



## Mediastinoscopy: ‘The Rise and Fall of the Gold Standard’

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### Short Communication

Mediastinoscopy was developed as a procedure to obtain tissue for histological diagnosis of upper mediastinal masses. Over the last decades mediastinoscopy has been increasingly used for mediastinal lymph node staging in patients with non-small cell lung cancer (NSCLC).

The history of mediastinoscopy originates from the early fifties of the 20th century. In 1954 Harken [1] was the first to insert a laryngoscope through a supraclavicular incision, thus performing a unilateral mediastinoscopy. Five years later, Carlens reported on hundred cases of a cervical suprasternal approach of the superior mediastinum, thereby defining ‘cervical mediastinoscopy’ as we know it today [2]. Over time the cervical mediastinoscopy underwent several procedural and technical modifications and became the ‘gold standard’ in oncologic staging of the mediastinum. Pearson proved that mediastinal lymph node involvement in patients with lung cancer resulted in a dismal prognosis and he therefore suggested that subsequent surgical intervention would not change the outcome [3]. His work triggered the development of an internationally accepted mediastinal lymph node map by Mountain and Dressler [4]. One of the typical features that made conventional cervical mediastinoscopy a complex procedure was the ‘tunnel’ view through the instrument. Through this tunnel, the surgeon had to find his way amongst vulnerable vital structures such as trachea, esophagus, azygos vein, right pulmonary artery, recurrent nerve, pleural space, and lung and also, depending on the patient’s anatomy, the carotid and innominate arteries. It took a surgeon quite some time to acquire routine skills in this complex environment to perform adequate staging of the mediastinum. For the very same reasons, teaching conventional cervical mediastinoscopy is extremely difficult. Therefore conventional cervical mediastinoscopy is considered a complex procedure and its success strongly depends on the skills of the operator. The development of videoscopic assisted surgery in the eighties of the 20<sup>th</sup> century opened new perspectives for minimal invasive closed chest surgery and teaching opportunities. The ‘operating field’ became visible for all participants of the procedure, or even in the room ‘next door’. In the late eighties Lerut developed this concept into what is now called video-assisted mediastinoscopy (VAM) [5]. The uncomfortable ‘tunnel-view’ of conventional cervical mediastinoscopy transformed into a clear ‘operating field’ on a flat screen with highly detailed images which allowed better vision on the vital mediastinal structures as well as the abnormal tissue and lymph nodes. Moreover, it proved to be a major improvement for teaching purposes without compromising the procedure itself [6]. Although the above mentioned advantages of VAM are obvious, the sensitivity and negative predictive values of VAM and conventional cervical mediastinoscopy are not different [7]. At present the ESTS guidelines on mediastinal staging recommends performing VAM [8].

Cervical mediastinoscopy has a mortality of less than 0.5% and morbidity of 2.5%. Complications are rare in experienced hands [9]. Cervical mediastinoscopy allows access to lymph node stations 2R, 2L, 4R, 4L, 7, 10R and 10L. The posterior subcarinal nodes, paraesophageal nodes, pulmonary ligament nodes, subaortic nodes, and para-aortic nodes cannot be reached and therefore they cannot be biopsied. As mentioned before, during the last decades the main reason to perform a cervical mediastinoscopy was staging of patients with operable non-small cell lung cancer (NSCLC). In fact, for many decades, cervical mediastinoscopy was the gold standard for staging the mediastinum with a sensitivity between 79% and 93%, specificity of 100% and a negative predictive value of 91% [10,11]. Due to new technologies such as positron emission tomography (PET) and endoscopic ultrasound techniques, the diagnostic algorithm of NSCLC has changed. The number of mediastinoscopies decreased by more than 50% in many institutions [12]. Integrated PET-CT became clinically available in 2000 and it significantly improved diagnostic accuracy and sensitivity of preoperative mediastinal staging in NSCLC compared with that of CT alone or PET alone [13]. Yet PET-CT has still a considerable false positive and negative outcome in NSCLC especially in early

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stage and central tumors. For this reason, mediastinal abnormalities identified on PET-CT still need pathological confirmation [14]. The endoscopic ultrasound techniques EBUS-TBNA (Endobronchial UltraSound-guided TransBronchial Needle Aspiration) and EUS-FNA (Endoesophageal UltraSound Fine Needle Aspiration) made a rapid evolution in staging patients with NSCLC. Especially combined EBUS-EUS allows for better evaluation of lymph node stations compared with a single technique alone, since both techniques are complementary. The sensitivity, specificity, negative predictive value, and diagnostic accuracy of combined EBUS-EUS were 91%, 100%, 96% and 97%, respectively [15]. Combined EBUS-EUS covers almost all the lymph node stations in the mediastinum and also the commonly involved metastatic structures below the diaphragm. The complication rate of endoscopic ultrasound techniques is approximately 0.05% and no mortality has been reported in the literature [16]. These endoscopic ultrasound techniques are also used for the more advanced stage IIIa-N2, in primary staging and for restaging after induction therapy. Clinical trials are underway to answer the question whether cervical mediastinoscopy is still necessary when combining such novel approaches. The ease of EBUS-EUS makes it an ideal staging test: fast, accurate, high negative predictive value, no anesthesia, real-time imaging, safe, and well tolerated. Similar to mediastinoscopy, EBUS-EUS is also a procedure in which its success in staging depends on the skills of the operator [17]. Experience and skills (quality) varies with the training (quantity) of the operator. Therefore, a solid training is required in educational programmes and every center has to look at its own diagnostic yields and negative predictive values of staging procedures. The decreasing numbers of cervical mediastinoscopy will compromise the quality of the procedure and the experience of the operator, as quality comes with quantity. The thoracic surgical community has to be aware of this quality-issue and must find a solution. After more than sixty years of great service 'the golden age' of cervical mediastinoscopy seems to be over. Its role in the investigation of the upper part of the mediastinum and its role in staging of NSCLC have to be redefined.

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