Bronchoscopy with transbronchial biopsies: measurement of bleeding volume and evaluation of the predictive value of coagulation tests

Ø. Bjørtuft*, F. Brosstad**, J. Boe*

ABSTRACT: The objectives of this study were to measure the bleeding volume associated with fibreoptic bronchoscopy with transbronchial biopsies (TBB), to correlate it with coagulation tests and to compare bleeding volume in patients with and without lung transplant. A total of 104 consecutive TBB in 51 different patients was evaluated prospectively. Before each procedure, haemoglobin, blood platelets, prothrombin time (PT), activated partial thromboplastin time (aPTT) and bleeding time were measured. During the procedure, lavage fluid and blood were collected by suction. The haemoglobin concentration of the mixture was measured and bleeding volume was calculated. Clinically significant bleeding was arbitrarily defined as >20 mL blood present in lavage fluid.

The mean±SD bleeding volume was 7±10 mL with no statistically significant difference between transplanted and nontransplanted patients. In eight procedures (7.7%) the bleeding volume was >20 mL (range 22–61 mL). Prebiopsy values for blood platelet counts, PT and aPTT did not predict a bleeding tendency in any of the procedures in which significant bleeding occurred. No correlation was found between bleeding time and bleeding volume in the 17 procedures performed in patients with a prolonged bleeding time (>10 min).

The bleeding associated with transbronchial biopsies was usually minor and quantitatively similar in patients with or without lung transplant. Coagulation tests could not predict clinically significant bleeding, which may occur in patients with normal coagulation test results.

Fibreoptic bronchoscopy with transbronchial biopsies (TBB) is a useful tool in diagnosing lung diseases [1, 2] and establishing a diagnosis of rejection and/or infection in patients with heart–lung and lung transplants [3–7]. However, TBB is associated with complications such as pneumothorax, bleeding, cardiac arrhythmias and possibly respiratory failure [8–13]. Previous literature on lung biopsy-related bleeding has generally not addressed TBB, and does not provide exact figures for blood volumes lost during the procedure. Although all previous reports, which are retrospective with the exception of one study [8], showed that life-threatening or fatal bleeding secondary to TBB is a rare event, every attempt to predict and thereby prevent its occurrence should be made.

As hospital practice, every patient is screened with coagulation tests before TBB was performed, and since blood platelets play a significant role in haemostasis, bleeding time has routinely been included in this coagulation screening. The aims of the present study were, therefore, threefold: 1) to quantify prospectively the bleeding associated with bronchoscopy and TBB; 2) to evaluate the capacity of coagulation tests such as bleeding time, platelet count, prothrombin time (PT) and activated partial thromboplastin time (aPTT) to predict clinically significant bleeding; and 3) to compare bleeding volume in TBB performed in patients with and without lung transplants.

Patients and methods

The bleeding associated with 104 TBB performed consecutively at our department was evaluated prospectively. The patients’ diagnoses are summarized in table 1.

Bronchoscopy was performed with an Olympus BF P20D or IT 20D (Olympus, Tokyo, Japan) under fluoroscopic control. In patients with lung transplants, biopsies were obtained using a 3-mm alligator forceps (Endo-Flex KK 0418-100, Düsseldorf, Germany). If possible, biopsies were taken from all lobes of the transplanted lung. For the remainder of the patients, 2-mm forceps (Olympus FB-19C) were used. These biopsies were taken from areas with marked radiological abnormalities in one of the lungs. The number of biopsies in patients with lung transplants ranged 7–10 biopsies-patient⁻¹, whereas 4–5 biopsies-patient⁻¹ were regarded as satisfactory for the patients without lung transplants. All of the bronchoscopies were performed by experienced bronchoscopists and 75 of the procedures were performed by one of the authors (Ø. Bjørtuft).
During bronchoscopy, blood and saline lavage fluid were collected through a vacuum suction system connected to the bronchoscope. The volume of mixed blood and lavage fluid (Vm) and the haemoglobin concentration in this mixture (HbM) were measured. Haemoglobin in the patient's blood (Hbp) and haemacrit were measured before the procedure and the volume of blood loss was calculated using the formula: Vm×Hbp/HbM. A volume of >20 mL was arbitrarily defined as a clinically significant bleeding.

All patients were screened before the procedure with coagulation tests including bleeding time, PT, aPTT and platelet count. Bleeding time was measured according to Ivi et al. [14] and a bleeding time of >10 min was regarded as prolonged [14]. None of the patients had renal failure, known liver disease, a history of bleeding tendency or anticoagulants therapy.

Values are given as mean±SD. A two-tailed Student's t-test was used to compare groups, and a correlation coefficient (r) between bleeding volume and bleeding time was determined using Pearson's test. A p-value <0.05 was considered statistically significant.

