

## VIDEO-ASSISTED THORACOSCOPIC LUNG AND PLEURAL BIOPSY IN THE DIAGNOSIS OF CHRONIC PLEURAL EFFUSION

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**SUMMARY** – Chronic pleural effusion requires pleural and lung biopsy in more than 60% of patients. Open lung biopsy was formerly considered as the most reliable diagnostic method, whereas now the procedure is mostly performed *via* video-assisted thoracoscopy. During the last ten-year period (1995-2005), 96 patients aged 31-72 (mean age 53) years were operated on at University Department of Thoracic Surgery, Jordanovac University Hospital for Lung Diseases by video-assisted thoracoscopy in general anesthesia. All biopsies were done by clamp sampling from parietal or visceral pleura, and in 31 patients lung tissue was sampled by endostapler wedge resection. Conversion to mini-thoracotomy was needed in only 12 patients, due to massive adhesions. Tissue samples were referred for histopathologic analysis. After the procedure, the patients had a thoracic drain connected to negative pressure. Histopathologic diagnosis was made in almost all patients, yielding a 97% success rate. In 16 patients, drain airflow had to be prolonged to more than 5 days, while the mean drainage duration was 4 days and mean hospital stay 8 days. Talc pleurodesis was performed in most patients with malignant effusion to stop effusion accumulation. Video-assisted thoracoscopic biopsy allows for adequate pleural and lung sampling with a high rate of accuracy. Postoperative mortality and morbidity are lower in comparison with open lung biopsy. It is concluded that video-assisted thoracoscopic biopsy is an efficient and safe method in the diagnosis of chronic pleural effusion.

**Key words:** *Pleural effusion – therapy; Pleural effusion – surgery; Lung – pathology; Lung diseases – pathology; Thoracoscopy – methods*

### Introduction

Chronic pleural effusion manifests as prolonged intrathoracic fluid finding consequential to various pulmonary, pleural and extrathoracic diseases, mostly of malignant origin. The most common symptoms include breathlessness at minimal exertion, irritative coughing, shooting pain in the chest, and febrile state in case of empyema. A dozen of pathologic conditions should be considered on differential diagnosis. Practical approach

in the management of these patients implies thorough history and physical examination, lung x-ray, sputum analysis, effusion cytology and bacteriology, catheter aspiration and brush swab bronchoscopy, transthoracic biopsy (TTB), transbronchial biopsy (TBB), and computed tomography (CT) of the thorax. If the specific etiology of the disease remains unknown, tissue sampling is warranted to make the diagnosis and to identify patients that require treatment<sup>1</sup>.

When less invasive methods (TTB, TBB) fail to point to the diagnosis or are contraindicated, thoracoscopy or surgical biopsy of the lungs and pleura may frequently prove necessary. There are two methods to obtain an adequate tissue sample: video-assisted thoracoscopic lung biopsy (VATB) and open lung biopsy (OLB).

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Formerly, the latter was a gold standard in the diagnosis of this disease, however, due to aggressive approach and significant morbidity and mortality it has recently been replaced by VATB as a less invasive procedure associated with a lower rate of complications than OLB<sup>2</sup>.

## Patients and Methods

From 1995 until 2005, biopsy was performed in 96 patients with chronic pleural effusion of unknown etiology at University Department of Thoracic Surgery, Jordanovac University Hospital. Prior to the procedure, the patients underwent standard diagnostic work-up including lung x-ray, thorax CT, cytology, and other analyses of effusion material. Catheter aspiration and brush swab bronchofibroscopy, TTB and TBB were performed, followed by biopsy sample cytology and microbiology. As definitive diagnosis could not be reached in quite a large proportion of patients admitted to pulmonary wards, pleural and lung biopsy was indicated.

Our patient series included 62 males and 34 females aged 31-72 (mean 53) years. All biopsy procedures were performed in general anesthesia with the use of double-lumen endotracheal tube for unilateral lung ventilation. Patients were placed in lateral position and properly prepared for the possible conversion to mini-thoracotomy. The operation started with thoracic port placement in the 7<sup>th</sup> intercostal space at median axillary line to enable inspection of the pleural space with a camera. Upon visual control, another two thoracic ports were inserted in the 5<sup>th</sup> intercostal space along posterior axillary line. Biopsy sites were determined by use of CT and intraoperative finding. Three samples were obtained from the seemingly healthy tissue, and four samples from the altered tissue to ensure a definitive diagnosis.

