Hemoptysis in Patients With Renal Insufficiency*

The Role of Flexible Bronchoscopy

Nicholas Kallay, MD; Donnie P. Dunagan, MD, FCCP; Norman Adair, MD, FCCP; Robert Chin, MD, FCCP; and Edward F. Haponik, MD, FCCP

Study objectives: To assess the indications, yield, and therapeutic impact of flexible bronchoscopy (FB) in patients with hemoptysis and renal insufficiency.

Design: Retrospective cohort analysis.

Setting: Tertiary-care university hospital.

Patients: Thirty-four patients over a 7.5-year period who underwent FB to evaluate hemoptysis in the setting of renal insufficiency (ie, serum creatinine level, > 1.5 mg/dL).

Measurements and results: The etiology of hemoptysis was undetermined in 41% of cases. Defined causes of bleeding included infections (29%), pulmonary renal syndromes (15%), airway injury (9%), and pulmonary embolism (6%). No specific bleeding site was identified, but FB lateralized hemorrhaging to one lung in 24% of patients. FB results influenced therapy in 29% of patients overall and in 8% of patients without respiratory tract infection. The hospital survival rate was 47% and did not differ based on the presence or absence (presence vs absence) of the following variables: a defined etiology for hemoptysis (45% vs 50%); lateralized bleeding (38% vs 50%); or management alterations prompted by other FB findings (50% vs 46%). Factors associated with survival included the onset of bleeding prior to hospital admission (80% vs 33%; p = 0.02), the absence of respiratory failure requiring mechanical ventilation at the time of FB (90% vs 29%; p = 0.002), and lack of prohemorrhagic factors (other than uremia) such as disseminated intravascular coagulation, recent treatment with warfarin, heparin, or antiplatelet agents (78% vs 33%; p = 0.05). During the 6 months following hospital discharge, hemoptysis recurred in 14% of patients, and 5 patients died, for an overall mortality rate of 62%.

Conclusions: These data suggest that FB in hospitalized patients with hemoptysis and renal insufficiency, and without radiographic findings suggesting neoplastic disease, has a low yield and limited impact. Whether FB influences outcome in selected patients in this setting requires prospective investigation.

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Key words: bronchoscopy; hemoptysis; human; kidney failure; outcome assessment

Abbreviations: FB = flexible bronchoscopy; FIO2 = fraction of inspired oxygen; INR = international normalized ratio; NS = not significant; PSB = protected-specimen brush; SPO2 = oxygen saturation as measured by pulse oximetry

In patients with hemoptysis, flexible bronchoscopy (FB) is commonly used to help determine a specific etiology, to localize bleeding, and to guide therapeutic decisions.1–3 Hemoptysis has a myriad of potential causes, and its severity may range from inconsequential bleeding to an acute, life-threatening event.4,5 In patients with renal failure, important and potentially treatable considerations include pulmonary renal syndromes, most commonly, Wegener’s granulomatosis, Goodpasture’s syndrome, and systemic lupus erythematosus. Moreover, such patients may have increased predispositions toward infection, bleeding diatheses, and iatrogenic factors, as well as the spectrum of conditions seen in persons without renal failure. Although FB is performed frequently in the evaluation of hemoptysis, its role in
evaluating patients with coexisting renal insufficiency has not been defined. We reviewed our experience with FB in this clinical setting to better characterize this patient population, to clarify the role of FB and its clinical impact, and to appraise whether clinical characteristics may be associated with improved outcome.

**Materials and Methods**

**Patient Selection**

The study was designed as a retrospective cohort analysis. Using a database of hospital billing records, all patients discharged from Wake Forest University Baptist Medical Center between January 1, 1990, and June 30, 1998, who had been evaluated with FB and had been given a diagnosis of renal insufficiency (defined as a serum creatinine level $>1.5$ mg/dL, the upper limit of the normal range in our hospital laboratory) and who experienced hemoptysis at any time during hospitalization were identified. Medical records for these patients were examined to identify those in whom FB was performed to evaluate hemoptysis with concurrent renal insufficiency.