Results

The number of procedures performed in different patient categories (ultimately proven diagnoses) is shown in table 1. The mean amount of bleeding in all procedures was 7±10 mL (range 0–61 mL). Eight patients (7.7%) had clinically significant (>20 mL) bleeding, ranging 22–61 mL. One patient haemorrhaged >50 mL. None of the bleeding episodes was regarded as serious or life-threatening, in that the patient developed hypotension or required intubation or blood transfusion. There was no statistically significant difference in bleeding volume between patients with or without lung transplants (range 0–61 mL and 0–44 mL, respectively) (table 2).

Table 3. Number of patients, sex, age, bleeding volume and coagulation tests in all procedures and in procedures with and without significant bleeding

<table>
<thead>
<tr>
<th>Procedure</th>
<th>All procedures</th>
<th>Procedures with &lt;20 mL bleeding</th>
<th>Procedures with &gt;20 mL bleeding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age yrs (range)</td>
<td>50 (25–78)</td>
<td>50 (25–78)</td>
<td>50 (34–63)</td>
</tr>
<tr>
<td>Bleeding mL</td>
<td>7±10</td>
<td>4±5</td>
<td>36±12</td>
</tr>
<tr>
<td>Haemoglobin g/100 mL</td>
<td>11.5±2.0</td>
<td>11.5±2.0</td>
<td>11.4±2.9</td>
</tr>
<tr>
<td>Platelets</td>
<td>318±123</td>
<td>320±126</td>
<td>288±95</td>
</tr>
<tr>
<td>Prothrombin time INR</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Activated partial thromboplastin time s</td>
<td>27±4</td>
<td>27±3</td>
<td>28±6</td>
</tr>
</tbody>
</table>

Table 2. Bleeding volume in different groups of patients

<table>
<thead>
<tr>
<th>Patients with lung transplant</th>
<th>Patients without lung transplant</th>
<th>Patients with bleeding time</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>82</td>
<td>22</td>
</tr>
<tr>
<td>Age yrs (range)</td>
<td>50 (25–62)</td>
<td>50 (28–78)</td>
</tr>
<tr>
<td>Bleeding mL, mean±SD</td>
<td>6±10</td>
<td>7±12</td>
</tr>
</tbody>
</table>

*: presented as number and biopsies·patient⁻¹.

Discussion

The major finding of this study was that there is no correlation between coagulation tests and the likelihood of bleeding following TBB. This indicates that normal coagulation test results do not guarantee that bleeding will not occur.

These results are in accordance with the only previous paper that has addressed the relationship between coagulation test results and bleeding associated with fiberoptic bronchoscopy with biopsies [15]. Kozak and Brach [15] retrospectively evaluated 305 procedures and found that coagulation tests such as PT and aPTT did not predict bleeding. TBB was not distinguished from ordinary bronchial biopsies in their study.
In a comprehensive review, bleeding time was not judged to be useful in predicting haemorrhage associated with operations and renal biopsies [16]. Bleeding time has not previously been addressed in relation to transbronchial biopsies. In the present study, a prolonged bleeding time was not indicative of a general or local bleeding tendency, as no correlation was found between bleeding time and volume, indicating that the bleeding time does not predict clinically significant bleeding during TBB.

Measurement of the haemorrhage during TBB probably underestimates the actual volume of blood lost. Blood will be retained in the lung parenchyma, sometimes indicated by opacities on postbiopsy radiographs [17]. Some blood is also dispersed in the suction system, and sometimes, patients cough up blood during the procedure. Even with this in mind, the present measurements show that the bleeding associated with bronchoscopy with TBB is usually minor and <20 mL.

Previous reports have not established any common definition of clinically significant bleeding related to biopsies via the fibreoptic bronchoscope. Definitions of significant (terms such as "major", "profuse" and "excessive" are also used) bleeding have varied: >50 mL [11], >100 mL [15], >100 mL blood intermixed with saline lavage [10], or merely the judgement of the bronchoscopist [6]. None of these previous reports described how the measurement of blood volume was performed or the clinical situation associated with this bleeding volume. In planning the present study an arbitrary decision was made to consider a bleeding volume of 20 mL as clinically significant. With the accurate measurements used this would be comparable to the previously less precise volume estimates [10, 11, 15]. Significant bleeding was found in 7.7% of the procedures, compared with <1–19% in previous studies [5, 10, 11], indicating that significant bleeding will occur regularly, but the rate depends on the definition of significance. The present data further support previous findings that life-threatening bleeding after TBB is rare [10, 13].

This study has shown that bleeding associated with transbronchial biopsies is similar in patients with or without lung transplant. Bleeding time is a time-consuming technique. Screening with coagulation tests such as prothrombin time, activated partial thromboplastin time and blood platelets do not appear to identify patients who eventually develop clinically significant bleeding, indicating that clinically significant bleeding can occur, even with normal coagulation test results and without risk factors such as a history of bleeding and anticoagulant therapy.

References