Fiberoptic Bronchoscopy in the Evaluation of Acute Chest and Upper Airway Trauma*

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To determine the utility of fiberoptic bronchoscopy (FFB) in the short-term evaluation of patients with trauma, we identified 53 consecutive patients (45 male patients; mean age, 36 years) seen over a ten-year period who had FFB performed within the first three days of trauma to the chest and upper airway. There were eight deaths. Fifty patients had blunt trauma to the chest. These were mostly due to motor vehicle accidents (38 patients), crushing injuries (three patients), and falls (three patients). In addition, there were three patients with trauma to the neck. Physical and radiographic findings included pneumothorax (37 patients), subcutaneous emphysema (31), pulmonary contusion (22), hemothorax (21), mediastinal emphysema (16), flail chest (ten), atelectasis (ten), and hemoptysis (five). The FFB was of diagnostic use in 28 patients (53 percent) by revealing complete tracheal transection (one patient), tracheal laceration (three), complete bronchial transection (one), bronchial laceration (two), bronchial contusion (two), ongoing distal hemorrhage/pulmonary contusion (seven), aspirated material (three), mucous plugging/thick secretions (eight), and supraglottic lesions (three). One of the cases of tracheal laceration was not fully appreciated as a complete transection. We conclude that FFB has value in the short-term evaluation of patients with trauma. (Chest 1989; 96:627-30)

Bronchoscopy has been recommended for all cases of major trauma to the chest.1,2 This has been recommended mainly to evaluate for injury to the airway.3 In part, this is due to the often occult presentation and serious nature of these injuries. However, bronchoscopy may also be useful in the assessment and management of other problems encountered in acute trauma. Bronchoscopy for hemoptysis may reveal hemorrhage associated with pulmonary contusion and prompt the placement of a double-lumen endotracheal tube or balloon catheter for tamponade. Bronchoscopy for lung, lobar, or segmental collapse may reveal aspirated material or thick secretions and mucous plugging. Despite the frequency of this procedure in the initial assessment of trauma, there are very few data on the findings obtained from bronchoscopy.

In order to determine the utility of FFB in the short-term evaluation of patients with trauma we retrospectively reviewed the patients seen at the Mayo Clinic who had FFB performed during an evaluation of trauma.

Materials and Methods

We retrospectively identified all of the patients who were seen at the Mayo Clinic between 1977 and 1987 who had FFB performed during an admission for trauma. Ninety-six patients were identified, and 53 of these patients had bronchoscopy performed within three days of the traumatic event. Thirty patients had FFB performed on day 0, five patients on day 1, ten patients on day 2, and eight patients on day 3. This report will be limited to the findings encountered in these 53 patients. Forty-five patients were male patients, and eight were female patients. The mean age was 36 years (range, 10 to 84 years). Forty-five patients survived and eight patients died during the admission.

Results

Fifty patients had blunt trauma to the chest. Most of these were due to motor vehicle accidents, which involved 38 patients (72 percent). Three patients (6 percent) each were injured by falls or a crushing injury. One patient (2 percent) each was involved in the following: an airplane crash; bicycle accident; pedestrian accident; thrown and stepped on by a horse; trampled by cows; and repeatedly butted by a bull. Three patients had cervical trauma; one (2 percent) was from a gunshot wound, one (2 percent) was from a clothesline injury, and one (2 percent) was from an attempt at suicide by hanging.

Pneumothorax was the most common finding, occurring in 37 patients. Subcutaneous emphysema was present in 31 patients, pulmonary contusion in 22, hemothorax in 21, mediastinal emphysema in 16, flail chest in ten, atelectasis and collapse in ten, and hemoptyis in five (Table 1).

