

The Effect of Cup Versus Alligator Forceps on the Results of Transbronchial Lung Biopsy

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Background: Transbronchial lung biopsy (TBLB) is a routine diagnostic procedure for pulmonary diseases and is performed by using either the alligator or cup forceps. The purpose of this study was to compare the role of the type of forceps in the quality and complications of TBLB.

Methods: This was a prospective, observational, double-blinded study. Four samples were taken from each patient through TBLB. Characteristics of the samples, including sample size and number of alveoli, whether it was diagnostic or not, and side effects such as pneumothorax and bleeding, were all recorded.

Results: One hundred seventy-six biopsy samples obtained from 44 patients were evaluated; 21 patients (47.7%) were male. Of the 88 samples taken with an alligator forceps, based on size, 21.6% were small, 45.5% were medium, and 33% were large. Corresponding results for the samples taken with a cup forceps were 43.2% small, 29.5% medium, and 27.3% large. Of the 88 biopsy samples taken with an alligator forceps, 18.2% were diagnostic; this rate was 23.9% for cup forceps. Significant pneumothorax was not seen in any of the cases in the alligator forceps group, but it was detected in 9% of the cases in the cup forceps group. Significant bleeding was seen in 1% of the alligator forceps and 5.7% of the cup forceps procedures.

Conclusions: Our study results, comparing the effect of 2 different kinds of forceps on TBLB results, were consistent with those of other studies with larger samples ($P = 0.008$) using alligator forceps. The diagnostic value of the procedures was not significantly different ($P = 0.355$).

Key Words: transbronchial lung biopsy, cup forceps, alligator forceps

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Lung biopsy through the bronchus [transbronchial lung biopsy (TBLB)] is a commonly used diagnostic procedure and is used to diagnose a variety of

pulmonary conditions, such as interstitial lung disease (sarcoidosis), vascular disease (vasculitis), small airway disease (obstructive bronchiolitis), malignant conditions (alveolar cell carcinoma), and opportunistic infections.¹

This procedure was first performed by using a flexible bronchoscope in 1974.²

TBLB is mainly performed using 2 different kinds of forceps: alligator and cup forceps. There have been several studies on the diagnostic sensitivity of TBLB but the results have not been consistent.²

TBLB is associated with complications such as bleeding and pneumothorax.³ Complication rate may vary with the use of different forceps. Thus, it is important to evaluate biopsy samples taken with different types of forceps in terms of their diagnostic utility.

Some studies have evaluated the quality of samples based on sample size and content of alveoli.^{4,5} Yet, major characteristics have not been described determining the quality of the biopsy samples.⁶

Our study was aimed at comparing the effect of the type of forceps used based on diagnostic utility and safety of samples obtained with TBLB.

METHODS

This was a prospective, double-blind, observational study conducted in the interventional pulmonology ward of Masih Daneshvari Hospital, a referral center for pulmonary diseases in Tehran, Iran, and was approved by the institutional review board and ethics committee of the hospital. Patients who were scheduled to undergo bronchoscopy and TBLB for infiltrative processes seen in the chest x-ray were considered for the study. Patients who had a history of significant bleeding during an earlier bronchoscopy or a blood coagulation abnormality were excluded from the study. On the basis of a reference from earlier studies, our sample size was calculated to be 40 patients in each type of forceps group. All patients signed written informed consent to participate in the trial. Patients were consecutively enrolled and alternatively assigned to the use of either alligator or cup forceps.

Local anesthesia was induced using 2 mL of 5% lidocaine spray through the nose. No sedation was required during the procedure and fluoroscopy was not used. Two types of forceps were used to obtain proper samples. The alligator forceps was Alligator

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There is no conflict of interest.

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Jaw Type FB-15C-1 (Olympus) and the cup forceps was Standard Type Fenestrated FB-19C-1 (Olympus), and both were reusable. The patients, the pathologist, and the assistant were all blinded to the type of forceps used.

