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Hot Biopsy Forceps in the Diagnosis of Endobronchial Lesions

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ABSTRACT

Introduction: Electrocoagulation bronchoscopy biopsy forceps may prevent bleeding, but could also impair the quality of the specimens obtained.

Methods: Patients with endobronchial lesions during bronchoscopy underwent 6 endobronchial biopsies with a hot biopsy forceps alternating with electrocoagulation (Hot) and without (Cold). Bleeding was quantified on a scale of 1 to 4. The generator was set on “soft coagulation” mode, with power settings of 40W/60W/80W/100W for each group of 10 patients in a sequential fashion. Clinical pathology results were recorded then samples reviewed by a second blinded pulmonary pathologist.

Results: Thirty-nine patients with 40 endobronchial lesions had 6 biopsies performed (one patient had only 4 samples taken) for a total of 238 biopsy samples. Concordance between hot and cold samples was 92.5% for clinical pathologist and 87% for blinded pathologist ($p>0.05$). Paired analysis suggested lower average bleeding score with the use of hot forceps ($p=0.03$). Overall bleeding rates for cold and hot biopsies were: grade 1- 30.3/41.2%; 2- 62.2/49.6%; 3- 7.6/9.2%; 4- 0/0% ($p>0.05$).

Conclusions: The use of hot biopsy forceps for endobronchial biopsy does not appear to have a negative impact on the pathological samples. Hot biopsy forceps showed a statistically significant reduction in bleeding score unlikely to be of clinical significance.

Introduction

The traditional approach to diagnosis of endobronchial lesions relies on forceps biopsy during flexible bronchoscopic examination. A new electrocautery “hot” bronchoscopy biopsy forceps is now commercially available and may prevent bleeding following biopsy. Unfortunately, no published data exist regarding the use of this device.

The primary objective of this study was to determine the impact of electrocautery forceps on pathological diagnosis following biopsy of endobronchial lesions. Our secondary objective was to compare bleeding rates between the two techniques.

Methods:

This study was conducted as a prospective controlled study, with each patient serving as their own control. The study protocol was approved by the Conjoint Health Research Ethics Board of the University of Calgary. Written informed consent was obtained for all patients included in this study.

Inclusion / Exclusion Criteria:

Patients aged > 18 years with a visible endobronchial lesion at flexible bronchoscopy performed by one of the investigators and in whom biopsy was indicated for diagnosis of the lesion were eligible for the study. Patients were excluded if they had a known or suspected bleeding disorder or a cardiac pacemaker or implantable defibrillator (ICD) in place.

Procedure

Patients underwent flexible bronchoscopy on an outpatient basis under conscious sedation with an opiate (morphine or fentanyl) and/or benzodiazepine (midazolam) administered intravenously as well as topical anesthesia. All patients had intravenous lines in place as well as supplemental oxygen by mask or nasal canullae. All patients were monitored with ECG, automated blood pressure cuff and pulse oximetry. Patients were monitored post-procedure for a minimum period of two hours.

Once a suitable lesion was identified, 6 biopsies were taken, alternating between "Hot" and "Cold" without specifying the method for the initial biopsy. The samples were placed in two separate formalin containers. Quantification of bleeding was done and recorded by the bronchoscopist (unblinded to biopsy method) after each biopsy according to a 4 point scale (1: no bleeding; 2: minimal bleeding not requiring intervention; 3: mild to moderate bleeding requiring intervention such as iced cold saline, topical epinephrine or electrocoagulation; 4: moderate to severe bleeding requiring termination of procedure, endotracheal intubation or other invasive treatment). Additional biopsies or other sampling was performed at the discretion of the bronchoscopist but placed in separate containers.

All biopsies were taken with an electrocoagulation capable biopsy forceps (FD-6C-1A – Hot biopsy forceps, Olympus America, Melville NY.) with (Hot) or without (Cold) the application of an electrocoagulation current (ERBE ICC 350 electrosurgical generator, Tübingen, Germany) set on "soft coagulation" mode. The power setting on the generator was set at 40, 60, 80 and 100 watts for each group of 10 patients in a sequential fashion.

Pathology

All biopsy samples were sent to the pathology department without any identification of treatment group, for interpretation by the clinical pathologist assigned to the case. The diagnosis reported by the clinical pathologist was recorded for each sample. Once patient enrollment was completed, a research pathologist blinded to treatment group reviewed all samples without knowledge of the clinical pathology report. Only one set of the biopsy pair from a given patient was reviewed at a given time. The research pathologist recorded a pathological diagnosis for each set of samples and was asked to grade the quality of the sample with regards to electrocoagulation damage according to a 3 point scale (1: no or mild damage; 2: moderate damage; 3: severe damage).

