

# Video-assisted cervical thoracoscopy: a novel approach for diagnosis, staging and pleurodesis of malignant pleural mesothelioma<sup>☆</sup>

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## Abstract

**Objectives:** In the preoperative workup for radical surgery for malignant pleural mesothelioma (MPM), mediastinal lymph node staging, diagnostic pleural biopsies and effusion control with talc pleurodesis are required. We present a new technique combining these objectives via a single cervical incision using the videomediastinoscope and demonstrate its clinical benefits. **Methods:** Video-assisted cervical thoracoscopy (VACT) was attempted in 15 patients (13 male, mean age 57 years), who were potential candidates for radical surgery. Following conventional cervical videomediastinoscopy, a 5 mm thoracoscope was advanced into the relevant pleural cavity through the mediastinoscope via a mediastinal pleurotomy. Pleural biopsies were taken followed by talc insufflation and cervical tube drainage. The clinical outcome was compared with 26 patients undergoing a staged preoperative workup during the same period. **Results:** VACT was successful in 10 patients (66.6%). In five patients (three right and two left), thoracoscopy was abandoned due to excessive mediastinal fat (1), thick pleura (2) and inability to enter the left hemithorax (2). Mean operative time was 71 (65–90) min and hospital stay 4 (3–7) days. One patient suffered recurrent laryngeal nerve palsy and one had persistent air leak. Ten patients subsequently underwent radical surgery. Time to radical surgery was significantly reduced by nearly 2 months in VACT patients ( $28 \pm 17$  days vs  $87 \pm 56$  days,  $p < 0.001$ ). **Conclusions:** The benefits of this approach include reduction in postoperative pain, risk of biopsy site tumour seeding, and preoperative delay to radical surgery. VACT is feasible in right-sided mesothelioma but has not yet been validated on the left.

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**Keywords:** Mesothelioma; Diagnosis; Staging

## 1. Introduction

Malignant pleural mesothelioma (MPM) is increasing in incidence and is expected to continue to rise [1]. Median survival of patients who receive supportive care only may be 6 months [2]. Maximum reported survival occurs in those patients given multimodality treatment, including radical surgical resection, either extra pleural pneumonectomy or radical decortication [3]. In selecting patients suitable for resection, accurate tissue diagnosis and staging of disease are paramount. In particular extrapleural lymph node status is a predictor of poor outcome following radical resection [4].

Early referral of potential candidates for radical surgical resection, often based on cytology alone, is encouraged. These patients require a confirmatory histological biopsy of their pleural disease and staging of their

mediastinal lymph nodes. With this purpose in mind, we have developed video-assisted cervical thoracoscopy (VACT) as a method of obtaining both histological diagnosis and staging from both sites through a single cervical incision, which also allows simultaneous talc pleurodesis for symptom control.

## 2. Methods

### 2.1. Patients

VACT was attempted on 15 patients (13 male; 2 female, age 57 [43–72] years). All were highly suspicious for MPM due to a history of asbestos exposure with a symptomatic pleural effusion and percutaneous pleural biopsies suggestive of MPM. They were all potential candidates for radical surgical resection. Thirteen patients (86%) had right-sided disease, 2 (14%) left-sided disease.

Over the same period, 26 patients underwent conventional staged preoperative workup. The clinical outcome of the two groups was compared.

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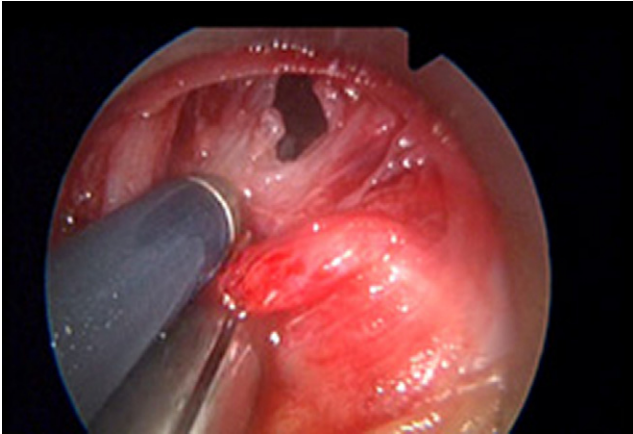


Fig. 1. Intraoperative view of the right pleurotomy seen through the video mediastinoscope with a mediastinoscopy sucker and biopsy forceps visible.

