A Safe and Minimally Invasive Method for Thoracoscopic Lung Biopsy in Interstitial Lung Disease

Ergun Ergun, MD,¹ Ufuk Ates, MD,² Kutay Bahadir, MD,² Gulnur Gollu,² Meltem Bingol-Kologlu,² Murat Cakmak,² Huseyin Dindar,² and Aydin Yagmurlu²

Background: Interstitial lung disease (ILD) represents a spectrum of lung diseases that may contain different levels of fibrosis and inflammation. Sometimes, the clinical picture and imaging studies are insufficient to determine the diagnosis and lung biopsy becomes crucial, which may be performed in a thoracoscopic or open manner. The aim of this study was to present a new minimally invasive biopsy method that seems to be technically easy, safe, and inexpensive. Herein, we present a minimally invasive method for thoracoscopic lung biopsy using a Vicryl loop.

Methods: The charts of patients with suspected ILD who underwent thoracoscopic lung biopsy using a Vicryl loop between 2007 and 2017 were analyzed retrospectively.

Results: Nine patients were identified, four were boys and five were girls. The median age was 76 months. The mean weight of the patients was 10.9 kg. The mean chest tube removal time was 3.8 days. The mean surgical time was 37 minutes. There was an air leakage for 13 days in one child postoperatively.

Conclusions: Thoracoscopic lung biopsy with a knot and scissors is an easily applicable and minimally invasive method that may be performed in children with suspected ILD.

Keywords: interstitial lung disease, lung biopsy, minimally invasive surgery, thoracoscopy

Introduction

INTERSTITIAL LUNG DISEASE (ILD) REPRESENTS a spectrum of lung diseases that may contain different levels of fibrosis and inflammation.¹ Even though the clinical picture and imaging studies are usually decisive, sometimes histopathological evaluation may be needed due to nonspecific findings.² These imaging studies also help the surgeon to decide the area for biopsy. With the development of new radiological imaging devices, the need for biopsy is reduced, but recent guidelines recommend surgical lung biopsy (SLB) as the gold standard for disease that cannot be diagnosed with clinical findings and imaging.^{2,3} Lung biopsy may be performed in a thoracoscopic or open manner.⁴ Thoracoscopic biopsy seems to reduce mortality rates and hospital stay, even though the mortality and morbidity rates are still considerable.^{5,6} Even though SLB is recommended, although in a limited group of patients by recent guidelines and articles for the diagnosis of ILD, the benefit and potential harm should be considered carefully.^{7,8} In thoracoscopic procedures, biopsy is usually performed using a stapler.⁹ We aimed to present a new and minimally invasive method for thoracoscopic lung biopsy using a Vicryl loop.

Materials and Methods

The study was conducted in accordance with the Declaration of Helsinki. The charts of patients with suspected ILD who underwent thoracoscopic lung biopsy using a Vicryl loop between 2007 and 2017 were analyzed retrospectively. Demographic data, the underlying pathologies of children, surgical procedures, surgical time, complications, and pathological diagnoses were evaluated.

Anesthetic approach

The operations were performed under general anesthesia with the patient placed in the lateral decubitus position. Endotracheal intubation was the method of choice. Selective intubation was not needed in any patients.

Surgical technique

While the patient is in the lateral decubitus position on the operation table, a 5-mm camera trocar is placed from the third intercostal space-midaxillary line intersection and two working ports are placed from the fourth intercostal space-anterior and fourth intercostal space-posterior axillary line

¹Department of Pediatric Surgery, Sami Ulus Children's Hospital, Ankara, Turkey.

²Department of Pediatric Surgery, Ankara University School of Medicine, Ankara, Turkey.

intersections. A 5-mm 30° camera is inserted through the camera trocar. Single-lung ventilation is not necessary because the procedure is quite short. The inferior lobe of the right lung is grasped gently using an atraumatic grasper. An Endoloop through laparoscopic knot pusher (Karl Storz GmbH) is passed to the inferolateral end of the right lung and tied firmly (Fig. 1A, B). A biopsy specimen is cut using laparoscopic scissors and removed from the trocar site (Fig. 2). A chest tube is inserted through one of the working ports as the final step of the procedure.

Results

Nine patients were identified, four were boys and five were girls. The median age was 76 months. The mean weight of the patients was 10.9 kg. The mean chest tube removal time was 3.8 days. The mean surgical time was 37 minutes. There was a postoperative air leakage for 13 days in one child. The children's data are presented in Table 1.

Discussion

With this new method of biopsy, all children who underwent the procedure had pathological diagnoses without complications. All children were referred from the pulmonology department. Each child was evaluated by anesthesiologists before the operation. The risks and potential benefit of the biopsy were discussed with the parents.