If the endobronchial biopsies were non-diagnostic, other samples taken at the time of bronchoscopy or additional samples taken at a later date were reviewed and recorded for study purposes.

Analysis

All patients with documented endobronchial lesions who underwent at least 2 biopsies (one with and one without electrocoagulation) were included in the analysis. Data was analyzed using the SPSS v13.0 statistical software (Chicago, IL).

The primary outcome measure for the study was the discordance of pathological results obtained with the Hot and Cold methods. A McNemar's test for changes to a 4x4 table was applied comparing results from both diagnostic techniques. Fisher's exact test was also used to compare the diagnostic yield between the two approaches, and a 95% confidence interval of the frequency of positive concordance between the two approaches was calculated.

The study sample size of 40 patients was calculated with the Fisher's exact test (2 sided) as if the samples were unmatched, with a power of 0.80 to detect a decrease in diagnostic yield from 95% to 70%, with an alpha of 0.05. This approach was used as there was no way to determine the expected frequency of discordant results between each diagnostic test required for the McNemar's test to be used in sample size calculations. Ten discordant results would be required to show the above difference with the McNemar's test.

Comparison of bleeding rates was performed by comparing the average bleeding score for Hot versus Cold biopsies in a paired non-parametric analysis (Wilcoxon Signed Ranks Tests).

Results

Thirty nine patients with 40 endobronchial lesions were entered into the study and had the 6 biopsies performed as per protocol (one patient had only 4 samples taken) for a total of 238 biopsy samples. Fifty six percent of subjects were male (22 of 39) and mean age was 60.8 years (range 20-85).

Location of biopsy and final diagnoses are listed in table 1. A diagnosis was made in 35/40 (87.5%) of cases with endobronchial biopsy.

Concordance between hot and cold samples was 92.5% for clinical pathologist and 87% for research pathologist ($p>0.05$ McNemar test) suggesting lack of significant impact of hot biopsy on diagnostic yield (Table 2). The degree of electrocoagulation damage was graded as 1 (minimal) for all samples.

Paired analysis of the average bleeding score between hot and cold biopsies showed statistically significant lower bleeding score for hot samples ($p=0.03$). Overall bleeding rates for cold and hot biopsies were respectively: grade 1- 30.3/41.2%; 2-62.2/49.6%; 3- 7.6/9.2%; 4- 0/0% ($p>0.05$ Kruskal-Wallis test, figure 1, panel A). No significant difference in bleeding was seen when analyzed according to power level (figure 1, panel B). This suggests that the main effect of the Hot biopsy on bleeding is a reduction in the number of mild bleeding episodes but that a reduction in moderate bleeding is not seen. No cases of severe bleeding were seen during the study period.

Discussion

The diagnostic yield following endobronchial biopsy is excellent, with the largest case series demonstrating sensitivities of 76% to 97%[1;2]. It has also been demonstrated that 3 samples are sufficient to maximize diagnostic yield[3], although the collection of additional samples has been justified by others[4;5].

The only significant complication following endobronchial biopsy is bleeding. Mild, self limited bleeding is common[6], and may lead to difficult visualization potentially impeding the remainder of the examination. Severe life-threatening bleeding is fortunately a rare event. One report described 2 deaths attributed to bleeding in a questionnaire study of approximately 48,000 bronchoscopy procedures.[7] Brisk bleeding was seen in 6 of 330 patients reported in a second series, but no fatalities occurred.

Endobronchial electrocoagulation is an effective tool in the management of endobronchial lesions and can be very effective at controlling bleeding from an identified bleeding site[8-10]. This makes new biopsy forceps capable of applying an electrocoagulation current at the time of biopsy promising in terms of reducing bleeding risk following this common procedure. Despite the commercial availability of such a forceps, no published investigations address the potential impact of this approach on the quality of the biopsy specimen obtained despite the fact that electrocautery applied to the airway can lead to significant pathological changes in the tissues[11;12]. The impact of hot forceps on bleeding rate has not been reported either.

This study was performed to better understand the performance characteristics of a new commercially available device designed to obtain endobronchial biopsies with simultaneous application of an electrocautery current aimed at preventing or reducing bleeding. The study was powered to detect a significant impact on the diagnostic yield of the samples as it was felt that a greater harm could come to patients if this device lowered the diagnostic yield from bronchoscopy biopsy than if the device simply failed to prevent bleeding.

Fortunately the hot biopsy forceps did not appear to impair the quality of the specimens obtained or hinder the pathologist's ability to make a diagnosis.

