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Is video mediastinoscopy a safer and more effective procedure than conventional mediastinoscopy?

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Abstract

A best evidence topic in cardiothoracic surgery was written according to a structured protocol. The question addressed was whether video-assisted mediastinoscopy (VAM) is a more effective procedure than conventional mediastinoscopy (CM). A total of 108 papers were identified using the search as discussed below. Of which, eight papers presented the best evidence to answer the clinical question as they included a sufficient number of patients to reach conclusions regarding the issues of interest for this review. Complications, complication rates, number of lymph nodes biopsies, number of stations sampled and training opportunities were included in the assessment. The author, journal, date and country of publication, patient group studied, study type, relevant outcomes, results and study weaknesses of the papers are tabulated. Literature search revealed that CM is a safe procedure associated with low mortality (0–0.05%) and morbidity (0–5.3%). CM has high levels of accuracy (83.8–97.2%) and negative predictive value (81–95.7%). Training in CM can be difficult as the limited vision means that the trainer cannot monitor directly the dissection and the areas biopsied by the trainee as one operator and effectively see at any time. VAM is also a safe procedure with comparable results to that of CM in term of mortality (0%), morbidity (0.83–2.9%), accuracy (87.9–98.9%) and negative predictive values (83–98.6%). The main advantage is higher number of biospsies taken (VAM, 6–8.5; CM, 5–7.13) and number of mediastinal lymph node stations sampled (VAM, 1.9–3.6; CM, 2.6–2.98). VAM can be associated with more aggressive dissecting and that can lead to more complications. The use of VAM can provide a better and safer training opportunity since both trainer and trainee can share the magnified image on the monitor. All studies available are comparing heterogeneous groups of non-matched group of patients which can bias the outcomes reported. There is a lack of comprehensive randomized studies to compare both procedures and to support any preference towards VAM over CM. We conclude that there is actually very little objective evidence of VAM superiority over CM.

Keywords: Evidence-based medicine • Mediasinoscopy • Safety • Complication rate • Mediastinal lymph nodes

INTRODUCTION

A best evidence topic was constructed according to a structured protocol. This protocol is fully described in the ICVTS [1].

CLINICAL SCENARIO

A newly appointed thoracic surgeon discovers that the thoracic unit does not have access to a video mediastinoscopy set, and that a business case must be presented to justify the cost of purchase when compared with the conventional mediastinoscopy (CM) offered. The new surgeon feels that the video mediastinoscopy technique is safer, with lower complication rates and is more effective in sampling mediastinal lymph node but in writing a business case evidence of superior safety and effectiveness is needed. Is there any evidence?

THREE-PART QUESTION

In patients undergoing mediastinoscopy does [video mediastinoscopy] reduce the incidence of [complications], increase the [effectiveness] of the procedure in terms of the number of mediastinal lymph nodes biopsies, and improve [training] opportunities?

SEARCH STRATEGY

Medline 1950–November 2011 and Embase 1974–June 2011 using the Dialog Datastar interface. [Mediastinoscopy#.DE. OR Video assisted mediastinoscopy#.W.DE. OR conventional mediastinoscopy.W.DE.] AND [Complications#.W.DE.] AND [mediastinal lymph nodes.TI,AB]. Limit to English. This search was repeated in Cochrane Central Register of Controlled Trials.

SEARCH OUTCOME

A total of 108 papers were identified; of which, 8 were deemed to be relevant (see Table 1).

COMMENTS

The data presented suggest that CM is a safe procedure associated with low mortality (0–0.05%) and morbidity (0–5.3%)

Table 1: Summary table.