**Data Collection**

All data regarding the patients were obtained directly from hospital databases, the patient’s medical record, and FB reports, and included patient demographics, the primary reason for hospital admission, and laboratory studies at presentation or within 24 h of hemoptysis onset (i.e., WBC count, hemoglobin count, platelet count, prothrombin time/international normalized ratio [INR], partial thromboplastin time, BUN level, serum creatinine level, PaO$_2$, oxygen saturation as measured by pulse oximetry [SpO$_2$], and chest roentgenogram). Relevant clinical features were noted, including the timing of the onset of hemoptysis relative to hospital admission, the volume of bleeding, the etiology of renal failure and hemoptysis, the need for mechanical ventilation at the time of FB, and the use of drugs or existence of conditions that might predispose the patient to hemorrhage (in addition to uremia). FB findings, including airway examinations and findings from BAL and protected specimen brush (PSB) studies, were recorded. Mortality at the time of hospital discharge was noted. In addition, follow-up data regarding recurrence(s) of bleeding, hospitalization, and survival for the 6 months following discharge were obtained.

**FB**

All patients were seen in consultation by members of the pulmonary faculty. Prospective criteria for patient selection for FB were not defined, but general indications favoring the performance of FB in patients with hemoptysis at our center include increasing volume and duration of bleeding, as well as the presence and pattern of abnormal chest radiograph findings. Contraindications to FB included hemodynamic instability, oxygenation status that would be significantly compromised by FB, acute myocardial ischemia, and life-threatening cardiac arrhythmia.

Airway examination was performed in all patients to determine the location and etiology of the hemorrhage. If the specific bleeding site was not reported, information regarding a more general origin of bleeding (i.e., localization to an individual lobe or right/left laterolization) was determined from the FB report. Specimen sampling during the procedure was individualized for each case and included BAL and PSB. In general, BAL and PSB specimens were submitted for quantitative bacterial culture, fungal smear and culture, viral culture, mycobacterial studies, direct fluorescent antibody test for **Pneumocystis carinii**, and cytology testing. Techniques for microbiological specimen processing and interpretation have been reported previously.$^6$ The results of bacterial cultures were considered to be positive if an organism was isolated in numbers $\geq 10,000$ cfu/mL from BAL specimens or $\geq 1,000$ cfu/mL from PSB specimens.

**Outcome Measures**

The impact of FB on patient management was evaluated by a review of all progress notes and physician orders following the procedure. Treatment changes were recorded if it was clear that they had been made based on FB results. Potential therapeutic modifications included, but were not limited to, changes in antimicrobial therapy, the addition or discontinuation of immunosuppressive medications, interventional angiography, and/or surgical treatment.

In-hospital mortality data were obtained for all patients. Relationships were sought between survival and a number of variables, including the presence or absence of hemoptysis at the time of hospital admission, whether FB was performed before or after endotracheal intubation (if needed), the presence or absence of exposure to drugs or conditions predisposing the patient to hemorrhage (other than uremia), and therapeutic changes based on FB results. Further outcome data were sought for all patients surviving to hospital discharge to determine the reported recurrence of hemoptysis, readmission rates (and indications), subsequently diagnosed etiologies of hemoptysis, and mortality during the 6 months following discharge.

**Data Analysis**

Data were analyzed using a standard statistical package (SAS; SAS Institute; Cary, NC). Descriptive statistics such as means, SDs, and frequencies were generated for the variables of interest. Fisher’s Exact Test was used to test for the significance of dichotomous variables. Wilcoxon rank sum test was used to assess the association between continuous variables and the outcomes of interest. A $p$ value $\leq 0.05$ was considered to indicate statistical significance.

**Results**

**Patient Selection, Demographics, and Laboratory Data**

During the period of review, we identified 13,145 patients with renal failure, 365 (2.8%) of whom also experienced hemoptysis. One hundred seventeen patients (0.9%) were evaluated with FB and experienced hemoptysis at some time during their hospitalization. Of these patients, 115 sufficiently complete patient medical records could be found and were reviewed to extract 34 patients (29%) in whom these three characteristics were present simultaneously.

Demographic data, the primary reasons for hospital admission, and the overall survival rate at discharge are summarized in Table 1. The most common reasons for hospitalization included hemoptysis,
renal failure, and respiratory failure (24 patients, 71% of total), but there was considerable variability in other less common precipitants. Eight patients were admitted with hemoptysis as their presenting complaint; however, two additional patients later admitted that they had experienced hemoptysis before their hospitalization. There was a wide range in the duration (1 day to 2 months) and volume (from trace amounts to 200 mL/d) of hemoptysis. None of the patients were described as having “massive hemoptysis” or volumes exceeding 200 mL/d. The all-cause mortality rate was high in this selected population, as 16 patients (47%) survived and 18 patients (53%) died. The precise cause of death was often unclear, but chart review suggested that hemoptysis was the direct cause of death in only one patient. This individual had bronchoscopically diagnosed aspergillus pneumonia, underwent a previously scheduled tracheostomy following FB, and died the following day from massive airway hemorrhage that was thought to be related to his tracheostomy site.