## 2.2. Operative technique

Patients are intubated with a double lumen tube to allow collapse of the lung on the diseased side. They were placed supine on the operating table with a sandbag between the shoulder blades and the head supported on a head ring. They were prepared and draped in standard fashion with the diseased side exposed to allow thoracoscopy should access to the pleura from the neck be unfeasible. A conventional cervical video-assisted mediastinoscopy was performed. Biopsies were taken from left and right paratracheal lymph nodes (stations 2 and 4) and subcarinal lymph node station 7. Following this, the video mediastinoscope was partially withdrawn and directed towards the diseased side. Aspiration of the pleural space was performed (above the superior vena cava [SVC] on the right) and if successful, a mediastinal pleurotomy was fashioned (Fig. 1). A 5 mm thoracoscope was inserted through the mediastinoscope (Fig. 2) and mediastinal pleurotomy into the pleural cavity and visualised on a second video-assisted thoracoscopic (VATS) system (Fig. 3). Pleural biopsies were then taken under direct vision, the pleural effusion aspirated and pleurodesis performed using



Fig. 2. A 5 mm thoracoscope inserted through the cervical mediastinoscope directed into the diseased right hemithorax.

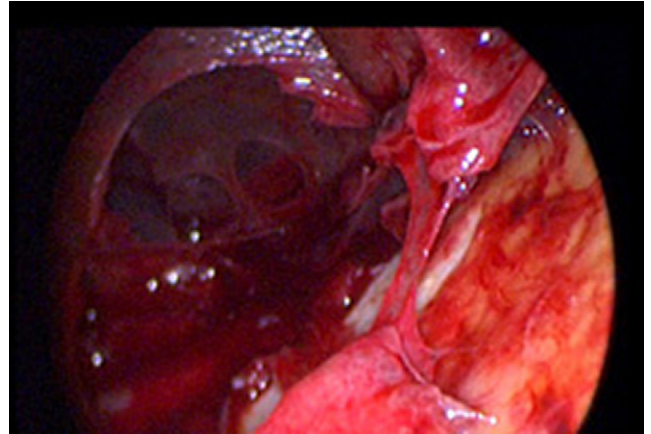


Fig. 3. Intraoperative view through the 5 mm thoracoscope into the diseased right hemithorax.

8 g of medical talc. A 28 Fr chest drain was inserted into the pleural space via the mediastinoscope and tunnelled caudal to the collar incision through the pre-sternal tissues (Fig. 4) (Video 1). The mediastinoscopy wound was closed and the drain placed on 5 kPa suction. When unable to enter the diseased hemithorax through the neck, a conventional single port VATS biopsy was performed with the patient supine, the effusion was drained and talc pleurodesis performed. A 28 Fr intercostal drain was inserted through the VATS port site.

## 3. Results

VACT was successful in 10 out of 15 patients (66.6%). In the 13 patients with right-sided disease, there were three (23%) failures. In one, this was a result of excessive mediastinal fat obscuring the view of the pleura. In the remaining two, failure was attributed to thick diseased pleura, preventing safe entry to the hemithorax. VACT was unsuccessful in both patients with left-sided disease as thick pleura surrounding the aortic arch prevented safe entry. In successful cases, mean operative time was 71 min (range 65–90 min) and

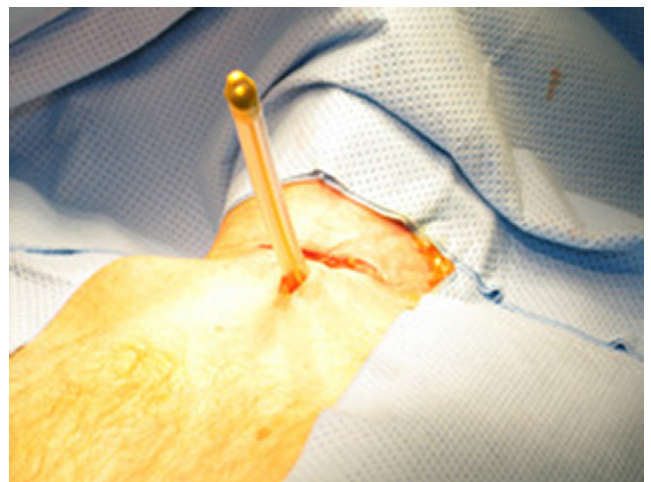


Fig. 4. Pleural chest drain seen exiting through the superficial sternal tissues below the cervical mediastinoscopy incision draining the right hemithorax.

hospital stay was 4 days (range 3–7 days). One patient with left-sided disease suffered a transient postoperative left recurrent laryngeal nerve palsy. Prolonged air leak occurred in one patient with emphysematous lung disease who went on to have radical resection.

In all failures, the procedure was converted to conventional VATS. Ten patients subsequently underwent radical surgery, six of whom had extra pleural pneumonectomy and four had radical decortication. Time to radical surgery from diagnosis was significantly reduced by nearly 2 months in VACT patients ( $28 \pm 17$  days vs  $87 \pm 56$  days,  $p < 0.001$ ) when compared to patients referred following a VATS biopsy elsewhere who required further staging with conventional mediastinoscopy.

