

# Minimally Invasive versus Open Thymectomy for Thymic Malignancies: Systematic Review and Meta-Analysis



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## ABSTRACT

Complete resection is the standard of care for treatment of thymic malignancies. The use of minimally invasive surgery remains controversial. We searched online databases and identified studies from 1995 to 2014 that compared minimally invasive to open thymectomy for thymic malignancies. Study end points included operative blood loss, operative time, respiratory complications, cardiac complications, length of hospital stay, R0 resection, and recurrence. We summarized outcomes across studies using random-effects meta-analysis to account for study heterogeneity. We calculated ORs for binary outcomes and standardized mean differences for continuous outcomes. We calculated incidence rate ratios for the number of recurrences, accounting for total person-time observed in each study. Of 516 potential reference studies, 30 with a total of 2038 patients met the inclusion criteria. Patients with Masaoka stage I or II thymic malignancy constituted 94.89% of those in the minimally invasive surgery (MIS) group and 78.62% of those in open thymectomy (open) group. Mean tumor size was 4.09 cm (MIS) versus 4.80 (open). Of the 1355 MIS cases, 32 were converted to open cases. Patients in the MIS group had significantly less blood loss; however, no significant differences in operating time, respiratory complications, cardiac complications, or overall complications were identified. Length of stay was shorter for patients in the MIS group. When patients with Masaoka stage I and II thymic malignancy only were analyzed, there was no difference in rate of R0 resection or overall recurrence rate. One postoperative death occurred in the open group. The results of this unadjusted meta-analysis of published reports comparing minimally invasive with open thymectomy suggest that in selected patients with thymic malignancy, minimally invasive thymectomy is safe and can achieve oncologic outcomes similar to those of open thymectomy.

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## Introduction

Thymic malignancies (thymomas and thymic carcinomas) are rare cancers whose etiologies and risk factors are not well understood.<sup>1-13</sup> Complete (R0) surgical resection is the standard of care for thymic malignancies, but the safest and most effective method of resection is controversial.<sup>7,9,13-26</sup> Minimally invasive surgery (MIS), including robotic-assisted thoracoscopic surgery (RATS) and video-assisted thoracoscopic surgery (VATS), is a newer alternative to open approaches such as median sternotomy and thoracotomy. Many surgeons are reluctant to adopt minimally invasive approaches because they are concerned that such techniques may be associated with increased manipulation of the tumor and a corresponding risk for capsular disruption, tumor seeding of the pleura, incomplete resection, and increased risk for local recurrence.

Current research suggests that minimally invasive thymectomy for early-stage thymic malignancies may be correlated with shorter length of hospital stay (LOS) and lower intraoperative blood loss than is open thymectomy.<sup>27-34</sup> The literature suggests that minimally invasive surgery may be as effective as or better than