The next issue then was to determine if the device actually does what it is designed to do – reduce bleeding rates. Although a statistically significant decrease in mean bleeding score was noted with the use of the electrocoagulation current, this seemed to be limited to a reduction in the number of minor bleeding episodes (grade 2), unlikely to be of clinical significance. No decrease in moderate bleeding was noted, although the number of these events was low and a larger study would be needed to have sufficient power to confirm this finding. Similarly, severe bleeding episodes were rare enough that it would be difficult to show a significant difference in this outcome. Given that the population studied did not have any particular increased risk for bleeding, we

cannot exclude that this technique may reduce bleeding in high risk patients or lesions. During the study period, only one patient had severe bleeding resulting in termination of the procedure. Interestingly, this occurred during a hot biopsy, but the patient was not included in the study as per protocol given that no matching “cold” biopsy was obtained.

The lack of blinding at the time of quantification of bleeding could potentially bias the results of the study, but is difficult to remedy. The use of a simple scoring system and the initial equipoise of the investigators regarding the effect of this device should have minimized any bias. Another potential bias relates to the lack of randomization of the sequence of the biopsies. Given an alternating biopsy protocol (e.g. cold-hot-cold-hot-cold-hot or vice-versa), it seems unlikely that starting with one approach vs. the other would impact bleeding rates or quality of the samples.

The cost of the biopsy forceps is relatively minor as it is a re-usable device, however, infection control implications of re-usable biopsy forceps need to be considered. The cost of the electrosurgical generator is much more important but these may be easily accessible in most hospitals.

Given these findings, it would not seem that routine use of this device is warranted. We have occasionally found it useful to apply electrocautery when moderate bleeding occurs following endobronchial biopsy. This can be done using the biopsy forceps as the electrocautery probe and is of course facilitated if all the equipment is already set-up. Familiarity with this equipment is also important and may lead to improved patient and bronchoscope safety. Other simpler methods such as topical application of iced-cold saline or epinephrine may be easier to apply and more easily accessible to bronchoscopists.

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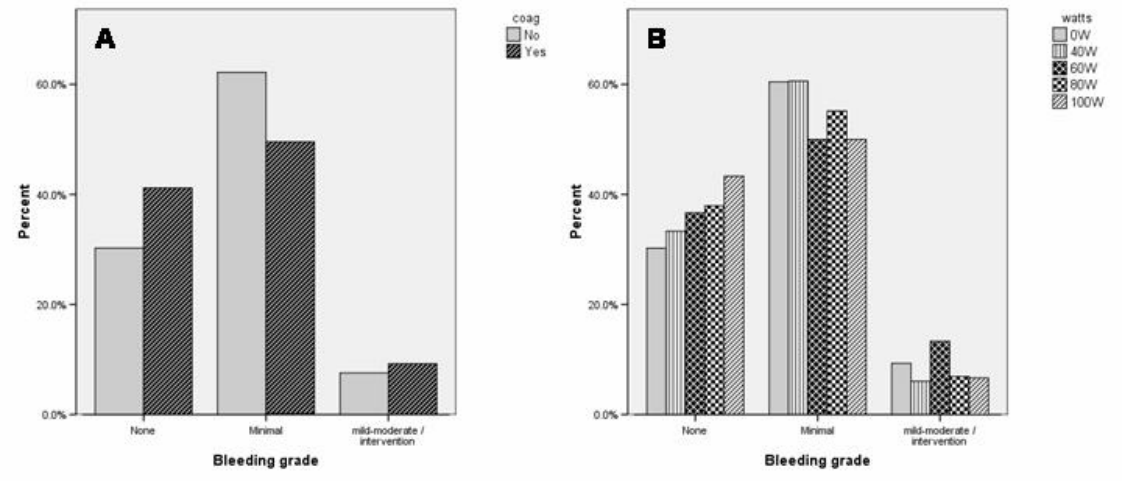
TABLE 1

Location of lesion (%)	
RUL	24.4
Right mainstem	15.1
Left mainstem	12.6
LUL	12.6
RLL	12.6
LLL	7.6
RML	5.0
Trachea	5.0
BI	5.0
Final diagnosis (%)	
Non-small cell carcinoma	65.0
Lymphoma	12.5
Small cell carcinoma	7.5
Carcinoid tumour	7.5
Renal cell carcinoma	2.5
Granular cell tumour	2.5
Hamartoma	2.5

RUL: Right upper lobe. LUL: Left upper lobe. RLL: Right lower lobe. LLL: Left lower lobe.
RML: Right middle lobe. BI: Bronchus intermedius.

TABLE 2

Pathology Results (Clinical/Research)		COLD		Total
		-	+	
HOT	-	5/4	1/1	6/5
	+	2/4	32/30	34/34
Total		7/8	33/31	40/39


A
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Yes
60.0%
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