#### 4. Discussion

VACT is feasible on the right side but as yet we have been unable to validate this on the left. The presence of the aortic arch within the superior mediastinum on the left makes advancement of the thoracoscope safely into the hemithorax difficult and may preclude this approach particularly in the presence of extensive pleural thickening as seen in mesothelioma. Attempts were made to enter the left hemithorax by dissecting between the innominate vein and left carotid artery in a similar fashion to the technique of extended cervical mediastinoscopy advocated by Ginsberg [5] (Fig. 5). On the right, a window into the hemithorax above the SVC (when patient lying supine on the operating table) is present allowing safe entry to the hemithorax (Fig. 6). The pleura is often seen to bulge here due to the presence of pleural effusion making entry into the hemithorax safe.

Relative contraindications to VACT are patients with extensive thickening of the pleura on the mediastinal surface and at the apex of the chest seen on staging CT scan. Excessive mediastinal fat may also prevent successful pleurotomy. The complication of recurrent laryngeal nerve palsy is recognised after cervical mediastinoscopy, particu-

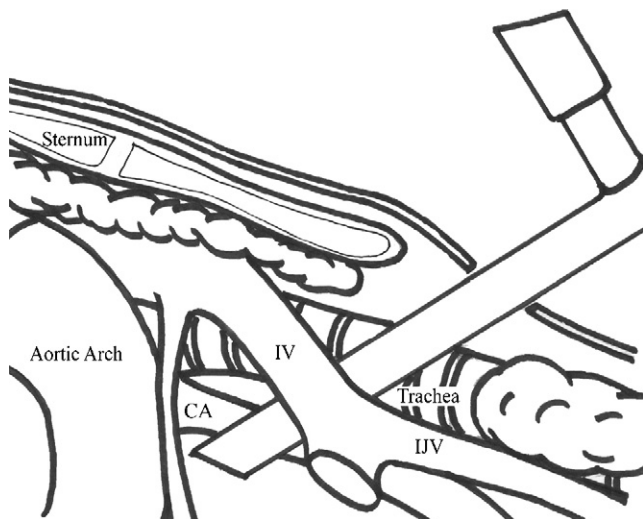


Fig. 5. Diagram illustrating the path of the mediastinoscope on the left between the innominate vein (IV)/internal jugular vein (IJV) and left carotid artery (CA).

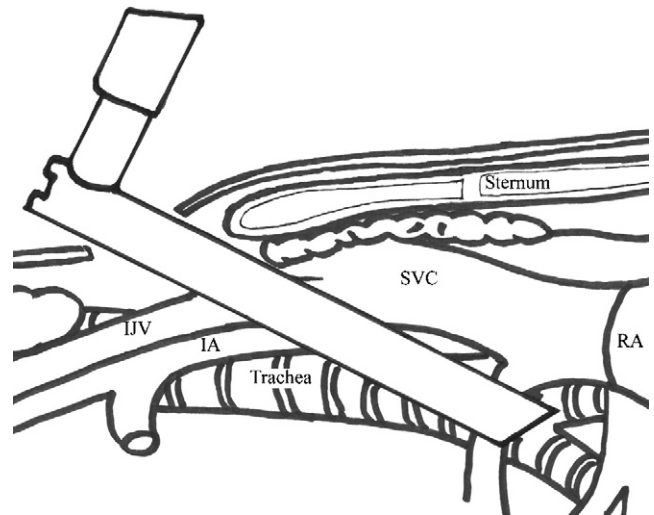


Fig. 6. Diagram illustrating the path of the mediastinoscope towards the right pleural cavity passing over the superior vena cava (SVC) and internal jugular vein (IJV). IA: innominate artery; RA: right atrium.

larly on the left side [6] and in our series was probably attributable to extensive dissection when attempting to enter the left hemithorax.

The presence of N2 positive lymph nodes in MPM has significant implications for the choice of treatment [4]. We have previously demonstrated that nodal involvement in malignant pleural mesothelioma cannot be based on CT long axis size alone [7]. Recently, the introduction of PET was seen as a potential replacement for surgical staging in MPM. However, a number of studies have shown limitations of PET in MPM with lack of sensitivity and specificity in relation to lymph node involvement with mesothelioma [8]. Improved accuracy of tumour staging has been demonstrated using integrated CT-PET [9]. In the same study however, nodal status was only accurately determined in 6 of 17 patients [9]. In our practice, therefore, we advocate the use of video-assisted cervical mediastinoscopy as the method of choice for accurately staging mediastinal lymph nodes in MPM [7].

