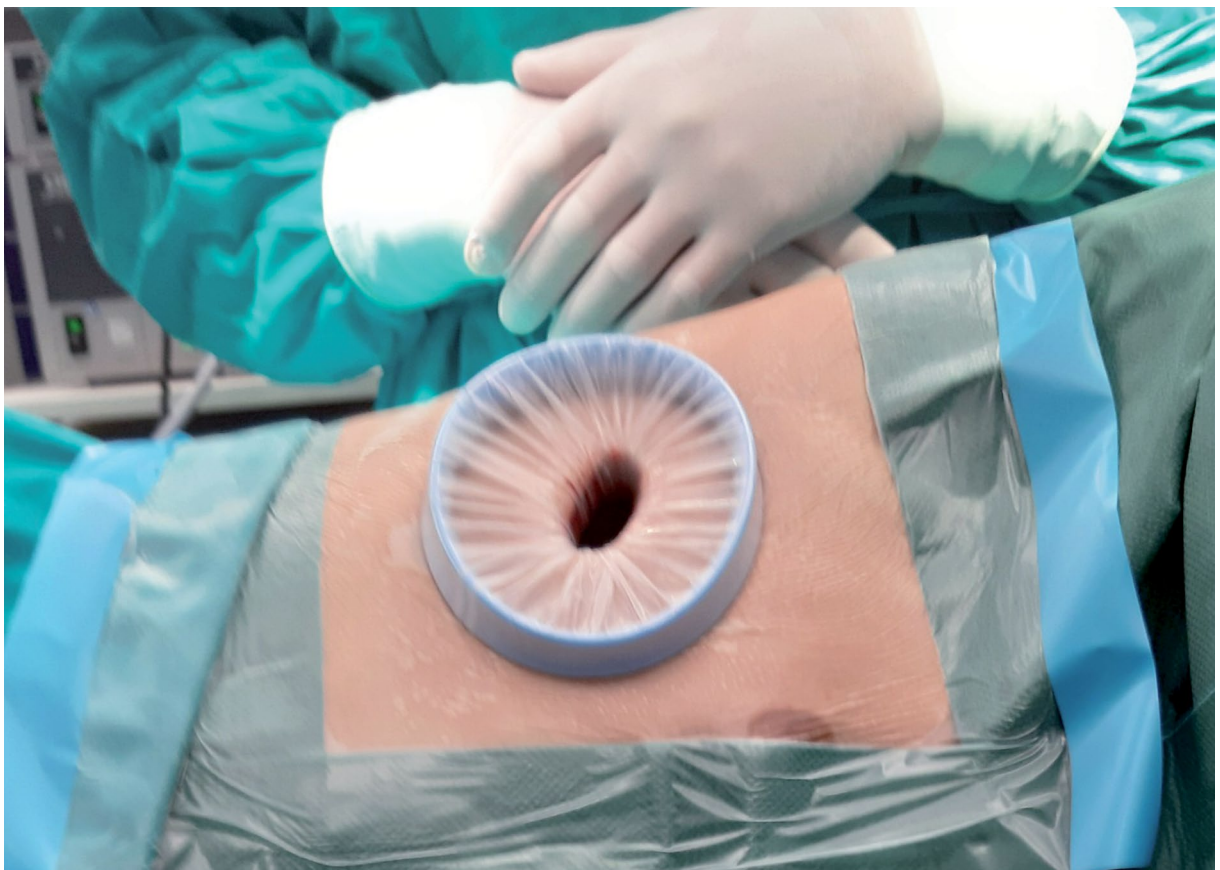
**FIGURE 1.** Three-portal approach in a patient in the semi-lateral position



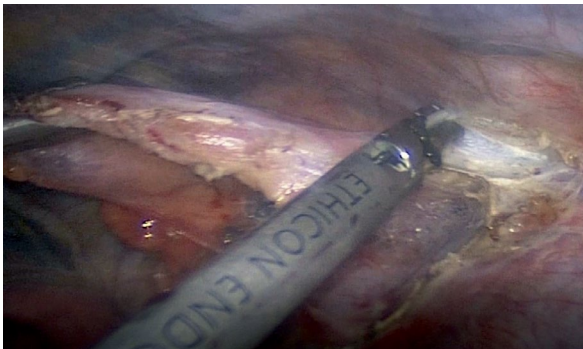
**FIGURE 2.** Uniportal approach with an incision up to 4 cm in length

lung. The approach was usually through three ports (Figure 1), with an optional fourth port for additional visualization in some cases. In cases of tumor presence, a uniportal technique was used (Figure 2 and Figure 3).

Glandular tissue was removed with an ultrasonic harmonic scalpel (Figure 4). The surgical technique includes incising the mediastinal pleura above the pericardium, under the internal mammary artery and in front of the phrenic nerve. Anatomical landmarks for the removal of the glandular and surrounding fat tissue are the mediastinal pleura of the contralateral side, the pericardium, the brachiocephalic vein and the cervical region above the brachiocephalic vein



**FIGURE 3.** Uniportal approach with an Alexis wound protector



**FIGURE 4.** Ultrasonic Harmonic® knife used for the preparation of glandular tissue

for the removal of the gland's cervical horns. The complete removal of glandular tissue is crucial for the positive effects of the operation on myasthenic symptoms.