Laboratory and radiographic data obtained at hospital admission or within 24 h of hemoptysis onset are presented in Table 2. In five patients (15%), chest radiographs demonstrated unilateral findings. Of the remaining radiographs, 18 (82%) demonstrated bilateral opacities in the lung fields, and 1 (3%) was interpreted as normal. Only one patient had a radiographic suggestion of neoplastic disease, a peripheral nodule.

Four clinical measures correlated with outcome. Increased $\text{SpO}_2$ (95% vs 82%; $p = 0.036$) and decreased oxygen requirements (fraction of inspired oxygen [$\text{FiO}_2$] 0.34 vs 0.54; $p = 0.003$) at the time of hemoptysis were associated with survival. Serum creatinine levels were higher in survivors than in nonsurvivors (6.9 vs 3.0 mg/dL; $p = 0.001$); however, all four patients admitted to the hospital with preexisting end-stage renal disease (mean serum creatinine level, 8.0 mg/dL), as well as a single patient admitted with a creatinine level of 23 mg/dL, survived to discharge, possibly skewing these data. Measurements of mean prothrombin time, INR, activated partial thromboplastin time, and platelet count did not discriminate between patients who did or did not survive. However, the 73% of our patients having one or more prohemorrhagic factors (ie, the presence of exposure to warfarin, heparin, or antiplatelet agent during the preceding 24 h and/or the presence of disseminated intravascular coagulation or other coagulopathy) proved to have a lower survival (33% vs 78%; $p = 0.05$).

### Etiologies of Renal Failure and Hemoptysis

The etiologies of renal failure are described in Figure 1. In only five patients (15%) was renal failure thought to be due to a pulmonary/renal syndrome, including Wegener’s granulomatosis (three patients), systemic lupus erythematosus (one patient), and

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Values</th>
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<tbody>
<tr>
<td>Total patients admitted, No.</td>
<td>34</td>
</tr>
<tr>
<td>Age, yr</td>
<td>58.4 ± 15.9</td>
</tr>
<tr>
<td>Sex</td>
<td>Male 18 (53) Female 16 (47)</td>
</tr>
<tr>
<td>Race</td>
<td>White 26 (76) Nonwhite 8 (24)</td>
</tr>
<tr>
<td>Reason for admission</td>
<td>Hemoptysis 8 (24) Renal failure 7 (21) Respiratory failure 9 (26) Leukemia/myelodysplastic 5 (16) Chest pain 3 (9) Myocardial infarction 2 (6) Arrhythmia 1 (3) Trauma 1 (3) AAA repair 1 (3) Mediastinal masses 1 (3) Septis 1 (3) Fever 1 (3) Mental status change 1 (3) Metabolic acidosis 1 (3) Survival at discharge 16 (47)</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>Variables</th>
<th>Patients With Data Available, No. Alive Dead p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>WBC count, 1,000/mL</td>
<td>34 13.0 9.1 NS</td>
</tr>
<tr>
<td>Hemoglobin, g/dL</td>
<td>34 8.9 8.7 NS</td>
</tr>
<tr>
<td>Platelet count, 1,000/mL</td>
<td>34 211 102 NS</td>
</tr>
<tr>
<td>Prothrombin time, s</td>
<td>33 12.8 13.5 NS</td>
</tr>
<tr>
<td>INR</td>
<td>22 1.2 1.4 NS</td>
</tr>
<tr>
<td>Partial thromboplastin time, s</td>
<td>32 27 30 NS</td>
</tr>
<tr>
<td>BUN, mg/dL</td>
<td>34 61 70 NS</td>
</tr>
<tr>
<td>Creatinine, mg/dL</td>
<td>34 6.9 3.0 0.001</td>
</tr>
<tr>
<td>$\text{SpO}_2$, %</td>
<td>9 95 82 0.036</td>
</tr>
<tr>
<td>$\text{FiO}_2$</td>
<td>31 0.34 0.54 0.003</td>
</tr>
<tr>
<td>$\text{Pao}_2$, mm Hg</td>
<td>22 82 84 NS</td>
</tr>
<tr>
<td>$\text{Pao}_2/\text{FiO}_2$</td>
<td>22 247 186 NS</td>
</tr>
<tr>
<td>Chest radiograph findings</td>
<td>Lateralizing 5 60% 40% NS Bilateral 28 45% 55% NS Normal 1 0% 100% NS</td>
</tr>
</tbody>
</table>

*Values given as mean unless otherwise indicated. NS = not significant.
idiopathic pulmonary renal syndrome (one patient, in whom serum antineutrophilic cytoplasmic antibody showed a positive perinuclear pattern and renal biopsy specimen demonstrated immune complex glomerulonephritis). Other causes of renal failure were multiple myeloma, hypertensive nephrosclerosis, and otherwise unspecified glomerulonephritis.