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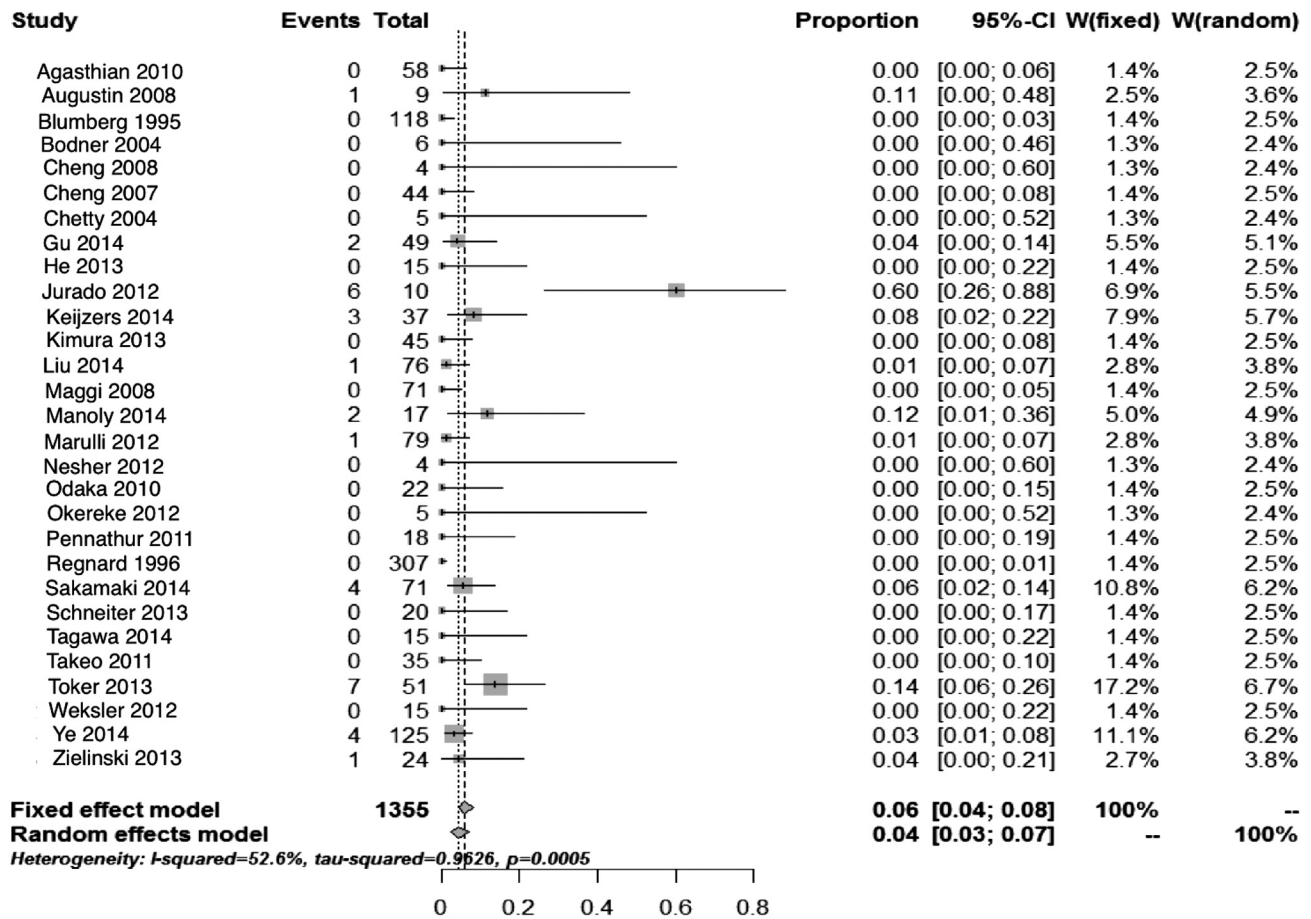


Figure 1. Minimally invasive versus open thymectomy, open conversion.

open thymectomy in treating small, early-stage thymic malignancies.<sup>25,26,32,33,35,36</sup> Studies have shown comparable survival data and oncologic outcomes between the two procedures<sup>30,37,38</sup>; however, such claims are limited by small sample size and lack of long-term follow-up comparisons between patients who have undergone MIS and those who have undergone open thymectomy. In addition, fewer studies focus on thymectomy performed for thymic malignancies as opposed to including thymectomy performed for myasthenia gravis.<sup>7,8,12,16,19,21,33,36,38-40</sup>

The purpose of this meta-analysis is to compare perioperative and long-term outcome variables between minimally invasive and open thymectomy for thymic malignancies by using the current body of literature to determine whether minimally invasive thymectomy is as safe and oncologically effective as open surgery.

## Materials and methods

### Search strategy

A thorough literature review of the following online databases was performed: PubMed, Science Direct, Oxford Journals, Springer, Sage Journals, and Ovid. References

and related PubMed citations for retrieved articles were also reviewed for potential inclusion in our meta-analysis. The search period lasted from May 2014 to September 2014, and we used appropriate free text terms, including *thymoma*, *thymectomy*, *minimally invasive thymoma*, *minimally invasive thymectomy*, and *minimally invasive thymic carcinoma*, in our search.

### Study selection

All the studies included in our meta-analysis of thymectomy for thymic malignancies were published in English. Studies were analyzed if they detailed a comparison between any type of minimally invasive thymectomy and any type of open thymectomy for thymoma, thymic carcinoma, or both. Not all studies were included in the analyses for each end point. Studies with only one arm were included in the evaluation for demographics (age and gender), tumor characteristics (stage and size), and open conversion rate.

Any studies indicating minimally invasive thymectomy, open thymectomy, or both for other benign conditions alone (myasthenia gravis and thymolipomas) or nonthymic malignancies alone (germ cell tumors, lymphoma, and lung cancer) were excluded.

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