Flexible fiberoptic bronchoscopy was of diagnostic value in 28 patients (53 percent) (Table 2). Traumatic lesions of the trachea or major bronchi were found in eight patients; three had involvement of the trachea, four had involvement of the major bronchi, and one had involvement of both. One patient who was involved in a motor vehicle accident was found to have a complete tracheal transection. This was surgically
Table 1 — Physical and Radiographic Findings in 53 Patients with Acute Trauma to the Chest and Upper Airway Who Underwent FFB*

<table>
<thead>
<tr>
<th>Finding</th>
<th>Total</th>
<th>Bronchoscopy of Value</th>
<th>Bronchoscopy Not of Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pneumothorax</td>
<td>37 (70)</td>
<td>16 (57)</td>
<td>21 (84)</td>
</tr>
<tr>
<td>Subcutaneous emphysema</td>
<td>31 (58)</td>
<td>15 (54)</td>
<td>16 (64)</td>
</tr>
<tr>
<td>Pulmonary contusion</td>
<td>22 (42)</td>
<td>11 (39)</td>
<td>11 (44)</td>
</tr>
<tr>
<td>Hemothorax</td>
<td>21 (40)</td>
<td>10 (36)</td>
<td>11 (44)</td>
</tr>
<tr>
<td>Mediastinal emphysema</td>
<td>16 (30)</td>
<td>11 (39)</td>
<td>5 (20)</td>
</tr>
<tr>
<td>Flail chest</td>
<td>10 (19)</td>
<td>2 (7)</td>
<td>8 (32)</td>
</tr>
<tr>
<td>Atelectasis</td>
<td>10 (19)</td>
<td>7 (25)</td>
<td>3 (12)</td>
</tr>
<tr>
<td>Hemothysis</td>
<td>5 (9)</td>
<td>3 (11)</td>
<td>2 (8)</td>
</tr>
<tr>
<td>Total patients</td>
<td>53 (100)</td>
<td>28 (100)</td>
<td>25 (100)</td>
</tr>
</tbody>
</table>

*Data are numbers of patients; numbers within parentheses are percentages of group.

Flexible fiberoptic bronchoscopy revealed aspirated material in a total of three patients. Eight patients had mucus plugging and thick secretions.

Three patients had supraglottic lesions detected by FFB. The hanging patient had an avulsive supraglottic tear causing glottic obstruction. The patient from the airplane crash had distortion and narrowing of the supraglottic space. A bullet entry site 1 cm above the cords was identified in the patient with the gunshot wound, although the exit site was not seen.

**DISCUSSION**

Despite the frequent recommendation for bronchoscopy in the short-term evaluation of trauma,¹,² there are very few data on its sensitivity or the spectrum of findings encountered. Snow and Lucas¹ reported on 67 bronchoscopic examinations performed on 51 patients in a surgical intensive care unit. The primary diagnosis was blunt trauma to the chest in seven patients and trauma to the airway in three patients. The primary indication for bronchoscopy was suspicion of trauma to the airway in eight patients (12 percent). The specific findings in these patients with trauma were not described.

Bronchoscopy has proven itself to be useful in the evaluation of injury to the airways.³ ⁴ Eckert et al⁵ reported the findings in 24 patients admitted with traumatic tracheal or bronchial injuries. Thirteen patients underwent bronchoscopy and in each instance the diagnosis was either established or confirmed. Grover et al⁶ described 14 patients treated with major tracheal or bronchial injury. Bronchoscopy was diagnostic in all six patients in which it was performed. Kelly et al⁷ reported the findings in 24 consecutive patients with combined injuries of the trachea and esophagus. Twenty-one injuries were due to penetrating gunshot or stab wounds, and three were due to blunt trauma to the chest. All patients had undergone bronchoscopy. In only one patient did bronchoscopy fail to identify the lesion. The patient was...
had sustained a gunshot wound and died because of a missed cervical tracheal injury. Jones et al described 13 patients with tracheobronchial disruption from blunt trauma to the chest due to motor vehicle accidents. Bronchoscopy was diagnostic in six (86 percent) of seven patients. One patient injured in a motor vehicle accident was found to have an 80 percent concentric stenosis of the right main-stem bronchus on the 29th day after injury, following previous normal findings on bronchoscopic examinations at days 1, 2, 3, and 6. Roxburgh reported the findings in eight patients with tracheobronchial injury in whom bronchoscopy was performed immediately. In three patients the injury was overlooked. Two of these patients had significant hemorrhage which impaired the examination. Our series revealed eight patients with tracheobronchial injury. In one patient an injury to the cervical trachea was identified but not fully appreciated to represent a complete transection. In no other patient was there any evidence that FFB failed to identify an injury to the airway or any other significant abnormalities. Because of the possibility that a lesion can be overlooked by bronchoscopy, repeat bronchoscopic examination should be performed if the clinical situation suggests that a lesion is present.

