CHEST

Ultrasound-Guided Medical Thoracoscopy in the Absence of Pleural Effusion

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BACKGROUND: Medical thoracoscopy (MT) is a diagnostic and therapeutic procedure that permits the study of the pleural space. The presence of pleural adhesions is the most important contraindication to performing MT. Lesions of the pleura in absence of pleural effusion are usually studied in video-assisted thoracoscopic surgery (VATS) with preoperative ultrasound evaluation. No data are available about ultrasound-guided MT in the absence of pleural effusion.

METHODS: From January 2007 to June 2013, 622 consecutive MTs were performed under ultrasound guidance without inducing a pneumothorax. A retrospective cohort of 29 patients affected by pleural diseases without fluid was reviewed. The fifth or sixth intercostal spaces along the midaxillary line with a good echographic "sliding sign" and normal appearance of the pleural line were chosen as the entry site. The pleural cavity was explored, and biopsies were performed.

RESULTS: The mean age of the patient cohort was 62.8 years; there were 20 male patients and nine female patients. Pleural adherences were avoided, and adequate number of pleural biopsies were performed. No parenchymal lung injuries, bleeding, or hematoma occurred. Seventeen patients had a completely free pleural cavity, four patients had a single pleural adhesion, and eight had multiple pleural adhesions; in all cases, however, endoscopic exploration was possible and biopsy specimens were adequate. The most frequent histopathologic diagnosis was malignant pleural mesothelioma.

CONCLUSIONS: We have shown that thoracic ultrasound accurately identifies intrathoracic adhesions and, in experienced hands, can guide MT access, replacing the VATS approach, even in the complete absence of pleural effusion. CHEST 2015; 147(4):1008-1012

Manuscript received May 20, 2014; revision accepted August 1, 2014; originally published Online First September 4, 2014.

ABBREVIATIONS: MT = medical thoracoscopy; VATS = video-assisted thoracoscopic surgery

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FUNDING/SUPPORT: The authors have reported to *CHEST* that no funding was received for this study.

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DOI: 10.1378/chest.14-0637

Pleuroscopy or medical thoracoscopy (MT) is a procedure that permits evaluation of the pleural space in a spontaneously breathing patient. MT needs an explorable pleural space, the lack of which, due to adhesions, is the only absolute contraindication to the procedure.[1] In the past, a pneumothorax was induced to separate the lung from the chest wall and to create a space for trocar insertion.[2] Separation was then demonstrated by fluoroscopy or a plain chest radiograph.

Chest ultrasonography has become increasingly widespread because its usefulness has been widely demonstrated in the study of thoracic pathology. During the normal respiratory cycle, the parietal pleura slides on the visceral pleura, producing an echographic phenomenon called the "sliding sign." Presence of pleural adherence, pneumothorax, or previous pleurodesis does not permit the observer to appreciate this sign.[3]

In 1993, Macha et al[4] first evaluated the combination of ultrasonic examination of the thorax and thoracoscopy in the diagnosis of pleural diseases in a series of 687 consecutive patients. They demonstrated that prethoracoscopy pleural sonography could avoid pneumothorax and recommended wider use of ultrasound guidance for thoracoscopy. In that study, transthoracic ultrasonography was performed in the lateral decubitus position corresponding to the pleuroscopy position to verify the presence of a real pleural space (pleural effusion or pneumothorax) and localize an appropriate entry site, avoiding pleural adherence. Furthermore, other authors established that chest ultrasonography can detect pleural adhesions with a high sensitivity ($\geq$ 75%) and specificity ($\geq$ 96%), particularly if it is performed in the lower zone of the lung. These data were confirmed by video-assisted thoracoscopic surgery (VATS) and surgical exploration.[5,6] A subsequent study demonstrated the value of preoperative VATS chest sonography to detect pleural adhesions to avoid lung injury during the insertion of the trocar.[7] This was performed evaluating the sliding sign: When the excursion was at least 1 cm, pleural adhesions could be excluded.

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In addition to surgical procedures, chest ultrasonography has been applied to MT. In MT, it has been established that prethoracoscopy ultrasonography permits the detection of thick fibrous adhesions, the localization of the entry site, and the reduction of pleural access failure.[8,9] Research by Hersh et al[8] and Medford et al[9] refer to MT performed only when pleural effusion deeper than 1 cm and 3 cm, respectively, is present.

Thus, over time it has become evident that ultrasonography may have a role in selecting the safest entry position, because thoracic ultrasonography enables study of pleural space characteristics and detection of pleural thickening and diaphragmatic disease.[10] Thoracic ultrasonography can also permit the recognition of potential procedural difficulties like minimal pleural fluid, pleural thickening, pleural adherences, or multiple septation.[11,12] Today, most practitioners choose to enter the pleural space in the presence of pleural effusion using chest ultrasonography without inducing pneumothorax. To our knowledge, however, no reported experiences exist in the literature regarding MT in absence of pleural effusion. The aim of the current study is to demonstrate that thoracic ultrasonography may be used to access the pleural space directly, even in absence of pleural effusion, choosing as the entry site a point where the sliding sign is evident.

Materials and Methods

From January 2007 to June 2013, we performed 622 consecutive MTs without inducing a pneumothorax. For this study, we chose a retrospective cohort of 29 patients affected by pleural diseases without fluid and in whom chest ultrasonography showed the presence of a sliding sign in the B mode (Fig 1). The main indications for thoracoscopy were pleural thickening and the presence of nodules or pleural masses. All the subjects were hospitalized in our division. All patients had chest radiographs taken a maximum of 2 weeks before MT and, more commonly, a thoracic CT scan.

On the day before thoracoscopy, we evaluated systematically with ultrasound the dorsal, lateral, and anterior chest wall to detect pleural adhesions, pleural thickenings, pleural nodules, and masses. We used an Esaote SpA ultrasound machine (MyLab 30 CV) with convex (3.5 MHz) and linear (7.5 MHz) transducers. When possible, we correlated the sonographic findings with CT scan images to better outline pleural adhesions, masses, and thickening.

In addition, chest ultrasonography was performed the day of the procedure with the patient in the lateral decubitus position on the operating table. To fix the better entry site, we searched for areas with a good echographic sliding sign and a normal appearance of the chest wall and pleural line. First we explored the fifth and sixth intercostal spaces along the midaxillary line and when the appropriate echographic aspects were not present, we examined other adjacent areas to avoid pleural adhesion.

After having identified with chest sonography the ideal entry site, we were able to perform MT. Local anesthesia was induced with mepivacaine (200 mg) and after making a small skin incision, we slowly introduced curved blunt-point scissors into the chest wall as far as the pleural space. Then a blunt-point trocar was carefully introduced and air spontaneously allowed to enter the pleural space with consequent lung collapse (Fig 2). At least eight pleural biopsy specimens for each patient were collected. We used a 7-mm Endoskope set (Karl Storz GmbH & Co). We were assisted by an anesthetist who provided conscious sedation. Written informed consent was obtained from all patients and the publication of this retrospective study was approved by the ethics committee of the Spedali Civili of Brescia (CE62/2013).