During a video-assisted bronchoscopy procedure, 4 biopsy samples were obtained from areas with the most radiographic abnormalities.

Sample size was described by the assistant as follows:

If the sample did not fill the forceps, it would be considered as a small size sample; if it filled the forceps, it would be considered medium; and if it was larger than the forceps size, it would be considered a large sample.

At the end of the procedure, complications such as pneumothorax or bleeding were also assessed. If the bleeding was not significant and did not require any intervention, it was considered “mild.” If suctioning was required to clear the bronchoscopy field, the bleeding was considered “moderate,” and if interventions such as the use of ice-cold saline, topical adrenaline, or balloon tamponade were required, it was considered “significant.”

A chest x-ray was obtained after each bronchoscopic procedure.

If pneumothorax did not take place, the case was assigned as “no pneumothorax.” If the size of pneumothorax was closer than 2.5 cm to the chest wall on chest x-ray, it was graded as “mild,” and it was graded as “significant” if it was further than 2.5 cm from the chest wall or required a chest tube placement.

Subsequently, the samples were sent for histopathologic examination. From each biopsy, at least 24 tissue sections were prepared (4 slides) and the number of alveoli in each sample was counted and classified by the pathologist as follows:

1. Alveoli greater than 20: Alveolated
2. Alveoli < 20: Nonalveolated
3. No alveoli: Unsatisfactory

All the samples were evaluated by 1 pathologist in a blinded manner and are described as follows:

1. The studied tissue yielded a pathological diagnosis: Diagnostic
2. The studied tissue did not yield a pathological diagnosis: Nondiagnostic

The prominent tissue present in each sample was described by the pathologist as parenchyma, bronchial mucosa, surface epithelium, pleura, necrotic tissue, or lacking pulmonary tissue.

RESULTS

Forty-four patients were recruited in the study, of which 21 (47.7%) were male. Among the 21 male patients, 11 underwent biopsy using alligator forceps and 10 using cup forceps. Among the 23 female

patients, 11 underwent biopsy using alligator forceps and 12 using cup forceps.

The youngest patient was 16 years old and the oldest was 71 years (3 individuals). The mean age of the patients was 46.6 years.

A total of 176 biopsy samples were collected from 44 patients (4 each).

Sample Grouping Based on Size

Of a total of 176 samples, 57 were small (32.4%), 66 were medium (37.5%), and 53 were large (30.1%) (Table 1).

Sample Distribution Based on the Type of Forceps

Of the 88 samples taken by the alligator forceps, 19 were small (21.6%), 40 were medium (45.5%), and 29 were large (33.0%).

Of the 88 samples obtained by the cup forceps, 38 were small (43.2%), 26 were medium (29.5%), and 24 were large (27.3%).

The number of small samples taken by the cup forceps ($n = 38$) was twice the number of those taken by the alligator forceps ($n = 19$). This difference was smaller regarding medium and large samples. The type of forceps used was significantly correlated with the sample size ($P = 0.008$). In other words, with the alligator forceps larger samples were taken as compared with the cup forceps.

Alveolation of Samples

Of a total of 176 samples, 84 were alveolated (47.7%), 26 were nonalveolated (14.8%), and 66 were unsatisfactory (37.5%) (Table 2).

Grouping Based on the Type of Forceps

Of a total of 88 samples taken by the alligator forceps, 42 were alveolated (47.7%), 18 were nonalveolated (20.5%), and 28 were unsatisfactory (31.8%); whereas, of a total of 88 samples obtained by the cup forceps, 42 samples were alveolated

TABLE 1. Results of Sample Size

	Forceps		
	Alligator	Cup	Total
Small			
N	19	38	57
% within forceps	21.6%	43.2%	32.4%
Medium			
N	40	26	66
% within forceps	45.5%	29.5%	37.5%
Large			
N	29	24	53
% within forceps	33.0%	27.3%	30.1%
Total			
N	88	88	176
% within forceps	100.0%	100.0%	100.0%

N indicates number.