The samples of parietal and visceral pleura were collected by forceps at four different sites. The lungs were grasped by atraumatic grasper, followed by wedge resection with a 50-mm endostapler. Samples were referred for urgent cytology, followed by histopathology. Resected lungs were controlled for hemorrhage, high air loss and need for additional hemo- or aerostasis. At the end of the procedure, the lungs were aerated for additional control of the suture line, and then a thoracic drain was inserted in the inferior incision and connected to negative pressure. The drain was removed upon cessation of airy and sanguineous flow within the next 3-4 days.

## Results

Right-sided biopsy was performed in 54 (56.25%; 95%CI 45.8-66.4%), and left-sided biopsy in 42 (43.75%; 95%CI 33.6-54.3%) patients ( $p > 0.05$ ). Pleural biopsy at four sites was obtained in all study patients, and additional lung biopsy at one site was performed in 31 (32.3%) patients. Tissue sample was most commonly obtained from the right inferior lobe ( $n=12$ ; 12.5%), followed by the left inferior lobe in eight (8.3%), right superior lobe in four (4.2%), left superior lobe in three (3.1%) and middle lobe in five (5.2%) patients. Parietal pleura was sampled in 59 (61.5%) and visceral pleura in 37 (38.5%) patients.

In 12 (12.5%) patients, mini-thoracotomy had to be performed due to massive adhesions. There was no postoperative mortality, while postoperative complications were rare and included prolonged drain aeration (for more than 5 days) in 16 (16.7%) patients. The mean duration of drain placement was 3 (range 1-8) days, whereas the mean patient hospital stay was 7 (range 5-11) days. Histologic diagnosis was established in 97% of patients and included pleural malignancy (mesothelioma) in 17 (17.7%), pleural metastasis in 44 (45.8%), specific lung disease (lung tuberculosis) in four (4.2%), chronic pneumonia in 11 (11.5%), primary lung carcinoma in 16 (16.7%), i.e. 11 (11.5%) adenocarcinoma, 3 (3.1%) bronchoalveolar carcinoma and 2 (2.1%) macrocellular carcinoma, and nonspecific lung fibrosis in four (4.2%) patients.

Sterile talc (8 g) pleurodesis was intraoperatively performed in 34 (35.4%) patients with a definitive diagnosis of metastatic pleural carcinoma, and upon the receipt of the histopathologic report in another 37 (38.7%) patients. Initial solitary mesothelioma was detected in three (3.1%) patients; however, they refused radical surgery and received conservative treatment. In 14 (14.6%) patients, talc pleurodesis resulted in inadequate regression of drain effusion (below 500 mL/day), thus the procedure had to be repeated. In four (4.2%) patients, repeat talc pleurodesis induced massive, persisting effusion, and the drain was replaced by permanent pleurotomy catheter to be exchanged every 2-3 months. Pleural empyema developed in three (3.1%) patients and was treated conservatively.

## Discussion

Pleural and lung biopsy is frequently performed to make definitive diagnosis in patients with chronic pleu-

ral effusion. Parenchymal biopsy is recommended when other diagnostic methods such as lung x-ray, thorax MSCT, TTB, effusion cytology and bacteriology, catheter aspiration and brush swab bronchofibroscopy, and TBB fail to identify the cause of the disease<sup>3</sup>.

Histopathologic diagnosis can be made on the samples obtained by TBB, TTB, surgical biopsy, i.e. video-assisted thoracoscopy, or open biopsy. Multiple problems are encountered in patients with chronic pleural effusion. There are a dozen of various factors that can lead to the development of specific clinical picture, the disease frequently does not affect the entire lung, thus biopsy samples may frequently be obtained from an unaffected area, tissue sample may be inadequate to make the diagnosis, etc. Fine-needle TBB and TTB may cause a number of diagnostic problems to the pathologist, the samples are non-selective and too small, the tissue is usually grossly damaged, and in TBB the sample is obtained from the regions adjacent to the bronchial tree that may frequently be affected with trivial fibrous changes or chronic inflammation<sup>4</sup>. Fine-needle biopsy can only produce minimal tissue samples, which leads to poor diagnostic results (63%-75%) and is associated with high morbidity (42%-44%) and even minimal mortality<sup>5</sup>. TBB is a very unreliable method of tissue sampling in chronic lung and pleural diseases, with a diagnostic precision of 37%-70%. Complications are recorded in 15% of patients, and include iatrogenic pneumothorax in 1%-5% and hemothorax in 2%-9% of patients<sup>6</sup>.

In the past, OLB used to be considered the sampling method of choice, which yielded good diagnostic results in more than 90% of patients<sup>7</sup>. Many surgeons perform OLB by sparing anterior axillary thoracotomy. This approach yields satisfactory cosmetic results, induces minimal pain, and is associated with lower postoperative morbidity than posterolateral thoracotomy. Its shortcoming, however, is that it provides rather limited visualization of the pleural and lung surface where biopsy sample is to be obtained<sup>8</sup>.