We found that FFB was useful in identifying other abnormalities encountered in trauma. Ongoing distal hemorrhage representing pulmonary contusion was found in 13 percent (seven) of our patients. In two patients, this prompted the placement of a double-lumen endotracheal tube and in one the placement of a Fogarty balloon catheter for tamponade. Aspirated material was found in 6 percent (three patients), and mucous plugging and thick secretions were found in 15 percent (eight patients).

The importance of evaluation of the upper trachea, larynx, and supraglottic region was emphasized in our series. Fourteen percent of the positive findings involved this area. Angood et al have previously advocated the liberal use of FFB in the evaluation and management of injuries to the larynx and cervical trachea. In addition, these investigators noted the importance of performing bronchoscopy at the time of extubation in patients who had blind intubation done in the acute trauma setting, as 15 percent of their patients had laryngeal injury discovered in this way.

The nature of trauma to the chest and upper airway involves a wide spectrum and range of severity of injuries from trivial to lethal. The retrospective nature of this study limits our ability to make many conclusions. The decision to perform bronchoscopy was made by the surgeon managing the patient. This surgeon could have been a surgical resident or an attending staff physician, and thus the experience and clinical judgment of the surgeon deciding on bronchoscopy was highly variable. Therefore, we were unable to produce a meaningful total or control number of patients with trauma to compare to our group.

Understanding these limitations, we have compared our two groups of patients who underwent bronchoscopy within or after three days of the trauma. In addition, we have compared our two groups who had bronchoscopy performed within three days but had either abnormal or normal findings; however, only generalizations can be made because of the number of variables looked at retrospectively and the risk of claiming an association when none exists.

The 53 patients who had bronchoscopy performed within three days of the traumatic event tended to have more of the physical and radiographic findings than the 43 patients who had bronchoscopy performed later; however, none of the reported physical and radiographic findings appeared particularly more common in those who underwent early bronchoscopy to indicate a reason for the procedure. Comparison of our two groups who had early bronchoscopy revealed similar incidences of the physical and radiographic findings, except for the presence of mediastinal emphysema, which was approximately twice as common in the patients with abnormal findings. Of the patients with disruption of the airway, all five patients had mediastinal emphysema, and four of the five had a pneumothorax.

No specific criteria for performing bronchoscopy in the short-term evaluation of trauma to the chest and upper airway can be made because of the wide spectrum of injuries. This decision must rely on the clinical judgment of the evaluating physician; however, we have shown that bronchoscopy is a useful procedure and should be considered in this setting.

In conclusion, we found FFB useful in acute trauma in 28 out of 53 patients in which it was performed within three days of injury. In only one instance was a lesion identified whose full extent was not appreciated. In no other case was there any evidence that any significant abnormalities were overlooked. Because of the rare possibility that lesions could be missed, repeat bronchoscopic procedures should be performed if the clinical situation suggests an abnormality. Examination of the cervical trachea, larynx, and supraglottic region should also be done.

REFERENCES
8 Jones WS, Mavroudis C, Richardson JD, Gray LA, Howe WR. Management of tracheobronchial disruption resulting from blunt trauma. Surgery 1984; 95:319-23

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