ILD is a term that can be used for classifying a considerable amount of lung diseases. Pathological evaluation seems to be the most certain way to differentiate the diagnosis because they share common clinical features.¹⁰ As can be seen in this study, pathology evaluations revealed different pathological diagnoses in seven patients whose conditions could not be differentiated by any other test, sampling, or imaging. Before biopsy, bronchoalveolar lavage may be considered as a diagnostic intervention. Even though it may not be the final diagnostic test, it may be helpful for cytological and microbiological examinations, especially in alveolar diseases.⁷

Different lung biopsy methods have been defined. Percutaneous needle biopsy is a safe and minimally invasive method, but it may not supply enough material for certain pathological diagnoses. Thoracoscopic methods are all minimally invasive and feasible. However, biopsy with a stapler requires additional equipment that may not be found in every center, and also widening of one trocar site and

FIG. 2. Cutting the specimen using scissors.

biopsy with Ligasure may result with bronchopleural fistula if the lung tissue is tied below the intended extraction material. Also, the tissue being extracted may be harmed due to the heat caused by Ligasure. Thoracotomy may also be an option but only if thoracoscopy fails. In the presented method, sufficient specimen excision is guaranteed owing to the magnified vision and use of scissors instead of Ligasure, also bronchopleural fistulae are avoided with the use of a firm knot.

In studies, thoracoscopy is usually described as providing good vision, reducing postoperative pain and disability, and offering a greater selection of biopsy sites and better cosmetic results.^{11–13} Also, some studies claim that thoracoscopy is related with less analgesia need, less blood loss, and shorter hospital stays when compared with thoracotomy, even though there are also studies claiming that there are no differences in outcomes between open and thoracoscopic approaches.^{1,10,14–16} Selective intubation was not needed in any patients because the surgical method is not very demanding and the surgical time may be considered as short, which was also useful for having good vision of the lung while ventilating and determining the pathological area under direct vision. Although one child's chest tube remained in place for 13 days, it is thought that the reason for the protracted air leakage was the child's poor condition; the child was in the intensive care unit and had necrotizing pneumonia.

The authors of this study believe that thoracotomy should be avoided in children if at all possible. However, there may

FIG 1. (A, B) Grasping and tying the lung with Endoloop.

TABLE 1. CHILDREN'S DATA

<i>Patient</i>	<i>Gender, age</i>	<i>Weight (kg)</i>	<i>Underlying condition</i>	<i>Operation time (minutes)</i>	<i>Chest tube removal time (days)</i>	<i>Complication</i>	<i>Pathological evaluation</i>	<i>Clinical outcome</i>
1	F, 15 years	35	CCAM	25	3	—	Fibrosis	Minimal respiratory distress, doing well
2	F, 5 years	18	Atelectasis	20	2	—	Chronic granulomatous inflammatory process	Hodgkin lymphoma, cured
3	M, 6 months	4	Surfactant production dysfunction	20	6	—	Type 2 pneumocyte hyperplasia	Chronic respiratory distress, exitus
4	M, 3.5 years	6.5	Recurrent pneumonia	30	2	—	Surfactant metabolism dysfunction	Chronic respiratory distress, doing well
5	M, 22 days	1.5	Congenital airway malformation	35	1	—	Normal	Doing well with reduced lung lesion
6	F, 8 months	6.5	Recurrent pneumonia	20	13	Postoperative air leakage	Chronic granulomatous inflammatory process	Tuberculosis, cured
7	F, 3 months	4	Recurrent pneumonia	40	2	—	Desquamative interstitial pneumonia	Immunodeficiency, ILD, exitus
8	M, 7 years	19	Interstitial lung disease	40	3	—	Organized pneumonia	ILD, chronic respiratory distress, doing well with tracheostomy
9	F, 24 days	3	Atelectasis	60	2	—	Desquamative interstitial pneumonia	ILD, chronic respiratory distress, doing well

CCAM, congenital cystic adenomatoid malformation; F, female; ILD, interstitial lung disease; M, male.

be some situations in which one cannot avoid converting to open surgery such as in the presence of dense adhesions, severe hypoxia, and bleeding, even though the authors have not yet experienced any of these.^{1,10}

Some authors recommend performing more than one biopsy and others suggest that one biopsy >2 cm in diameter is enough for tissue diagnosis.¹⁰ It may be argued that more than one biopsy may increase the specificity of a diagnosis, but it may also increase complication risks and surgical time. This study includes nine children, all of whom underwent a single biopsy. In these patients, histopathological examination was possible.

Multiple biopsies were suggested as a consensus by Langston et al. to reduce sampling errors in heterogeneous diseases.¹⁷ It has also been reported that the localization, type, or number of biopsies did not significantly affect the diagnosis rate.¹⁸ The authors of this study suggest that multiple biopsies may be the method of choice in patients with heterogeneous diseases, but to reduce complication risks, single biopsies from the suspicious site in imaging studies may also be enough for appropriate pathological evaluations. Although the histopathological diagnosis seems to be the final step of diagnosis, patients should be followed up afterward because undetermined results and nonspecific pathological findings may not always lead to a precise result. Although in this study the authors did not encounter such confusing results, there is always a possibility that pathological evaluations may be misleading.

The limitation of the study is the small number of patients and the method is only feasible in the corners and edges of the lung.

Thoracoscopic lung biopsy with knot and scissors is easily applicable and a minimally invasive method that may be performed in children with suspected ILD, and has a comparable precision rate to other methods.

Author Disclosure Statement

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Address correspondence to:

Ufuk Ates, MD

Department of Pediatric Surgery
Ankara University School of Medicine
Dikimevi, Ankara 06100
Turkey

E-mail: drufukates@gmail.com

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