As summarized in Figure 2, the precise cause of hemoptysis frequently remained unclear (41% of patients) at the time of patient death or hospital discharge. Infectious etiologies accounted for 29% of instances, a pulmonary renal syndrome was thought to be the only etiology in 15%, airway injury in 9% (two patients with suction catheter trauma and one patient with pulmonary contusion), and pulmonary embolism in 6%.

**FB Results**

FB was performed most often at least 48 h after the onset of hemoptysis, when deemed appropriate and safe by the consulting and attending physicians. Although all patients had hemoptysis, other indications for FB were also present in 28 patients (82%), 24 of whom had clinically suspected respiratory tract infections. The relative weight assigned to these factors in the decision for FB could not be determined with certainty, but chart review confirmed that hemoptysis figured prominently in the decision to proceed with FB in all cases. In particular, increased bleeding was not observed except in the previously mentioned instance following scheduled tracheostomy. FB findings are summarized in Table 3. Neither a specific endobronchial etiology nor a focal site of bleeding was identified during FB in any patient. Blood was visualized in 88% of patients, and the most common finding was bilateral hemorrhage (50%). Progressively bloody lavage fluid suggesting diffuse alveolar hemorrhage was observed in a single patient. Two of these patients underwent transbronchial forceps lung biopsy, the results of both of which were nondiagnostic. FB cultures were positive in 15 patients (63%) and revealed the following broad range of microorganisms: *Staphylococcus epidermidis* (n = 1); *Staphylococcus aureus* (n = 3); *Streptococcus pneumoniae* (n = 1); *Stenotrophomonas maltophilia* (n = 2); *Haemophilus parainfluenzae* (n = 1); *Pseudomonas aeruginosa* (n = 1); *Mycobacterium avium* (n = 1); Candida species (n = 5); *Aspergillus* (n = 1); Pneumocystis carinii (n = 2); herpes simplex virus (n = 1); cytomegalovirus (n = 1); and adenovirus (n = 1). The results of cytology testing in one instance were thought to be suspicious for small cell carcinoma (in the absence of endobronchial abnormality), but the patient died before a definite diagnosis could be made, and an autopsy was not obtained.

**Relationship of FB to Outcomes**

Overall, FB did not appear to have a substantial impact on outcome. Identification of the etiology of hemoptysis was not associated with improved survival (45% in known vs 50% in unknown etiologies; the p value was not significant [NS]), nor was

**Table 3—FB Findings in Renal Failure Patients With Hemoptysis**

<table>
<thead>
<tr>
<th>Airway Examination</th>
<th>No. (%)</th>
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<tbody>
<tr>
<td>Specific endobronchial diagnosis</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Bilateral blood</td>
<td>17 (50)</td>
</tr>
<tr>
<td>Unilateral blood</td>
<td>6 (18)</td>
</tr>
<tr>
<td>Bilateral clot</td>
<td>2 (6)</td>
</tr>
<tr>
<td>Unilateral clot</td>
<td>2 (6)</td>
</tr>
<tr>
<td>Bilateral friable mucosa</td>
<td>2 (6)</td>
</tr>
<tr>
<td>Blood in endotracheal tube</td>
<td>1 (3)</td>
</tr>
<tr>
<td>No blood seen</td>
<td>4 (12)</td>
</tr>
</tbody>
</table>
lateralization of bleeding (38% when lateralized vs 50% when not lateralized; NS). The 10 patients (29%) identified as having hemoptysis prior to hospital admission were more likely to live than those in whom hemoptysis began after admission (80% vs 33%; p = 0.02).

