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Research Article

Surgical Lung Biopsy can be Achieved in Tertiary Hospital with Low Complication

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Abstract

Background: More than 200 pulmonary conditions manifest with a diffuse change of lung parenchyma. Their etiology is heterogenous and therefore difficult to define [1]. Since the Prognosis strongly correlates with the etiology, the clinicopathological features and the histology, it is important to classify the diffuse parenchymal lung diseases prior to treatment. Surgical lung biopsy is consider to be a mainstay in cases in which diagnosis through other methods has failed. The aim of this analysis is to evaluate the risk factors associated with the surgical lung biopsy in tertiary center.

Method: We reviewed our databank retrospectively, looking for all patients in which the surgery was performed under the diagnosis of Interstitial Lung Disease (ILD). Complications and risk factors for complications were analyzed. **Results:** Between 0ctober 2018 and October 2020, altogether 33 consecutive operations were performed under the diagnosis of ILD. All of the patients have clinically- and radiologically-apparent ILD. The patients had a mean age of 66 years old, and there were 25 males (75.75%). In all cases, Video-Assisted Thoracic Surgery (VATS) was performed. The uniportal approach was conducted in 26 (78.78%) cases and biportal in seven (23.21%) cases. The mean operation time was 43 (range: 21-122) minutes. Only two (6.66%) patients had ILD and Chronic Obstructive Pulmonary Disease (COPD) in combination. Nineteen (57.57%) patients were former or active smokers. The mean Body Mass Index (BMI) was 27.61 kg/m2 (range: 19.3-37). Only six patients revealed a history of coronary artery disease. The six-minute walking test mean was 383 meters (range: 177-530). Seven patients needed permanent oxygen with a mean of 2.7 liters/minute (range: 1.5-4). The mean FEV1 was 2.16 liters (range: 1.21-3.53) and DLCO 60.4% (range: 26-91). One patient (3.03%) died due to respiratory failure within 60 days. The mean length of stay was 6 days (range: 3-23), the tricuspid annular plane systolic excursion (TAPSE) had a mean of 21.71 mmHg (range: 16-33.8) and the systolic pulmonary arterial pressure had a mean of 38.13 mmHg (range: 18-80). In 69,69 % of the cases, we found usual interstitial pneumonia (UIP), in 6,06% Non-Specific Interstitial Pneumonia (NSIP), in 3,03% Desquamative Interstitial Pneumonia (DIP),in 12,21% unspecific granulomatous disease and in other 9,01% non-conclusive histology. Only one (3.03%) patient developed an air leak post-operatively with consecutive atelectasis. **Conclusion:** Surgical lung biopsy for ILD is safe and can be achieved in this high-risk collective in tertiary center. The mortality is similar to other minimally-invasive procedures. Investigation with large patient numbers in a prospective multi-center manner could provide more details.

Keywords: Idiopathic pulmonary fibrosis; Diagnosis; Interstitial lung disease; Lung biopsy; Surgery

Introduction

There are more than 200 diffuse parenchymal lung diseases, which differ in their prognosis, etiology and therapeutics option [2]. Moreover, the therapeutic options to slow the progression of the disease are limited, and the prognosis in poor, particularly in cases of interstitial lung fibrosis, which is evaluated to be 2.8 years [3,4].

Although high-resolution chest computer tomography provides high-quality efficiency to define the diagnosis and therefore guide in the choice of therapeutic option [3], in approximately 50% of cases additional tools such as lung biopsy are required to differentiate Usual Interstitial Pneumonia (UIP) from others ILDs [5]. The most commonly-conducted TBLN achieves a specific diagnosis only in 29-79% of reported cases [6,7,10-14].

For patients with an unavailable diagnosis through either a CT scan or TBLB, an SLB should be considered [2]. It should also be keep in mind that the SLB can be associated with high complications. Even if the VATS has lower complications and higher post-operative quality of life compare with thoracotomy, minimally invasive surgical lung biopsy can be associated with high risks due to the impaired lung function before surgery. Hutchinson reported a mortality rate of up to 16% for non-elective procedures [1]. We hypothesize that with the effective selection of patients and under consideration of important clinical surgical pathways, the surgical lung biopsy can be undertaken without high mortality.

