

# Open Surgical Approaches for Pulmonary Metastasectomy



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## KEYWORDS

• Pulmonary metastasectomy • Surgical approaches • Thoracotomy • Open approaches

## KEY POINTS

- Both video-assisted thoracic surgical techniques and open thoracotomy are accepted as appropriate incisions for performing pulmonary metastasectomy.
- Open techniques have been shown to lead to the detection and hence, resection of more metastases than VATS techniques.
- Retrospective studies suggest that this improved detection and resection with open techniques does not lead to improved survival after surgery.
- The technical aspects of the various thoracotomy techniques are reviewed.

## BACKGROUND

Resection of pulmonary metastases from nonpulmonary primary malignancies has been widely adopted with the goal of cure. Thoughtful surgeons differ in the approach to such resections, with some favoring procedures that minimize the trauma to the patient, and others performing open procedures with the goal of maximizing the likelihood of resection of all detectable sites of disease. In this article, we review how pulmonary metastasectomy emerged as a therapy for metastatic disease, focusing on how surgical approaches used for this procedure have evolved; the available literature addressing whether open procedures lead to more complete resections; and if so, whether resection by open procedures increases the likelihood of cure following resection. After this background, we review the technical aspects of the various thoracotomy techniques.

The first English language report was by Edwards<sup>1</sup> in 1927 of a subtotal lobectomy for pulmonary recurrence 6 years after lower extremity amputation for a sarcoma. The criteria for suitability were established first by Alexander and

Haight in 1947<sup>2</sup> and remain by and large appropriate today. They are (1) the primary site of disease is controlled or controllable, (2) there should be no evidence for extrapulmonary metastatic disease, and (3) the patient must be able to tolerate the resection. In addition, as newer effective therapies have emerged, there should be no better alternative therapy (eg, the highly effective use of chemotherapy for germ cell tumors has reduced the need for pulmonary resection). The first pulmonary metastasectomy was performed at Memorial Hospital in 1940, and in line with the general practice adopted by the thoracic surgical community, subsequently was offered primarily to patients with one or two metastases and with long disease-free intervals (DFIs) (Fig. 1).

Over the years, there have been many hundreds of publications on the subject of pulmonary metastasectomy. By and large, these studies suffer from multiple deficiencies. For example, they combine diverse histologies that likely should be treated as separate diseases; and patients in a given study are often treated with varying induction and adjuvant chemotherapy and radiation

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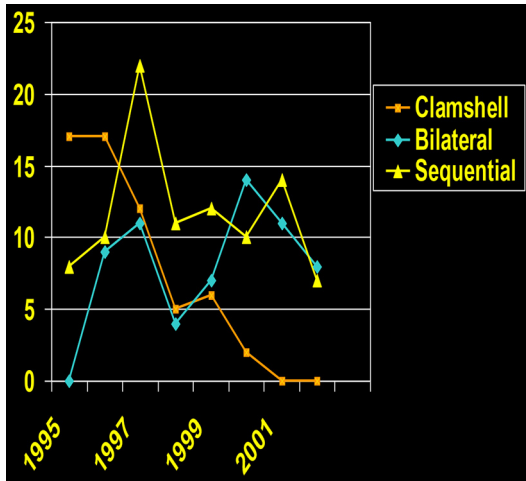
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**Fig. 1.** Changes in the use of thoracotomy techniques at Memorial Hospital for resection of bilateral pulmonary metastases.

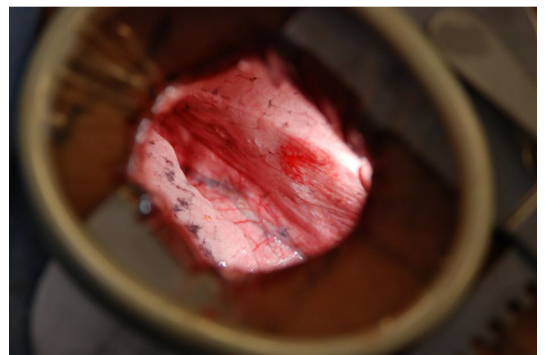
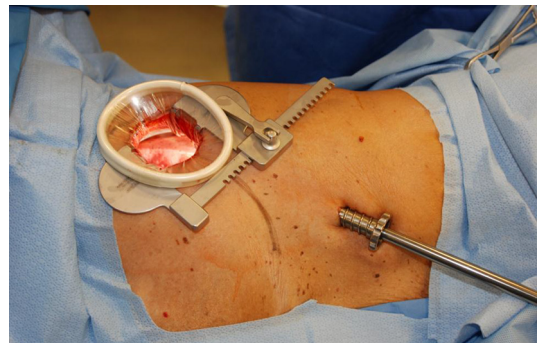
therapy regimens, which clouds the added benefit of surgical resection. Most importantly, all of the published series are retrospective and therefore that denominator of all patients with the disease from which the surgical patients are selected is not known. A fair criticism of these studies is that patients selected for surgery may represent those with indolent disease who may have experienced prolonged survival without resection.

Some retrospective evidence for efficacy is compelling. For example, members of the orthopedic service at Memorial Hospital noted that of 145 pediatric patients who underwent resection of extremity osteogenic sarcomas, 83% developed pulmonary metastases within 2 years, all of whom died within next 2 years.<sup>3</sup> Subsequently, Martini and colleagues<sup>4</sup> resected metastases from 22 patients who experienced a 32% 5-year and an 18% 20-year survival. The strongest evidence for the probable benefit from metastasectomy was developed by Pastorino and colleagues<sup>5</sup> who developed a registry of 5206 patients from 18 international centers and identified risk stratification factors including completeness of resection, a DFI of 36 months, and one versus more than one metastasis. Patients with one metastasis and a DFI of more than 3 years were found to have a 5-year survival of approximately 60%, whereas patients with more than one metastasis and a DFI of less than 3 months had a 5-year survival of approximately 30%. Currently, the PulMICC trial (A Randomized Trial of Pulmonary Metastasectomy in Colorectal Cancer), a phase III trial<sup>6</sup> randomizing patients to

resection or best medical therapy, is accruing well and it is hoped will provide stronger evidence of which patients are likely to benefit from metastasectomy.

## INTRODUCTION OF VIDEO-ASSISTED THORACIC SURGERY TECHNIQUES

Beginning about 1995, minimally invasive surgical techniques (video-assisted thoracic surgery [VATS]) were introduced into thoracic surgical practice and applied to pulmonary metastasectomy (Fig. 2). VATS techniques were assessed for oncologic safety<sup>7</sup> and it is likely that as techniques have matured, VATS procedures are no more or less likely than open techniques to disseminate disease. Concerns were also raised that VATS might be less effective than open procedures at achieving the first of the Alexander and Haight criteria discussed previously, that is, that the metastases be completely resected. Open thoracotomy incisions allow palpation of at least one lung, and it was noted that routinely nonradiographically evident metastases would be found by palpation. Because resection of all disease was believed to be important and because a posterolateral thoracotomy allowed evaluation of only one lung, some institutions routinely used median sternotomy even if there was no radiographic



**Fig. 2.** Operative images of a left video-assisted muscle-sparing thoracotomy.

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