TABLE 2. Number of Alveoli

Number of Alveoli	Forceps		Total
	Alligator	Cup	
> 20			
N	42	42	84
% within forceps	47.7%	47.7%	47.7%
< 20			
N	18	8	26
% within forceps	20.5%	9.1%	14.8%
No alveoli			
N	28	38	66
% within forceps	31.8%	43.2%	37.5%
Total			
N	88	88	176
% within forceps	100.0%	100.0%	100.0%

N indicates number.

(47.4%), 8 were nonalveolated (9.1%), and 38 were unsatisfactory (43.2%).

The number of samples with more than 20 alveoli was similar for the 2 types of forceps used. However, the number of samples without alveoli was higher in the cup forceps group (38 samples vs. 28 samples), but this difference was not statistically significant ($P = 0.065$).

Diagnostic Value

Of a total of 176 samples, 38 were diagnostic (21%) (Tables 3, 4).

On the basis of the type of forceps used, of the 88 samples taken by the alligator forceps, 16 were diagnostic (18.2%), whereas of the 88 samples obtained by the cup forceps, 21 were diagnostic (23.9%).

The number of diagnostic samples obtained with the cup forceps was more than that of the alligator forceps (21 samples vs. 16 samples), but the difference was not statistically significant ($P = 0.355$).

Pneumothorax

Of a total of 44 patients, 41 showed no pneumothorax (93.2%), 1 patient (4 samples) showed mild

TABLE 4. Final Diagnosis and Type of Forceps Used

	Forceps		
	Alligator	Cup	Total
Diagnostic			
N	9	12	21
% within forceps	40.9%	54.5%	47.7%
Nondiagnostic			
N	13	10	23
% within forceps	59.1%	45.5%	52.3%
Total			
N	22	22	44

N indicates number.

pneumothorax (2.3%), and significant pneumothorax was present in 2 cases (8 samples) that required chest tube placement (4.5%).

As noted earlier, mild pneumothorax occurred in 1 case, which resolved with needle aspiration.

The frequency of pneumothorax based on the type of forceps used was as follows:

Of a total of 22 patients in the alligator forceps group, 21 patients showed no pneumothorax (95.5%), 1 patient showed mild pneumothorax (4.5%), and significant pneumothorax was not found in any patient (0%).

Of a total of 22 patients in the cup forceps group, 20 patients had no pneumothorax (90.9%), mild pneumothorax was not found (0%), and 2 patients developed significant pneumothorax (9.1%).

According to the above-mentioned results, no significant association was found between the type of forceps used and the development of pneumothorax ($P = 0.999$).

Bleeding

The frequency of bleeding was as follows: 114 biopsies were not associated with any bleeding (64.8%), 56 had mild bleeding (31.8%), and 6 caused significant bleeding (3.4%); even in cases with significant hemorrhage, bleeding easily stopped with ice-cold saline or adrenaline instillation. No uncontrollable bleeding occurred (Table 5).

Bleeding frequency based on the type of forceps used was as follows:

Of a total of 88 samples taken by the alligator forceps, 59 had no bleeding (67%), 28 had mild bleeding (31.8%), and 1 had significant bleeding (1.1%). Of a total of 88 samples obtained by the cup forceps, 55 had no bleeding (62.5%), 28 had mild bleeding (31.8%), and 5 had significant bleeding (5.7%).

According to the above findings, only in the latter situation (significant bleeding) was the number of cases in the cup forceps group comparatively larger than that of the alligator forceps group (5 vs. 1); however, this difference was not statistically significant ($P = 0.246$).