Patients and Method

Clinical data was obtained retrospectively from patient records. The diagnosis during the enrolment period was made through Multidisciplinary Discussion (MDD) using criteria for 2011 IPF, the guidelines and multidisciplinary classification 2013 for IIPs [8].

All of the patients had a pre-operative HRCT and were biopsied due to atypical clinical or radiographic features, or owing to “diagnostic uncertainty”.

We evaluated patient characteristics and pulmonary function tests, PaO2, and the modified Medical Research Council (MRC) scale was used to evaluate dyspnea in daily living. We considered 30-and 90-day mortality, post-operative complications and length of stay.

We performed the VATS technique in all cases under general anesthesia with a double lumen endobronchial tube. We placed the patient in the lateral decubitus position and the uniportal 3cm skin incision was made at the level of the fifth intercostal space and a wound retractor was put in place. Subsequently, the thorax was inspected for adhesion and for localizing the area with the most visual change. A lung biopsy was taken using a 60mm endoscopic linear stapler (covidien). The indication for SLB and the operation side was made at a multi-disciplinary team (MDT). After the SLB had been conducted, we infiltrated the intercostal space 3 to 7 with 40mg bupivacaine for better pain control post-operatively. Biopsies were sent to the pathology department in a Jar filled with formalin. For the right lung, wedge resection was performed in the upper, middle, and lower lobe. For the left lung, we conducted a biopsy on segment 4-5 and in the lower lobe at the observational predominant segment, mostly segment 9 or 10. At the end of the procedure, one 24 F drain was placed through the uniportal access in to the chest or through the camera port in case of the biportal technique.

Results

Between 0october 2018 and October 2020, altogether 30 consecutive operations were performed under the diagnosis of ILD. All of the patients had clinically- and radiologically-apparent ILD and had a mean age of 66 years old. There were 23 males (76.66%). In all cases, video-assisted thoracic surgery (VATS) was performed. The uniportal approach was conducted in 23 (76.66%) cases and biportal in seven cases (23.33%). The mean operation time was 42 minutes (range: 21-122). Only two (6.66%) patients had ILD and chronic obstructive pulmonary disease (COPD) in combination. Seventeen (62.96%) patients were former or active smokers. The mean BMI was 27.96 kg/m2 (range: 19.3-37).Only six patients revealed a history of coronary artery disease. Prior to surgery, the six-minute walking test had a mean of 383 meters (range: 177-530). Seven patients needed permanent oxygen at a mean of 2.7 liters/minute (range: 1.5-4). The mean FEV1 was 2.16 liters (range: 1.21-3.53) and DLCO 60.4% (range: 26-91). One patient (3.33%) died due to respiratory failure within 60 days. The mean length of stay was six days (range: 3-23), the tricuspid annular plane systolic excursion (TAPSE) had a mean of 21.71 mmHg (range: 16-33.8) and the systolic pulmonary arterial pressure had a mean of 38.13 mmHg (range: 18-80). In 63,63 % of the cases, we found usual interstitial pneumonia (UIP), in 6,06% non-specific interstitial pneumonia (NSIP), in 3,03% desquamative interstitial pneumonia (DIP), and in 12,12% unspecific granulomatous disease. Only one (3.33%) patient developed an air leak post-operatively with consecutive atelectasis. One patient developed pneumonia post-operatively with the need of antibiotic therapy.

None of the patients developed cardiac event, hemorrhage, pulmonary embolism in the post-operative phase or pleural empyema. None of the patients displayed delayed wound healing (Table 1).