The development of video technology has enabled the video-assisted thoracoscopic surgery to become a reliable procedure in the diagnosis and management of many intrathoracic conditions. Video-assisted thoracoscopy reduces postoperative pain and pulmonary dysfunction<sup>9,10</sup>, and provides considerably better visualization of the pleural space and lung surface than mini-thoracotomy. In case that lung collapse cannot be achieved due to inappropriate endotracheal tube placement or the patient cannot tolerate unilateral ventilation (intraop-

erative arterial blood SO<sub>2</sub> decrease below 90% on unilateral ventilation), biopsy can be performed with alternating ventilation and short apneic periods. Pleural adhesions can generally be removed by electric knife, and only in case of abundant adhesions the video-assisted procedure is discontinued and conversion to mini-thoracotomy is performed. Lung biopsy is done by use of endostaplers, which minimize the risk of prolonged drain airflow. Resection is faster, easier and safer to perform, thus minimizing blood loss and airflow during the postoperative period (% in our series). In comparison with OLB and TBB, thoracoscopic lung biopsy has a significantly lower morbidity and almost no mortality<sup>11</sup>.

In our patients with talc pleurodesis during video-assisted thoracoscopy, thoracic drain was removed as early as postoperative day 2-3, and they suffered less pain than those with postoperative pleurodesis<sup>12</sup>. Video-assisted thoracoscopic pleural biopsy and stapler resection of the lungs is an efficient and safe alternative to OLB, and is associated with minimal postoperative complication rate and high diagnostic usefulness.

## Conclusion

Video-assisted thoracoscopic biopsy of the lung and pleura is an important diagnostic method in determining the etiology of chronic pleural effusion. In many patients, the diagnosis cannot be reached by use of less aggressive methods; then video-assisted thoracoscopy with appropriate tissue sampling is indicated. This method is preferable to open lung biopsy because of the lower morbidity and mortality, high percentage of definitive diagnoses (97%), and reduced hospital stay. According to some authors, the method has proved less expensive than the classic surgical procedure, which should not be neglected either.

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#### Sažetak

### VIDEOTORAKOSKOPSKA BIOPSIJA PLUĆA I PLEURE U DIJAGNOSTICI KRONIČNIH IZLJEVA PRISIŠTA

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Dugotrajni izljevi pleuralne šupljine zahtijevaju biopsiju pleure i pluća kod više od 60% bolesnika. Ranije se otvorena biopsija pluća smatrala najpouzdanijom dijagnostičkom metodom, dok se danas taj zahvat najčešće izvodi videotorakoskopskim putem. U zadnjih deset godina, od 1995. do 2005. godine, u Klinici za torakalnu kirurgiju „Jordanovac“ operirano je videotorakoskopskim načinom 96 bolesnika u općoj anesteziji. Prosječna životna dob bila je 53 godine, s rasponom od 31-72 godina. Sve biopsije su rađene uzimanjem uzoraka hvataljkom s parijetalne ili visceralne pleure, a kod 31 bolesnika uzet je i komadić plućevine klinastom resekcijom uz pomoć endostaplera. Samo kod 12 bolesnika učinjena je konverzija u minitorakotomiju zbog opsežnih priraslica. Svi uzorci su upućeni na patohistološku analizu. Nakon zahvata svaki bolesnik je imao torakalni dren koji je spojen na negativni tlak. Histopatološka dijagnoza postavljena je kod gotovo svih bolesnika, tako da je uspješnost zahvata bila 97%. Kod 16 bolesnika postojao je produženi protok zraka na dren kroz više od pet dana, dok je prosječno vrijeme drenaže iznosilo 4 dana, a prosječni boravak u bolnici 8 dana. Kod većine bolesnika s malignim izljevom rađena je pleurodeza talkom kako bi prestalo nakupljanje izljeva. Videotorakoskopska biopsija omogućava uzimanje kvalitetnog uzorka pleure i plućevine (biopsata) uz visok postotak točnosti. Poslijeoperacijska smrtnost i pobol bili su niži nego kod otvorene biopsije pluća. Zaključak je da je videotorakoskopska biopsija pluća učinkovita i sigurna metoda u dijagnostici kroničnog pleuralnog izljeva.

Ključne riječi: *Pleuralni izljevi – terapija; Pleuralni izljevi – kirurgija; Pluća – patologija; Plućne bolesti – patologija; Torakoskopija – metode*