## Results

We operated on 14 patients in the first year. The approach was mostly right-sided through three ports. In cases of diagnosed or suspected thymoma, the approach was selected according to the location of the tumor. In cases of tumor presence, a uniportal technique was used for easier specimen removal from the thoracic cavity. In the following years, we operated on 8, 9 and 19 patients annually. We had only one conversion to right thoracotomy for hemorrhage control in a patient with a large thymoma in the first year. All patients spent less than 24 hours in the intensive care unit. Thoracic drains were removed on the first postoperative day in all patients. Hospitalization duration was two to four days and most patients did not need analgesics after release. The aesthetic effects were very good with a high level of satisfaction. There were no issues with wound healing.

## Discussion

The treatment of MG includes medication and thymectomy at the optimal moment<sup>1</sup>. Since the first thymectomy, performed over a hundred years ago by Schumacher and Roth<sup>1</sup>, the technique has developed from total to partial sternotomy and the now widely accepted VATS thymectomy as the standard of surgical treatment<sup>2,3,5,6,7</sup>. The last and most promising method is robotic surgery, which is not widely used yet, mostly due to its price<sup>8</sup>.

There is no more controversy about the superiority of VATS thymectomy compared with the open approach<sup>2-7</sup>. VATS offers a faster recovery, better postoperative pain control, a shorter ICU stay, a shorter overall hospital stay and superior aesthetic effects<sup>2-7</sup>. Other advantages include a faster recovery and return to full physical activity, as well as a shorter sick leave<sup>2,3</sup>.

There is no consensus about the exact approach, but the right-sided triportal approach is mostly used<sup>2-5</sup>. However, some authors recommend the left approach for better visualization of the left phrenic nerve<sup>9,10</sup>. The final option is the uniportal approach<sup>11,12</sup>, which — in our experience — is most suitable for cases with thymoma, when the side of the operation is chosen depending on the size and location of the tumor.

Better visualization can be achieved with new equipment like 3D Vision, which can improve the outcome of minimally invasive thymus surgery<sup>13</sup>.

Therefore, thymectomy should be offered to MG patients whenever possible, since less than 7% of patients develop progressive disease after thymectomy<sup>14</sup>.

The role of minimally invasive surgery in thymic diseases is becoming increasingly important, since open techniques are being replaced by multiportal VATS, uniportal VATS, or robotic surgery that offer the same long-term oncological results with less operational trauma<sup>15</sup>.

The limitations of our study are the small number of cases and the lack of a control group, since we have not performed sternotomy in the above-mentioned cases since the beginning of the VATS program in March 2016.

Lately, there have been reports of non-intubated uniportal thoracoscopic thymectomies, where patients recovered faster and complications occurred less frequently<sup>16</sup>.

## Conclusion

VATS thymectomy is the standard in the multimodal treatment of patients with MG and patients with thymomas up to 5 cm in diameter. In our experience, this technique offers numerous advantages for the patient and healthcare system. Although sternotomy has its place in the treatment of large, locally advanced thymomas, there is no justification for sternotomy in the treatment of MG patients. The overall results of VATS thymectomy are superior to those of sternotomy, while the neurological and oncological effects are the same. ■

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## SAŽETAK

### Video asistirana torakoskopska timektomija: jednocentrična studija Željko Djaković i Vedran Cesarec

Timektomija kao dio multimodalnog liječenja mijastenije gravis dugi je niz godina etablirana metoda koja donosi pozitivne učinke u određenog broja pacijenata. Tradicionalni torakokirurški pristup za odstranjenje timusa bila je sternotomija. Taj se pristup kroz godine modificirao prema manje invazivnim postupcima iz totalne u parcijalnu sternotomiju, ali je to i dalje bio zahvat sa suboptimalnim estetskim rezultatima i ožiljkom u području dekoltea kod većinom mladih žena. Na Klinici za torakalnu kirurgiju Jordanovac od 2016. godine u liječenju pacijenata s mijastenijom gravis kod kojih se u suradnji s neurologom procijeni da bi mogli imati dobrobiti od timektomije, ista se izvodi minimalno invazivnom videoasistiranom metodom.

Prikazujemo rezultate nove torakokirurške metode na Klinici za torakalnu kirurgiju Jordanovac u multimodalnom liječenju pacijenata s mijastenijom gravis. U prve 4 godine operirali smo 50 pacijenata s iznimno niskim perioperacijskim komplikacijama, kratkim trajanjem hospitalizacije i malom potrebom za postoperacijskom analgetskom terapijom.

U prvoj smo godini operirali 14 pacijenata. Pristup je u pravilu bio s desne strane kroz tri ili četiri torakalna porta. U slučaju timoma ili sumnje na njega pristup je ovisio o lokalizaciji tumora.

U drugoj smo godini operirali osam pacijenata, u trećoj devet, a u četvrtoj 19. Torakalni dren svim je pacijentima odstranjen na prvi postoperacijski dan. Hospitalizacija je trajala dva do četiri dana.

Videoasistirana timektomija je standard u liječenju pacijenata s mijastenijom gravis i pacijenata s timomom do 5 cm u promjeru. Rezultati su značajno bolji nego kod sternotomije, a onkološki su jednako vrijedni.

#### KLJUČNE RIJEČI

VATS timektomija; Mijastenija gravis; Minimalno invazivna kirurgija