Authors, date, country, study type (level of evidence)	Patient group	Outcomes	Key result	Comments
Puhakka, 1989, Finland [2] Retrospective cohort study (level 2b)	2021 patients underwent CM for malignant (64.5%) and benign (35.5%) diseases	Mediastinoscopy diagnostic: 54% Total mortality: 0% Morbidity: 2.3% (47 patients) Vascular injury: 0.2% (four cases of major haemorrhage) Nerve injury: 0.15% Training: no data	CM is an effective and safe diagnostic procedure with acceptable morbidity and very low mortality	Single centre. Between 1968 and 1987. This was a historic retrospective study looking at data where CM was a recently established technique that can explain the results published. This study had a wide range of complications including: nerve injury, major haemorrhage, tracheal injury, and pericardial rupture
Hammoud *et al.*, 1999, USA [3] Retrospective cohort study (level 2b)	2137 patients (1237 males, 900 females) underwent CM for malignant (82%) and benign (18%) diseases	Mediastinoscopy diagnostic: 93.6% Total mortality: 0.2% (four deaths, one death (0.05%) directly attributed to the procedure, aortic injury) Morbidity: 0.6% Vascular injury: 0.15% Nerve injury: no data Training: no data	CM is a safe and effective diagnostic procedure with acceptable morbidity and very low mortality	Single centre. Between 1988 and 1998. Retrospective study. The study included cervical mediastinoscopies, anterior mediastinotomies and combined procedures. The paper does not look at the complications in relation to specific procedure type. Does not include the results or complications for patients who underwent repeat mediastinoscopy (total of 19). No data regarding nerve injury. No indication of training numbers
Venissac *et al.*, 2003 [4] Retrospective cohort study (level 2b)	240 patients (186 males) underwent VAM for malignant (79%) and benign (21%, including 0.8% for mesothelial cyst resection) cases	Mean number of biopsies taken: 6 (1–20) Mean number of nodes sampled: 2.3 (1–4) Mortality: 0% Morbidity: 0.83% Vascular injury: 0.4% (1 opening) Nerve injury: no data Training: no data Overall sensitivity: 98.3% Overall specificity: 100% Overall accuracy: 98.6%	VAM is a safe and effective method in nodal assessment of the mediastinum	Single centre. Between 2001 and 2003. Retrospective study with a small number of patients. The study included patient who underwent combined VATS and camera mediastinoscopy procedureNo data regarding nerve injury. No training data
Karfis *et al.*, 2008, Greece [5] Retrospective cohort study (level 2b)	Total of 139 mediastinoscopies carried out, but 138 patients (113 males) reviewed. Include malignant (63%) and benign (37%) cases	Mean number of nodes sampled: 1.9 (1–4) Mortality: 0%. Morbidity: 1.4%. Vascular injury: 0.7%. Nerve injury: no data. Training: no data. Overall sensitivity: 86.1%. Overall specificity: 100%. Overall accuracy: 88.4%.	VAM is a safe and effective method for the assessment of both benign and malignant mediastinal diseases	Single centre. Between 1999 and 2006. Retrospective study with a small number of patients. No training data
Cho *et al.*, 2011, Republic of Korea [6] Retrospective cohort study (level 2b)	Total of 521 patients: 222 patients (43%) underwent CM (170 males) and 299 patients (57%) underwent VAM (220 males) for malignant disease staging and diagnosis	Total mean number of lymph nodes sample: VAM 8.53 ± 5.88, CM 7.13 ± 4.88 Mean number of station biopsied: VAM 3.06 ± 0.75, CM 2.98 ± 0.71 Mortality: VAM 0%, CM 0% Morbidity: VAM 1.6%, CM 3.6% Nerve injury: VAM 0.9%, CM 3.1% Vascular injury: VAM 0.34%, CM 0.4% Negative predictive value: VAM 95.5%, CM 94.7% Accuracy: VAM 95.9%, CM 95.5%	The total number of dissected lymph nodes is significantly higher in VAM group ($P = 0.004$) CM is associated with more statistically significant complications ($P = 0.03$) VAM offer a more through method for mediastinal lymph nodes sampling with fewer complications	Single centre. Between 2008 and 2009. Retrospective study comparing heterogeneous group of patients. The authors committed on their technique for counting the lymph nodes based on whether the lymph nodes were dissected en-block or fragmented into small pieces. No training data