TABLE 3: Final Diagnosis

	Frequency	Percent
Granulomatous disease	10	26.3
Constrictive bronchiolitis	2	5.3
Malignant process	9	23.7
Lymphoproliferative disorder	3	7.9
Organizing pneumonia	4	10.5
Eosinophilic pneumonitis	2	5.3
Hypersensitivity pneumonitis	1	2.6
Pneumocystis infection	3	7.9
Vasculitis	1	2.6
Alveolar hemorrhage	1	2.6
Lymphocytic interstitial pneumonitis	2	5.3
Total	38	100.0

TABLE 5. Severity of Bleeding

	Forceps		
	Alligator	Cup	Total
No bleeding			
N	59	55	114
% within forceps	67.0%	62.5%	64.8%
Mild			
N	28	28	56
% within forceps	31.8%	31.8%	31.8%
Significant			
N	1	5	6
% within forceps	1.1%	5.7%	3.4%
Total			
N	88	88	176
% within forceps	100.0%	100.0%	100.0%

N indicates number.

DISCUSSION

In a study by Curley et al,⁷ the effect of factors such as different types of forceps, size, flotation, and number of samples on quality and diagnostic value of sampling was studied, and it was concluded that the diagnostic value of the sample is increased by the following measures: (a) size of forceps, (b) number of samples per biopsy, and (c) type of forceps (alligator forceps).

Visher and Faro⁸ in their study emphasized the diagnostic role of TBLB in pediatric illnesses and concluded that the use of adult-sized bronchoscopes with larger working channels, instead of pediatric bronchoscopes, can increase the diagnostic sensitivity of bronchoscopy.

In a study on the diagnostic ability of biopsy of peripheral pulmonary lesions, alligator forceps yielded more sensitivity as compared with standard forceps.⁹

In this study, a significant correlation was found between the biopsy sample size and type of forceps used, and larger samples were obtained by alligator forceps (21.6% small specimens with alligator vs. 43.2% with cup forceps).⁷ Therefore, it was concluded that alligator forceps provide larger biopsy samples.

In our study, from a total of 176 specimens, 37 (21%) were diagnostic. In comparison with the other studies, we do not feel that the size of our samples, number of alveolated samples, or the diagnostic yield was any different.⁷⁻⁹ Among the 88 specimens taken by each of the 2 different kinds of forceps, 18 samples (18.2%) in the alligator forceps group and 21 samples (23.9%) in the cup forceps group were diagnostic; however, this difference was not statistically significant. Maybe with a larger study sample size a statistically significant result can be obtained. In similar studies, even though no significant difference was found between the 2 types of forceps in terms

of abnormal or alveolated tissue, the cup forceps provided a smaller specimen with less diagnostic value. In this study, although the alligator forceps yielded larger samples, the diagnostic yield was not increased. The relatively low diagnostic yield is most likely related to the case mix of various suspected diagnoses.

Although in 6 specimens (3.4%) bleeding was moderate to severe, requiring lavage with ice-cold saline and/or local adrenaline, uncontrollable bleeding was not found in any of the cases and significant bleeding (requiring more than 10 mL of normal saline for irrigation) was observed in 5 cases in the cup forceps group and in 1 case in the alligator forceps group. However, this difference was not statistically significant, which may be because of a small sample size. A larger study sample may yield more conclusive results.

In general, 3 individuals had pneumothorax, which was resolved in 1 case with needle aspiration and in 2 cases required chest tube placement. The first case was in the alligator forceps group and the latter 2 were in the cup forceps group. In other words, pneumothorax was more frequent in the cup forceps group, but it was not statistically significant. Similar studies have not shown any cases of pneumothorax. Development of pneumothorax in 3 cases in our study may have been because of the lack of fluoroscopic guidance.

According to our study results, the incidence of postprocedure bleeding and pneumothorax was higher in those who underwent biopsy with the cup forceps.

It is noteworthy that 12.3% of the cases with small biopsy samples developed pneumothorax, whereas this rate was much lower in cases with medium or large biopsy samples. In other words, contrary to our expectation, obtaining a larger size of biopsy specimen is not necessarily associated with more complications.

In conclusion, the alligator forceps yield a larger specimen than did cup forceps.

No significant difference was seen in the diagnostic yield between the 2 types of forceps. Biopsy complications (pneumothorax and bleeding) occur less frequently when using alligator forceps, but the difference in this regard is not statistically significant. Larger studies are indicated.

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