There is a recognised risk of wound and drain site recurrence of MPM following any surgical intervention, hence the practice of adjuvant radiotherapy [10]. By reducing the number of incisions to one using VACT the risk of wound recurrence in mesothelioma patients is reduced. As we perform radical resections in MPM on the right side through a median sternotomy [11] this facilitates resection of the VACT wound and drain tract simultaneously. We have seen no evidence of wound recurrence in patients undergoing VACT. In left-sided MPM, we do not recommend radical surgery through a sternotomy so the use of VACT on the left does not have the benefit seen on the right. Another potential advantage of VACT is the reduction in postoperative pain from a collar incision compared with a thoracic incision.

Multimodality therapy for MPM is directed towards prolongation of a limited median survival. By reducing the time taken to diagnose/stage patients we are allowing them to undergo definitive treatment sooner, potentially prolonging disease-free survival. By diagnosing and staging simultaneously in patients highly suspicious for MPM, we may operate on patients at an earlier surgical stage with possible

implications on survival. Patients with MPM are set to gain the most by a simultaneous approach seen in VACT as they have a very limited life expectancy. Any reduction in time to radical treatment may be gained in length of disease-free survival.

Lemieux and co-workers described mediastinopleuroscopy in 1976 as a technique for obtaining lung and/or pleural biopsies rather than resorting to thoracotomy [12]. With the advent of less invasive methods for obtaining tissue diagnosis, the procedure has fallen out of favour. However, we have shown the advantages of this technique in MPM and suggest there may be scope for expanding its use into other areas. Papagiannopoulos and co-workers have recently advocated the use of cervical mediastinoscopy in pulmonary metastasectomy for more accurate staging of metastatic disease [13]. A possible future application of VACT may include concurrent pulmonary metastasectomy and mediastinal lymph node staging through the neck. As patients commonly develop further metastases, this leaves open the possibility for future VATS and later open metastasectomy, potentially increasing the number of resections possible and patient survival.

In conclusion, VACT is a feasible and reproducible technique for simultaneous diagnosis, staging and pleurodesis in patients with right-sided mesothelioma. It reduces time from diagnosis to radical surgery without increased risk of procedural morbidity, is acceptable to patients by reducing the number of incisions and decreases the potential for wound site recurrence. Other potential applications including left-sided disease remain to be validated in future.

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## Appendix A. Conference discussion

**Dr P. van Schil (Antwerp, Belgium):** Could you comment on what you're doing exactly on the left side? In fact, it is a procedure like an extended cervical mediastinoscopy as described by Ginsberg, and I think many thoracic surgeons do not feel really comfortable with the technique. It seems to be very difficult to go on the left side.

**Dr Chamberlain:** Yes, so far we have been unable to do this, and it may be that this is simply a procedure that you can perform on the right and it has to be exclusive for that.

**Dr van Schil:** But when you do it, you go anterior to the aortic arch?

**Dr Chamberlain:** Yes, we attempt to go anterior to the aortic arch. But as I demonstrated, the aorta does get in the way. And with the thickened pleura there as well, it's just too difficult.

**Dr van Schil:** And on the right side, what is the limit you can reach?

**Dr Chamberlain:** It all goes on the length of the instruments that you use essentially.

**Dr R. Rami-Porta (Barcelona, Spain):** I only have one comment. My experience is limited to one case on the left side, and I did a cervical extended mediastinoscopy putting the scope above the aortic arch, as Ginsberg described, between the innominate artery and the left carotid artery. And I could tear the mediastinal pleura, examine the whole left pleural cavity, and even take biopsies from the diaphragm. I think that if you do not perform extended cervical mediastinoscopy in your routine practice, maybe you need some training just to go through above the aortic arch and then the pleura is just there, and I think that it would be easier to tear it and go into the pleural space.

**Dr L. Lang-Lazdunski (London, United Kingdom):** The operative time you mentioned is not really dissimilar from the one usually necessary for doing a VATS procedure followed by a conventional cervical mediastinoscopy. So clearly your operative time is not really reduced. How is the vision for this procedure? Is it as good as the vision you have with a conventional VATS procedure?

**Dr Chamberlain:** I think if you refer back to the slide that I showed, it's very clear. There are no problems.

**Dr Lang-Lazdunski:** And are you not worried of getting tumour seeding through the breach in the mediastinal pleura?

**Dr Chamberlain:** That's obviously an issue, but as I demonstrated it, when it comes to radical surgery and excision, it is something that we can easily excise.

## Appendix B. Supplementary data

Supplementary data associated with this article can be found, in the online version, at doi:10.1016/j.ejcts.2008.03.034.