Continued

Table 1: Continued

Authors, date, country, study type (level of evidence)	Patient group	Outcomes	Key result	Comments
Anraku *et al.*, 2010, Canada [7] Retrospective cohort study (level 2b)	Total of 645 patients: 505 (78%) patients underwent CM and 140 (22%) underwent VAM Patients were divided into two groups: 500 patients (78%) staging for lung cancer and 145 patients (22%) for diagnostic Patients included in the study are the staging group (500 patients) CM carried out in 396 patients (79%) and VAM in 104 patients (21%)	Total mean number of lymph nodes sample: VAM 7.0 ± 3.2, CM 5 ± 2.8. Mean number of station biopsied: VAM 3.6 ± 1.1, CM 2.6 ± 1.1. Mortality: VAM 0%, CM 0%. Morbidity: VAM 2.9%, CM 0.8%. Nerve injury: VAM 0.96%, CM 0%. Vascular injury: VAM 1.9%, CM 0.25%. Negative predictive value: VAM 98.6%, CM 95.7%. Accuracy: VAM 98.9%, CM 97.2%. Training data: no specific data.	Both methods for mediastinal exploration are safe and effective. The total number of dissected lymph nodes is significantly higher using VAM. ($P < 0.001$). VAM is associated with better negative predictive value but with more complications when compared to CM	Single centre. Between 2008 and 2009. Retrospective study comparing different numbers of heterogeneous groups of patients. There is no comment regarding the method used for counting the number of lymph nodes sampled. The authors commented that 90% of VAMs was performed by surgical trainees with the staff surgeon scrubbed but not actively performing the procedure in contrast to CM where the staff surgeon performed at least part of the procedure in the vast majority of the cases
Leschber *et al.*, 2007, Germany [8] Retrospective cohort study (level 2b)	Total of 377 patients: 11 patients excluded for incomplete data, 132 (36.1%) patients underwent CM and 234 (63.9%) underwent VAM for malignant disease staging and diagnosis	Total mean number of lymph nodes resected: VAM 8.1 (3–25), CM 6 (3–11) Mortality: VAM 0%, CM 0% Morbidity: VAM 4.3%, CM 5.3% Nerve injury: VAM 2.1%, CM 3% Vascular injury: VAM 0.9, CM 2.3% Negative predictive value: VAM 83%, CM 81% Accuracy: VAM 87.9%, CM 83.3% Training data: no data	Both methods for mediastinal exploration are safe and effective. The total number of dissected lymph nodes is higher. VAM is associated with better negative predictive value but with less complications when compared with CM	Single centre Between 2003 and 2005. Retrospective data analysis. The study compares two heterogeneous groups of patients with different numbers in each group. There are no data regarding mortality rates in this study. No training data
Martin-Ucar *et al.*, 2004, UK [9] Prospective audit (level 2b)	43 patients were operated upon by two first-year thoracic trainees during their initial formation in general thoracic surgery (25 patients in 15 months, and 18 patients in 9 months, respectively) using VAM. Indications included diagnosis and staging in 29 patients (67%) and diagnostic in 14 patients (33%).	Mortality: 0% Morbidity: 0% Nerve injury: 0% Vascular injury: 0% False negative results: 0% Sensitivity: 100% Operative time: 29 (18–51) min	Operative time ($R^2 = 0.83$ and 0.77), need for consultant assistance ($R^2 = 0.98$ and 0.94), failure to independently reach all nodal stations ($R^2 = 0.95$ and 0.94) significantly decreased with experience in both trainees' cases (cubic curve fit; $P < 0.001$ throughout). VAM permits a rapid learning and adequate supervision of the technique without compromising safety, operative time or completeness of the procedure. The main advantages are: increased visual field, image magnification, adequate light source and the ability to use two instruments simultaneously. VAM should be the technique of choice in thoracic surgical teaching units	This was a single centre prospective audit with selected end-points including: operative time, need of consultant assistance during the procedures and the ability of the trainee to reach and identify all nodal stations independently. Using VAM. Although only a small number of cases in this series underwent pulmonary resection after a negative VAM, there were no false negatives when the resected specimens from the routine lymphadenectomy at time of surgery were analysed. The number of patients included is small