In 10 patients (29%), therapy was changed on the basis of bronchoscopic findings. These changes included eight cases of modifications to antibiotic regimens, one case of angiography/bronchial artery embolization, and one case of minimizing endotracheal tube suctioning. Thus, FB influenced therapy in only 2 of 24 noninfected patients (8.3%). When patient therapy was changed by FB results, the survival to discharge rate (50%) was similar to that in patients who did not have therapy changed (46%). When FB was performed in 24 patients after the initiation of mechanical ventilation, survival was lower than in the 10 patients who received FB prior to a need for mechanical ventilation (29% vs 90%; p = 0.002) (Fig 3). There were no recorded complications resulting from FB.

**Postdischarge Follow-up**

Of the 16 patients who had been discharged alive from the hospital, 14 (87.5%) had detailed follow-up records available that spanned at least 6 months. Ten patients required a total of 15 additional hospitalizations in the 6 months following their initial discharge. Three admissions (20%) were caused by pneumonia, three admissions (20%) were caused by pulmonary edema, two admissions (13%) were caused by complications relating to hemodialysis access, and one admission (6.7%) each was caused by chest pain, vertebral osteomyelitis, spontaneous pneumothorax, bilateral vocal cord paralysis, severe bronchitis, following cardiopulmonary arrest while receiving hemodialysis, and with hemoptysis not otherwise specified. The recurrence of small amounts of hemoptysis was described in 2 of 14 patients (14%) in the 6 months after their initial hospitalization. In one patient, bleeding was attributed to pneumonia, while the other patient received a diagnosis of idiopathic pulmonary hemosiderosis following an otherwise nondiagnostic open lung biopsy.

Survival status 6 months after hospital discharge could be determined in all 16 discharged patients. Five patients (31%) died in the 6 months following their hospital discharge, for an overall mortality of rate of 62% (21 of 34 patients). Deaths were attributed to pneumonia (three patients, one of whom had presented with small amounts of hemoptysis), sepsis complicating a hospitalization for spontaneous pneumothorax, and cardiopulmonary arrest of unclear etiology while receiving hemodialysis.

**DISCUSSION**

Hemoptysis and renal failure are common clinical conditions with potentially important morbidity and mortality, but reports about their simultaneous occurrence are generally limited to those in patients with pulmonary renal syndromes. This report is the first to review the use of FB in patients selected on the basis of the presence of concurrent hemoptysis and renal failure. While the etiology of hemoptysis often is established, earlier reports have described hemoptysis as cryptogenic in 3 to 22% of patients. The frequency of idiopathic hemoptysis (41% after hospitalization, 35% after follow-up) in our patients is high and may be due, at least in part, to a greater incidence of comorbidities, including concomitant renal insufficiency. In a large proportion of our patients (73%), coexisting factors (in addition to uremia) or recent treatment with medications that might increase the tendency to bleed were identified. Importantly, all but one of these patients had no radiologic findings suggesting neoplastic disease.

The coexistence of hemoptysis and renal insufficiency often raises concerns about pulmonary renal syndromes, but these conditions were found in only 15% of our patients. This group of diseases includes Wegener’s granulomatosis, Goodpasture’s syndrome, and systemic lupus erythematosus, as well as less common entities such as Behçet’s syndrome and Henoch-Schönlein purpura, all of which may have a component of pulmonary capillaritis that may result in diffuse alveolar hemorrhage. The FB finding of increasingly bloody return after the instillation of successive aliquots of saline solution lavage has been associated with alveolar hemorrhage, and a pathologic diagnosis of pulmonary capillaritis can be made with transbronchial forceps biopsy.
patients underwent transbronchial forceps biopsy, which was not diagnostic in either patient. The only patient with progressively bloody lavage fluid return eventually proved to have an idiopathic etiology of bleeding despite extensive evaluation. Importantly, it is likely that the low frequency of pulmonary renal syndromes in this review reflects the availability of serologic markers together with institutional philosophies favoring renal biopsy and/or lung biopsy (open or thoracoscopic), rather than bronchoscopic evaluation, when these conditions are most strongly considered.

A major goal in the evaluation of hemoptysis is to localize the site of bleeding. Such information may help to guide decisions regarding surgery, interventional angiography, and effective airway control. In our patients, FB did not identify any discrete source of bleeding and demonstrated lateralizing findings in only 24% of cases, without an apparent impact on survival. Most of our patients underwent FB > 48 h after the onset of hemoptysis, potentially influencing the diagnostic yield. In the report of Gong and Salvatierra on 129 patients, early FB (during active hemoptysis or within 48 h of cessation) was associated with an increased likelihood of visualizing active bleeding or its site, but clinical outcomes were similar compared to those patients in whom FB was delayed. In addition, although FB contributed to a modification of therapy in nearly a third of our patients, survival did not appear to be influenced by these changes.