Age in year	66
Gender	
Male	23 (76.66%)
FEV1 in liters	2.16 (1.21-2.16)
DLCO predicted or normal	60.4 (26-91)
Smoker	
Former smoker	14(42.42%)
Active smoker	5(15.15%)
BMI	27.96 (19.3-37)
Surgical approach	
Uniportal	26 (78.78%)
Biportal	7 (21.21%)
Thoracotomy	0
History of coronary bypass	6(18.18%)
Operation time in minutes	42 (21-122)
Post-operative complications	
Cardiac event	0
Pneumonia	0
Respiratory failure	1(3.03%)
Atelectasis	1(3.03%)
Pneumothorax	0
Air leak	1(3.03%)
Co-morbidity	
Diabetes mellitus	6(18.18%)
History of coronary artery disease	6(18.18%)
Oxygen prior to surgery	
<2 liters/minute	3 (9.09%)
>2 liters/minute	4(12.12%)
Rheumatoid arthritis	3(9.09%)
Cardiac record	
EF(%)	58,08(40.5-74)
TAPSE in mmHg	21,93(16-33.8)
sPAP in mmHg	37,21(18-80)
Histology	
UIP	21(63.63%)
NSIP	2(6.06%)
DIP	1(3.03%)
Granulomatosis	4(12.12%)
Undifferentiated	5(15.15%)
60-day mortality	1 (3.33%)

Table 1: Baseline patient characteristics.

Discussion

In most cases, ILD can be diagnosed by HRCT scan and clinicopathological pathway [2,9]. The presence of basal, subpleural, and reticular opacities – which are associated with honeycombing and traction bronchiectasis – is highly typical of UIP [2]. However, in around 50% of cases of UIP, CT scans do not display features that are highly typical of UIP [10].Therefore, another diagnostic tool should be considered.

We reported cases in which the surgical lung biopsy was performed because the clinical findings were not typical to differentiate ILD. Other reasons were atypical findings in HRCT scans, often with a lack of honeycomb. A further indication for SLB was the clinical decline by the time suggesting a secondary process, which should be ruled out. Especially when UIP is suspicious but not fully confirmed though non-surgical diagnostic tools, SLB is mandatory for biopsy because the transbronchial biopsy is not accurate for diagnosing UIP in about 50% of cases [11].

Some publishers have reported about thoracotomy for lung biopsy, most of them before the introduction of the VATS technique in 1990 [12]. We performed all of our procedures with the VATS technique because the advantages of minimally invasive thoracic surgery have already been demonstrated and described elsewhere [13]. We usually used uniportal access. The second port was placed when we found adhesions, which could be quickly removed with the help of the second port.

We only considered a single lung ventilation at the moment when we inserted the stapler for resection. Furthermore, the ventilation of the lung was keep at the lowest pressure possible, tolerating an oxygenation rate of 85-90%. Previous publishers have already mention that an acute exacerbation of ILD could be triggered by SLB and some of the reasons could be related to factors such as hyperoxia and mechanical stress during ventilation of the fibrotic lung and intra-operative fluid balance [14,15].

Single-shot antibiotic prophylaxes with ampicillin/sulbactam

were administrated prior to skin incision. This could explain the absence of "delayed wound healing" and the low incidence of post-operative pneumonia.

In some publications, fine needle biopsy was considered particularly in ILD in association with lung nodules. As previously mentioned, this tool is not mandatory in the diagnosis of UIP and furthermore the complication as pneumothorax with the need of intervention is high at 6%. Other complications are hemoptysis and hemothorax. In a prospective randomized trial comparing the concordance between transbronchial lung biopsy (TBLC) and surgical lung biopsy (SLB) performed sequentially in the same patients, it could be demonstrated that SLB was more concordant with the final diagnosis retained at multidisciplinary assessment (MDA) [16].

The 60-day mortality was 3.33 %. One 70-year-old man with 2 liters/minute oxygen therapy prior to surgery died due to respiratory failure post-operatively. His BMI was 19. The 30-day mortality after SLB in England was 2.4% [17]. In a high-volume center for SLB, Fisher found a 30 day mortality of 7.1%, 20.2% and 1.9% in overall, non-elective and elective patients, respectively. [18] Our findings demonstrate that thorough patient selection for SLB can be offered in a low-volume center with equal quality as in high-volume centers. The most important factor is the team's experience with the procedure. The author had previously worked in a high-volume center.

Conclusion

In the light of our experience, we conclude that surgical lung biopsy can be performed in small-volume centers with similar results to high-volume centers if the surgical team has sufficient previous experience and surgical skill in the treatment of ILD patients.

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