[2–8]. Major haemorrhagic complication requiring sternotomy is rare, but can by fatal [3]. CM has high levels of accuracy (83.8–97.2%) [6–8] and negative predictive values (81–95.7%) [6–8]. Training in CM can be difficult as the limited vision means that the trainer cannot monitor directly the dissection and the areas biopsied by the trainee as one operator and effectively see at any time [7]. Video-assisted mediastinoscopy (VAM) is also a safe procedure with comparable results with that of conventional in term of mortality (0%), morbidity (0.83–2.9%), accuracy (87.9–98.9%) and negative predictive values (83–98.6%) [6–8]. The main advantage is higher number of biospsies taken (VAM, 6–8.5; CM, 5–7.13), number of mediastinal lymph node stations sampled (VAM, 1.9–3.6; CM, 2.6–2.98) and number of station sampled [6–8], although no study directly compared the two techniques in a randomized fashion.

Cho *et al*. [6] carried out a comparative analysis of VAM and CM of 521 mediastinoscopies (CM, 222; VAM, 299). The group reported 11 complications (2.11%), more occurring in the CM (3.6%) when compared with the VAM group (1.6%; $P = 0.030$). In this study, there was higher number of dissected nodes in the VAM group (8.53 ± 5.8) than in the CM group (7.13 ± 4.9; $P = 0.004$), however; there was no statistically significant difference between the average number of stations sampled in CM (2.98 ± 0.7) and in the VAM group (3.06 ± 0.75).

Anraku *et al*. [7] retrospectively reviewed 645 mediastinoscopies (CM, 505; VAM, 140). In this study, patients were divided into two groups: staging for lung cancer group (500 patients) and diagnostic group (145 patients). The staging group was further analysed, using 304 patients who eventually underwent thoracotomy to evaluate accuracy and negative predictive values of mediastinoscopy, comparing between the two mediastinoscopy methods (CM, 233; VAM, 71). Although there was no mortality, however; eight complications (1.2%) occurred, more in the VAM group (3.8%) than in the CM group (0.8%; $P = 0.04$). More lymph nodes were examined and fewer lymph nodes remained after mediastinoscopy by VAM than by CM. The total number of dissected nodes was higher in the VAM group (7.0 ± 3.2) than in the CM group (5.0 ± 2.8); ($P < 0.001$), and so was the number of stations sampled (VAM, 3.6 ± 1.1; CM, 2.6 ± 1.1; $P < 0.01$). No statistical difference in sensitivity was noted (VAM, 95%; CM, 92.2%), as well as in the negative predictive value (VAM, 98.6%; CM, 95.7%). The group concluded that both methods are safe. More lymph nodes and stations were evaluated by VAM, with trend towards higher negative predictive value. It is important to note that the group experienced a higher complication rates in the VAM that can be attributed to a more vigorous dissection in for staging in the VAM.

Both studies had several limitations as they were retrospective studies comparing two heterogenous groups of patients. The groups did not have a standard method for counting the number of lymph nodes dissected that can create bias if a single lymph node is taken in small pieces.

The use of VAM can provide a better and safer training opportunity without compromising safety, operative time or completeness of the procedure since both trainer and trainee can share the magnified image on the monitor as opposed to a limited operating field visualized only through the scope as has been demonstrated by Martin-Ucar *et al*. [9], in their prospective audit.

It is a paramount to note that all these studies are retrospective studies comparing heterogeneous groups of non-matched group of patients, which can bias the outcomes reported. There is no standardized method for counting the lymph nodes dissected, as surgeons do not always remove the lymph node in one attempt.

There is a lack of comprehensive randomized studies to compare both procedures that should be able to provide safety and effectiveness data that can be used for evidence-based practice and to support any preference towards VAM over CM. Although clearly training opportunities seem to be a very obvious difference between the two techniques, there is actually very little objective evidence of VAM superiority over CM.

CLINICAL BOTTOM LINE

There is actually very little objective evidence of VAM superiority over CM. Both procedures are safe with very low mortality and morbidity.

There is a tendency towards an increased number of biopsies and lymph node stations taken with VAM as well as an apparent better training opportunity. Further studies are needed, to assess safety, effectiveness and training variation between the two approaches.

Conflict of interest: none declared.

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