Thus, knowledge of the etiology of hemoptysis (when determined), localization of the bleeding site, and FB-directed therapeutic changes in this patient series had no apparent impact on patient survival. This observation suggests that in patients with renal failure the need for generalized respiratory supportive measures and the clinical course of associated comorbidities, rather than the hemoptysis itself, may have the greatest impact on short-term patient survival. Although none of our patients with renal insufficiency had hemoptysis that would generally be described as massive (when volumes were reported), their overall mortality rate was high (53%). This observation suggests that associated comorbidities accounted for many of the deaths in our group of patients.

Five other clinical markers were associated with survival in these selected patients. The onset of hemoptysis prior to hospital admission was associated with an increased likelihood of survival, perhaps reflecting a relative lack of coexisting illnesses in these patients compared to those hospitalized patients in whom hemoptysis was superimposed on other critical problems (including acute renal failure). Similarly, the ominous outcome for patients with a lower SpO2 level, a higher FIO2 requirement, or the need for mechanical ventilation prior to FB is consistent with the underlying severity of illness rather than solely the hemoptysis that they experienced. The absence of any prohemorrhagic factors (ie, exposure to warfarin, heparin, or antiplatelet agent during the preceding 24 h, and/or the presence of disseminated intravascular coagulation or other coagulopathy at the time of FB) was associated with survival. The individual elements of this category might be expected to vary in their prognostic implications, but the small size of our series limits this analysis.

The 6-month follow-up of patients who survived their initial hospitalizations revealed a modest 14% recurrence rate of small-volume hemoptysis and a more substantial 31% mortality. While one of the five deaths was associated with a recurrence of small-volume hemoptysis in the setting of pneumonia, the other four deaths had no clear link to the hemoptysis experienced during the initial hospitalization. Follow-up yielded only one additional etiology for the patient’s initial hemoptysis. It is noteworthy that no diagnoses of neoplastic disease were made during this period.

Several limitations to this report must be acknowledged and include those inherent to retrospective studies. There were no a priori criteria used to identify candidates for bronchoscopy, and complete data sets were not always available for all patients. While uniform prospective criteria for FB were not defined, bleeding had to be sufficient in volume and/or duration to merit FB. Patients with brief, self-limited episodes and low volumes of hemoptysis generally would not receive FB. Despite selection criteria that might have favored FB, its yield and apparent impact were low. Our patients tended to have multiple comorbidities, prolonged hospitalizations, and, in 28 cases, more than one potential indication for FB. We can only speculate as to whether these patients would have undergone FB in the absence of hemoptysis. The inclusion of patients with multiple indications for FB might allow greater opportunities for the procedure to demonstrate its worth. The prognostic impact of the volume of hemoptysis could not be determined because reliable quantitation of bleeding was inconsistently recorded. In addition, we did not appraise the impact of nonspecific or negative results of FB. Such findings have the potential to influence management, but these effects could not be measured readily.

**COMMENTS**

Despite these limitations, the current findings suggest that in most hospitalized patients with he-
moptysis and renal failure, a specific endobronchial etiology of bleeding is often (41%) undefined, hospital mortality is high (53%), and short-term survival is not altered substantially by bronchoscopic information. A known etiology of hemoptysis, the presence of lateralizing bronchoscopic findings, and alteration of therapy by FB did not appear to alter outcome. Factors associated with survival included the onset of hemoptysis prior to hospital admission, the performance of FB prior to mechanical ventilation, a preserved level of oxygen saturation with low $\text{F}_{1}\text{O}_{2}$ requirements, a high serum creatinine level, and the absence of recent exposure to prohemorrhagic factors (other than uremia) at the time of hemoptysis onset. Follow-up over 6 months revealed that although additional etiologies for hemoptysis seldom were established after hospital discharge (7%) and the frequency of recurrent hemoptysis was low (14%), the mortality rate was nevertheless substantial (31%). Deaths during and shortly after hospitalization often appear to be due to reasons other than hemoptysis, likely representing other comorbidities. These data suggest that FB in hospitalized patients with concurrent renal failure and hemoptysis, without radiographic findings suggesting neoplastic disease, has a low yield and a limited impact on outcome. Whether FB in selected patients with renal failure is beneficial requires prospective investigation.

REFERENCES


